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UNITED STATES GEOLOGICAL SURVEY
GEORGE OTIS SMITH, Director

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SURFACE WATER SUPPLY OF HAWAII

JULY 1, 1920, TO JUNE 30, 1921

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Prepared in cooperation with the
TERRITORY OF HAWAII

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SURFACE WATER SUPPLY OF HAWAII, JULY 1, 1920, TO JUNE 30, 1921.

AUTHORITY FOR INVESTIGATIONS.

This volume contains results of measurements of the flow of certain streams and ditches in the Territory of Hawaii made during the year ending June 30, 1921. The investigations leading to the report were made by the United States Geological Survey in cooperation with the Territory of Hawaii, under the general sanction of the organic law of the Survey (Stat. L., vol. 20, p. 394), which contains the following paragraph:

Provided, That this officer [the Director] shall have the direction of the geological survey and the classification of public lands and examination of the geological structure, mineral resources, and products of the national domain.

As water is the most abundant and most valuable of the minerals, the investigation of water resources is authorized under the provision for examining mineral resources. The work has been supported since the fiscal year ending June 30, 1895, by appropriations in successive sundry civil bills passed by Congress under the following item:

For gaging the streams and determining the water supply of the United States, and for the investigation of underground currents and artesian wells, and for the preparation of reports upon the best methods of utilizing the water resources.

The legislature of the Territory of Hawaii approved on March 22, 1909, "An act to promote the conservation and development of the natural resources of the Territory," which provided in substance as follows: A special tax of 2 per cent shall be levied, assessed, and collected annually on all incomes in excess of \$4,000; and all amounts so collected shall constitute a special fund to be expended only for the encouragement of immigration and the conservation of natural resources in the proportion of three-fourths for immigration and one-fourth for conservation. The conservation fund shall be used for the development, conservation, improvement, and utilization of the natural resources, and shall be available for expenditure at such times and in such manner as a board of three persons appointed in accordance with section 80 of the organic act shall, with the approval of the governor, determine.

An act of April 26, 1911, amended the original act so as to extend it until December 31, 1913.

On April 4, 1913, the governor of the Territory of Hawaii approved the following acts providing (act 56) for the creation and maintenance of a division of hydrography under the board of agriculture and forestry, and (act 57) appropriating the revenues from water licenses for the use of the board of commissioners of agriculture and forestry toward forest protection and hydrographic surveying.

Section 1 of act 56 reads:

The board of agriculture and forestry is hereby authorized to create and maintain a division of hydrography for the investigation and determination of the water resources of the Territory by the gaging of streams and rainfall and other means, in cooperation with the United States Geological Survey or otherwise, and in furtherance thereof to take over and exercise the functions of the Territory in the conduct of the present hydrographic survey of the Territory.

Section 2 provides that this act shall take effect July 1, 1913.

Section 1 of act 57 reads:

All revenues derived from water licenses issued by the Territory during the period beginning July 1, 1913, and ending June 30, 1915, whether by way of rentals or otherwise, shall constitute and be held as a special fund in the treasury of the Territory to be disbursed on warrants of the auditor issued on approved vouchers of the president of the board of commissioners of agriculture and forestry. Such moneys shall be apportioned and applied from time to time by the board of commissioners of agriculture and forestry, acting with the approval of the governor, equally between the division of forestry and the division of hydrography to the following general purposes, and not otherwise:

1. For the protection of forest reservations, established or set apart according to law, against damage by fire, animals, and otherwise by means of fences and any other means whatsoever, and for the expenditures of the division of forestry.

2. For the development and maintenance of the hydrographic survey throughout the Territory.

Each voucher against said fund shall designate the general purpose for which it is drawn.

Section 2 provides that this act also shall take effect July 1, 1913.

Since June 30, 1915, the funds for the use of the division of hydrography have been supplied by successive appropriations from the general revenues of the Territory.

On March 23, 1917, the following act by the Legislature of the Territory of Hawaii was approved:

ACT 27.

SEC. 1. The division of hydrography, authorized by and created pursuant to section 483 of the Revised Laws of Hawaii, 1915, is hereby transferred, together with all the materials, equipment, and supplies now under the control of the division or of the board of commissioners of agriculture and forestry for the division, to the commissioner of public lands.

SEC. 2. The commissioner of public lands shall have and exercise the same powers, duties, and jurisdiction with respect to said division as are now exercised by the board of commissioners of agriculture and forestry.

SEC. 3. All unexpended balances of appropriations heretofore made for said division, the expenditure of which is now by law vested in the board of commissioners of agri-

culture and forestry, are hereby transferred to the commissioner of public lands and the expenditure thereof vested in said commissioner.

SEC. 4. This act shall take effect upon its approval.

On April 27, 1917, act 156 by the Legislature of the Territory of Hawaii, "Relating to the use of water from artesian wells," was approved, defining and prohibiting waste therefrom. Sections 5, 7, and 10 of this act read as follows:

SEC. 5. Any person boring, or causing to be bored, an artesian well shall keep a complete and accurate record of the depth and thickness of the different strata penetrated and within ninety days after the last day of boring, shall file such record in the office of the superintendent of hydrography of the Territory of Hawaii.

SEC. 7. For the more effectual carrying out of this act, the high sheriff and deputy high sheriff of the Territory, the sheriff and deputy sheriff of any county or city and county, all police officers, and any authorized representative of any city, or county, or city and county, or of the superintendent of hydrography of the Territory may at all times enter without warrant the premises where an artesian well is situated or whereon or wherein artesian water is used in order to procure such information or for such other purpose as may be necessary.

SEC. 10. This act shall take effect from and after July 1, 1917, A. D.

A special item in the appropriation for the division of hydrography provided \$1,200 for "Expenses, water investigation," to be used for obtaining information regarding artesian wells. Since that time no further appropriations for the purpose have been made.

COOPERATION.

COOPERATION WITH THE TERRITORY OF HAWAII.

Under the authority conferred by the Federal and Territorial legislation, the Director of the United States Geological Survey and the governor of the Territory of Hawaii entered into a cooperative agreement, dating from July 1, 1910, for "the gaging of streams and the determination of the water supply of the Territory of Hawaii."¹

The principal features of this agreement are:

1. The United States Geological Survey assumes the responsibility of gathering, analyzing, and publishing the data.

2. During the progress of the work all notes, maps, and data gathered as a result of field studies are at all times open to inspection by the representative of the Territory, and if they are not satisfactory the agreement can be terminated.

3. Accounts for payment of salaries, travel, and subsistence, supplies, or other expenses necessary to the completion of the work shall be rendered in the manner required by the laws and regulations of the contracting parties, and vouchers shall be preferred to either party for payment according as it may be convenient or according to the balance remaining in the respective allotments.

¹ The United States Geological Survey also cooperated with the Territory of Hawaii in mapping several islands. The whole of the islands of Kauai and Oahu and a part of the island of Hawaii have been mapped.

4. The cost of publication is borne entirely by the Geological Survey.

Unless otherwise stated, all data have been collected and are published under this cooperative agreement with the Territory of Hawaii, which has borne from 60 to 80 per cent of the cost thereof.

Until June 30, 1913, the Territory of Hawaii was represented in the cooperation by the Board of Conservation; from July 1, 1913, to March 23, 1917, by the Board of Commissioners of Agriculture and Forestry; and since this date by the Commissioner of Public Lands.

OTHER COOPERATION.

Special investigations have been made in cooperation with the Hawaiian department of the United States Army, the city and county of Honolulu, and private persons and corporations, under one of the plans indicated in the following paragraphs:

1. Expense of work, equipment, or installation paid entirely or in part by the cooperating party or by direct reimbursement to the field men.

2. Records collected by employees of a cooperating party but under supervision of and by methods of the Survey.

3. Assistance given in the collection of records, such as furnishing transportation, subsistence, or equipment.

4. Records furnished by a cooperating party, collected by his methods and under his supervision.

Cooperation in the collection of records for whose accuracy responsibility has not rested with the Survey has been acknowledged in the descriptions of the stations. Special acknowledgment is due to the following individuals and companies cooperating under plans 1, 2, and 3: Island of Kauai—Waimea Sugar Co., Kekaha Sugar Co., and Princeville plantation; Island of Oahu—Wahiawa Water Co.; Island of Maui—Pioneer Mill Co. and East Maui Irrigation Co.

SCOPE OF WORK.

The investigations of the surface waters of the Territory are not complete nor do they include all the streams and ditches that might advantageously be studied. They include, however, as many of the streams and ditches on the five larger islands as the available appropriations would allow. It is essential that records of stream flow should be kept during a period of years long enough to determine within reasonable limits the range of flow from the maximum to the minimum. The length of such a period manifestly varies for different streams. Experience has shown that the records should be kept from 20 to 30 years.

In the performance of this work an effort is made to reach the highest degree of precision possible with a rational expenditure of

time and money. In all engineering work there is a point beyond which refinement is needless and wasteful, and this statement applies with especial force to stream-measurement work in Hawaii. It has been found, however, that it is possible to obtain data which are sufficiently accurate, although many of those presented in this report are for periods too short to yield definite conclusions.

Special intensive investigations of the discharge of certain streams which are of major importance for domestic water supply, power, and irrigation have been made.

Investigations of ditch seepage and other losses, in certain localities, were made in cooperation with private corporations.

Records were kept of the artesian heads on typical wells in the more important artesian areas on Oahu.

DEFINITION OF TERMS.

The volume of water flowing in a stream—the “run-off” or “discharge”—is expressed in various terms, each of which has become associated more or less definitely with a certain class of work. These terms may be divided into two groups: (1) Those which represent a rate of flow, as “second-feet,” “gallons per minute,” “gallons per day,” “miner’s inches,” and “run-off in second-feet per square mile,” and (2) those which represent the actual quantity of water, as “run-off in depth in inches,” “million gallons,” and “acre-feet.” They may be defined as follows:

“Second-foot” is an abbreviation for cubic foot per second, and is the unit for the rate of discharge of water flowing in a stream 1 square foot in cross section at a rate of 1 foot per second. It is generally adopted as the fundamental unit in the measurement of flowing water and is the “natural” unit, as the foot and the second are the units used in making the physical determinations. Other units may be computed from this by the use of factors given in the table of equivalents.

“Gallons per minute” is generally used in connection with pumping and city water supply, the United States gallon of 231 cubic inches being the unit of quantity and 1 minute the unit of time.

The “miner’s inch” is the unit for the rate of discharge of water that passes through an orifice 1 inch square under a head which varies locally. It is commonly used by miners and irrigators throughout the West, and is defined by statute in each State in which it is used.

“Second-feet per square mile” is the average number of cubic feet of water flowing per second from each square mile of area drained, on the assumption that the run-off is distributed uniformly, both as regards time and area.

“Run-off in inches” is the depth to which the drainage area would be covered if all the water flowing from it in a given period were con-

served and uniformly distributed on the surface. It is used for comparing run-off with rainfall, which is usually expressed in depth in inches.

An "acre-foot" is equivalent to 43,560 cubic feet, and is the quantity required to cover an acre to the depth of 1 foot. The term is commonly used in connection with storage for irrigation.

In the Territory of Hawaii the unit most commonly used in measuring water is the "million gallons." This is used with two meanings—(1) to indicate a rate of flow and (2) to express an actual quantity of water. In the former sense "million gallons per day" is inferred, 1,000,000 gallons being taken as the unit of quantity and 24 hours as the unit of time. With this meaning the term is generally used in connection with pumping and irrigation. In the latter sense "million gallons" as an absolute quantity is used in the measurement of storage capacities of reservoirs.

The following convenient approximate relations exist between second-feet, million gallons per day, and acre-feet: 1 second-foot flowing 24 hours equals about 2 acre-feet; 1,000,000 gallons equals about 3 acre-feet; and 1 second-foot equals approximately two-thirds millions gallon per day.

"Man's water" is an irrigator's term also in common use in Hawaii. It signifies the amount of water that one irrigator can properly handle in the field. It varies greatly, being dependent upon the condition of the furrows, the age of the crop, and the skill and individuality of the irrigator.

EXPLANATION OF TABLES.

For each current-meter gaging station are given, in general, the following data: Description of station, list of discharge measurements, table of daily discharge, table of monthly and yearly discharge and run-off in acre-feet and million gallons.

All rates of flow are expressed as million gallons per day.

In addition to statements regarding the location and installation of current-meter stations, the descriptions give information in regard to any conditions which may affect the constancy of the relation of gage height to discharge, covering such points as shifting channels and backwater; also information regarding diversions which decrease the total flow at the measuring section. Statements are also made regarding the utilization of the water, the maximum and minimum stage and discharge, and the accuracy of the data.

The discharge-measurement table gives the results of the discharge measurements made during the year, including the date, name of hydrographer, gage height, and discharge in second-feet and million gallons per day.

The table of daily discharge gives the discharge in million gallons per day corresponding to the observed gage height as determined

from the rating table, the number of significant figures used varying with the size of the discharge.

In the table of monthly discharge the column headed "Maximum" gives the flow for the day when the total discharge was greatest. This does not correspond to the rate of flow at the crest of the flood which is given under the heading "Extremes of discharge." Likewise in the column of "Minimum" the quantity given is the flow for the day when the total discharge was least. The columns headed "Mean" give the average flow in million gallons per day and in cubic feet per second during the month. The "Total in million gallons" and "Total in acre-feet" given in the columns under these heads are computed from the mean discharge in million gallons per day.

Owing to the volcanic formation of the Hawaiian Islands there is so wide a diversity in the character and porosity of the rocks of the drainage basins that the determination of a general relation between rainfall and run-off is of no value. For this reason information concerning drainage areas has been omitted in the various station descriptions.

ACCURACY OF FIELD DATA AND COMPUTED RESULTS.

The accuracy of stream-flow data depends (1) on permanence of the relation between discharge and stage, (2) number, accuracy, and distribution of discharge measurements, and (3) on the accuracy of observations of stage and interpretation of data.

The accuracy recorded in the station description is based on the accuracy of the rating curve, the reliability of the gage-height record, the range of the fluctuation in stage, and knowledge of local conditions. The use of "excellent," "good," "fair," or "poor," indicates that the probable errors are within 5, 10, 15, and 25 per cent, respectively.

It should be borne in mind that the observations in each succeeding year may be expected to throw new light on data already collected and published.

DIVISION OF WORK.

The data were collected and prepared for publication under the direction of James E. Stewart, district engineer, Honolulu, Hawaii, by Max. H. Carson, office engineer, B. F. Rush, W. C. Renshaw, Reid Jerman, Robert Remington, E. M. Pickop, Karl Jetter, Sherman B. Hall, E. E. Goo, John Kaheahu, Francis Kanahale, Keiji Suzuki, and Miss Marie A. Davison. The manuscript was prepared by E. D. Burchard and reviewed by Max. H. Carson.

GAGING-STATION RECORDS.

ISLAND OF KAUAI.

KAUAIKINANA STREAM NEAR WAIMEA, KAUAI.

LOCATION.—1 mile east of Kokee, 12 miles north of Waimea (20 miles from Waimea by road and trail), and 200 feet above Kokee, Mohihi trail.

RECORDS AVAILABLE.—July 1, 1919, to June 30, 1921. Miscellaneous measurements 1911-1916.

GAGE.—Stevens continuous water-stage recorder.

DISCHARGE MEASUREMENTS.—Made by wading or from cable suspended at the gage CHANNEL AND CONTROL.—Rocky boulder-strewn bed and high rocky banks. Control composed of large boulders. Subject to shift at high floods.

EXTREMES OF DISCHARGE.—Maximum stage recorded, 8.30 feet at 2.40 p. m. December 24, 1920 (discharge, 380 million gallons per day or 588 second-feet); minimum stage recorded, 1.77 feet at 5.30 a. m. August 9, 1920 (discharge, 0.26 million gallons per day or 0.40 second-foot).

DIVERSIONS.—None.

REGULATION.—None.

OBJECT OF STATION.—To determine feasibility of high level (3,100 feet) diversion to serve semiarid Territorial lands now idle on account of lack of water.

UTILIZATION.—After it reaches Waimea River low-water flow is used for power and irrigation.

ACCURACY.—Stage-discharge relation permanent throughout the year. Rating curve fairly well defined below 14 million gallons per day. Operation of water-stage recorder satisfactory. Records fair below 14 million gallons per day and poor above that quantity.

Discharge measurements of Kauaikinana Stream near Waimea, Kauai, during the year ending June 30, 1921.

Date.	Made by—	Gage height (feet).	Discharge.	
			Second-feet.	Million gallons per day
July 31	M. H. Carson.....	1.86	0.6	0.4
Aug. 24	.....do.....	2.25	7.6	4.9
Sept. 27	J. E. Stewart.....	1.94	1.35	.85
Nov. 5	B. F. Rush.....	1.98	1.25	.8
Dec. 12	.....do.....	2.17	3.4	2.2
Jan. 22	.....do.....	2.91	18.8	12.2
Mar. 15	W. C. Renshaw.....	2.12	2.0	1.3
May 6	E. M. Pickop.....	2.06	2.0	1.3

Discharge, in million gallons per day, of Kauaikihana Stream near Waimea, Kauai, for the year ending June 30, 1921.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	0.5	0.6	0.6	0.8	1.0	1.9	3.5	8.5	5.7	2.4	1.2	0.8
2	.6	.5	.5	.8	1.1	1.6	3.2	6.4	20.0	2.1	1.2	.8
3	.6	.6	.7	.8	2.0	1.6	3.3	4.6	3.6	2.0	1.3	.7
4	.5	1.4	.8	.6	1.1	1.4	11.8	4.4	3.0	1.8	1.2	.7
5	.5	.6	.6	.6	.9	1.5	47	4.2	3.1	3.3	1.3	.6
6	.5	.4	.7	.6	.7	2.0	30	3.7	3.0	2.1	1.6	.6
7	.4	.3	2.0	2.2	9.1	1.6	9.8	3.4	2.3	5.4	1.2	.6
8	.4	.8	1.6	1.0	15.0	9.8	11.0	3.2	2.2	4.7	1.1	.6
9	.4	.3	3.0	.7	2.3	7.0	18.9	3.0	2.1	2.9	1.0	.6
10	.4	.3	2.4	.6	6.1	5.8	15.2	2.8	2.0	2.0	1.0	.6
11	.6	.3	2.6	.6	2.8	2.6	13.8	2.8	2.0	1.8	1.0	.6
12	2.0	.3	2.4	1.0	2.1	3.4	19.1	2.7	1.9	1.8	1.0	1.0
13	1.1	.3	1.4	.9	1.8	11.0	25	2.5	1.8	1.7	1.0	2.8
14	.7	.3	1.2	.6	1.6	11.0	107	2.4	1.8	1.6	1.0	1.2
15	.8	.3	2.4	5.7	1.4	4.2	137	2.3	1.3	1.6	1.0	.8
16	1.6	.3	5.1	2.2	1.3	2.9	100	2.3	3.5	2.6	.9	.6
17	4.2	.3	1.6	1.8	1.2	2.5	44	2.3	2.3	1.9	.9	.6
18	1.2	.6	1.4	1.3	1.1	2.3	23	2.3	1.9	1.6	.8	.6
19	.8	.4	1.2	1.0	1.2	2.1	18.9	2.1	1.8	1.5	.8	.6
20	.6	2.0	1.4	.8	1.5	2.0	39	2.2	1.7	1.5	.8	.6
21	.6	11.3	1.5	1.0	1.2	2.0	15.8	7.5	1.8	1.4	.8	.5
22	.5	4.8	1.0	.8	1.2	12.4	11.8	3.3	1.8	1.4	.8	.5
23	.5	2.3	.9	.8	1.8	27	9.5	2.4	14.6	1.3	.8	.5
24	.4	2.2	.9	.9	2.2	35	7.9	2.1	5.0	1.3	.8	.5
25	.4	1.4	1.0	.8	4.7	23	7.3	2.0	2.6	1.3	.8	.5
26	.4	1.7	1.3	.9	3.6	11.8	6.6	2.0	2.1	1.4	.8	.5
27	.4	1.2	.8	2.6	1.7	8.9	9.2	1.9	2.0	1.5	.8	.5
28	.4	.8	.7	1.2	1.4	6.0	6.3	1.8	3.3	1.3	.8	.5
29	.4	.8	.6	.8	5.3	5.1	4.9	.....	4.6	1.3	1.4	.5
30	.4	.8	.9	.8	4.7	4.4	10.9	.....	9.3	1.2	1.5	.6
31	.4	.6	.....	1.2	.....	3.8	7.8	.....	3.0	.....	.9	.....

Monthly discharge of Kauaikihana Stream near Waimea, Kauai, for the year ending June 30, 1921.

Month.	Discharge.			Total run-off.		
	Million gallons per day.			Second-foot (mean).	Million gallons.	Acro-feet
	Maximum.	Minimum.	Mean.			
July	4.2	0.4	0.75	1.16	23.2	71
August	11.3	.3	1.24	1.92	38.3	118
September	5.1	.5	1.42	2.20	42.6	131
October	5.7	.6	1.17	1.51	36.4	111
November	15.0	.7	2.73	4.30	33.5	266
December	35	1.4	8.60	13.3	267	818
January	137	3.2	24.3	38.4	770	2,390
February	8.5	1.3	3.22	4.98	90.1	277
March	20.0	1.7	3.79	5.86	113	361
April	5.4	1.2	1.97	3.05	59.1	181
May	1.6	.8	1.02	1.58	31.5	97
June	2.8	.5	.70	1.08	21.1	64
The year	137	.3	4.32	6.68	1,580	4,846

KAWAIKOI STREAM NEAR WAIMEA, KAUAI.

LOCATION.—3 miles northeast of Knudsen's mountain house and 21 miles by road and trail from Waimea.²

RECORDS AVAILABLE.—April 13, 1909, to July 11, 1917, and July 1, 1919, to June 30, 1921. No record of value after December 17, 1916, until July 2, 1919.

GAGE.—Stevens continuous water-stage recorder installed August 4, 1919. Staff April 13, 1909, to May 26, 1910; Friez water-stage recorder May 26, 1910, to October 11, 1911; Barrett and Lawrence water-stage recorder October 11, 1911, to August 4, 1919.

DISCHARGE MEASUREMENTS.—Made by wading or from cable suspended near trail crossing 300 feet downstream.

CHANNEL AND CONTROL.—One channel at all stages, straight for 100 feet above and below station; banks high and wooded. Control composed of rock ledge and boulders. Shifts slightly.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 10.35 feet at 12.30 p. m. January 16 (discharge, 740 million gallons per day or 1,140 second-feet); minimum stage recorded during year, 1.39 feet at 5 p. m. June 27 and 10.40 a. m. December 2 (discharge, 2.0 million gallons per day or 3.1 second-feet).

1909-1921: Maximum stage recorded during period of record, 15.2 feet December 18, 1916 (discharge not determined); minimum stage recorded in November and December, 1919.

DIVERSIONS.—None.

REGULATION.—None.

OBJECT OF STATION.—To determine feasibility of diverting flood water into high-level (3,100 feet) ditch to serve Territorial lands now idle on account of lack of irrigation.

UTILIZATION.—After it reaches Waimea River, low water is used for power and irrigation.

ACCURACY.—Stage-discharge relation changed by flood of January 16. Rating curve to January 16 well defined below 10 million gallons per day and fairly well defined up to 30 million gallons per day. Rating curve from January 17 well defined below 30 million gallons per day and fairly well defined up to 60 million gallons per day. Operation of water-stage recorder satisfactory throughout the year. Records good.

Discharge measurements of Kawaihoi Stream near Waimea, Kauai, during the year ending June 30, 1921.

Date.	Made by—	Gage height (feet).	Discharge.	
			Second-feet.	Million gallons per day.
July 31	M. H. Carson	1.94	14.9	9.6
Aug. 26	do	2.38	41	26.5
Sept. 27	J. E. Stewart	1.86	13.7	8.8
Nov. 5	B. F. Rush	1.31	11.7	7.6
Dec. 12	do	2.60	47	30.5
Jan. 22	do	2.50	44.5	29
Mar. 15	W. C. Renshaw	1.77	8.5	5.5
May 7	B. F. Rush	1.80	9.6	6.2

² This supersedes distances previously published but represents same location as old station.

Discharge, in million gallons per day, of Kawaikoi Stream near Waimea, Kauai, for the year ending June 30, 1921.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1.....	11.6	8.8	7.2	7.4	14.2	14.8	12.6	35	54	14.7	5.3	3.1
2.....	9.2	9.2	9.2	14.1	21	.....	14.5	20.0	126	11.4	4.8	6.0
3.....	6.4	16.8	12.6	8.9	38	.....	24	16.0	20.0	9.8	5.0	4.3
4.....	4.2	25	11.4	6.1	10.1	.....	106	15.3	24	8.9	5.9	3.9
5.....	2.9	11.4	9.4	5.0	7.4	.....	246	15.6	19.3	27	6.2	2.8
6.....	2.5	4.4	22	8.8	11.3	.....	163	13.1	16.9	25	8.0	2.4
7.....	2.4	3.4	33	45	110	.....	51	12.0	10.5	79	6.3	2.5
8.....	3.6	3.1	13.9	9.9	109	.....	81	11.1	8.9	56	5.0	2.8
9.....	3.1	3.1	50	6.8	19.4	.....	118	10.5	8.0	30	4.2	3.1
10.....	8.2	4.2	38	5.4	67	.....	86	10.0	7.6	14.4	3.8	2.7
11.....	43	6.3	40	7.6	24	.....	86	9.8	7.1	11.1	3.4	2.3
12.....	46	6.0	44	20.0	15.9	51	58	10.3	6.9	9.8	3.4	29
13.....	15.9	8.3	16.2	10.1	13.2	124	101	9.1	6.3	12.8	3.5	44
14.....	5.9	5.0	19.0	6.8	11.6	90	446	8.4	6.0	10.0	3.6	9.1
15.....	14.4	2.8	33	72	10.1	31	538	8.2	5.9	8.7	3.2	4.7
16.....	31	2.5	79	26	8.8	19.4	442	7.8	44	33	3.0	4.3
17.....	45	15.7	17.9	31	7.8	16.2	171	7.6	16.6	14.7	2.9	2.7
18.....	9.3	8.9	17.0	17.9	7.4	13.9	66	10.5	9.6	10.5	2.8	2.4
19.....	6.8	4.7	13.9	10.5	25	12.6	57	8.2	6.7	8.2	2.8	2.6
20.....	8.4	70	17.7	13.6	22	11.4	115	10.7	5.9	7.1	2.7	3.5
21.....	5.2	86	22	11.6	14.6	16.5	40	46	19.5	8.9	2.7	2.7
22.....	4.1	56	.....	7.4	17.8	33	28	16.0	9.8	7.2	2.6	2.4
23.....	6.3	25	.....	6.8	24	145	24	9.6	129	6.5	2.5	3.0
24.....	4.1	32	.....	17.6	37	249	21	8.0	40	6.9	2.5	2.5
25.....	4.5	25	.....	10.5	66	66	51	7.2	16.0	8.7	2.5	2.2
26.....	3.6	33	.....	16.5	29	30	36	6.9	10.5	7.4	2.4	2.1
27.....	3.1	16.2	.....	37	15.6	21	45	6.3	11.1	6.7	2.4	2.1
28.....	6.6	12.6	6.9	12.9	13.2	19.4	28	6.0	46	6.2	2.4	8.2
29.....	8.0	19.5	6.6	8.0	96	17.0	18.3	.....	61	5.7	4.2	10.4
30.....	7.8	16.1	12.7	6.6	41	15.9	41	.....	77	5.6	6.0	4.6
31.....	12.5	8.6	.....	24	.....	13.4	30	.....	22	.....	4.4	.....

NOTE.—Sept. 22-27, no record; discharge estimated by comparison with adjacent streams at 15 million gallons per day. Dec. 2-11, no record; discharge estimated by comparison with stage of Mohihi Stream at 35 million gallons per day.

Monthly discharge of Kawaikoi Stream near Waimea, Kauai, for the year ending June 30, 1921.

Month.	Discharge.			Second-foot (mean).	Total run-off.	
	Million gallons per day.				Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July.....	46	2.4	11.1	17.2	346	1,060
August.....	86	2.5	17.7	27.4	550	1,680
September.....	79	6.6	21.4	33.1	643	1,970
October.....	72	5.0	15.9	24.6	492	1,510
November.....	110	7.4	30.2	46.7	907	2,780
December.....	249	10.5	43.7	67.6	1,350	4,160
January.....	538	12.6	108	167	3,340	10,300
February.....	46	6.0	12.7	19.6	355	1,090
March.....	129	5.9	27.5	42.5	852	2,620
April.....	79	5.6	15.7	24.3	472	1,450
May.....	8.0	2.4	3.88	6.00	120	369
June.....	44	2.1	5.95	9.21	178	548
The year.....	538	2.1	26.3	40.7	9,600	29,500

WAIAKOALI STREAM NEAR WAIMEA, KAUAI.

LOCATION.—150 feet below Kokee-Mohihi trail, a quarter of a mile below Waiakoali camp, and 12 miles northeast of Waimea (22 miles from Waimea by road and trail)

RECORDS AVAILABLE.—April 13, 1909, to December 4, 1912, and July 1, 1919, to June 30, 1921. Occasional measurements 1913 to 1917 reported as miscellaneous.

GAGE.—Stevens continuous water-stage recorder installed July 30, 1919. Staff gage April 13, 1909, to December 4, 1912.

DISCHARGE MEASUREMENTS.—Made by wading or from cable suspended near trail.

CHANNEL AND CONTROL.—Channel, a series of pools with mud and silt bottom divide by rapids of boulders and cobblestones. High sloping banks covered with fern and underbrush. Control, large boulders, not subject to shift.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 8.60 feet at 2.2 p. m. January 16 (discharge, 304 million gallons per day or 470 second-feet); minimum stage recorded during year, 1.31 feet at 10.40 a. m. January 7 (discharge 0.73 million gallons per day or 1.15 second-feet).

1909-1921: Maximum stage recorded during period of record, January 16, 1921
Minimum stage recorded, 1.45 feet (old staff gage), November 29, 1909 (discharge 0.4 second-foot or 0.3 million gallons per day).

DIVERSIONS.—None.

REGULATION.—None.

OBJECT OF STATION.—To determine feasibility of diverting flood water into high-level (3,100 feet) ditch to serve Territorial lands now idle on account of lack of irrigation

UTILIZATION.—After it reaches Waimea River low water is used for power and irrigation.

ACCURACY.—Stage-discharge relation changed by flood of January 16. Rating table used to January 16 well defined between 0.5 million gallons per day and 15 million gallons per day. Rating table used from January 17 fairly well defined up to 3 million gallons per day. Operation of water-stage recorder satisfactory. Record good.

Discharge measurements of Waiakoali Stream near Waimea, Kauai, during the year ending June 30, 1921.

Date.	Made by—	Gage height (feet).	Discharge.	
			Second-feet.	Million gallons per day.
July 31	M. H. Carson.....	1.41	1.85	1.2
Aug. 26	.....do.....	2.26	13.5	8.7
Sept. 23	B. F. Rush.....	1.50	1.9	1.2
Nov. 5	.....do.....	1.52	2.3	1.6
Dec. 13	.....do.....	3.28	45	29
Jan. 24	.....do.....	2.56	17.4	11.2
Mar. 16	W. C. Renshaw.....	1.75	6.0	3.9
May 7	E. M. Pickop.....	1.55	3.7	2.4

Discharge, in million gallons per day, of Waiakoali Stream near Waimea, Kauai, for the year ending June 30, 1921.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	0.9	1.4	1.4	1.6	2.0	4.8	5.8	15.7	6.8	5.6	2.4	1.4
2	1.6	1.1	1.2	2.3	2.7	3.4	5.6	12.0	30	4.5	2.2	1.4
3	1.2	1.2	1.0	2.1	5.1	4.3	6.9	10.1	9.4	3.9	2.3	1.4
4	1.0	3.1	1.6	1.4	2.5	3.2	22	9.4	8.8	3.0	2.9	1.4
5	.9	1.8	1.6	1.2	1.6	2.9	45	10.1	7.6	5.0	2.6	1.3
6	.8	1.2	1.4	1.2	1.4	5.0	40	8.8	6.9	4.8	2.8	1.2
7	.7	.9	5.8	7.1	16.2	4.3	19.0	8.2	5.5	8.7	2.4	1.2
8	.8	.8	2.9	2.5	36	24	22	7.5	4.9	11.4	2.2	1.2
9	.7	.8	6.9	1.6	6.6	16.2	32	7.0	4.5	9.4	2.0	1.2
10	.7	.9	6.9	1.3	10.6	18.5	28	6.7	4.2	5.1	2.0	1.2
11	2.2	1.1	7.7	1.2	7.3	7.2	20.0	6.3	4.1	4.1	1.9	1.2
12	9.5	1.0	8.9	3.1	4.3	6.9	19.0	6.2	3.8	3.7	1.9	1.4
13	5.5	1.3	3.5	2.6	3.3	32	24	5.7	3.6	3.6	1.9	7.2
14	1.8	1.2	2.3	1.8	2.8	26	105	5.5	3.5	3.4	2.0	3.0
15	4.5	.8	9.7	8.8	2.4	11.5	128	5.4	3.4	3.3	1.8	1.8
16	4.8	.9	17.0	6.5	2.2	7.1	126	5.1	5.1	3.6	1.7	1.4
17	10.1	4.1	5.0	7.9	2.1	5.6	59	5.2	5.4	3.8	1.7	1.3
18	2.9	2.0	3.0	4.4	2.0	4.8	30	6.3	4.2	3.4	1.6	1.2
19	1.8	1.4	2.4	2.3	2.3	4.2	28	5.1	3.5	3.0	1.6	1.2
20	1.6	8.2	2.0	2.6	3.5	3.9	50	7.0	3.3	2.8	1.6	1.2
21	1.4	20.0	2.5	2.2	2.5	3.4	24	22	3.5	3.0	1.5	1.2
22	1.2	8.7	2.0	1.6	3.0	4.9	18.6	9.4	3.7	2.9	1.5	1.1
23	1.0	6.0	1.6	1.4	3.3	42	15.7	6.7	18.3	2.7	1.4	1.0
24	.9	8.2	2.1	1.8	5.8	72	13.4	5.6	12.9	2.6	1.4	1.0
25	.8	4.5	1.9	1.8	12.2	27	15.7	5.0	6.3	2.7	1.4	1.0
26	.8	7.3	3.9	1.5	10.4	14.4	15.7	4.6	4.2	2.9	1.4	1.0
27	.8	3.4	1.8	5.8	4.8	10.8	22	4.4	3.9	2.7	1.4	1.0
28	.8	2.3	1.5	2.3	3.2	3.9	15.7	4.2	6.8	2.9	1.4	1.0
29	1.2	2.3	1.4	1.6	14.3	7.7	11.4	.....	12.0	2.5	1.6	1.2
30	1.2	2.9	1.8	1.4	12.9	7.2	19.4	.....	18.7	2.5	1.7	1.4
31	1.0	1.8	.....	1.7	.....	6.4	18.6	.....	8.2	.....	1.5	.....

Monthly discharge of Waiakoali Stream near Waimea, Kauai, for the year ending June 30, 1921.

Month.	Discharge.			Second-foot (mean).	Total run-off.	
	Million gallons per day.				Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July	10.1	0.7	2.10	3.25	65.1	200
August	20.0	.8	3.31	5.12	108	315
September	17.0	1.0	3.76	5.82	113	346
October	8.8	1.2	2.81	4.35	87.1	267
November	35	1.4	6.28	9.72	188	578
December	72	2.9	12.9	20.0	400	1,230
January	128	5.6	32.4	50.1	1,000	3,030
February	22	4.2	7.69	11.9	215	661
March	30	3.3	7.32	11.3	237	696
April	11.4	2.5	4.12	6.37	124	379
May	2.9	1.4	1.86	2.88	57.7	177
June	7.2	1.0	1.49	2.31	44.7	137
The year	128	.7	7.20	11.1	2,030	8,070

KOAIE STREAM AT ELEVATION 3,700 FEET, NEAR WAIMEA, KAUI.

LOCATION.—At elevation 3,700 feet 4 miles east of Mohihi station, a mile below swamps, and 13 miles northeast of Waimea (27 miles by trail from Waimea by way of Kokee).

RECORDS AVAILABLE.—July 1, 1919, to June 30, 1921.

GAGE.—Stevens continuous water-stage recorder; installed September 5, 1919.

DISCHARGE MEASUREMENTS.—Made by wading or from cable 200 feet upstream from gage.

CHANNEL AND CONTROL.—Channel covered with boulders and cobblestones and flanked by steep high banks; straight for 100 feet above and 400 feet below station. Control is bedrock across stream forming low falls. Right end is low and blocked by cobblestones and boulders which may shift slightly. Control is too wide to be very sensitive at low stages.

EXTREMES OF DISCHARGE.—Maximum stage recorded, 5.70 feet at 12.40 p. m. January 16 (discharge estimated, 3,230 million gallons per day or 5,000 second-feet); minimum stage recorded, 0.47 foot from 1 to 2 a. m. July 7 (discharge, 2.1 million gallons per day or 3.2 second-feet).

1919-1921: Maximum stage recorded January 16, 1921. Minimum stage recorded September 28, 1919 (discharge, 1.3 million gallons per day or 2.0 second-feet).

DIVERSIONS.—None.

REGULATION.—None.

OBJECT OF STATION.—To determine amount of flood water available for storage for use in irrigating high-level lands above Waimea and Kekaha.

UTILIZATION.—After it reaches Waimea River low water is used for power and irrigation.

ACCURACY.—Stage-discharge relation changed by flood of January 16. Rating curves both fairly well defined between 2 and 80 million gallons per day. Operation of water-stage recorder satisfactory. Records good.

Discharge measurements of Koaie Stream at elevation 3,700 feet, near Waimea, Kauai, during the year ending June 30, 1921.

Date.	Made by—	Gage height (feet).	Discharge.	
			Second-feet.	Million gallons per day.
July 29	M. H. Carson.....	0.80	28	18.2
Aug. 25	do.....	.77	25	16.3
Sept. 29	B. F. Rush.....	.61	5.8	3.8
Nov. 6	do.....	.60	4.9	3.2
Dec. 14	do.....	1.20	125	81
Jan. 25	do.....	1.10	113	73
Mar. 17	W. C. Renshaw.....	.61	10.0	6.5
May 8	B. F. Rush.....	.56	7.4	4.8

Daily discharge, in million gallons per day, of Koaie Stream at elevation 3,700 feet near Waimea, Kauai, for the year ending June 30, 1921.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	3.9	6.1	8.5	5.0	15.0	7.8	6.1	17.3	30.0	6.7	8.0	4.4
2	5.0	7.2	19.1	51	22	5.6	19.3	9.3	68	3.0	5.0	3.4
3	3.4	14.8	22	9.4	39	8.8	20	6.0	11.4	4.2	11.8	3.8
4	3.0	21	10.3	6.1	7.8	6.1	66	6.3	10.6	8.0	17.0	3.4
5	2.6	7.8	8.3	3.6	3.9	.....	221	6.7	8.6	16.4	17.0	8.1
6	2.3	3.8	12.1	7.9	5.6	.....	165	5.5	7.3	8.2	14.0	2.8
7	2.2	3.2	75	46	91	.....	62	4.7	5.2	25	6.0	2.7
8	2.3	2.7	17.1	11.1	97	.....	149	4.2	4.2	119	5.2	3.0
9	2.2	2.7	39	5.0	9.4	.....	80	3.7	8.7	32	5.5	4.4
10	2.6	3.9	42	3.4	27	.....	44	3.4	3.4	10.0	4.4	3.4
11	28	3.9	39	4.4	14.6	.....	64	3.4	3.3	5.5	3.7	3.0
12	25	12.4	52	35	6.1	.....	96	3.3	3.1	5.2	3.4	9.0
13	8.3	30	10.3	21	3.9	.....	174	3.1	3.0	19.5	3.3	4.2
14	3.8	5.6	8.3	8.3	3.4	.....	492	3.3	3.0	8.6	3.3	13.5
15	32	3.4	23	81	3.2	15.5	590	9.6	2.8	5.7	3.3	6.7
16	29	3.4	71	30	3.0	6.6	110	6.1	5.5	15.0	3.1	5.7
17	35	14.6	10.3	61	2.8	3.9	234	4.8	15.8	12.0	8.0	21
18	7.2	16.3	7.2	19.0	2.6	3.4	52	8.0	8.3	9.1	3.0	7.9
19	5.0	5.6	7.2	7.2	10.3	3.2	54	4.7	3.9	6.7	7.8	4.7
20	9.4	35	5.0	31	11.1	2.8	141	6.4	3.7	5.5	5.4	5.2
21	6.6	57	5.6	11.1	19.0	2.6	28	60	14.0	14.2	5.9	3.7
22	5.6	20	9.4	5.0	17.9	21	12.6	10.5	5.5	5.0	8.6	3.1
23	3.6	21	25	3.8	16.3	174	9.3	5.2	42	11.9	4.6	3.1
24	3.3	51	24	5.0	28	268	8.0	4.4	22	36	3.7	3.3
25	3.0	43	30	4.4	37	30	79	3.7	7.6	22	3.3	3.7
26	2.8	57	21	4.4	29	8.3	46	3.4	4.4	15.3	3.1	5.2
27	5.6	14.6	8.8	17.1	20	4.4	98	3.3	4.2	11.6	2.8	4.7
28	19.0	41	6.1	7.8	7.8	3.6	16.5	3.1	19.7	6.0	2.8	8.7
29	14.6	11.1	7.8	3.8	45	3.6	8.0	.....	41	16.4	2.8	10.0
30	6.1	6.1	12.0	3.3	27	3.4	37	.....	56	15.9	3.6	10.6
31	7.8	10.8	.....	3.9	.....	3.3	25	.....	12.6	.....	7.2	.....

NOTE.—No record and discharge in million gallons per day estimated by comparison with flow of adjacent streams as follows: Dec. 5-10, 35; Dec. 11-14, 45.

Monthly discharge of Koaie Stream at elevation 3,700 feet, near Waimea, Kauai, for the year ending June 30, 1921.

Month.	Discharge.			Second-foot (mean).	Total run-off.	
	Million gallons per day.				Million gallons.	Acres-foot.
	Maximum.	Minimum.	Mean.			
July	35	2.2	9.36	14.5	290	890
August	57	2.7	17.3	26.8	536	1,656
September	75	5.0	21.2	32.8	636	1,950
October	81	3.3	16.6	25.7	516	1,580
November	97	2.6	20.9	32.3	626	1,920
December	268	2.6	31.5	48.7	975	3,000
January	1,110	6.1	136	210	4,210	12,900
February	60	3.1	7.62	11.8	213	655
March	68	2.8	14.0	21.7	435	1,330
April	119	4.2	16.2	25.1	485	1,490
May	17.0	2.8	5.86	9.07	182	557
June	42	2.7	6.96	10.8	209	641
The year	1,110	2.2	25.5	39.5	9,310	28,600

WAIALAE RIVER AT ELEVATION 3,700 FEET, NEAR WAIMEA, KAUAI.

LOCATION.—At elevation 3,700 feet, 2 miles below swamps and 15 miles by trail northeast of Waimea, by way of Gay's mountain house.

RECORDS AVAILABLE.—January 26, 1920, to June 30, 1921, at present site, and August 1, 1910, to January 25, 1916, at old site 2 miles downstream from present location.

GAGE.—Stevens continuous water-stage recorder.

DISCHARGE MEASUREMENTS.—Made by wading.

CHANNEL AND CONTROL.—Channel, rocky boulder-strewn bed with steep high banks; straight for 300 feet above and 100 feet below station. Control solid rock shoulder about 15 feet below intake.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 8.44 feet at 1.30 p. m. January 16 (discharge, estimated at 4,500 million gallons per day or 6,960 second-feet); minimum stage recorded during year, 0.86 foot at 11 p. m. June 24 (discharge, 3.3 million gallons per day or 5.1 second-feet).

1920-1921: Maximum stage recorded January 16, 1921; minimum stage recorded, 0.75 foot at 1 a. m. May 17, 1920 (discharge, 2.4 million gallons per day or 3.7 second-feet).

DIVERSIONS.—None.

REGULATION.—None.

OBJECT OF STATION.—To determine amount of flood water available for storage for use in irrigating high-level lands above Waimea and Kekaha.

UTILIZATION.—After it reaches Waimea River low water is used for irrigation.

ACCURACY.—Stage-discharge relation permanent. Rating curve fairly well defined between 2 and 150 million gallons per day. Operation of water-stage recorder satisfactory. Records good.

Discharge measurements of Waialae River at elevation 3,700 feet, near Waimea, Kauai, during the year ending June 30, 1921.

Date.	Made by—	Gage height (feet).	Discharge.	
			Second-feet.	Million gallons per day.
July 30	M. H. Carson	1.00	7.5	4.8
Aug. 25	do	1.82	104	67
Sept. 29	J. E. Stewart	1.16	12.0	7.8
Nov. 7	B. F. Rush	1.10	9.3	6.0
Dec. 15	do	1.27	19.0	12.3
Jan. 26	do	1.37	29	18.7
Mar. 18	do	1.03	7.7	5.0
May 8	E. M. Pickop	.94	6.3	4.1

Discharge, in million gallons per day, of Wailae River at elevation 3,700 feet, near Waimea, Kauai, for the year ending June 30, 1921.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1.....	4.4	4.4	7.2	5.4	8.2	6.9	5.9	15.0	13.7	4.6	5.1	4.2
2.....	4.3	4.3	11.4	55	14.0	5.8	15.4	8.2	47	4.0	4.2	3.6
3.....	3.8	6.1	12.6	8.0	31	7.7	14.2	6.7	7.5	3.6	8.3	3.8
4.....	3.4	9.2	6.4	5.9	7.2	6.2	47	6.4	5.8	13.3	7.5	4.4
5.....	3.1	4.6	5.8	5.0	5.3	8.0	232	6.7	5.4	7.8	7.8	3.4
6.....	3.1	3.6	5.9	6.2	5.3	22	210	5.8	4.7	5.1	6.9	3.1
7.....	3.1	3.1	49	43	53	17.7	57	5.3	4.2	7.8	4.6	3.2
8.....	3.0	3.0	9.0	8.2	80	68	143	5.0	4.0	112	5.3	3.3
9.....	2.9	3.0	22	5.8	7.7	39	83	4.6	3.7	17.5	5.8	3.5
10.....	3.0	3.4	28	4.8	12.4	38	55	4.4	3.7	5.9	4.3	3.4
11.....	6.7	3.5	24	8.0	9.5	12.4	67	4.3	3.6	4.7	3.6	3.0
12.....	9.7	9.0	45	39	5.9	23	109	4.2	3.4	4.3	3.4	5.2
13.....	5.3	16.3	8.2	20.0	5.1	153	122	4.1	3.4	11.7	3.5	38
14.....	3.7	4.4	6.2	8.2	4.8	50	342	4.0	3.3	5.6	3.8	10.0
15.....	32	3.4	9.9	65	4.4	4.4	424	12.5	3.3	4.7	3.6	4.8
16.....	17.1	3.3	62	22	4.2	7.7	1,090	5.6	3.6	8.6	3.4	3.8
17.....	26	5.6	8.2	56	4.1	6.2	178	4.8	9.8	6.9	3.2	26
18.....	5.6	8.0	6.7	13.3	4.0	5.4	40	7.2	5.5	5.8	3.2	5.6
19.....	4.6	4.3	5.9	7.2	4.8	5.1	24	5.0	3.7	4.8	5.4	3.6
20.....	5.6	6.5	5.1	22	6.2	4.7	123	7.4	3.5	4.4	4.3	3.4
21.....	5.0	36	5.1	9.0	11.8	4.4	29	80	5.4	8.1	4.1	2.4
22.....	4.4	15.7	7.2	8.1	10.7	21	13.3	9.3	4.3	5.6	4.7	2.2
23.....	3.8	11.9	15.3	6.4	11.8	180	8.7	5.8	15.0	6.7	3.6	2.4
24.....	3.6	30	14.4	5.9	18.4	281	7.2	4.8	10.7	22	3.4	2.2
25.....	3.4	28	17.7	5.6	26	34	44	4.3	4.8	9.9	3.3	2.5
26.....	3.2	45	14.3	5.3	21	10.0	34	4.1	3.8	8.8	3.1	2.9
27.....	3.6	8.0	7.2	9.0	15.9	6.9	70	3.8	3.6	7.6	3.0	2.9
28.....	7.4	32	5.8	6.4	6.2	5.8	15.8	3.7	6.0	5.1	3.2	5.6
29.....	7.7	8.0	6.2	5.3	31	5.6	8.0	.....	12.0	7.6	3.3	5.0
30.....	4.8	5.1	7.7	4.7	19.4	5.3	44	.....	25	8.0	3.6	3.4
31.....	4.8	4.7	.....	4.7	.....	4.8	36	.....	5.9	.....	5.6	.....

Monthly discharge of Wailae River at elevation 3,700 feet, near Waimea, Kauai, for the year ending June 30, 1921.

Month.	Discharge.			Total run-off.		
	Million gallons per day.			Second-foot (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July.....	32	2.9	6.52	10.1	202	820
August.....	45	3.0	10.8	16.7	333	1,030
September.....	62	5.1	14.6	22.6	439	1,340
October.....	65	4.7	15.4	23.8	478	1,470
November.....	80	4.0	15.0	23.2	449	1,390
December.....	281	4.4	34.1	52.8	1,060	3,240
January.....	1,090	5.9	119	184	3,690	11,300
February.....	80	3.7	8.68	13.4	243	746
March.....	47	3.3	7.72	11.9	239	734
April.....	112	3.6	11.1	17.2	332	1,010
May.....	8.3	3.0	4.45	6.89	138	423
June.....	38	2.2	5.69	8.80	171	524
The year.....	1,090	2.2	21.3	33.0	7,780	23,800

WAIALAE RIVER AT ELEVATION 800 FEET, NEAR WAIMEA, KAUAI

LOCATION.—Half a mile above confluence with Waimea River and 10 miles north of Waimea.

RECORDS AVAILABLE.—December 31, 1915, to January 15, 1921, when station was discontinued. Data from December 19, 1916, to June 30, 1918, have been revised in Water-Supply Paper 515.

GAGE.—Gurley printing water-stage recorder.

DISCHARGE MEASUREMENTS.—Made by wading or from cable.

CHANNEL AND CONTROL.—One channel at all stages; straight for 120 feet above and 200 feet below gage; right bank sloping and brushy; left bank vertical and clean. Control composed of boulders, shifting.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 5.30 feet at 11.30 p. m. December 23 (discharge, about 1,020 million gallons per day, or 1,580 second-feet); minimum stage recorded during year, 0.67 foot, from 9 to 12 a. m. July 10 (discharge, 2.7 million gallons per day or 4.2 second-feet).

1915-1921: Maximum stage recorded, 6.55 feet at 10.30 p. m. December 18, 1916 (discharge, approximately 1,700 million gallons per day or 2,630 second-feet); minimum stage recorded, on July 10, 1920.

DIVERSIONS.—None.

REGULATION.—None.

OBJECT OF STATION.—To determine discharge above all diversions. Territorial land and water leased to Kekaha Sugar Co.

UTILIZATION.—Water used for irrigation of sugar cane, rice, and taro, and for domestic supply.

ACCURACY.—Stage-discharge relation not permanent but unchanged during period July 1, 1920, to January 15, 1921. Rating curves fairly well defined. Operation of water-stage recorder satisfactory. Records fair.

Discharge measurements of Waialae River at elevation 800 feet, near Waimea, Kauai, during the year ending June 30, 1921.

Date.	Made by—	Gage height (feet).	Discharge.	
			Second-feet.	Million gallons per day.
July 26	M. H. Carson	0.70	4.7	3.1
Aug. 21	do	1.59	45.5	29.5
Oct. 1	B. F. Rush	.96	12.1	7.8
Nov. 9	do	1.26	21.4	13.8
Dec. 16	do	1.30	25.5	16.4
Jan. 28	do	1.22	61	38.5
Mar. 19	W. C. Renshaw	.58	15.0	9.7

Discharge, in million gallons per day, of Waialae River at elevation 800 feet, near Waimea, Kauai, for the year ending June 30, 1921.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.
1.....	5.0	5.8	5.5	7.2	8.1	10.7	11.5
2.....	5.5	4.8	11.8	47	16.9	7.4	18.6
3.....	4.7	5.6	18.6	14.2	31	9.1	21
4.....	3.8	15.4	9.4	8.3	11.8	8.1	42
5.....	3.4	7.2	6.8	6.0	7.0	8.1	175
6.....	3.1	4.8	5.6	5.8	5.8	23	225
7.....	3.0	3.7	30	39	31	17.5	68
8.....	2.8	3.2	15.5	13.2	73	65	130
9.....	2.8	3.0	19.5	8.1	13.8	28	93
10.....	2.8	3.0	28	5.8	13.5	48	73
11.....	3.1	4.0	28	7.0	15.8	18.9	72
12.....	14.2	6.7	39	35	8.8	17.8	114
13.....	8.9	23	13.5	24	7.0	144	123
14.....	4.7	7.0	8.1	15.0	6.0	58	415
15.....	27	4.4	7.0	48	5.5	25	415
16.....	17.6	3.5	53	28	5.9	16.4	.....
17.....	31	6.8	13.8	47	4.7	12.6	.....
18.....	9.1	.....	8.6	21	4.7	10.4	.....
19.....	5.8	.....	7.6	11.8	4.8	9.1	.....
20.....	6.6	.....	6.2	28	7.8	8.1	.....
21.....	6.2	.....	5.8	15.8	7.2	7.2	.....
22.....	5.2	.....	6.6	19.1	18.8	16.8	.....
23.....	4.4	.....	12.9	13.1	14.4	214	.....
24.....	3.8	.....	17.8	8.8	20.0	371	.....
25.....	3.5	.....	14.8	7.8	18.5	84	.....
26.....	3.1	.....	22	6.6	30	33	.....
27.....	3.0	15.8	9.1	12.6	23	22	.....
28.....	5.3	29	7.2	9.6	9.6	17.8	.....
29.....	12.9	15.5	5.8	6.8	21	15.1	.....
30.....	6.6	7.8	9.9	5.5	29	13.5	.....
31.....	5.2	6.0	.....	5.2	.....	11.8	.....

NOTE.—No record Aug. 18-26. Discharge estimated by comparison with Waialae River at elevation 3,700 feet, at about 23 million gallons per day.

Monthly discharge of Waialae River near Waimea, Kauai, at elevation 800 feet, for the year ending June 30, 1921.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-foot (mean).	Million gallons.	Acres-feet.
	Maximum.	Minimum.	Mean.			
July.....	31	2.8	7.23	11.2	224	688
August.....	.....	3.0	12.7	19.6	398	1,220
September.....	53	5.5	14.9	23.1	447	1,370
October.....	48	5.2	16.9	26.1	526	1,610
November.....	73	4.7	15.8	24.4	474	1,450
December.....	371	7.2	43.6	67.5	1,350	4,150
January 1-15.....	.....	.....	.....	.....	2,000	6,140
The period.....	.....	.....	.....	.....	5,410	16,600

KEKAHA DITCH AT CAMP NO. 1, NEAR WAIMEA, KAUAI.

LOCATION.—800 feet below intake and 85 feet below Kekaha Sugar Co.'s weir, 8 miles by trail north of Waimea.

RECORDS AVAILABLE.—October 26, 1917, to June 30, 1921. Staff at flume No. 4, one mile below intake, March 18, 1916, to August 2, 1917; weir, 85 feet above present site, November 8, 1907, to June 30, 1915.

GAGE.—Vertical staff; read by Pokina Tanaguchi.

DISCHARGE MEASUREMENTS.—Made from upper end of covered section of ditch.

CHANNEL AND CONTROL.—Ditch about 9 feet wide cut in soft lava rock; straight for 100 feet above and below gage. Control is concrete-lined section of ditch and probably permanent.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 3.65 feet at 7 p. m. January 4 (discharge, 67 million gallons per day, or 104 second-feet); water shut off December 25 to 28.

1907-1921: Maximum stage recorded in January, 1921. Water occasionally shut off.

DIVERSIONS.—Ditch diverts part of flow of Waimea River.

REGULATION.—By head gates.

OBJECT OF STATION.—To measure water diverted from river by ditch. Land and water owned by Territory and leased to Kekaha Sugar Co.

UTILIZATION.—Water used for irrigation of sugar cane and for domestic supply.

ACCURACY.—Stage-discharge relation practically permanent. Curve well defined above 10 million gallons per day. Gage read to hundredths twice daily. Records good for all stages.

Discharge measurements of Kekaha ditch at camp No. 1, near Waimea, Kauai, during the year ending June 30, 1921.

Date.	Made by—	Gage height (feet).	Discharge.	
			Second-feet.	Million gallons per day.
July 26	M. H. Carson.....	2.15	44	28.5
Aug. 21	.....do.....	3.12	85	55
Oct. 1	J. E. Stewart.....	2.86	72	46.5
Nov. 9	B. F. Rush.....	3.38	89	58
Dec. 16	.....do.....	3.38	91	59
Jan. 28	.....do.....	1.89	34.5	22.4
Mar. 19	.....do.....	3.08	73	47

Discharge, in million gallons per day, of Kekaha ditch at camp No. 1, near Waimea, Kauai, for the year ending June 30, 1921.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1.....	37	51	53	43	48	59	7.6	12.5	59	56	58	34
2.....	45	40	45	45	56	53	12.5	12.5	62	56	43	32
3.....	34	43	59	59	59	53	26	12.5	67	48	43	32
4.....	32	59	53	37	59	48	45	12.5	62	48	62	35
5.....	30	53	45	31	43	45	51	12.5	65	56	62	32
6.....	29	37	37	30	37	65	67	13.2	67	56	62	30
7.....	29	32	59	59	59	65	19.4	12.5	67	56	48	30
8.....	30	28	59	59	59	65	38	12.5	65	59	40	30
9.....	30	28	59	45	59	65	26	19.4	62	62	45	29
10.....	30	32	59	36	59	65	23	30	56	62	40	31
11.....	51	32	59	32	59	65	21	31	51	62	37	29
12.....	59	40	59	59	59	65	28	35	51	53	35	37
13.....	59	59	59	59	48	65	19.4	45	43	56	37	56
14.....	45	45	59	53	43	65	48	48	40	62	38	56
15.....	45	30	59	51	38	65	48	51	40	51	36	45
16.....	59	26	59	59	35	65	34	51	51	56	32	40
17.....	59	48	59	59	32	62	7.6	53	67	62	32	45
18.....	56	51	59	59	31	59	5.5	51	67	62	32	48
19.....	40	45	56	59	45	53	6.5	51	53	51	31	37
20.....	43	48	43	53	59	45	6.5	51	51	45	40	35
21.....	43	59	53	59	51	45	7.6	51	53	53	34	32
22.....	40	59	40	56	56	51	9.3	51	59	53	40	30
23.....	37	59	59	51	59	45	8.2	51	53	48	36	29
24.....	34	59	59	48	59	28	6.5	56	67	56	34	29
25.....	32	59	59	45	59	.....	9.5	56	67	62	32	31
26.....	30	59	59	49	59	.....	11.0	56	67	56	34	32
27.....	29	59	51	59	59	.....	10.2	56	51	59	32	31
28.....	37	59	40	59	56	.....	11.8	56	59	51	35	38
29.....	56	59	35	40	59	4.5	11.8	.....	67	51	35	45
30.....	43	59	53	35	59	4.8	9.5	.....	67	56	37	43
31.....	40	45	.....	40	.....	5.0	10.2	.....	67	.....	38	.....

NOTE.—Jan. 17 and 18 only one reading a day. No flow Dec. 25-28.

Monthly discharge of Kekaha ditch at camp No. 1, near Waimea, Kauai, for the year ending June 30, 1921.

Month.	Discharge.			Second-foot (mean).	Total run-off.	
	Million gallons per day.				Million gallons.	Acres-feet.
	Maximum.	Minimum.	Mean.			
July.....	59	29	49.7	63.0	1,260	3,879
August.....	59	26	47.2	73.0	1,460	4,490
September.....	59	35	53.6	82.9	1,610	4,930
October.....	59	30	49.0	75.8	1,520	4,660
November.....	59	31	52.1	80.6	1,566	4,800
December (27 days).....	65	4.5	50.9	78.8	1,380	4,220
January.....	67	5.5	20.8	32.2	646	1,980
February.....	56	12.5	37.5	58.0	1,050	3,220
March.....	67	40	58.8	91.0	1,820	5,590
April.....	62	45	55.5	85.9	1,660	5,110
May.....	62	31	39.8	61.6	1,240	3,790
June.....	56	29	36.1	55.9	1,080	3,320
The year (361 days).....	67	4.5	45.1	69.8	16,300	50,000

KEKAHA DITCH BELOW TUNNEL NO. 12, NEAR WAIMEA, KAUAI:

LOCATION.— $7\frac{1}{2}$ miles below intake, 2 miles by trail from Waimea, and half a mile below diversion for Waimea domestic supply.

RECORDS AVAILABLE.—April 7, 1908, to November 30, 1914, and July 20, 1916, to June 30, 1921.

GAGE.—Vertical staff.

DISCHARGE MEASUREMENTS.—Made from bridge 100 yards below gage.

CHANNEL AND CONTROL.—Channel cut in lava rock; fairly straight in vicinity of gage. Control is old wooden weir.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 3.60 feet at 8 a. m. January 15 and 16 (discharge, 50 million gallons per day or 77 second-feet); minimum stage, water shut off December 25 to 31.

1916-1921: Maximum stage recorded, 4.0 feet March 1-2, 1919, (discharge, 53 million gallons per day or 82 second-feet); minimum, water shut off occasionally.

DIVERSIONS.—Small amount is diverted above station for domestic supply and occasionally for irrigation of rice and taro.

REGULATION.—By head gates.

OBJECT OF STATION.—To determine discharge above first important lateral, also determine ditch losses between intake and station. Territorial land and water.

UTILIZATION.—Water used for irrigation of sugar cane, rice, and taro and for domestic supply.

ACCURACY.—Stage-discharge relation changed slightly December 24. Rating curves well defined from 10 to 50 million gallons per day, used July 1 to December 24 and December 25 to June 30. Gage read to hundredths once a day. Records good.

Discharge measurements of Kekaha ditch below tunnel No. 12, near Waimea, Kauai, during the year ending June 30, 1921.

Date.	Made by—	Gage height (feet).	Discharge.	
			Second-feet.	Million gallons per day.
July 24	M. H. Carson.....	2.30	41	26.5
Aug. 11	do.....	2.42	42.5	27.5
Sept. 25	J. E. Stewart.....	3.16	61	39.5
Nov. 2	B. F. Rush.....	3.22	65	42
Dec. 11	do.....	3.43	66	43
Mar. 19	do.....	3.05	64	41.5
May 16	do.....	2.26	45	29

* Published as "Kekaha ditch at weir below tunnel No. 12, near Waimea, Kauai" in Water-Supply Paper 318 and as "Kekaha ditch at tunnel No. 12, near Waimea, Kauai" in Water-Supply Papers 399 and 430.

Discharge, in million gallons per day, of Kekaha ditch below tunnel No. 12, near Waimea, Kauai, for the year ending June 30, 1921.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	30	39	37	34	31	40	13.8	16.6	43	39	37	32
2	37	34	37	31	37	39	13.8	16.6	43	39	36	29
3	33	33	39	39	37	39	48	16.6	43	39	30	27
4	31	42	39	37	40	37	39	16.6	43	39	37	27
5	28	42	37	30	36	36	39	23	43	39	39	27
6	27	34	34	28	31	39	50	26	43	39	37	24
7	24	31	40	34	36	39	31	31	43	39	36	24
8	22	25	42	40	44	40	18	31	43	41	29	24
9	24	24	46	37	44	46	32	39	39	41	29	24
10	22	22	40	30	42	40	44	39	39	39	29	26
11	30	27	40	28	42	40	21	43	39	48	26	26
12	44	25	40	36	40	40	29	43	39	39	26	26
13	44	37	40	39	39	40	19.4	48	39	36	26	39
14	40	39	39	37	36	44	39	44	39	39	26	43
15	31	28	39	34	36	42	50	43	39	37	26	37
16	42	19.3	40	40	33	42	50	41	44	36	26	34
17	44	25	40	40	31	42	3.9	41	44	41	27	31
18	42	40	40	40	30	42	10.2	37	44	41	26	39
19	37	39	40	39	28	40	5.8	43	39	39	26	31
20	33	30	36	36	37	40	4.8	43	37	37	31	27
21	36	42	37	39	39	39	9.0	46	39	37	31	27
22	33	40	34	37	39	39	9.0	39	43	39	31	26
23	30	39	34	39	39	40	9.0	39	43	36	32	24
24	27	39	37	36	39	39	9.0	39	43	34	29	24
25	25	37	39	37	40	.....	9.0	39	39	41	26	24
26	25	37	39	36	40	.....	9.0	39	39	39	26	24
27	24	36	37	36	40	.....	15.2	39	39	37	26	24
28	24	36	36	39	39	.....	13.8	39	41	37	26	24
29	37	39	30	37	40	.....	13.8	.....	41	37	26	36
30	36	39	31	31	40	.....	13.8	.....	41	36	29	39
31	34	33	.....	27	.....	.....	13.8	.....	39	.....	29	.....

NOTE.—No flow on days for which discharge is not given. Discharge for May 15 interpolated.

Monthly discharge of Kekaha ditch below tunnel No. 12, near Waimea, Kauai, for the year ending June 30, 1921.

Month.	Discharge.			Second-foot (mean).	Total run-off.	
	Million gallons per day.				Million gallons.	Acres.
	Maximum.	Minimum.	Mean.			
July.....	44	22	32.1	49.7	996	3,050
August.....	42	19.3	33.9	52.5	1,050	3,230
September.....	42	30	37.8	58.5	1,130	3,480
October.....	40	27	35.6	55.1	1,100	3,390
November.....	44	28	37.5	58.0	1,120	3,450
December (24 days).....	44	36	39.9	61.7	958	2,940
January.....	50	3.9	22.1	34.2	686	2,100
February.....	48	16.6	35.7	55.2	1,000	3,070
March.....	44	37	41.0	63.4	1,270	3,900
April.....	48	34	38.7	59.9	1,160	3,560
May.....	39	26	28.7	44.4	889	2,730
June.....	43	24	29.0	44.9	869	2,670
The year (358 days).....	50	3.9	34.2	52.9	12,200	37,800

WAIMEA DITCH NEAR WAIMEA, KAUAI.

LOCATION.— $1\frac{1}{2}$ miles below intake, at lower portal of tunnel No. 22, $2\frac{1}{2}$ miles north of Waimea, and $1\frac{1}{2}$ miles below old station.

RECORDS AVAILABLE.—March 20, 1916, to June 30, 1921, at present site. November 4, 1911, to September 30, 1913, at old location at ditch intake, $1\frac{1}{2}$ miles above present location. Station was reestablished February 28, 1916, but there was no gage height reading till March 20, 1916. Station was discontinued June 30, 1921.

GAGE.—Vertical staff.

DISCHARGE MEASUREMENTS.—Made from foot plank 10 feet below gage.

CHANNEL AND CONTROL.—Clean channel about 4 feet wide in solid rock.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 1.45 feet at 9.15 a. m. August 21 (discharge, 8.0 million gallons per day or 12.4 second-foot); minimum stage recorded during year, 0.10 foot at 6.50 a. m. February 6 (discharge, 0.1 million gallons per day or 0.15 second-foot).

1916-1921: Maximum stage recorded, 1.50 feet at 7.35 a. m. November 11, 1919 (discharge, 8.4 million gallons per day, or 13.0 second-foot); minimum stage recorded, ditch occasionally dry.

DIVERSIONS.—Ditch diverts from Waimea River.

REGULATION.—None.

OBJECT OF STATION.—To determine amount of Territorial water diverted for Waimea plantation (fee simple land).

UTILIZATION.—Water used for irrigation of sugar cane and for domestic supply.

ACCURACY.—Stage-discharge relation practically permanent. Rating curve well defined above 1 million gallons per day. Gage read to hundredths twice daily. Records good.

Discharge measurements of Waimea ditch near Waimea, Kauai, during the year ending June 30, 1921.

Date.	Made by—	Gage height (feet).	Discharge.	
			Second-foot.	Million gallons per day.
July 24	M. H. Carson.....	1.03	6.8	4.4
Aug. 11	do.....	1.00	6.3	4.1
Sept. 25	B. F. Rush.....	1.16	8.1	5.2
Dec. 16	do.....	.82	4.3	2.8
Mar. 19	do.....	.38	.75	.45
May 16	E. M. Pickop.....	.91	5.5	3.5

Discharge, in million gallons per day, of Waimea ditch near Waimea, Kauai, for the year ending June 30, 1921.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1.....	4.6	6.6	6.6	6.6	5.7	2.7	.....	3.6	.....	.....	.....	3.3
2.....	5.0	6.2	5.5	7.0	7.5	3.0	.....	1.5	.....	.....	.....	3.6
3.....	4.6	6.2	3.9	6.6	.....	3.2	1.0	1.2	.....	.....	.....	3.6
4.....	4.4	7.5	3.3	6.6	.....	3.3	1.8	1.9	.....	.....	.....	4.4
5.....	3.4	7.5	2.1	6.6	6.6	4.0	3.2	2.5	.....	.....	.....	3.2
6.....	3.3	5.7	1.6	5.7	7.0	4.2	2.7	1.1	.....	.....	3.0	3.2
7.....	3.4	5.0	3.2	6.6	6.2	5.0	.8	3.3	.....	.....	2.7	2.7
8.....	3.6	4.6	5.0	6.6	5.7	5.7	2.0	2.3	.....	.....	2.0	2.5
9.....	3.6	4.0	7.0	6.6	5.7	5.2	.8	3.3	.....	.....	.....	2.7
10.....	3.4	4.0	7.5	6.2	4.6	5.0	.8	3.3	.....	.....	.....	3.2
11.....	5.0	5.5	7.0	5.7	.....	4.8	.8	2.3	.....	.....	3.0	3.3
12.....	6.2	5.0	2.3	6.6	.....	2.0	1.4	3.6	.....	.....	2.6	2.7
13.....	6.6	6.6	6.2	6.6	.....	2.5	1.6	1.1	.....	.....	3.2	6.3
14.....	5.7	7.0	6.2	7.0	4.0	1.6	1.6	.8	.....	.....	2.6	4.8
15.....	5.5	6.6	6.2	8.0	3.9	1.5	.8	.8	.....	.....	2.6	5.5
16.....	7.5	6.6	6.6	5.7	3.4	2.0	.8	.8	.....	.....	2.7	4.0
17.....	6.6	6.6	6.2	6.6	3.2	1.8	1.1	.8	.....	.....	3.2	3.9
18.....	6.6	7.0	5.7	6.2	3.0	2.0	3.3	2.5	.....	.....	6.6	3.4
19.....	5.7	7.5	5.7	6.6	3.3	3.3	1.1	1.1	.....	.....	5.7	3.6
20.....	5.5	6.6	5.0	6.6	3.6	1.5	3.3	2.7	.....	.....	6.6	3.9
21.....	6.6	7.5	5.5	6.6	3.6	1.1	2.6	.....	.....	.....	3.9	3.2
22.....	5.0	7.5	5.7	6.6	4.0	.....	1.1	.....	.....	.....	5.2	2.7
23.....	4.6	7.5	6.6	6.6	4.0	.....	3.0	.....	.....	.....	5.2	2.5
24.....	5.5	7.5	7.5	5.7	4.2	.....	1.1	.....	.....	.....	3.3	3.0
25.....	4.6	7.5	8.0	5.5	4.6	.....	3.3	.....	.....	.....	3.0	2.7
26.....	4.2	7.5	6.2	5.5	4.8	.....	2.0	.....	.....	.....	.....	3.0
27.....	4.0	7.0	6.6	6.6	4.8	.....	1.5	.....	.....	.....	.....	3.2
28.....	4.2	6.6	6.6	6.6	4.4	1.1	2.0	.....	.....	.....	5.0	3.2
29.....	6.6	7.5	6.6	6.6	4.6	1.1	3.4	.....	.....	.....	.....	3.2
30.....	6.8	6.6	6.6	6.2	4.0	1.0	1.4	.....	.....	.....	.....	3.2
31.....	5.5	6.6	.....	4.4	.....	1.0	1.5	.....	.....	.....	.....	.....

NOTE.—No record, and discharge in million gallons per day estimated as follows: Nov. 3-4, 8; Nov. 11-13, 4; Dec. 22-27, 1.1; Jan. 1-2, 1.0; May 9-10, 2.5; May 26-27, 4; May 29-31, 4. Discharge interpolated Sept. 14, Dec. 30, May 15, and June 26. No record Feb. 21 to May 5. No estimate for this period.

Monthly discharge of Waimea ditch near Waimea, Kauai, for the year ending June 30, 1921.

Month.	Discharge.			Total run-off.		
	Million gallons per day.			Second-foot (mean).	Million gallons.	Acre-foot.
	Maximum.	Minimum.	Mean.			
July.....	7.5	3.3	5.08	7.86	158	493
August.....	7.5	4.0	6.50	10.1	202	618
September.....	8.0	1.6	5.62	8.70	169	517
October.....	8.0	4.4	6.37	9.86	198	606
November.....	.....	3.0	4.81	7.44	144	443
December.....	5.7	.....	2.46	3.81	76.2	234
January.....	3.4	.....	1.74	2.69	53.8	166
June.....	5.5	2.5	3.36	5.20	101	309

HANAPEPE RIVER AT KOULA, NEAR ELEELE, KAUAI.

LOCATION.—Immediately below junction with Manuahi Stream, 500 feet below siphon at Koula, and 5 miles north of Eleele.

RECORDS AVAILABLE.—May 13, 1917, to January 22, 1921. August 16, 1910, to December 15, 1916, at old site half a mile above present gage. Station was discontinued January 22, 1921.

GAGE.—Vertical staff gage; read by D. E. Horner. Friez water-stage recorder at old site carried away by flood of December 18, 1916.

DISCHARGE MEASUREMENTS.—Made by wading at gage.

CHANNEL AND CONTROL.—Boulders and gravel; shifting in floods. One channel at all stages; straight for 1,200 feet above and 300 feet below station. Left bank high and steep; right bank low and sloping and is overflowed at high stages. Both banks covered with brush.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 10.50 feet at 9 a. m. January 17 (discharge, about 3,300 million gallons per day or 5,100 second-feet); minimum stage recorded during year, 0.50 foot from 5 p. m. July 7 to 5 p. m. July 9 (discharge, 8.6 million gallons per day or 13.3 second-feet).

1910-1921: Maximum stage at old station above inflow of Manuahi Stream occurred December 18, 1916 (water-stage recorder and shelter carried away by flood and stage not recorded) (discharge in excess of 5,000 million gallons per day); minimum stage recorded, 0.95 foot December 30 and 31, 1913 (discharge, 7.1 million gallons per day or 11 second-feet).

DIVERSIONS.—Hanapepe ditch and a small ditch for irrigation of rice divert part of flow above station.

REGULATION.—By diversions only.

OBJECT OF STATION.—To determine discharge of stream at boundary between fee simple land above and Territorial lands below.

UTILIZATION.—Part of flow diverted for irrigation of sugar cane, rice, and taro.

ACCURACY.—Stage-discharge relation not permanent, but shifts confined within narrow limits. Rating curves fairly well defined between 10 and 200 million gallons per day. Gage read to hundredths once daily. Records fair.

Discharge measurements of Hanapepe River at Koula, near Eleele, Kauai, during the year ending June 30, 1921.

Date.	Made by—	Gage height (feet).	Discharge.	
			Second-feet.	Million gallons per day.
July 23	M. H. Carson	0.55	13.4	8.7
Aug. 23	do	1.26	71	46
Sept. 24	B. F. Rush	1.20	60	38.6
Nov. 10	do	.92	40	25.5
Dec. 10	do	1.92	109	109
Feb. 5	do	1.80	131	85

Discharge, in million gallons per day, of Hanapepe River at Koula, near Eleele, Kauai, for the year ending June 30, 1921.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.
1	13.0	18.8	164	13.0	47	14.8	104
2	10.3	18.8	121	48	32	13.0	116
3	10.0	45	134	15.2	58	11.9	121
4	9.4	21	88	15.9	41	28	184
5	8.9	16.6	14.8	16.6	26	33	910
6	8.9	12.5	17.5	53	13.0	46	300
7	8.6	10.8	350	88	16.6	20.0	1,690
8	8.6	9.6	44	35	41	110	1,570
9	8.6	26	376	18.8	26	49	300
10	10.3	11.6	128	13.0	39	88	350
11	21	9.6	121	23	21	83	325
12	200	57	33	110	15.2	46	375
13	11.6	230	24	116	13.0	250	300
14	10.0	14.8	13.0	17.5	11.9	116	375
15	121	12.5	12.5	376	11.4	68	910
16	200	10.3	99	105	11.4	43	2,300
17	99	14.4	13.0	134	10.8	36	2,150
18	21	26	12.5	110	12.5	21	525
19	13.0	14.8	13.7	450	78	16.6	820
20	14.8	11.6	14.4	260	121	13.0	325
21	16.6	240	11.9	58	33	11.6	280
22	11.6	116	22	260	49	10.8	180
23	9.6	200	41	58	97	1,210	
24	9.3	172	42	21	56	300	
25	8.9	94	128	15.9	38	121	
26	18.8	260	33	17.5	134	121	
27	88	88	25	13.0	56	49	
28	220	121	15.2	12.5	24	78	
29	49	14.8	23	11.9	68	128	
30	180	11.9	30	11.4	16.6	121	
31	49	18.4		19.2		116	

Monthly discharge of Hanapepe River at Koula, near Eleele, Kauai, for the year ending June 30, 1921.

Month.	Discharge.			Second-foot (mean).	Total run-off.	
	Million gallons per day.				Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July	220	8.6	47.4	73.3	1,470	4,510
August	260	9.6	62.2	96.2	1,930	5,920
September	375	11.9	72.1	112	2,160	6,640
October	450	11.4	81.0	125	2,510	7,710
November	134	10.8	40.4	62.5	1,210	3,720
December	1,210	10.8	109	169	3,370	10,400
January (22 days)	2,300	104	657	1,020	14,500	20,300
The period					27,200	59,200

HANAPEPE DITCH AT KOULA, NEAR ELEELE, KAUAI.

LOCATION.—At first flume below siphon at Koula, 4 miles below intake and 4½ miles north of Eleele.

RECORDS AVAILABLE.—January 25, 1910, to June 30, 1921, when station was discontinued.

GAGE.—Vertical staff; read by D. E. Horner.

DISCHARGE MEASUREMENTS.—Made in flume.

CHANNEL AND CONTROL.—Wooden flume; straight for 50 feet above and 100 feet below gage; some vegetal growth on bottom and sides of flume. Control fairly permanent.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 3.18 feet at 7.30 a. m. June 15 (discharge, 35 million gallons per day, or 54 second-feet); ditch occasionally dry.

1910-1921: Maximum stage recorded during period of record ⁴ 3.20 feet at 7 a. m. April 10, 1918 (discharge, 36 million gallons per day or 56 second-feet); ditch occasionally dry.

DIVERSIONS.—Diverts part of flow of Hanapepe River.

REGULATION.—By head gates.

OBJECT OF STATION.—To determine discharge of ditch at boundary between fee simple land above and Territorial land below.

UTILIZATION.—Water used for domestic supply and for irrigation of sugar cane.

ACCURACY.—Stage-discharge relation practically permanent. Rating curve fairly well defined. Gage read to hundredths once daily. Records fair.

Discharge measurements of Hanapepe ditch at Koula, near Eleele, Kauai, during the year ending June 30, 1921.

Date.	Made by—	Gage height (feet).	Discharge.	
			Second-feet.	Million gallons per day.
July 23	M. H. Carson	2.65	41.5	27
Aug. 23	do	3.02	53	34.5
Oct. 7	B. F. Rush	3.05	49	31.5
Dec. 10	do	2.91	47	30.5
Mar. 28	W. C. Renshaw	2.82	44	28.5

⁴ Supersedes erroneous figure published in Water-Supply Papers 430, 445, 465 and 485.

Discharge, in million gallons per day, of Hanapepe ditch at Koula, near Eleele, Kauai, for the year ending June 30, 1921.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1.....	32	32	32	31	32	31	23		31	29	33	29
2.....	32	32	32	32	32	31	22		32	29	32	29
3.....	29	32	32	32	32	31	22		32	26	35	29
4.....	28	32	32	32	32	31	23		32	28	33	31
5.....	28	32	32	32	32	32	29		32	32	32	29
6.....	25	32	32	32	32	32			32	32	32	29
7.....	25	32	32	32	32	32			32	32	32	31
8.....	24	30	32	32	32	32			32	33	32	29
9.....	24	32	32	32	32	32			32	32	32	28
10.....	24	30	33	32	32	32			32	32	32	28
11.....	29	28	32	32	31	32			32	32		28
12.....	33	32	32	32	30	32			32	32		32
13.....	32	32	24	32	29	33			32	32		33
14.....	28	32	32	32	28	32		22	32	32		32
15.....	32	29	32	33	29	32		24	31	32		35
16.....	32	28	32	33	28	32		28	32	33		32
17.....	33	32	32	32	28	32		29	33	32		33
18.....	23	32	32	32	30	32		31	32	32	12.8	32
19.....	31	32	32	32	32	29		29	32	32	31	32
20.....	32	28	31	32	32	32		24	32	33	33	31
21.....	32	32	30	32	32	32		32	33	32	32	31
22.....	30	32	32	32	32	31		32	33	32	31	31
23.....	28	32	32	32	32	32		31	32	33	32	31
24.....	27	33	32	32	32	14.0		31	32	32	31	31
25.....	25	32	32	32	32	12.8		15.2	32	33	29	33
26.....	28	33	21	32	32	12.8		28	31	33	29	32
27.....	31	32	32	32	32	16.4		20.0	29	32	29	32
28.....	32	32	32	32	32			23	29	33	32	32
29.....	32	32	32	32	32				32	33	32	33
30.....	32	32	32	32	31				32	33	31	33
31.....	32	32		32					29		30	

NOTE.—Water turned out of ditch as follows: July 18, 7 hours; September 13, 6 hours; and September 26, 8 hours. Discharge interpolated April 29 and May 31. No flow on days for which discharge is not given.

Monthly discharge of Hanapepe ditch at Koula, near Eleele, Kauai, for the year ending June 30, 1921.

Month.	Discharge.			Total run-off.		
	Million gallons per day.			Second-foot (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July (30-17/24 days).....	33	23	29.5	45.6	905	2,780
August.....	33	28	31.5	48.7	975	3,000
September (29-5/12 days).....	33	21	31.9	49.4	939	2,880
October.....	33	31	32.1	49.7	994	3,050
November.....	33	28	31.2	48.3	937	2,870
December (27 days).....	33	12.8	29.1	45.0	785	2,410
January (5 days).....	29	22	23.6	36.5	118	362
February (15 days).....	32	15.2	26.2	40.5	393	1,210
March.....	33	29	31.7	49.0	982	3,020
April.....	33	28	31.8	49.2	955	2,930
May (24 days).....	33	12.8	30.7	47.5	738	2,260
June.....	35	28	31.0	48.0	931	2,850
The period (314½ days).....	35	12.8	30.7	47.5	9,650	29,600

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MANUAAHI STREAM AT KOULA, NEAR ELEELE, KAUAI.

LOCATION.—100 feet above confluence with Hanapepe River at Koula 5 miles north of Eleele.

RECORDS AVAILABLE.—May 13, 1917, to December 23, 1920, when station was discontinued.

GAGE.—Vertical staff, read by D. E. Horner.

DISCHARGE MEASUREMENTS.—Made by wading at gage.

CHANNEL AND CONTROL.—One channel at all stages. Straight for 100 feet above and below gage. Banks slope gently. Control composed of large boulders; fairly permanent.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 3.20 feet at 6 a. m. December 13 (discharge, over 190 million gallons per day, or 294 second-foot); stage was considerably higher on December 24 when gage was washed out. Minimum stage, 0.21 foot 5 p. m. August 11 (discharge, 0.65 million gallons per day or 1.0 second-foot).

1917-1920: Maximum stage recorded over 6.00 feet at 5 p. m. January 15, 1920 (discharge, over 810 million gallons per day or 1,250 second-foot); minimum stage recorded, 0.20 foot June 24, 1919 (discharge, 0.05 million gallons per day or 0.08 second-foot).

DIVERSIONS.—None.

REGULATION.—None.

OBJECT OF STATION.—To determine discharge of stream in connection with water rights of Territorial lands below. Water rises on fee simple land.

UTILIZATION.—Manuahi Stream empties into Hanapepe River; part of flow of latter is diverted for irrigation of sugar cane, rice, and taro.

ACCURACY.—Stage-discharge relation not permanent. Rating table fairly well defined between 0.3 and 30 million gallons per day. Gage read to hundredths once daily. Records fair.

Discharge measurements of Manuahi Stream at Koula, near Eleele, Kauai, during the year ending June 30, 1921.

Date.	Made by—	Gage height (feet).	Discharge.	
			Second-foot.	Million gallons per day.
July 23	M. H. Carson.....	0.26	1.3	0.85
Aug. 23	.....do.....	.72	13.3	8.6
Sept. 24	J. E. Stewart.....	.70	8.8	5.7
Nov. 10	B. F. Rush.....	.50	5.1	3.3
Dec. 10	.....do.....	1.25	41.5	27

Discharge, in million gallons per day, of *Manuahi Stream* at *Koula*, near *Eleele*, *Kauai*, for the year ending *June 30, 1921*.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1.....	3.1	1.1	4.4	4.6	9.6	4.6
2.....	1.8	1.5	2.4	16.0	6.9	3.9
3.....	1.7	2.4	3.1	5.0	8.5	3.5
4.....	1.6	1.8	2.4	4.2	6.9	3.9
5.....	1.4	1.4	1.7	3.9	5.5	4.2
6.....	1.4	1.0	2.6	5.5	4.6	6.4
7.....	1.2	.9	39	6.2	6.0	5.5
8.....	1.1	.8	18.4	4.6	5.5	38
9.....	1.1	1.0	37	3.9	6.0	11.8
10.....	1.0	.9	22	3.1	3.1	17.4
11.....	1.4	.6	16.7	6.4	2.8	16.7
12.....	2.4	1.8	11.8	8.5	2.6	15.4
13.....	1.8	41	6.7	20	2.1	123
14.....	1.4	1.8	2.7	7.0	1.8	16.0
15.....	3.1	1.7	2.1	96	1.7	7.4
16.....	20.0	1.2	4.2	22	1.5	7.4
17.....	13.4	1.4	5.0	30	1.4	6.4
18.....	4.0	1.8	3.1	15.4	1.2	4.6
19.....	4.0	1.5	2.4	49	2.4	3.9
20.....	5.0	1.4	2.3	20.0	5.0	3.9
21.....	1.8	20	1.7	10.8	3.1	3.1
22.....	1.6	8.8	2.1	7.4	4.0	2.8
23.....	.9	9.6	4.2	25	6.4	72
24.....	.8	28	6.9	19.3	5.0	.....
25.....	.7	4.0	8.5	16.0	4.6	.....
26.....	1.2	49	7.4	9.1	7.4	.....
27.....	.9	22	5.0	7.4	6.4	.....
28.....	1.4	20.0	3.5	4.2	5.5	.....
29.....	1.8	5.0	3.9	3.9	7.4	.....
30.....	1.4	3.9	6.0	3.7	5.0	.....
31.....	1.1	3.9	.....	4.6	.....	.....

Monthly discharge of *Manuahi Stream* at *Koula*, near *Eleele*, *Kauai*, for the year ending *June 30, 1921*.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-foot (mean).	Million gallons.	Acre-foot.
	Maximum.	Minimum.	Mean.			
July.....	20.0	0.7	2.76	4.27	85.5	263
August.....	49.	.6	7.78	12.0	241.	740
September.....	39.	1.7	7.97	12.3	239.	734
October.....	96.	3.1	14.3	22.1	443.	1,360
November.....	9.6	1.2	4.66	7.21	140.	429
December (23 days).....	.....	.....	.....	.....	382.	1,170
The period.....	.....	.....	.....	.....	1,530	4,700

SOUTH FORK OF WAILUA RIVER NEAR LIHUE, KAUAI.

LOCATION.—Two-thirds mile above Waiehu Falls at original location (moved one-third mile downstream on November 18, 1918) and 7 miles northeast of Lihue.

RECORDS AVAILABLE.—December 10, 1911, to June 30, 1921.

GAGE.—Stevens continuous water-stage recorder installed November 19, 1918, Friez water-stage recorder December 19, 1911, to November 8, 1918. Staff gage readings December 10-16, 1911.

DISCHARGE MEASUREMENTS.—Made from cable or by wading.

CHANNEL AND CONTROL.—One channel at all stages, straight for 600 feet above and 300 feet below station; right bank steep and high, left bank slopes gently. Control composed of solid rock ledge somewhat shifting owing to boulders lodging in water-worn grooves at left end of control.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 10.40 feet at 11.30 a. m. January 16 (discharge, 23,500 million gallons per day or 36,400 second-feet); minimum stage recorded, 1.11 feet at 8 p. m. June 11 (discharge, 7.2 million gallons per day or 11.1 second-feet).

1911-1921: Maximum stage recorded, 11.25 feet at 7.25 p. m. January 16, 1920 (discharge, 29,000 million gallons per day or 44,900 second-feet); minimum stage recorded, 2.06 feet (on old gage) at 6 p. m. October 7, 1918 (discharge, 2.8 millions gallons per day or 4.3 second-feet).

DIVERSIONS.—Several diversions above station for irrigation and power development.

REGULATION.—By diversions above station only.

OBJECT OF STATION.—To determine feasibility of diversion for homesteads after stream enters Territorial lands.

UTILIZATION.—Water going to waste, except a small amount used for irrigation of rice and taro.

ACCURACY.—Stage-discharge relation practically permanent. Rating curves well defined between 4 and 15,000 million gallons per day. Operation of water-stage recorder satisfactory except March 29 to May 3. Records good.

Discharge measurements of South Fork of Wailua River near Lihue, Kauai, during the year ending June 30, 1921.

Date.	Made by—	Gage height (feet).	Discharge.	
			Second-feet.	Million gallons per day.
July 21	M. H. Carson	1.81	42.	27.
Aug. 19	do	1.64	31.	20.
Oct. 10	B. F. Rush	1.99	66.	43.
Oct. 29	do	2.09	75.	48.5
Dec. 20	do	2.06	79.	51.
Feb. 11	do	2.34	126.	81.
Mar. 11	W. C. Renshaw	1.83	57.	36.5
May 13	E. M. Pickop	1.46	22.7	14.7

Discharge, in million gallons per day, of South Fork of Waikua River near Lihue, Kauai, for the year ending June 30, 1921.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	May.	June.
1.....	22	29	184	41	163	83	83	219	63	.....	32
2.....	18.9	27	98	91	129	71	95	167	101	.....	17.9
3.....	21	31	98	80	155	64	116	146	54	.....	25
4.....	18.6	52	69	62	114	60	163	136	46	.....	25
5.....	15.2	53	52	50	77	82	379	136	43	69	13.5
6.....	12.2	32	62	57	71	.....	505	116	40	75	11.3
7.....	14.0	22	360	108	196	.....	465	108	36	34	13.2
8.....	14.3	17.9	123	115	169	.....	1,550	108	34	27	12.2
9.....	12.5	21	212	58	77	118	572	97	33	23	11.3
10.....	19.3	17.9	167	44	73	169	303	90	32	19.2	9.2
11.....	119	14.6	191	50	66	116	219	100	31	17.3	7.9
12.....	130	76	204	123	53	273	326	89	30	16.3	28
13.....	46	210	95	64	45	1,970	621	81	27	85	125
14.....	22	35	70	62	42	204	715	77	27	56	52
15.....	34	21	64	140	39	136	1,270	100	24	27	39
16.....	31	17.0	154	155	28	100	8,900	83	24	23	24
17.....	195	24	69	320	17.9	83	1,596	74	78	19.2	37
18.....	31	65	52	108	22	69	1,260	78	37	19.2	24
19.....	24	23	57	430	220	60	1,290	70	20.0	54	21
20.....	32	16.0	53	720	80	48	2,970	71	21	28	21
21.....	31	99	47	186	226	41	414	161	58	25	16.0
22.....	19.2	52	58	108	114	55	249	78	28	33	13.8
23.....	14.9	95	48	95	128	718	219	68	46	19.2	13.8
24.....	12.2	151	70	100	136	1,420	195	62	51	17.3	11.8
25.....	13.0	83	81	76	139	245	1,080	58	29	16.3	18.4
26.....	25	209	140	64	233	136	793	57	23	13.5	19.8
27.....	89	87	78	80	201	98	1,090	54	16.3	12.5	18.6
28.....	178	108	50	94	108	84	475	48	16.3	33	16.0
29.....	131	66	46	59	116	98	234	.....	.....	54	16.0
30.....	56	69	66	51	100	84	714	.....	.....	42	11.5
31.....	32	157	.....	69	.....	76	880	.....	.....	30	.....

NOTE.—No record Dec. 6-8 and Mar. 29 to May 3. Discharge estimated for Dec. 6-8 by comparison with flow at other Waikua River station and with flow of Apahala River, at 160 million gallons per day.

Monthly discharge of South Fork of Waikua River near Lihue, Kauai, for the year ending June 30, 1921.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-foot (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July.....	178	12.2	41.7	64.5	1,290	3,970
August.....	210	14.6	63.9	98.9	1,980	6,080
September.....	360	46	104	161	3,120	9,570
October.....	729	41	125	193	3,860	11,900
November.....	233	17.9	111	172	3,340	10,200
December.....	1,970	41	234	362	7,240	22,300
January.....	8,900	83	959	1,480	29,700	91,200
February.....	219	48	97.6	151	2,780	8,390
June.....	125	7.9	23.5	36.4	765	2,160

NORTH FORK OF WAILUA RIVER AT ELEVATION 650 FEET, NEAR LIHUE, KAUAI.

LOCATION.— $1\frac{1}{2}$ miles above intake of Kanaha ditch and 10 miles northwest of Lihue.

RECORDS AVAILABLE.—September 21, 1914, to June 30, 1921. Records available for old station at elevation 500 feet August 1 to October 28, 1910, and December 28, 1910, to September 25, 1914.

GAGE.—Stevens continuous water-stage recorder.

DISCHARGE MEASUREMENTS.—Made by wading or from cable.

CHANNEL AND CONTROL.—One channel at all stages; straight for 80 feet above and 50 feet below gage; right bank steep and high; left bank slopes gently. Control composed of boulders; fairly permanent.

EXTREMES OF DISCHARGE.—Maximum stage during year, 7.64 feet January 16 (discharge, 1,520 million gallons per day or 2,350 second-feet); minimum stage recorded, 1.16 feet 9 p. m. November 17 (discharge, 19.8 million gallons per day or 30.6 second-feet).

1914-1921: Maximum stage recorded, 9.5 feet at 6.30 p. m. September 26, 1914 (discharge, computed from extension of rating curve, approximately 2,200 million gallons per day, or 3,400 second-feet); minimum stage recorded, 0.93 foot May 7, 1919 (discharge, 12.9 million gallons per day, or 20.0 second-feet).

DIVERSIONS.—None.

REGULATION.—None.

OBJECT OF STATION.—To determine feasibility of diversion above or near this elevation. Territorial land and water. Important in relation to proposed homesteads.

UTILIZATION.—Part of flow diverted for irrigation of sugar cane, but most of it is wasted.

ACCURACY.—Stage-discharge relation changed by flood of January 16. Rating curve used July 1 to January 16 well defined, between 20 and 400 million gallons per day. Rating curve used January 17 to June 30 well defined between 20 and 200 million gallons per day. Operation of water-stage recorder unsatisfactory until September 23; satisfactory September 24 to June 30. Records good when water-stage recorder was operating.

Discharge measurements of North Fork of Wailua River at elevation 650 feet, near Lihue, Kauai, during the year ending June 30, 1921.

Date.	Made by—	Gage height (feet).	Discharge.	
			Second-feet.	Million gallons per day.
July 22	M. H. Carson.....	1.27	35	22.6
Aug. 19	do.....	1.26	41	26.5
Sept. 23	B. F. Rush.....	1.50	58	37.5
Oct. 29	do.....	1.33	41	26.4
Dec. 7	do.....	1.35	44	28.5
Feb. 10	do.....	1.12	43	28
Mar. 25	W. C. Renshaw.....	1.07	42.5	27.5
May 14	B. F. Rush.....	1.27	61	39

Discharge, in million gallons per day, of North Fork of Waialua River at elevation 650 feet, near Lihue, Kauai, for the year ending June 30, 1921.

Day.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1.		26	46	30	32	58	55	28	35	28
2.		61	43	26	39	48	46	28	38	28
3.		62	56	30	36	41	26	28	88	40
4.		34	48	37	55	38	28	39	38	28
5.		27	30	33	133	35	26	35	45	26
6.		33	34	50	146	32	24	39	35	26
7.		49	85	43	168	32	24	60	32	28
8.		65	71	71	337	32	24	226	30	26
9.		31	36	42	174	30	22	71	28	24
10.		27	49	58	90	28	22	41	28	24
11.		30	34	50	81	33	22	35	26	27
12.		48	28	103	137	30	22	35	26	55
13.		34	25	359	211	28	22	37	50	67
14.		32	23	86	420	28	22	30	34	32
15.		67	22	67	620	30	22	32	28	34
16.		56	21	58	920	28	24	35	26	32
17.		77	20	49	620	28	40	32	26	42
18.		47	22	40	568	28	22	32	27	28
19.		216	85	33	505	26	22	32	43	30
20.		190	40	26	465	30	31	53	28	26
21.		87	109	23	125	59	33	40	37	26
22.		56	52	67	77	28	24	41	28	26
23.		43	42	288	67	26	39	32	24	26
24.	40	44	54	376	66	24	35	117	26	30
25.	60	33	46	91	297	24	28	62	24	28
26.	60	30	99	50	245	24	24	62	22	35
27.	42	46	72	37	490	22	26	62	22	30
28.	29	33	36	31	137	22	30	35	40	30
29.	30	26	45	32	72	.....	52	103	53	26
30.	32	25	40	28	167	.....	77	67	39	50
31.	.....	33	.....	26	99	.....	32	.....	30	.....

NOTE.—July 1 to Sept. 23, no record. Discharge for July and August not estimated. Discharge in million gallons per day for Sept. 1-23 estimated as follows: Sept. 1-3, 80; Sept. 4-6, 35; Sept. 7-12, 100; Sept. 13-17, 60; Sept. 18-23, 30; Estimates by comparison with flow at other Waialua River stations and at Anahola River station.

Monthly discharge of North Fork of Waialua River near Lihue, Kauai, at elevation 650 feet, for the year ending June 30, 1921.

Month.	Discharge.			Total run-off.		
	Million gallons per day.			Second-foot (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
September			57.3	88.7	1,720	5,280
October	216	25	53.8	83.2	1,670	5,120
November	109	20	47.1	72.9	1,410	4,340
December	376	23	75.5	117	2,340	7,180
January	920	32	245	379	7,600	23,300
February	59	22	32.8	50.7	917	2,820
March	77	23	30.5	47.2	946	2,900
April	226	26	52.3	80.9	1,570	4,820
May	88	22	34.1	52.8	1,060	3,240
June	67	24	31.9	49.4	958	2,940
The period.	.....	.....	.....	.....	20,200	61,900

KANAHA DITCH NEAR LIHUE, KAUAI.

LOCATION.—500 feet above point where Kauai Electric Co.'s power line crosses ditch and 9 miles north of Lihue.

RECORDS AVAILABLE.—August 6, 1910, to June 30, 1921.

GAGE.—Vertical staff. New datum May 28, 1913, read by K. Shimokawa and S. Morimoto.

DISCHARGE MEASUREMENTS.—Made in wooden flume at gage.

CHANNEL AND CONTROL.—Gage in rectangular wooden flume; straight for 30 feet above and 10 feet below gage. Control composed of soft lava rock; fairly permanent between times of cleaning ditch.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 2.48 feet at 9.38 a. m. August 28 (discharge, 19 million gallons per day or 29 second-feet); minimum stage recorded during year, ditch dry December 13 to 27 and January 15 to February 7.

1910-1921: Maximum stage recorded, 2.64 feet at 8.10 a. m. September 20, 1919 (discharge, 23 million gallons per day or 36 second-feet); ditch occasionally dry.

DIVERSIONS.—Ditch diverts part of flow of North Fork of Wailua River.

REGULATION.—By head gates.

OBJECT OF STATION.—To determine discharge of ditch which diverts water from river and delivers it to fee simple and Territorial lands leased to Lihue plantation, Territorial water. Important station relative to North Wailua homesteads.

UTILIZATION.—Water used for irrigation of sugar cane and for domestic supply.

ACCURACY.—Stage-discharge relation practically unchanged throughout the year.

Rating curve fairly well defined between 5 and 20 million gallons per day. Gage read to hundredths once daily. Records fair.

Discharge measurements of Kanaha ditch near Lihue, Kauai, during the year ending June 30, 1921.

Date.	Made by—	Gage height (feet).	Discharge.	
			Second-feet.	Million gallons per day.
July 22	M. H. Carson.....	2.00	22.7	14.7
Aug. 19	do.....	2.11	26	16.8
Oct. 9	J. E. Stewart.....	2.19	25.5	16.4
Oct. 29	B. F. Rush.....	2.20	25	16.3
Dec. 7	do.....	1.90	22.7	14.7
Feb. 10	do.....	1.39	14.9	9.6
Mar. 25	W. C. Renshaw.....	.99	11.8	7.6
May 14	E. M. Pickop.....	1.99	23.9	15.4

Discharge, in million gallons per day, of Kanaha ditch near Lihue, Kauai, for the year ending June 30, 1921.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	15.8	16.6	18.2	16.6	17.4	13.4	9.2	.....	10.0	8.1	10.7	14.2
2	15.8	15.8	16.6	17.4	17.4	13.4	9.6	.....	9.6	8.8	10.7	14.2
3	15.0	16.6	15.8	17.4	17.4	13.4	9.6	.....	9.6	9.2	13.4	14.2
4	14.2	16.6	16.6	17.4	17.4	14.2	9.6	.....	9.6	9.6	10.7	14.2
5	15.0	16.6	16.6	18.2	17.4	13.4	8.8	.....	9.6	10.0	11.8	14.2
6	15.0	16.6	17.4	17.4	16.6	13.4	9.6	.....	9.6	9.2	11.8	14.2
7	15.8	16.6	17.4	17.4	16.6	12.6	9.6	.....	9.6	10.0	11.1	13.4
8	15.8	16.6	16.6	18.2	16.6	12.6	8.8	11.8	9.6	11.8	10.7	13.4
9	15.0	15.8	17.4	17.4	18.2	11.8	9.2	11.8	9.2	10.0	11.8	13.4
10	17.4	15.8	16.6	16.6	18.2	11.1	9.6	11.8	9.2	8.8	11.8	13.4
11	17.4	15.8	15.8	18.2	17.4	10.0	9.6	11.1	9.2	8.4	11.8	13.4
12	16.6	18.2	15.8	17.4	17.4	6.6	9.6	11.8	9.2	8.1	13.4	13.4
13	15.8	18.2	17.4	18.2	17.4	.....	9.6	11.8	9.2	11.1	13.4	15.8
14	15.0	16.6	17.4	17.4	17.4	.....	9.6	11.8	9.2	9.2	15.0	15.0
15	16.6	16.6	17.4	17.4	16.6	.....	.....	11.8	9.2	9.6	15.0	15.8
16	16.6	15.0	17.4	18.2	16.6	.....	.....	11.1	9.6	10.3	14.2	14.2
17	16.6	17.4	15.8	17.4	17.4	.....	.....	11.1	9.6	9.6	14.2	15.0
18	16.6	18.2	16.6	17.4	17.4	.....	.....	10.3	9.6	9.6	13.4	14.2
19	16.6	16.6	16.6	18.2	17.4	.....	.....	10.3	9.6	11.1	15.8	14.2
20	16.6	15.8	16.6	18.2	17.4	.....	.....	10.3	9.6	11.8	15.0	14.2
21	16.6	17.4	16.6	17.4	18.2	.....	.....	10.0	9.6	11.8	14.2	14.2
22	16.6	16.6	17.4	17.4	18.2	.....	.....	10.0	9.6	11.8	14.2	14.2
23	15.8	16.6	17.4	18.2	17.4	.....	.....	9.6	9.6	11.8	13.4	14.2
24	14.2	17.4	17.4	17.4	16.6	.....	.....	9.6	9.6	11.8	13.4	14.2
25	15.0	17.4	17.4	14.2	16.6	.....	.....	9.6	9.6	12.6	14.2	15.8
26	16.6	17.4	17.4	17.4	16.6	.....	.....	9.6	9.6	11.8	14.2	15.8
27	16.6	16.6	17.4	17.4	16.6	.....	.....	9.6	9.6	11.8	13.4	14.2
28	17.4	19.0	16.6	17.4	15.0	9.6	.....	9.6	8.1	11.8	12.6	14.2
29	17.4	17.4	16.6	17.4	14.2	9.6	.....	.....	10.3	12.6	13.4	15.0
30	17.4	16.6	17.4	16.6	15.0	9.6	.....	.....	9.6	12.6	14.2	15.0
31	16.6	18.2	.....	18.2	.....	9.2	.....	.....	8.8	.....	14.2	.....

NOTE.—Discharge for May 31 interpolated. No flow on days for which discharge is not given.

Monthly discharge of Kanaha ditch near Lihue, Kauai, for the year ending June 30, 1921.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July	17.4	14.2	16.1	24.9	499	1,530
August	19.0	15.0	16.9	26.1	523	1,610
September	18.2	15.8	16.9	26.1	508	1,560
October	18.2	14.2	17.5	27.1	541	1,660
November	18.2	14.2	17.0	26.3	510	1,570
December (16 days)	14.2	6.6	11.5	17.8	184	582
January (14 days)	9.6	8.8	9.43	14.6	132	403
February (21 days)	11.8	9.6	10.7	16.6	224	689
March	10.3	8.1	9.47	14.7	294	901
April	12.6	8.1	10.5	16.2	315	967
May	15.8	10.7	13.1	20.3	407	1,250
June	15.8	13.4	14.4	22.3	431	1,330
The period (326 days)	19.0	6.6	14.0	21.7	4,570	14,000

EAST BRANCH OF NORTH FORK OF WAILUA RIVER NEAR LIHUE, KAUAI.

LOCATION.—1,200 feet above confluence with North Fork and 8 miles north of Lihue.

RECORDS AVAILABLE.—July 31, 1912, to June 30, 1921.

GAGE.—Stevens continuous water-stage recorder, December 31, 1914, to June 30, 1921; staff 800 feet below present site July 31, 1912, to September 30, 1914.

DISCHARGE MEASUREMENTS.—Made by wading or from cable.

CHANNEL AND CONTROL.—One channel at all stages; straight for 60 feet above and 400 feet below gage; banks low and wooded. Control composed of boulders; shifting.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 9.07 feet at 11.30 a. m. January 16 (discharge, approximately 2,690 million gallons per day or 4,160 second-feet); minimum stage recorded during year, 1.82 feet at 3.30 p. m. December 17 (discharge, 13.5 million gallons per day or 21 second-feet):

1912-1921: Maximum flow recorded, 8.9 feet at 8 a. m. March 3, 1916 (discharge, approximately 3,000 million gallons per day, or 4,640 second-feet); minimum stage recorded, 1.6 feet March, 1915 (discharge, 7 million gallons per day or 11 second-feet).

DIVERSIONS.—None.

REGULATION.—None.

OBJECT OF STATION.—To determine feasibility of diversion above this point. Territorial land and water. Valuable for prospective homesteads of North Wailua.

UTILIZATION.—After joining North Fork of Wailua River, part of the water is diverted for irrigation of sugar cane, but most of it is wasted.

ACCURACY.—Stage-discharge relation not permanent owing chiefly to growth of moss and grass on control. Rating curves fairly well defined as follows: July 1 to January 16 between 20 and 100 million gallons per day; January 17 to June 30 between 10 and 500 million gallons per day. Operation of water-stage recorder unsatisfactory. Records fair when water-stage recorder was operating.

Discharge measurements of East Branch of North Fork of Wailua River near Lihue, Kauai, during the year ending June 30, 1921.

Date.	Made by—	Gage height (feet).	Discharge.	
			Second-feet.	Million gallons per day.
July 22	M. H. Carson.....	1.90	25.5	16.5
Aug. 19	do.....	2.04	39.5	25.5
Sept. 23	J. E. Stewart.....	1.99	34	22.0
Oct. 28	B. F. Rush.....	2.00	36	23.3
Dec. 8	do.....	2.44	94	61
Feb. 10	do.....	2.06	43.5	28
Mar. 25	W. C. Renshaw.....	1.87	28	18.2
May 14	B. F. Rush.....	2.00	39.8	25.5

Discharge, in million gallons per day, of East Branch of North Fork of Wailua River near Lihue, Kauai, for the year ending June 30, 1921.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1.....	18.9	22.	100	18.4	31	.....	.....	59	36	18.9	.....	17.6
2.....	17.8	21	61	24	30	.....	.....	59	48	17.6	.....	17.6
3.....	17.2	22	53	25	28	.....	.....	49	19.8	17.2	.....	18.5
4.....	16.3	26	39	21	26	.....	.....	45	18.9	20.0	.....	17.2
5.....	15.8	24	33	18.4	17.2	.....	.....	41	18.0	29	.....	15.5
6.....	15.8	18.9	35	23	21	.....	130	38	17.2	27	.....	15.1
7.....	16.7	17.8	71	27	58	23	79	35	16.4	44	.....	15.5
8.....	15.4	17.6	39	33	59	40	336	32	15.9	109	.....	15.1
9.....	14.9	18.4	47	22	28	23	176	31	15.5	51	.....	15.1
10.....	17.2	17.2	43	20.0	34	.....	87	28	15.1	32	.....	14.8
11.....	38	15.8	71	20.0	26	.....	86	30	15.1	25	.....	14.5
12.....	34	26	61	30.0	21	.....	74	26	14.8	23	.....	21
13.....	24	30	40	22.0	19.5	.....	181	24	14.5	22	.....	37
14.....	18.9	18.9	35	20.0	17.2	.....	503	23	14.2	20.0	28	21
15.....	26	18.9	34	42	15.8	.....	890	24	14.2	19.3	18.9	19.8
16.....	25	20.0	63	39	14.9	.....	1,430	22	19.3	18.9	18.0	17.2
17.....	39	27	35	56	14.0	.....	516	21	15.8	19.3	17.2	23
18.....	24	36	32	33	14.9	.....	405	22	14.8	18.0	17.2	18.5
19.....	22	22	.....	156	33	.....	507	19.8	14.2	18.0	19.3	21
20.....	21	21	.....	.....	22	.....	571	19.3	15.4	18.0	17.2	17.6
21.....	21	36	.....	.....	42	.....	164	18.5	19.3	22	17.2	16.8
22.....	16.7	24	.....	.....	27	.....	97	17.6	15.9	18.9	17.2	16.4
23.....	15.8	40.	29	.....	23	.....	70	17.2	48	18.0	15.5	16.4
24.....	15.4	71	24	.....	30	.....	138	16.8	28	.....	17.2	16.4
25.....	17.2	40	29	.....	26	.....	228	16.4	17.6	.....	15.9	18.5
26.....	19.5	70	29	.....	37	.....	216	15.9	15.5	.....	15.5	18.0
27.....	26	41	24	.....	33	.....	241	15.9	14.5	.....	14.5	17.6
28.....	52	53	21	26	19.5	.....	104	15.5	16.4	.....	28	17.6
29.....	31	42	21	21	.....	.....	141	.....	45	.....	35	18.9
30.....	24	38	21	18.9	.....	.....	147	.....	69	.....	25	18.0
31.....	23	160	.....	22	.....	.....	98	.....	23	.....	20.0	.....

NOTE.—No record and discharge in million gallons per day estimated by comparison with flow at other Wailua River stations and at Anahou River stations as follows: Sept. 19-22, 26; Oct. 20-22, 60; Oct. 23-27, 30; Nov. 29-30, 25; Dec. 1-6, 22; Dec. 10-14, 110; Dec. 15-21, 40; Dec. 22-26, 140; Dec. 27-31, 35; Jan. 1-5, 50; Apr. 24-30, 35; May 1-4, 20; May 5-8, 25; May 9-13, 20.

Monthly discharge of East Branch of North Fork of Wailua River near Lihue, Kauai, for the year ending June 30, 1921.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-foot (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July.....	52	14.9	22.6	35.0	700	2,150
August.....	160	15.8	34.1	52.8	1,060	3,240
September.....	100	21	39.6	61.3	1,190	3,680
October.....	156	18.4	34.8	53.8	1,080	3,310
November.....	59	14.0	27.1	41.9	813	2,500
December.....	.....	.....	62.0	95.9	1,920	5,900
January.....	1,430	.....	25.4	39.3	7,860	24,200
February.....	59	15.5	27.9	43.2	782	2,400
March.....	69	14.2	23.1	34.2	636	2,100
April.....	109	17.2	29.0	44.9	871	2,670
May.....	35	14.5	20.5	31.7	637	1,950
June.....	37	14.5	18.2	28.2	547	1,680
The year.....	1,430	14.0	49.7	78.9	18,100	55,800

KAPAHU DITCH NEAR KEALIA, KAUAI.

LOCATION.—500 feet below intake and about 5 miles west of Kealia.

RECORDS AVAILABLE.—April 15, 1909, to May 2, 1914; May 10, 1915, to June 30, 1921.

GAGE.—Stevens continuous water-stage recorder, installed March 4, 1920. Prior to this Stevens 8-day water-stage recorder used; installed May 10, 1915, and replaced original Watson recorder.

DISCHARGE MEASUREMENTS.—Made by 20-foot sharp-crested weir immediately below gage and from foot plank across box flume 100 feet below gage.

CHANNEL AND CONTROL.—Channel straight for 50 feet above weir.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year 2.40 feet 7.10 a. m. January 16 (discharge, 158 million gallons per day or 244 second-feet); minimum stage recorded, 0.03 foot 2 p. m. April 16 and 3 p. m. April 18 (discharge, 0.4 million gallons per day or 0.6 second-foot).

1915-1921: Maximum stage recorded during period of record January 16, 1921; minimum stage water shut off November 23 and 24, 1916.

DIVERSIONS.—Ditch diverts part of flow of Kapaa River.

REGULATION.—Flow regulated by head gates.

OBJECT OF STATION.—To determine amount of water diverted by ditch. Water owned by Territory and part is leased to Makee Sugar Co. Homesteads entitled to a part of water.

UTILIZATION.—Water used for irrigation of sugar cane and for domestic supply.

ACCURACY.—Stage-discharge relation permanent. Rating curve well defined. Operation of water-stage recorder satisfactory except as shown in footnote to table of daily discharge. Records excellent when water-stage recorder was operating; poor for estimated periods.

The following discharge measurement was made by M. H. Carson:

July 20: Gage height, 0.42 foot; discharge, 18.1 second-feet or 11.7 million gallons per day.

Discharge, in million gallons per day, of Kapahi ditch near Kealia, Kauai, for the year ending June 30, 1921.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1.	10.4		16.6	10.4		10.8	15.6	2.8	11.2	15.1	13.0	13.0
2.	10.0		17.1	13.8		11.7	15.6	2.6	11.7	13.4	13.0	15.1
3.	11.7	16.9	19.5	15.1		14.2	15.6		12.5	13.4	19.0	13.0
4.	9.7	22	16.6	11.7		13.4	16.6		12.5	14.7	14.7	12.1
5.	8.5	20.0	13.8	9.7		12.5	14.2		13.0	8.5	20.0	31.2
6.	8.1	13.0	14.7	14.1		12.1	9.3		13.0	8.1	16.6	11.2
7.	10.4	11.7	32	30		11.7	13.0	14.2	12.5	11.8	13.8	12.1
8.	9.3	12.1	20.0	21		11.2	17.2	14.2	11.2	16.1	13.0	11.7
9.	8.1	14.2		13.4		8.9	14.2	13.8	8.9	15.1	12.5	11.2
10.	10.4	12.1		10.8		9.3	13.4	13.8	9.3	14.7	12.1	10.8
11.	27	10.0		11.2		10.0	9.3	16.1	10.4	14.7	12.1	10.4
12.	37	14.7		18.0		10.4	7.8	14.7	11.2	14.2	12.1	22
13.	13.4	22		12.5		9.4	8.9	13.8	11.2	14.2	25	35
14.		11.7		12.5	9.3	5.4	10.0	12.5	11.2	8.7	16.1	16.6
15.		11.7		23	10.4	6.7	11.7	9.7	10.8	8.2	13.4	16.1
16.		14.9		20.0	10.0	8.9	13.5	9.3	13.4	7.1	13.0	12.5
17.		23		28	10.0	13.0	2.1	8.9	15.1	12.1	12.5	13.3
18.		31		19.0	12.1	13.0	1.6	8.9	12.5	7.3	13.4	12.5
19.		15.1		23	12.5	2.8	8.9	11.7	12.1	16.6	15.1	11.2
20.	11.2	14.2		20.0	12.1	4.1	4.1	8.9	12.1	11.7	14.7	12.1
21.	13.4	26			14.2	11.7	4.4	11.2	15.1	8.4	15.1	31.7
22.	10.8	15.6	13.0	18.0	13.1	10.0	4.1	12.5	8.5	13.0	15.1	11.2
23.	9.7	29	13.4	15.6	20.0	6.7	3.8	12.1		7.4	13.0	10.8
24.	9.3	32	16.6	19.5	17.6	6.0	4.1	11.7		12.5	16.1	12.1
25.	10.0	26	20.0	14.2	17.6	5.1	4.1	11.7		8.0	20.0	15.1
26.	12.5	28	17.1	13.4	15.6	5.1	3.6	11.7	8.5	15.1	15.1	14.7
27.	17.1	22	14.2	22	15.1	4.8	3.8	11.7	13.0	18.0	12.0	15.6
28.		16.1	11.2	20.0	15.1	6.7	3.3	11.7	11.4	13.8	33	14.2
29.		15.1	13.0	13.8	12.5	6.7	3.3		14.3	13.0	35	16.6
30.		16.6	14.2	12.5	11.2	5.7	4.2		20.0	17.8	22	16.1
31.		28				7.6	3.1		17.1		16.6	

NOTE.—No record and discharge estimated in million gallons per day, by comparison with stages at Kapaa and Anahola River stations, as follows: July 14-19, 11.5; July 23-31, 20; Aug. 1-2, 14; Sept. 8-16, 18; Sept. 17-31, 14; Oct. 19-21 and Oct. 31 to Nov. 13, no estimate; Feb. 3-6, 4; Mar. 23-25, 15.

Monthly discharge of Kapahi ditch near Kealia, Kauai, for the year ending June 30, 1921.

Month.	Discharge.			Second-foot (mean).	Total run-off.	
	Million gallons per day.				Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July.....			13.5	20.9	417	1,280
August.....	32.5	10.0	18.5	28.6	574	1,760
September.....			16.6	25.7	498	1,530
December.....	14.2	4.8	9.46	14.6	293	900
January.....	17.2	1.6	8.33	12.9	258	792
February.....	16.1		10.1	15.6	283	868
March.....			12.5	19.3	388	1,196
April.....	18.0	7.1	12.3	19.0	369	1,130
May.....	35.	12.1	16.5	25.5	511	1,570
June.....	35.	10.4	14.3	22.1	430	1,320

ANAHOLA RIVER NEAR KEALIA, KAUAI.

LOCATION.—A quarter of a mile above dam at Kiokala and 6 miles northwest of Kealia.

RECORDS AVAILABLE.—August 22 to November 2, 1910; December 30, 1912, to June 30, 1921. Fragmentary record December 15, 1910, to December 28, 1912, at dam a quarter of a mile below present site.

GAGE.—Stevens continuous water-stage recorder March 14, 1920, to June 30, 1921; Friez water-stage recorder August 22 to November 2, 1910, and December 28, 1912, to March 7, 1920.

DISCHARGE MEASUREMENTS.—Made by wading or from footbridge.

CHANNEL AND CONTROL.—One channel at all stages; straight for 75 feet above and below gage; right bank steep and high and covered with underbrush; left bank low for about 40 feet from low-water channel then rises abruptly. Control composed of boulders; permanent for low and medium stages; shifts during floods.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 8.70 feet at 1.30 a. m. December 13 (discharge, approximately 1,250 million gallons per day or 1,930 second-foot); minimum stage recorded, 1.58 feet at 2.30 p. m. June 10 (discharge, 2.4 million gallons per day or 3.7 second-foot).

1910, 1912-1921; Maximum stage recorded during period of record, 12.9 feet at 7.30 a. m. September 26, 1914 (discharge estimated from extension of rating curve, approximately 1,450 million gallons per day or 2,240 second-foot); minimum stage recorded, 1.3 feet February 27 and 28, 1915 (discharge, 2.0 million gallons per day or 3.1 second-foot).

DIVERSIONS.—Part of flow diverted 3 miles above station.

REGULATION.—None except by diversions.

OBJECT OF STATION.—To determine feasibility of additional diversions for sugar-cane irrigation. Water owned by Territory and leased to Makee Sugar Co.

UTILIZATION.—Water used for irrigation of sugar cane.

ACCURACY.—Stage-discharge relation not permanent. Three rating curves were used; one effective July 1 to August 31, one September 1 to January 16 and the other January 17 to June 30. All curves are fairly well defined below 15 million gallons per day but poorly defined above that point. Operation of water-stage recorder satisfactory except January 15-21 and April 5-13. Records fair when water-stage recorder was operating and discharge less than 15 million gallons per day.

Discharge measurements of Anahola River near Kealia, Kauai, during the year ending June 30, 1921.

Date.	Made by—	Gage height (feet).	Discharge.	
			Second-feet.	Million gallons per day.
July 21	M. H. Carson.....	2.19	6.9	4.5
Aug. 20	do.....	2.19	7.3	4.7
Sept. 22	B. F. Rush.....	2.32	9.3	6.0
Oct. 27	do.....	2.56	20.0	12.9
Dec. 6	do.....	2.60	22.2	14.3
Feb. 14	do.....	1.97	13.7	8.8
Mar. 10	W. C. Renshaw.....	1.75	7.9	5.1
May 13	B. F. Rush.....	1.70	5.7	3.7

Discharge, in million gallons per day, of Anahola River near Kealia, Kauai, for the year ending June 30, 1921.

Day	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	4.7	5.0	18.1	5.1	10.7	14.3	6.3	37	16.8	8.0	5.6	3.7
2	4.6	4.6	10.5	6.8	10.4	13.0	7.4	24	18.2	6.7	5.2	4.0
3	4.3	5.8	7.3	6.1	11.0	16.6	7.9	21	5.8	34	5.0	3.2
4	4.2	10.5	3.3	5.6	7.2	16.7	35	18.6	5.6	38	4.7	2.8
5	4.0	9.1	3.2	5.1	6.3	14.3	29	17.0	6.7	.....	5.0	2.6
6	4.0	5.6	4.2	5.5	7.2	17.8	19.4	15.1	6.2	.....	4.9	2.6
7	5.4	5.2	11.8	9.6	25	17.4	10.5	12.8	4.9	.....	4.1	2.6
8	4.3	4.9	3.9	14.4	15.2	24	141	10.5	4.7	.....	3.8	2.5
9	3.9	4.9	5.4	5.8	7.9	15.5	67	9.7	4.6	.....	3.7	2.5
10	6.0	4.7	6.5	5.1	13.2	18.4	26	9.2	4.4	.....	3.6	2.5
11	15.2	4.3	10.3	4.8	9.4	19.7	22	9.4	4.2	.....	3.4	2.6
12	9.8	4.6	7.7	17.5	7.4	75	19.2	8.2	4.1	.....	3.4	7.3
13	8.2	7.9	4.0	5.6	6.5	201	88	7.6	4.1	.....	7.1	15.6
14	5.4	4.7	3.8	5.1	6.1	30	105	8.0	4.0	10.5	5.1	4.5
15	6.8	5.0	4.4	10.2	5.8	17.9	.....	8.2	4.2	8.9	3.7	3.6
16	7.3	4.4	11.9	7.0	5.6	13.3	.....	7.1	6.9	8.2	3.7	3.5
17	8.6	5.2	5.0	18.5	5.5	9.4	.....	7.1	5.4	7.8	3.4	5.6
18	5.0	10.0	4.7	9.2	6.3	7.2	.....	7.3	4.4	7.4	3.4	3.8
19	5.4	6.0	4.5	56	39	6.3	.....	6.4	4.0	6.4	4.0	4.1
20	5.0	4.9	4.8	32	19.3	5.8	.....	6.0	3.3	5.8	3.5	3.7
21	4.7	22	5.1	12.3	36	5.6	.....	5.9	5.4	6.0	3.4	3.6
22	3.4	6.6	6.3	8.8	17.9	29	36	5.6	4.5	5.8	3.4	3.7
23	4.0	12.1	6.1	7.9	12.6	109	28	5.4	58	5.9	3.2	3.5
24	4.2	18.6	6.5	9.4	29	113	24	5.3	33	10.4	3.0	3.5
25	4.2	14.8	9.5	6.8	31	32	79	5.2	8.9	11.3	15.5	3.6
26	5.2	36	8.8	6.5	34	16.7	43	5.0	6.4	6.4	4.2	3.7
27	4.9	11.2	6.8	11.8	30	10.5	47	4.9	5.6	6.2	3.3	3.6
28	24	12.0	5.8	11.3	17.9	8.8	24	4.7	7.1	5.9	9.8	3.6
29	7.0	8.4	6.1	6.8	33	9.1	17.7	.....	35	5.6	13.4	4.6
30	5.2	8.5	5.5	6.5	26	7.6	102	.....	50	5.6	7.6	4.1
31	5.2	70	.....	10.9	.....	6.8	40	.....	11.3	.....	5.0	.....

NOTE.—Jan. 15-21 and Apr. 5-13, no record; discharge in million gallons per day estimated by comparison with the Waialua River stations, as follows: Jan. 15-21, 470; Apr. 5-9, 120; and Apr. 10-13, 30.

Monthly discharge of Anahola River near Kealia, Kauai, for the year ending June 30, 1921.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-foot (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July.....	24	3.9	6.29	9.73	195	598
August.....	70	4.3	10.9	16.9	338	1,040
September.....	18.1	3.2	6.73	10.4	202	620
October.....	56	4.8	10.8	16.7	334	1,030
November.....	39	5.5	16.4	25.4	492	1,510
December.....	201	5.6	29.1	45.0	902	2,770
January.....	.....	6.3	139	215	4,310	13,200
February.....	37	4.7	10.4	16.1	292	894
March.....	58	3.3	11.2	17.3	348	1,070
April.....	.....	5.6	31.0	48.0	921	2,850
May.....	15.5	3.0	5.10	7.89	158	485
June.....	15.6	2.5	4.08	6.24	121	371
The year.....	.....	2.5	23.6	36.5	8,620	26,400

ANAHOLA DITCH ABOVE KANEHA RESERVOIR, NEAR KEALIA, KAUAI.

LOCATION.—At lower end of third tunnel above Kaneha reservoir, 7 miles from Kealia.

RECORDS AVAILABLE.—May 29, 1915, to June 30, 1921.

GAGE.—Stevens continuous water-stage recorder installed April 10, 1920. Stevens 8-day water-stage recorder June 26, 1915 to April 10, 1920, and Friez water-stage recorder May 29 to June 26, 1915.

DISCHARGE MEASUREMENTS.—Made from wooden footbridge at gage above control and spillway or by wading.

CHANNEL AND CONTROL.—Channel at gage is short straight stretch of open ditch cut in firm earth between two tunnels. Control is timber sill on check gate below spillway and rock section of ditch; probably permanent when spillway is not in use.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 6.25 feet at 7.10 a. m. January 16 (discharge, 130 million gallons per day or 200 second-feet); minimum stage recorded, 0.89 foot 7 a. m. December 6 to 9 a. m. December 7 (discharge by measurement, 0.55 million gallons per day or 0.85 second-foot).

1915-1921: Maximum stage recorded in January, 1921; minimum stage recorded in reservoir gates occasionally shut (discharge into reservoir 0.0).

DIVERSIONS.—Diverts from Anahola River.

REGULATION.—By head gates. When Kaneha reservoir is full, water is turned out of ditch at spillway just below gage.

OBJECT OF STATION.—To determine amount of water diverted from Anahola River to Kaneha reservoir. Water owned by Territory and leased to Makee Sugar Co.

UTILIZATION.—Water is stored in Kaneha reservoir for irrigation of sugar cane and for domestic supply.

ACCURACY.—Stage-discharge relation permanent when spillway is closed and reservoir gate opened. Effect of opening spillway on relation of stage to discharge into reservoir not determined but is probably slight and has been neglected. Rating curve well defined below 10 and fairly well defined below 35 million gallons per day. Figures do not include discharge through spillway. Operation of water-stage recorder not satisfactory. Records good except when water was wasting or recorder not operating.

Discharge measurements of Anahola ditch above Kaneha reservoir, near Kealia, Kauai, during the year ending June 30, 1921.

Date.	Made by—	Gage height (feet).	Discharge.	
			Second-feet.	Million gallons per day.
July 20	M. H. Carson	1.44	6.3	4.0
Aug. 20	do	1.90	18.2	11.8
Sept. 22	B. F. Rush	1.63	10.0	6.5
Oct. 27	do	2.15	19.6	12.7
Dec. 6	do	.89	.85	.55
Jan. 8	do	1.90	22.3	14.4
Mar. 26	do	1.42	6.2	4.0
May 13	E. M. Pickop	1.19	2.7	1.75

Discharge, in million gallons per day, of Anahola ditch above Kaneha reservoir, near Kealia, Kauai, for the year ending June 30, 1921.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1			15.0	1.2	8.9		6.2	1.9	7.1	4.4	3.0	3.4
2			11.6	4.3	7.8		7.5	1.6	10.0	4.4	2.8	5.5
3			13.9	4.2	9.8		5.8	1.6	4.5	4.6	4.4	3.2
4			8.6	2.1	6.2		3.7	1.5	5.1	7.7	2.8	3.0
5			6.4	1.8	4.9		3.7	1.4	5.8	6.1	3.0	2.7
6			9.6	4.5	7.4	.55	5.5	1.4	3.9	3.7	3.7	2.6
7			18.0	8.6	8.9	1.2	6.1	4.2	3.6	9.3		2.8
8			9.7	8.3	3.6	1.5		6.0	3.2	10.8		2.7
9			2.6	2.5	1.2			5.6	2.9	7.6		2.5
10				2.2	3.1	1.2		5.2		3.6		2.4
11	14.4			2.0	2.7	1.3		5.7		3.9		2.3
12	7.0			6.9	3.5	2.1		5.1	2.3	4.2		7.3
13	7.5			2.5	4.4			5.0	2.2	4.1		10.8
14	3.9			2.7	4.1			4.7	2.2	3.6	4.7	4.6
15	6.5			12.1	3.9			6.8	3.5	3.3	2.8	3.5
16	8.5			4.9	3.7			4.8	6.2	3.2	2.6	3.0
17	7.5			10.6				4.5	4.5	3.2	2.5	5.2
18	4.0			8.5				4.2	2.8	3.0	3.0	3.0
19	4.7			9.8		6.1		4.0	2.4	3.0	6.3	3.7
20	6.3			6.1		5.7	8.9	4.0	2.9	2.8	3.4	2.9
21	5.6	11.9		3.6		5.5	2.2	3.8	6.2	5.0	3.3	2.7
22	3.5	5.7		2.4		5.1	1.8	3.6	3.8	3.6	3.6	3.0
23	3.1	12.2	4.9	4.2		5.8	1.5	3.5	12.1	4.3	2.7	2.7
24	3.5	14.1	6.9	9.0		4.2	2.2	3.3	10.8	7.4	2.7	2.9
25	3.6	12.4	7.9	5.0		1.5	5.6	3.3	6.0	7.2	4.7	3.0
26	6.5	10.9	3.8	5.0		3.9	4.1	3.2	4.2	4.6	2.8	3.3
27	7.6	7.9	1.8	11.6		7.9	3.9	3.1	3.8	5.4	2.5	2.8
28		8.6	1.4	7.9		6.9	3.6	3.1	6.1	3.8	6.4	3.2
29		7.8	1.8	5.0		7.6	2.4		11.5	3.1	7.5	5.4
30		6.6	1.3	5.0		6.8	5.5		9.6	3.8	6.6	4.1
31		18.3		9.1		5.8	2.8		4.6		5.1	

NOTE.—No records where discharge is not given except Nov. 17 to Dec. 5 when paper was slipping on drum of recorder causing irregular time record. Discharge in million gallons per day estimated for this period from condensed graph and one measurement as follows: Nov. 17-24, 7.8; Nov. 25-30, 1.0; Dec. 1-5 0.7. No estimate for periods of no record.

Monthly discharge of Anahole ditch above Kaneha reservoir, Kaala, Kauai, for the year ending June 30, 1921.

Month.	Discharge.			Total run-off.		
	Million gallons per day.			Second-foot (mean).	Million gallons.	Acre-foot.
	Maximum.	Minimum.	Mean.			
October.....	12.1	1.2	5.60	8.66	174	153
November.....	.....	.....	5.13	7.94	159	142
February.....	6.8	1.4	3.79	5.86	106	96
April.....	10.8	2.8	4.82	7.46	145	144
June.....	10.8	2.4	3.67	5.68	110	108

KALIHIWAI RIVER NEAR HANAIEI, KAUAI.

LOCATION.—At elevation 700 feet, 1 mile east of Kauai Electric Co.'s power line and about 9 miles southeast of Hanalei.

RECORDS AVAILABLE.—March 13, 1914, to June 30, 1921.

GAGE.—Stevens continuous water-stage recorder.

DISCHARGE MEASUREMENTS.—Made by wading or from footbridge.

CHANNEL AND CONTROL.—One channel at all stages; straight for 100 feet above and 50 feet below gage; current sluggish at low stages; right bank low and wooded; left bank a high and nearly vertical cliff. Control composed of large boulders; fairly permanent.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 7.91 feet at 6 a. m. January 8 (discharge, approximately 1,850 million gallons per day or 2,860 second-foot). Flood of January 16 probably exceeded this but there is no record for that day; minimum stage recorded, 0.22 foot 1 a. m. March 15 (discharge, 6.5 million gallons per day or 10.1 second-foot).

1914-1921: Maximum stage recorded, 14.4 feet at 6.30 a. m. September 25, 1914 (discharge, computed from extension of rating curve, approximately 4,000 million gallons per day, or 6,200 second-foot); minimum flow recorded 0.58 foot 8 a. m. February 22, 1920 (discharge, 5.8 million gallons per day or 9.0 second-foot).

DIVERSIONS.—None.

REGULATION.—None.

OBJECT OF STATION.—To determine feasibility of high-level diversion in connection with Territorial project relative to Hanalei River.

UTILIZATION.—Part of flow is diverted below station for irrigation of rice and taro.

ACCURACY.—Stage-discharge relation not permanent. Three rating curves were used; one effective July 1 to 11; one effective July 12 to January 7; and the other effective January 8 to March 23. Shifting-control method was used March 24 to June 30. All rating curves fairly well defined below 70 million gallons per day. Operation of water-stage recorder satisfactory except August 30 to September 19 and January 16 to March 2. Records good when water-stage recorder was operating.

Discharge measurements of Kalkihwai River near Hanalei, Kauai, during the year ending June 30, 1921.

Date.	Made by—	Gage height (feet).	Discharge.	
			Second-feet.	Million gallons per day.
July 12	M. H. Carson.....	0.98	24.4	15.8
Aug. 18	do.....	1.11	34	22
Sept. 20	B. F. Rush.....	.98	24.8	16.0
Oct. 26	do.....	1.00	25.5	16.6
Dec. 5	do.....	1.29	47	30.5
Jan. 11	do.....	1.44	87	56
Mar. 8	W. C. Renshaw.....	.34	13.2	8.5
May 4	B. F. Rush.....	.53	24.3	15.7

Discharge, in million gallons per day, of Kalkihwai River near Hanalei, Kauai, for the year ending June 30, 1921.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Mar.	Apr.	May.	June.
1.....	13.4	22		12.5	34	25	18.6		17	21	14
2.....	11.4	18.6		22	25	22	27		14	19	16
3.....	11.4	19.0		21	35	26	35	10.3	12	28	15
4.....	10.1	28		15.2	22	23	81	11.9	14	16	13
5.....	8.9	24		13.4	18.2	25	88	10.5	29	17	12
6.....	8.6	17.8		18.4	22	33	84		13	16	12
7.....	14.2	16.1		45	66	36	72		29	14	13
8.....	9.5	16.1		41	40	61	247		86	13	12
9.....	8.3	16.4		17.0	22	28	104	7.7	84	13	12
10.....	23	14.9		15.8	33	34	54	7.4	20	12	11
11.....	55	18.1		15.5	21	32	49	7.2	16	12	11
12.....	22	19.8		37	17.4	118	70	7.0	15	12	24
13.....	17.0	34		17.0	15.2	225	180	6.8	14	16	40
14.....		15.8		16.1	14.6	55	302	6.7	12	15	17
15.....		15.2		43	14.0	34	575	7.0	12	12	16
16.....		14.6		31	12.8	26		18.9	12	12	14
17.....	37	21		38	11.9	22		12.1	12	12	22
18.....	16.4	29		26	15.0	19.8		9.0	12	15	14
19.....	14.3	16.7		144	68	17.8		7.7	12	21	14
20.....	16.1	27	16.7	86	30	16.4		7.7	15	15	12
21.....	18.2	42	15.8	48	64	15.5		18.4	17	19	11
22.....	13.4	21	16.4	27	30	49		10.7	15	16	11
23.....	12.2	52	17.0	21	28	132		65	16	14	10
24.....	11.3	66	19.4	21	47	184		74	37	14	11
25.....	11.6	67	29	17.0	45	42		19	26	16	12
26.....	19.6	74	24	20.0	50	27		14	26	14	12
27.....	18.6	38	18.2	27	34	21		12	56	13	12
28.....	54	38	14.3	19.4	26	19.0		14	26	23	12
29.....	32	26	14.6	19.4	64	22		46	25	20	14
30.....	22		14.6	15.2	46			76	34	16	13
31.....	22			26		16.7		23		15	

Monthly discharge of Kalihiwai River near Hanalei, Kauai, for the year ending June 30, 1921.

Month.	Discharge.			Second-foot (mean).	Total run-off.	
	Million gallons per day.				Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July.....	55	8.3	19.5	30.2	604	1,860
August.....	74	13.1	27.6	42.7	855	2,620
September.....	144	14.3	28.8	44.6	864	2,450
October.....	144	12.5	30.2	46.7	936	2,870
November.....	68	11.9	32.4	50.1	971	2,980
December.....	225	15.5	46.0	71.2	1,430	4,380
January.....			122	189	3,780	11,600
February.....			12.5	19.3	350	1,070
March.....	76	6.7	20.1	31.1	622	1,910
April.....	86	12	22.6	35.0	678	2,080
May.....	28	12	15.8	24.4	491	1,500
June.....	40	10	14.4	22.3	432	1,230
The year.....		6.7	32.9	50.9	12,000	36,900

WAIOLI STREAM NEAR HANALEI, KAUAI.

LOCATION.—3 miles above mouth of stream and 4 miles from Hanalei.

RECORDS AVAILABLE.—July 1, 1914, to June 30, 1921. Data from December 19, 1916, to June 30, 1918, have been revised in Water-Supply Paper 515.

GAGE.—Stevens water-stage recorder.

DISCHARGE MEASUREMENTS.—Made by wading or from cable at gage.

CHANNEL AND CONTROL.—One channel at all stages; straight for 30 feet above and 20 feet below gage; right bank steep, left bank slopes gently. Control composed of boulders; shifting.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 5.88 feet at 12.30 p. m. January 16 (discharge, 880 million gallons per day or 1,360 second-feet); minimum stage recorded, 0.94 foot from 2 to 5 p. m. July 6 (discharge, 5.5 million gallons per day or 8.5 second-feet).

1914-1921: Maximum stage recorded, 6.15 feet at 6.30 a. m. December 19, 1916 (discharge, computed from extension of rating curve, approximately 955 million gallons per day or 1,480 second-feet); minimum stage recorded, 0.6 foot July 22, 1914 (discharge, 2.0 million gallons per day or 3.1 second-feet).

DIVERSIONS.—None.

REGULATION.—None.

OBJECT OF STATION.—To determine feasibility of high-level diversions, in connection with Territorial Hanalei River project. Territorial land and water.

UTILIZATION.—Small part of flow is diverted for irrigation of rice and taro.

ACCURACY.—Stage-discharge relation not permanent. Rating curve used July 1 to January 16 well defined below 80 million gallons per day and rating curve used January 17 to June 30 well defined below 60 million gallons per day. Operation of water-stage recorder satisfactory, except July 21-29 and August 21 to September 18. Records fair when water-stage recorder was operating.

Discharge measurements of Waioli Stream near Hanalei, Kauai, during the year ending June 30, 1921.

Date.	Made by—	Gage height (feet).	Discharge.	
			Second-feet.	Million gallons per day.
July 19	M. H. Carson	1.22	13.4	8.7
Aug. 14	do	1.20	16.4	10.6
Sept. 19	B. F. Rush	1.18	15.3	9.9
Oct. 25	do	1.24	16.9	10.9
Dec. 3	do	1.26	17.1	11.1
Jan. 12	do	1.88	55	36
Feb. 16	W. C. Renshaw	1.59	16.3	10.5
May 12	B. F. Rush	1.50	15.0	9.7

Discharge, in million gallons per day, of Waioli Stream near Hanalei, Kauai, for the year ending June 30, 1921.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	10.8	12.3		7.6	22	14.1	12.6	20.0	43.0	15.3	11.5	14.1
2	8.4	11.0		26	19.5	19.0	14.0	15.0	41	13.3	11.5	17.2
3	7.0	12.7		11.8	23	12.9	19.2	13.3	16.0	13.0	17.8	14.7
4	6.1	30		8.6	11.3	11.3	65	12.8	19.8	14.4	11.7	13.9
5	5.7	24		7.5	9.4	21	135	12.5	19.4	7.4	31	12.8
6	5.6	11		13.3	13.3	18.5	96	11.7	16.0	28	17.2	12.5
7	10.4	9		27	73	35	42	11.7	12.8	87	13.6	14.4
8	7.5	8.2		16.4	88	51	115	11.5	11.7	118	11.2	13.1
9	6.8	9.4		9.2	14.1	38	69	11.2	11.5	24	10.5	14.1
10	19.3	9.6		7.8	33	28	36	11.0	11.0	18.0	10.3	12.8
11	38	8.4		9.6	15.7	24	31	11.2	10.8	14.4	9.9	12.5
12	19.8	19.2		29	11.3	106	58	11.5	10.8	14.1	9.4	42
13	34	21		16.9	10.2	137	94	11.2	10.6	17.5	10.2	46
14	12.9	9.6		11.3	9.2	38	206	11.0	10.6	13.9	11.0	18.4
15	15.8	11.7		82	8.4	17.4	859	17.3	11.2	18.3	9.0	16.3
16	30	10.5		39	7.8	13.2	405	11.7	29	29	9.2	14.1
17	25	16.6		41	7.6	11.5	213	14.5	27	15.0	8.8	16.5
18	11.3	16.6		19.2	9.6	10.8	86	12.0	14.1	14.4	9.4	11.7
19	10.8	9.4	9.4	77	31	10.1	103	11.0	12.0	13.9	12.0	12.8
20	12.0	43	11.5	51	13.8	9	83	10.8	15.4	15.4	9.6	10.1
21			9.6	16.4	37	9.4	25	11.0	24	14.4	10.8	9.0
22			9.6	11.5	17.8	9.8	17.5	10.8	14.4	14.1	10.6	8.8
23			12.3	10.1	26	40	15.0	10.8	127	15.0	9.4	8.0
24			15.4	18.3	35	130	14.4	11.8	39	26	9.9	7.4
25			23	10.8	42	28	96	10.0	17.5	17.8	9.9	7.1
26			15	11.8	38	14.1	51	11.0	14.1	15.6	9.9	6.4
27			9.8	20.0	26	11.6	54	11.0	14.7	22	10.1	7.1
28			7.8	13.2	16.0	10.6	21	11.0	46	14.4	15.4	7.8
29			10.4	9.4	68	11.0	15.3	75	12.5	26	9.4	9.4
30	14.7		10.6	9.9	30	11.3	43	80	15.4	22	22	7.2
31	12.9			29		10.3	16.9	21		15.3		

NOTE.—No record and discharge in million gallons per day estimated by comparison with flow of near-by streams as follows: July 21-25, 10; July 26-27, 20; Aug. 21-31, 23; Sept. 1-5, 13; Sept. 6-14, 23; Sept. 15-18, 24.

Monthly discharge of Waioli Stream near Hanalei, Kauai, for the year ending June 30, 1921.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-foot (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July.....	38	5.6	14.7	22.7	455	1,400
August.....		8.2	19.7	30.5	611	1,870
September.....		7.8	19.8	30.6	593	1,820
October.....	82	7.6	21.7	33.6	672	2,060
November.....	73	7.6	24.1	37.3	722	2,220
December.....	137	9.4	29.1	45.0	902	2,770
January.....	495	12.6	36.8	134	2,690	8,260
February.....	20.0	10.8	12.0	18.6	337	1,030
March.....	127	10.6	27.3	42.2	846	2,600
April.....	118	12.5	24.8	38.4	743	2,280
May.....	31	8.8	12.8	19.8	396	1,220
June.....	46	6.4	14.0	21.7	419	1,290
The year.....	495	5.6	25.7	39.8	9,390	28,800

LUMAHAI RIVER NEAR HANAIEI, KAUAI.

LOCATION.—6 miles above mouth and 10 miles by road and trail from Hanalei.

RECORDS AVAILABLE.—May 23, 1914, to October 11, 1917, and July 1, 1920, to June 30, 1921.

GAGE.—Stevens continuous water-stage recorder.

DISCHARGE MEASUREMENTS.—Made by wading or from cable.

CHANNEL AND CONTROL.—One channel at all stages; straight for 350 feet above and 150 feet below station; stream bed large boulders and cobblestones; right bank high and vertical; left bank low, wooded, and sloping. Control composed of large boulders. Shifting.

EXTREMES OF DISCHARGE.—1914-1917, 1920-1921: Maximum stage recorded, 5.45 feet at 2.50 p. m. January 8, 1921 (discharge, about 1,620 million gallons per day or 2,510 second-feet). This was probably exceeded by the flood of January 16, 1921; but recorder was not operating that day. Minimum stage recorded, 1.20 feet at 11 a. m. August 16, 1920 (discharge, 26 million gallons per day or 40 second-feet).

DIVERSIONS.—None.

REGULATION.—None.

OBJECT OF STATION.—To determine feasibility of high-level diversions in cooperation with Territorial Hanalei River project.

UTILIZATION.—Small part of flow is used for irrigation of rice and taro.

ACCURACY.—Stage-discharge relation not permanent. Rating curves well defined below 80 million gallons per day and fairly well defined up to 400 million gallons per day. From July 1, 1920, to February 18, 1921, intake located in edge of control where effect of shifts was not same as in pool above. Shifting-control method used based on recorder indicated gage heights. February 18 to 28, staff gage readings. February 28, recorder installed above control, July 1 to 17 and January 13 to February 28 recorder not operating. July 18 to August 12 string used on float subject to diurnal fluctuations. With above exceptions, operation of water-stage recorder satisfactory. Records poor prior to February 28 and good thereafter.

Discharge measurements of Lumahai River near Hanalei, Kauai, during the year ending June 30, 1921.

Date.	Made by—	Gage height (feet).	Discharge.	
			Second-feet.	Million gallons per day.
July 15	M. H. Carson	1.84	115	74
18	do.	1.38	52	33.5
Aug. 13	do.	1.92	124	80
Sept. 18	J. E. Stewart	1.54	69	44.5
Oct. 23	B. F. Rush	1.39	59	38
Dec. 4	do.	1.48	77	50
Jan. 13	do.	2.01	160	103
Feb. 26	do.	.75	52	33.5
May 11	E. M. Pickop	.74	51	33.

Discharge, in million gallons per day, of Lumahai River near Hanalei, Kauai, for the year ending June 30, 1921.

Day.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1		40	30	80	63	33		139	59	42	32
2		43	71	68	54	46		366	48	39	35
3		50	38	86	54	58		70	43	79	32
4		43	31	45	46	301		86	45	44	32
5		34	30	36	80	460		67	153	54	30
6		69	44	46	86	424		56	132	43	30
7		192	120	370	111	301		47	324	89	31
8		66	50	268	268	620		43	464	36	32
9		134	34	70	220	385		41	168	35	30
10		120	31	154	179	192		39	77	34	30
11		142	33	73	102	168		39	67	33	30
12		142	86	51	335	236		38	52	33	35
13	66		52	43	500			37	62	36	126
14	30		35	40	206			36	47	35	50
15	30		252	38	86			36	45	33	40
16	29	179	120	36	47			113	72	32	35
17	39	56	166	34	39			63	49	32	46
18	56	44	80	36	35			44	43	32	35
19	31	38	102	86	32		36	39	41	41	36
20	120	38	179	66	31		35	47	47	33	33
21	179	34	69	120	30		35	66	47	34	32
22	73	32	46	71	39		35	43	43	35	32
23	94	40	40	71	236		35	438	43	32	33
24	206	46	52	102	460		35	132	34	31	32
25	86	73	37	179	94		34	59	62	30	33
26	154	56	50	142	43		34	45	67	30	33
27	71	38	71	86	34		35	49	91	30	36
28	64	32	43	85	31		34	160	48	32	37
29	44	33	36	268	32			288	72	32	46
30	38	34	37	166	31			392	68	44	36
31	36		63		30			89		35	

NOTE.—July 1 to Aug. 12 string on float subject to diurnal expansion and contraction; discharge in million gallons per day averaged as follows: July 1-9, 25; July 10-19, 80; July 20-25, 30; July 26-31, 50; Aug. 1-2, 60; Aug. 3-12, 35. No record and discharge in million gallons per day estimated as follows: Sept. 13-15, 75; Jan. 13-24, 520; Jan. 25-29, 130; Jan. 30-31, 85; Feb. 1-14, 40; Feb. 15-17, 43.

Monthly discharge of Lumahai River near Hanalei, Kauai, for the year ending June 30, 1921.

Month.	Discharge.			Total run-off.		
	Million gallons per day.			Second-foot (mean).	Million gallons.	Acres-feet.
	Maximum.	Minimum.	Mean.			
July			48.5	75.0	1,500	4,610
August	206		61.2	94.7	1,900	5,880
September	192	32	69.0	107	2,070	6,350
October	252	30	68.7	106	2,130	6,540
November	370	34	99.9	155	3,000	9,200
December	500	30	117	181	3,630	11,100
January		33	330	511	10,200	31,400
February		34	38.3	59.3	1,070	3,290
March	438	36	105	162	3,260	9,990
April	464	41	88.4	137	2,850	8,140
May	79	30	37.7	58.3	1,170	3,590
June	126	30	39.7	61.4	1,190	3,660
The year			92.6	143	33,800	104,000

MISCELLANEOUS MEASUREMENTS.

Measurement of streams and ditches on the Island of Kauai at points other than regular gaging stations are listed below.

Miscellaneous measurements on Kauai during the year ending June 30, 1921.

Date.	Stream.	Tributary to—	Locality.	Gage height.	Discharge.	Million gallons per day.
July 27	Waiahulu	Waimea River	Near Waimea	2.60	19.3	12.9
Aug. 22	do.	do.	do.	3.33	81	52
Sept. 30	do.	do.	do.	2.96	34.5	24.8
July 28	Mohihi	do.	Elevation 3,500 feet, near Waimea	1.14	1.15	.75
July 29	do.	do.	do.	1.41	4.1	2.7
Aug. 24	do.	do.	do.	1.87	28.5	19.1
Sept. 28	do.	do.	do.	1.34	3.0	1.95
Nov. 5	do.	do.	do.	1.34	2.8	1.85
Jan. 25	do.	do.	do.	1.74	14.4	9.3
Mar. 16	do.	do.	do.	1.36	5.2	3.4
May 7	do.	do.	do.	1.19	3.7	2.4
July 27	Koale	do.	Near Waimea	2.05	16.6	12.0
Aug. 22	do.	do.	do.	2.55	50	32.5
Sept. 30	do.	do.	do.	2.49	38	24.6
Nov. 8	do.	do.	do.	3.59	225	145
Dec. 15	do.	do.	do.	2.83	71	46
Jan. 28	do.	do.	do.	3.58	115	74
Mar. 18	do.	do.	do.	2.68	34	22
Sept. 29	Kawaiiki	Koale Stream	Trail crossing near Waimea		1.4	.9
Jan. 26	do.	do.	do.		9.1	6.1
Mar. 17	do.	do.	do.		5.2	3.4
May 8	do.	do.	do.		1.9	1.25
May 20	Opaekaa	Waiua River	Above falls, near Kapaa		4.9	3.2
July 20	Kapaa River	Pacific Ocean	Near Kealia	2.14	15.1	9.8
Aug. 20	do.	do.	do.	2.01	20.2	13.1
Sept. 21	do.	do.	do.	1.96	18.8	10.7
Oct. 22	do.	do.	do.	1.81	23.8	15.4
July 12	Hanalei River	do.	Elevation 625 feet, near Hanalei	.93	30	52
Aug. 18	do.	do.	do.	1.16	128	83
Oct. 9	do.	do.	do.	.81	63	41
Nov. 20	do.	do.	do.	.93	73	47
Jan. 11	do.	do.	do.	1.50	186	120
Mar. 7	do.	do.	do.	.84	70	45
May 19	do.	do.	do.	1.16	102	66

NOTE.—Measurements on Waiahulu and Koale streams and on Kapaa and Hanalei Rivers were made at former gaging stations.

ISLAND OF OAHU.

KALIHI STREAM NEAR HONOLULU, OAHU.

LOCATION.—At Kioi Pool, three-eighths mile above Catholic orphanage, 3 miles up Kalihi Road from King Street car line, and 5 miles north of Honolulu post office.

RECORDS AVAILABLE.—September 6, 1913, to June 30, 1921.

GAGE.—Gurley 7-day water-stage recorder installed June 25, 1918. Friez recorder in use September 8 to November 22, 1913, and Gurley printing recorder December 4, 1913, to June 25, 1918.

DISCHARGE MEASUREMENTS.—Made by wading or from footbridge 500 feet above gage.

CHANNEL AND CONTROL.—Water drops over a 10-foot fall into pool at gage. Channel is solid rock, with steep, high banks; two channels for gage heights of 6 feet and over. High-water control, solid rock; low-water control, concrete dam completed January 11, 1919.

EXTREMES OF DISCHARGE.—Maximum stage during year determined from flood marks, 14 feet January 16 (discharge, estimated at 1,250 million gallons per day or 1,930 second-feet); minimum stage recorded during year, 2.84 feet at 8 p. m. June 28 (discharge, 0.7 million gallons per day or 1.1 second-feet).

1913-1921: Maximum stage recorded, January 16, 1921; minimum discharge recorded, 2.80 feet several times between February 27 and March 5, 1920 (discharge, 0.5 million gallons per day or 0.8 second-feet.)

DIVERSIONS.—Catholic orphanage diverts water for domestic use into a 4-inch pipe (which is reduced by several stages to 1 inch at the outlet) at a dam about 300 feet above the station. Dam was installed May, 1920. Prior to this there were no diversions above station.

REGULATION.—None.

OBJECT OF STATION.—To determine feasibility of using stream to augment water supply of city of Honolulu. Part of water rises on territorial lands.

UTILIZATION.—Part of water diverted 400 feet below station for power development; remaining low-water flow is diverted further downstream for irrigation of taro.

ACCURACY.—Stage-discharge relation permanent. Rating curve well defined between 1 and 150 million gallons per day. Operation of water-stage recorder satisfactory. January 15 to February 10, corrections made for obstructed channel. Records good.

Discharge measurements of Kalihi Stream near Honolulu, Oahu, during the year ending June 30, 1921.

Date.	Made by—	Gage height (feet).	Discharge.	
			Second-feet.	Million gallons per day.
Aug. 13	Reid Jerman.....	2.90	1.25	0.8
Sept. 17	M. H. Carson.....	2.98	2.6	1.7
Oct. 15	.....do.....	3.30	8.2	5.3
Nov. 19	.....do.....	2.94	2.7	1.75
Dec. 24	.....do.....	3.93	32	20.6
Jan. 14	J. E. Stewart.....	6.70	211	136
Feb. 10	M. H. Carson.....	3.44	6.7	4.3
June 25	.....do.....	2.85	1.15	.75

Discharge, in million gallons per day, of Kāhiki Stream near Honolulu, Oahu, for the year ending June 30, 1921.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1.	1.0	1.1	2.3	1.4	2.4	3.8	3.9	8.9	2.0	1.1	1.2	1.0
2.	1.0	1.0	1.9	3.4	2.1	3.3	3.9	8.6	2.0	1.0	2.0	1.0
3.	1.0	1.5	1.8	1.9	2.9	2.9	3.9	7.2	1.8	1.0	1.7	1.0
4.	1.0	1.1	1.7	1.6	2.0	3.1	3.4	7.1	1.8	1.0	1.7	1.0
5.	1.0	1.0	1.6	1.4	1.7	2.8	10.2	6.2	1.7	1.0	1.8	1.0
6.	.9	1.0	2.0	4.3	2.0	4.2	22	6.2	1.6	1.2	4.1	1.0
7.	.9	1.0	5.8	2.7	1.7	4.9	7.8	5.6	1.6	1.0	3.2	1.2
8.	1.0	1.0	2.4	1.8	4.2	11.9	15.8	5.0	1.6	3.5	2.2	1.0
9.	1.0	1.0	2.2	1.6	2.6	7.2	9.5	4.8	1.5	1.8	1.7	.9
10.	1.5	.9	2.1	1.6	2.0	4.9	6.3	4.2	1.5	1.3	1.6	.9
11.	1.0	.9	3.1	1.7	1.7	4.0	5.2	3.8	1.5	1.1	1.4	.9
12.	1.1	2.7	4.2	1.0	3.8	5.0	2.3	2.3	1.3	1.0	1.3	1.0
13.	5.2	1.0	2.7	1.9	1.5	59	9.4	3.0	1.8	1.0	1.5	1.0
14.	2.6	2.5	2.4	1.7	1.5	8.2	144	3.0	1.3	1.0	1.4	.9
15.	1.9	1.9	2.2	3.3	1.4	5.6		2.8	1.3	.9	1.4	1.0
16.	1.6	1.0	2.5	2.0	1.4	4.9		2.7	1.2	1.1	1.3	.9
17.	1.6	1.0	1.9	3.0	1.3	4.3		2.6	1.5	1.0	1.5	.9
18.	1.5	.9	1.8	2.8	1.3	3.9		3.8	1.2	.9	1.3	.9
19.	1.6	.9	1.7	2.5	1.5	3.8		3.1	1.2	.9	1.2	1.1
20.	1.5	1.1	1.6	2.2	3.3	3.5		2.7	1.1	1.6	1.5	.9
21.	1.6	1.8	1.7	2.8	2.2	3.3	17.0	3.2	1.4	1.1	2.3	.9
22.	1.8	1.6	1.6	1.8	10.8	3.0	14.5	2.7	1.3	1.0	1.6	.8
23.	1.4	4.8	1.6	1.6	5.5	50	12.5	2.3	1.6	1.0	1.5	.8
24.	1.3	3.2	1.6	1.7	3.5	53	11.0	2.4	2.6	1.3	2.2	.8
25.	1.3	3.5	1.7	1.7	3.4	17.5	30	2.3	1.4	1.1	2.0	.8
26.	1.4	3.0	1.6	1.5	7.1	8.6	29	2.1	1.2	1.6	1.8	1.0
27.	1.9	4.3	1.5	1.6	4.0	6.5	32	2.0	1.1	2.1	1.7	.9
28.	2.1	3.4	1.4	2.0	6.4	5.5	14.5	1.9	1.0	1.6	1.5	.9
29.	1.5	2.5	1.6	1.6	4.9	4.9	12.0		1.1	1.2	1.3	1.1
30.	1.2	2.1	1.4	1.7	5.0	4.4	12.5		1.6	1.8	1.2	.9
31.	1.2	2.0		3.5		4.0	10.5		1.2		1.1	

NOTE.—Jan. 15-20, no record; May 20-21, clock stopped and graph estimated from range of stage and weather records. May 25-28 clock stopped and discharge interpolated.

Monthly discharge of Kāhiki Stream near Honolulu, Oahu, for the year ending June 30, 1921.

Month.	Discharge.			Total run-off.		
	Million gallons per day.			Second-foot (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July	60	0.9	3.40	5.26	106	323
August	4.8	.9	1.75	2.71	54.2	166
September	5.8	1.4	2.07	3.20	62.0	191
October	4.3	1.4	2.21	3.42	68.5	210
November	10.8	1.3	3.33	5.15	99.8	307
December	59	2.8	10.0	15.5	311	951
January	3.4					
February	8.9	1.9	4.03	6.24	113	346
March	2.6	1.0	1.47	2.27	45.7	140
April	3.5	.9	1.27	1.96	38.2	117
May	4.1	1.1	1.71	2.65	53.1	163
June	1.2	.8	.95	1.47	28.4	88

NUUANU STREAM BELOW RESERVOIR NO. 2 WASTEWAY, NEAR HONOLULU, OAHU.

LOCATION.—On Pali road in upper Nuuanu Valley, 1 mile above end of car line and 5 miles from Honolulu post office.

RECORDS AVAILABLE.—October 21, 1913, to January 16, 1921, when station was destroyed by flood.

GAGE.—Friez weekly water-stage recorder installed August 7, 1920. Gurley weekly water-stage recorder used April 12, 1918, to August 7, 1920, at same location as old inclined staff, datum unchanged.

DISCHARGE MEASUREMENTS.—Low-water discharge measured by 2-foot sharp-crested weir with end contractions; flood discharge measured by 12-foot sharp-crested weir with end contractions, which, with small weir, gives total flood discharge. Both weirs set in concrete. Crest of small weir is 1 foot lower than that of large weir. The weirs were reconstructed April 10-27, 1914, but original dimensions were maintained.

CHANNEL AND CONTROL.—Channel is in solid rock; straight for about 75 feet above and below weir; banks high and covered with vegetation.

EXTREMES OF DISCHARGE.—1913-1921: Maximum stage, determined by levels to flood marks, 8.74 feet January 16, 1921 (discharge, 1,600 million gallons per day or 2,480 second-feet); Minimum stage recorded, 0.03 foot at 6 to 8 p. m. July 9, 1920 (discharge, 0.11 million gallons per day or 0.17 second-foot).

DIVERSIONS.—Most of the flow at low and medium stages is diverted above station for domestic supply and for power development.

REGULATION.—Amount diverted above station varies.

OBJECT OF STATION.—To determine feasibility of using Nuuanu Stream at this point to augment water supply for city of Honolulu. Territorial land and water.

UTILIZATION.—Station measures the waste water and seepage from reservoirs Nos. 2, 3, and 4 and the Luakaha weir. This waste water is used for irrigation of taro and rice.

ACCURACY.—Stage-discharge relation permanent. Rating curve well defined. Operation of water-stage recorder satisfactory except December 3-9. Records excellent.

Discharge measurements of Nuuanu Stream below reservoir No. 2 wasteway, near Honolulu, Oahu., during the year ending June 30, 1921.

Date.	Made by—	Gage height (feet).	Discharge.	
			Second-feet.	Million gallons per day.
July 23	B. F. Rush.....	0.10	0.40	0.25
Oct. 29	J. E. Stewart.....	.07	.25	.15

Discharge, in million gallons per day, of Nuuanu Stream below reservoir No. 2 wasteway, near Honolulu, Oahu, for the year ending June 30, 1921.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.
1	0.2	0.3	0.4	0.2	0.2	0.6	3.2
2	.2	.3	.3	.4	.2	.5	3.2
3	.2	.4	.3	.3	.5		3.0
4	.2	.3	.3	.2	.2		2.0
5	.2	.3	.2	.2	.2		3.7
6	.2	.3	.3	.2	.3		12.2
7	.2	.2	.5	.2	.2		5.1
8	.2	.2	.3	.2	1.9		8.6
9	.2	.2	.3	.2	.3		6.5
10	.2	.2	.4	.2	.2	.8	4.6
11	.2	.2	.5	.2	.2	.8	5.8
12	2.9	.2	.6	.6	.2	1.5	4.9
13	.3	.2	.4	.3	.2	19.3	4.
14	.2	.3	.3	.2	.2	3.8	
15	.2	.2	.3	.4	.2	2.5	
16	.2	.2	.2	.4	.2	2.1	
17	.2	.2	.2	.4	.2	2.0	
18	.2	.2	.2	.4	.2	1.9	
19	.2	.2	.2	.3	.2	2.4	
20	.2	.2	.2	.2	.3	1.7	
21	.2	.8	.2	.2	1.8	2.0	
22	.2	.2	.2	.2	2.5	1.8	
23	.2	.5	.2	.2	1.1	12.2	
24	.3	.4	.3	.2	.7	19.3	
25	.3	.5	.2	.2	.7	9.3	
26	.3	.4	.3	.2	1.7	5.8	
27	.3	.4	.2	.2	.9	4.2	
28	.5	.3	.2	.2	1.2	4.0	
29	.3	.2	.2	.2	.8	3.7	
30	.3	.2	.2	.2	.7	3.5	
31	.3	.4		.2		4.0	

NOTE.—Dec. 3-9, no record; discharge estimated at 0.8 million gallons per day.

Monthly discharge of Nuuanu Stream below reservoir No. 2 wasteway, near Honolulu, Oahu, for the year ending June 30, 1921.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-foot (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July	2.9	0.2	0.323	0.500	10.0	31
August	.5	.2	.277	.429	8.6	26
September	.6	.2	.237	.444	8.6	26
October	.6	.2	.255	.395	7.9	24
November	2.5	.2	.607	.939	18.2	56
December	19.3	.5	3.72	2.40	115	354
January 1-13					67.3	207
The period.					236	724

MAOLE DITCH, MAKAI STATION, NEAR HONOLULU, OAHU.

LOCATION.—In Nuuanu Valley, 150 feet from Pali road, opposite reservoir No. 4 into which the ditch empties; $6\frac{1}{2}$ miles from Honolulu post office.

RECORDS AVAILABLE.—October 5, 1917, to January 16, 1921, when station was discontinued owing to washout of ditch above station.

GAGE.—Gurley weekly water-stage recorder.

DISCHARGE MEASUREMENTS.—Made from plank at gage.

CHANNEL AND CONTROL.—Ditch is earth cut, with bottom lining of concrete. At the gage a section 50 feet long, $5\frac{1}{2}$ feet wide, and 3 feet deep is constructed of concrete, with concrete control at lower end.

EXTREMES OF DISCHARGE.—1919-1921: Maximum stage recorded, 4.17 feet at 3.30 a. m. January 16, 1921 (discharge, 168 million gallons per day or 260 second-feet); minimum stage recorded, ditch occasionally dry.

DIVERSIONS.—Ditch diverts water from Maole Stream and a few intermittent streams into Nuuanu reservoir No. 4.

REGULATIONS.—By head gates.

OBJECT OF STATION.—To determine amount of water diverted from Maole Stream in Hillebrand Glen to reservoir No. 4 of city.

UTILIZATION.—City water supply and power development.

ACCURACY.—Stage-discharge relation permanent, except during unusually high stages, when concrete control is not effective on account of large amount of silt carried. Rating curve is well defined below 10 million gallons per day. Operation of water-stage recorder satisfactory. Records good for low stages, poor for high stages.

Discharge measurements of Maole ditch, makai station, near Honolulu, Oahu, during the year ending June 30, 1921.

Date.	Made by—	Gage height (feet).	Discharge.	
			Second-feet.	Million gallons per day.
Aug. 27	J. E. Stewart	0.29	0.35	0.25
Dec. 17	M. H. Carson	.15	.1	.06

Discharge, in million gallons per day, of Maole ditch, makai station, near Honolulu, Oahu, for the year ending June 30, 1921.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.
1	0.00	0.00	0.09	0.00	0.04	0.07	0.03
2			.01	.3	.01	.03	.03
3		.09		.07	.1	.03	.04
4		.01			.01	.05	.02
5						.03	.3
6			.15	.15	.15	.2	2.7
7			.6	.07	.01	.3	.4
8			.02	.01	3.1	1.0	.7
9			.01		.15	.45	3
10	.06		.01		.04	.2	.1
11	.04		.2	.01	.01	.1	.07
12	9.8		.2	.3	.01	.1	.07
13	.2		.62	.01		18.3	.2
14	.04	.1	.01			.4	.35
15	.01		.01	.03		.15	.26
16			.06	.01		.06	.25
17						.07	
18				.06		.04	
19				.02	.02	.03	
20				.02	.5	.02	
21		.04			1.9	.02	
22					1.1	.02	
23		.25			.2	12.8	
24		.25		.08	.08	7.2	
25		.35		.01	.1	1.8	
26					.6	.15	
27	.1				.00	.08	
28	.15	.2			1.2	.04	
29	.01	.01		.01	.3	.04	
30					.35	.03	
31		.01		.15		.02	

NOTE.—No record and discharge in million gallons per day estimated as follows: Aug. 26-27, 0.3; Oct. 27-28, 0.01. No flow on other days for which discharge is not given.

Monthly discharge of Manoa ditch, main station, near Honolulu, Oahu, for the year ending June 30, 1921.

Month.	Discharge.			Total run-off.		
	Million gallons per day.			Second-foot (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July.....	9.8	0.00	0.336	0.520	10.4	32
August.....	.35	.00	.062	.096	1.91	6
September.....	.6	.00	.046	.071	1.39	4
October.....	.3	.00	.047	.073	1.46	4
November.....	3.1	.00	.336	.520	10.1	31
December.....	13.3	.02	1.40	2.17	43.5	133
January 1-16.....	35	.02	5.68	8.79	91.0	279
The period (200 days).....					160	489

WEST BRANCH OF MANOA STREAM NEAR HONOLULU, OAHU.

LOCATION.—At diversion dam at R. W. Shingle's bungalow, 300 feet above highway bridge, one-eighth mile above confluence with East Branch of Manoa Stream, and 4 miles northeast of Honolulu post office.

RECORDS AVAILABLE.—May 29, 1913, to January 13, 1921. Station was destroyed by flood of January 16, 1921.

GAGE.—Friez water-stage recorder. Watson water-stage recorder in use June 17 to October 20, 1914; replaced October 20, 1914, by a Friez water-stage recorder; replaced May 9, 1915, by a Stevens 8-day water-stage recorder; replaced August 15, 1917, by a Stevens continuous water-stage recorder; replaced April 13, 1920, by Friez water-stage recorder. Vertical staff gage (at different datum) 150 feet upstream from highway bridge, about 25 feet above small irrigation ditch diverting from right bank, read from May 29, 1913, to June 16, 1914.

DISCHARGE MEASUREMENTS.—Made by wading.

CHANNEL AND CONTROL.—Small masonry diversion dam with rounded crest acts as control, and forms a large quiet pool in the vicinity of the gage for low and medium stage. Leaves and small debris lodge on control and growth of grass on sides at times affects the discharge relation slightly. Channel clean and confined in the vicinity of the gage. A short distance upstream the natural slope is steep and channel is filled with boulders.

EXTREMES OF DISCHARGE.—Maximum stage during year, determined by levels to flood marks 10.4 feet January 16 (discharge, estimated at 2,100 million gallons per day or 3,250 second-feet); minimum stage recorded, 0.96 foot at 6 p. m. August 10 (discharge, 0.13 million gallons per day, or 0.28 second-foot).

1913-1921: Maximum stage recorded in January, 1921; minimum stage recorded, December, 1913 (discharge, 0.05 million gallons per day or 0.08 second-foot).

DIVERSIONS.—None.

REGULATION.—At low water, pool at gage is lowered slightly for short periods by the operation of a small hydraulic ram used for pumping water for domestic use and also by diversion for filling a swimming pool.

OBJECT OF STATION.—To determine feasibility of using stream to augment water supply of city of Honolulu. Part of water rises on Territorial lands. Records on west and east branches of Manoa Stream together show amount of surface water available in upper Manoa Valley, above nearly all diversions.

UTILIZATION.—Practically the entire low-water flow of Manoa Stream is utilized at lower elevation in Manoa Valley for irrigation of rice and taro.

ACCURACY.—Stage-discharge relation permanent. Rating curve well defined between 1 and 50 million gallons per day. Operation of water-stage recorder satisfactory. Records good.

Discharge measurements of West Branch of Manoa Stream near Honolulu, Oahu, during the year ending June 30, 1921.

Date.	Made by—	Gage height (feet).	Discharge.	
			Second-feet.	Million gallons per day.
July 9	J. E. Stewart	1.03	0.6	0.4
Sept. 24	M. H. Carson	1.07	1.65	1.85

Discharge, in million gallons per day, of West Branch of Manoa Stream near Honolulu, Oahu, for the year ending June 30, 1921.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.
1	0.9	0.5	.....	0.6	0.9	2.1	1.5
2	.9	.5	.....	.9	1.1	1.8	1.5
3	.7	.9	.....	.6	1.5	2.1	1.2
4	.6	.4	1.4	.5	.9	2.2	1.1
5	.4	.4	1.2	.6	.9	1.7	3.8
6	.4	.3	1.5	.7	1.7	2.4	19.5
7	.4	.3	2.2	.9	2.8	3.8	5.4
8	.5	.2	1.4	.6	17.7	5.6	6.0
9	.4	.3	1.2	.5	1.7	3.1	3.6
10	.6	.2	2.0	.3	1.2	2.7	3.1
11	.3	.2	2.0	.6	.9	2.1	2.2
12	6.4	.4	4.5	3.0	.9	2.1	2.0
13	1.0	.6	2.2	.7	.8	26	2.7
14	.7	2.4	1.7	.4	.6	3.4	.....
15	.7	.7	1.5	3.8	.6	2.1	.....
16	.6	.5	1.4	1.6	.6	1.8	.....
17	.6	.5	.9	1.8	.6	1.7	.....
18	.4	.4	.3	1.7	.6	1.5	.....
19	.6	.4	.3	1.2	.9	1.4	.....
20	.6	.6	.4	.9	4.3	1.1	.....
21	.6	1.2	.4	.8	14.1	1.0	.....
22	.5	.7	.5	.6	12.7	1.1	.....
23	.6	4.9	.6	.6	5.4	24	.....
24	.5	4.0	.9	.7	2.4	13.3	.....
25	.4	4.9	.9	.7	2.7	7.8	.....
26	.3	4.6	.7	.6	10.6	3.1	.....
27	.8	.....	.8	2.4	3.8	2.1	.....
28	1.2	.....	.6	1.0	7.3	2.0	.....
29	.7	.....	.6	.6	3.6	1.7	.....
30	.6	.....	.6	.5	3.4	1.7	.....
31	.5	.....	.....	1.1	.....	1.5	.....

NOTE.—Aug. 27 to Sept. 3 clock stopped; discharge estimated in million gallons per day by comparison with East Branch of Manoa Stream as follows: Aug. 27-31, 3.2; Sept. 1-3, 1.7.

Monthly discharge of West Branch of Manoa Stream near Honolulu, Oahu, for the year ending June 30, 1921.

Month.	Discharge.			Total run-off.		
	Million gallons per day.			Second-foot (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July.....	6.4	0.3	0.79	1.22	24.4	75
August.....	4.9	.2	1.52	2.35	47.0	145
September.....	4.5	.3	1.26	1.95	37.8	116
October.....	3.8	.3	.98	1.52	30.5	93
November.....	17.7	.6	3.57	5.52	107	329
December.....	26	1.0	4.23	6.54	131	402
January 1-13.....	19.5	1.1	4.12	6.37	58.6	164
The period.....					431	1,320

EAST BRANCH OF MANOA STREAM NEAR HONOLULU, OAHU.

LOCATION.—At highway bridge 400 feet above confluence with West Branch of Manoa Stream, in upper Manoa Valley, 4 miles northeast of Honolulu post office.

RECORDS AVAILABLE.—May 29, 1913, to January 13, 1921. Station was destroyed by flood of January 16, 1921.

GAGE.—Friez water-stage recorder. Watson water-stage recorder from May 5, 1913, to September 28, 1914; Stevens 8-day water-stage recorder October 11, 1915, to August 15, 1917; and Stevens continuous water-stage recorder August 15, 1917, to March 19, 1920. Vertical staff gage 200 feet upstream on right bank at different datum was read from May 29, 1913, to May 19, 1914.

DISCHARGE MEASUREMENTS.—Made by wading for low and ordinary high-water stages; flood measurements may be made from highway bridge.

CHANNEL AND CONTROL.—Channel steep just above gage, but slope is reduced for 30 feet past gage to control which is a riffle of small boulders and gravel. At low and medium stages stream past gage is fairly wide and deep and velocity well distributed. Both banks are fairly steep and covered with vegetation.

EXTREMES OF DISCHARGE.—Maximum stage during year determined by levels to flood marks 10.4 feet January 16 (discharge, estimated at 2,000 million gallons per day, or 3,090 second-feet); minimum stage recorded 1.18 feet at 9 p. m. August 19 (discharge, 0.54 million gallons per day or 0.84 second-foot).

1913-1921: Maximum stage recorded in January, 1921; minimum daily discharge occurred August 19 and also June 8 and 9, 1920.

DIVERSION.—East Manoa ditch diverts a quarter of a mile above station for irrigation.

REGULATION.—None.

OBJECT OF STATION.—To determine feasibility of using stream to augment water supply of city of Honolulu. Part of water rises on Territorial lands. Records on east and west branches of Manoa Stream together show amount of surface water available in upper Manoa Valley above nearly all diversions.

UTILIZATION.—Practically the entire low-water flow of Manoa Stream is utilized at lower elevations in Manoa Valley for irrigation of rice and taro.

ACCURACY.—Stage-discharge relation permanent. Rating curve well defined between 1 and 80 million gallons per day. Operation of water-stage recorder satisfactory. Records good.

Discharge measurements of East Branch of Manoa Stream near Honolulu, Oahu, during the year ending June 30, 1921.

Date.	Made by—	Gage height (feet).	Discharge.	
			Second-feet.	Million gallons per day.
July 9	J. E. Stewart	1.22	0.95	0.6
30	M. H. Merry	1.25	1.35	.9
Sept. 4	M. H. Carson	1.30	1.5	1.0
Oct. 15	do	1.24	1.7	1.1
Nov. 26	J. E. Stewart	1.74	9.9	6.4

Discharge, in million gallons per day, of East Branch of Manoa Stream near Honolulu, Oahu, for the year ending June 30, 1921.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.
1.	1.1	0.8	1.8	0.9	1.6	2.1	0.5
2.	1.2	.8	1.6	1.3	1.8	1.8	.5
3.	1.1	1.1	1.3	1.2	1.9	1.8	.5
4.	.9	.8	1.2	1.1	1.3	2.4	.4
5.	.8	.8	1.3	1.1	1.3	1.8	1.1
6.	.7	.6	2.4	1.3	2.7	2.9	4.6
7.	.7	.6	1.9	1.5	1.7	2.7	1.4
8.	.8	.6	1.3	.8	15.0	3.4	1.3
9.	.9	.6	1.3	.8	1.8	2.7	1.2
10.	1.3	.6	1.6	.8	1.5	2.0	1.3
11.	.8	.3	1.8	1.1	1.3	1.8	1.0
12.	6.4	.8	2.8	3.2	1.1	1.8	.8
13.	1.1	.8	1.8	1.0	1.1	2.1	1.5
14.	.9	2.8	1.6	.8	1.1	2.6	
15.	.9	.9	1.5	2.2	3.0	1.9	
16.	.8	.7	1.4	1.3	1.0	1.8	
17.	.9	.9	1.2	1.7	.8	1.8	
18.	.8	.6	1.1	1.5	.8	1.7	
19.	.8	.6	1.1	1.2	1.6	1.7	
20.	.8	.7	1.1	1.0	5.8	1.6	
21.	.9	1.6	1.2	.9	10.8	1.5	
22.	.8	1.2	1.1	.7	6.2	1.4	
23.	.9	3.4	1.1	.8	3.1	2.1	
24.	.8	3.6	1.1	1.6	1.9	6.9	
25.	.7	3.4	1.1	1.1	2.4	3.2	
26.	.7	2.8	1.0	1.0	6.3	1.1	
27.	1.6	3.0	.9	2.2	2.1	.8	
28.	1.3	2.0	.9	1.2	9.6	.6	
29.	1.1	1.6	.9	1.1	3.1	.6	
30.	.8	1.4	.9	2.2	3.1	.5	
31.	.9	4.0		1.9		.5	

Monthly discharge of East Branch of Manoa Stream near Honolulu, Oahu, for the year ending June 30, 1921.

Month.	Discharge.			Total run-off.		
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July	6.4	0.7	1.10	1.70	34.2	105
August	4.0	.6	1.44	2.23	44.7	137
September	2.8	.9	1.38	2.14	41.3	127
October	3.2	.7	1.31	2.03	40.5	125
November	15.0	.8	3.15	4.87	94.6	290
December	24	.5	3.30	5.11	102	314
January 1-13	4.6	.4	1.24	1.92	16.1	49
The period					373	1,150

EAST MANOA DITCH NEAR HONOLULU, OAHU.

LOCATION.—1,000 feet below intake. Ditch diverts from East Branch of Manoa Stream 1,000 feet above gaging station on that stream, 4 miles northeast of Honolulu post office.

RECORDS AVAILABLE.—May 24, 1915, to December 31, 1916; January 26, 1918, to January 16, 1921, when station was discontinued.

GAGE.—Gurley weekly water-stage recorder. Vertical staff May 24, 1915, to December 31, 1916. Stevens weekly water-stage recorder January 25, 1918, to April 20, 1918.

DISCHARGE MEASUREMENTS.—Made by wading.

CHANNEL AND CONTROL.—Weir basin about 6 feet wide, 30 feet long, and 2 feet deep below weir crest. Ditch in earth cut. Control is 2.5-foot wooden sharp-crested Cippoletti weir with metal crest.

EXTREMES OF DISCHARGE.—Maximum stage recorded during the year, 2.27 feet at 3 a. m., January 16 (discharge, about 26 million gallons per day or 40 second-feet); minimum stage recorded during year, 0.04 foot at 1 p. m. July 15 (discharge, 0.08 million gallons per day or 0.09 second-foot).

1915-1921: Maximum stage recorded in January, 1921. Minimum stage recorded 0.03 foot at 3 p. m. March 16, 1919 (discharge, 0.05 million gallons per day or 0.08 second-foot.).

DIVERSION.—None.

REGULATION.—None.

OBJECT OF STATION.—To determine feasibility of using water to augment water supply for city of Honolulu.

UTILIZATION.—Water used for irrigation of rice and taro.

ACCURACY.—Stage-discharge relation permanent, except for short periods when water was leaking around weir. Operation of water-stage recorder satisfactory. Records good.

Discharge measurements of East Manoa ditch near Honolulu, Oahu, during the year ending June 30, 1921.

Date.	Made by—	Gage height (feet).	Discharge.	
			Second-feet.	Million gallons per day.
July 16	J. E. Stewart.....	0.205	0.65	0.4
Sept. 24	M. H. Carson.....	.21	.65	.4
Nov. 12	.....do.....	.23	.9	.55

Discharge, in million gallons per day, of East Manoa ditch near Honolulu, Oahu, for the year ending June 30, 1921.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.
1.....	0.6	0.4	1.0	0.5	0.7	1.1	0.7
2.....	.6	.4	.8	.6	.7	1.0	.7
3.....	.5	.5	.7	.6	.8	.9	.6
4.....	.5	.5	.6	.4	.6	1.2	.6
5.....	.4	.4	.6	.4	.6	.8	1.0
6.....	.4	.4	.9	.6	.8	1.2	1.5
7.....	.4	.4	1.0	.7	.7	1.2	1.0
8.....	.5	.4	.7	.5	2.6	1.4	1.0
9.....	.6	.4	.6	.4	.8	1.2	.9
10.....	.7	.4	.7	.4	.6	.....	.9
11.....	.5	.4	.8	.5	.6	.....	.8
12.....	1.5	.5	1.0	1.0	.6	.....	.7
13.....	.8	.5	.7	.4	.6	.....	1.0
14.....	.6	1.1	.7	.5	.6	.....	4.3
15.....	.5	.5	.6	.8	.5	.....	4.5
16.....	.5	.4	.6	.6	.5	.....	4.4
17.....	.5	.6	.5	.6	.5	.8	.....
18.....	.4	.4	.6	.6	.4	.8	.....
19.....	.4	.4	.5	.6	.8	.8	.....
20.....	.4	.5	.5	.5	2.0	.7	.....
21.....	.4	.8	.6	.5	2.8	.7	.....
22.....	.4	.6	.5	.5	2.2	.7	.....
23.....	.5	1.7	.5	.4	1.5	2.8	.....
24.....	.5	1.3	.5	.7	1.0	1.5	.....
25.....	.4	1.5	.6	.6	1.2	1.2	.....
26.....	.4	1.2	.5	.4	2.0	.8	.....
27.....	.7	1.5	.5	.8	1.1	.7	.....
28.....	.8	1.0	.5	.7	2.7	.6	.....
29.....	.6	.7	.5	.5	1.5	.6	.....
30.....	.5	.6	.5	.5	1.4	.6	.....
31.....	.4	1.8	.....	.8	.....	.6	.....

NOTE.—Dec. 10-16 no record. Discharge estimated by comparison with East Branch of Manoa Stream and range of stage on recorder sheet, at 1.2 million gallons per day.

Monthly discharge of East Manoa ditch near Honolulu, Oahu., for the year ending June 30, 1921.

Month.	Discharge.			Second-foot (mean).	Total run-off.	
	Million gallons per day.				Million gallons.	Acro-feet.
	Maximum.	Minimum.	Mean.			
July.....	1.5	0.4	0.55	0.85	16.9	52
August.....	1.8	.4	.72	1.11	22.2	68
September.....	1.0	.5	.64	.99	19.3	59
October.....	1.0	.4	.57	.88	17.6	54
November.....	2.8	.4	1.11	1.72	33.4	102
December.....	2.8	.6	1.04	1.61	32.3	99
January 1-16.....	4.5	.6	1.54	2.38	24.7	76
The period.....	.....	.....	.....	.....	166	510

RIGHT BRANCH OF NORTH FORK OF KAUKONAHUA STREAM NEAR WAHIAWA, OAHU.

LOCATION.—200 feet upstream from intake of Wahiawa Water Co.'s tunnel, which is at confluence of right and left branches, or two main branches, of North Fork of Kaukonahua Stream, 8 miles northeast of Wahiawa.

RECORDS AVAILABLE.—May 29, 1913, to June 30, 1921.

GAGE.—Stevens continuous water-stage recorder.

DISCHARGE MEASUREMENTS.—Made by wading or from footbridge 20 feet upstream from gage.

CHANNEL AND CONTROL.—Channel is a straight stretch 200 feet long that has been cleared of boulders. Banks steep and flow well distributed and confined. Natural control of large boulders has been improved somewhat for low-water stages.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 8.06 feet at 4.40 a. m. January 16 (discharge about 980 million gallons per day or 1,520 second-feet); minimum stage recorded during year, 1.41 feet from 7 a. m. to 4 p. m. April 4 (discharge, 0.5 million gallons per day or 0.8 second-foot).

1913-1921: Maximum stage during period of record 9.0 feet at 3 a. m. March 26, 1920 (by flood marks and comparison with Left Branch record) (discharge, estimated by extension of rating curve, 1,300 million gallons per day⁵ or 2,010 second-feet); minimum daily discharge, March 24 and 28, 1914 (0.2 million gallons per day or 0.3 second-foot).

DIVERSIONS.—None.

REGULATION.—None.

OBJECT OF STATION.—To determine amount of water taken from Territorial lands by Wahiawa Water Co. Water rises on Territorial lands.

UTILIZATION.—Wahiawa Water Co.'s ditch diverts entire low-water flow of both right and left branches of North Fork of Kaukonahua Stream for domestic water supply and irrigation in vicinity of Wahiawa. All water, except the low flow, from North Fork is impounded in Wahiawa reservoir for irrigation of sugar cane on Waialua plantation.

ACCURACY.—Stage-discharge relation changed during the flood of January 16. Rating curves well defined between 1 and 200 million gallons per day, used July 1 to January 15 and January 16 to June 30. Operation of water-stage recorder satisfactory. Records good up to 200 million gallons per day but high-water extensions uncertain.

Discharge measurements of Right Branch of North Fork of Kaukonahua Stream near Wahiawa, Oahu, during the year ending June 30, 1921.

Date.	Made by—	Gage height (feet).	Discharge.	
			Second-foot.	Million gallons per day.
July 3	J. E. Stewart.....	1.45	2.2	1.4
31	B. F. Rush.....	1.50	3.7	2.4
Sept. 9	J. E. Stewart.....	1.80	4.3	2.8
Oct. 16	M. H. Carson.....	1.62	5.2	3.4
Nov. 8	do.....	1.68	5.5	3.6
Dec. 4	J. E. Stewart.....	1.62	5.7	3.7
Jan. 4	M. H. Carson.....	1.62	6.2	4.0
Feb. 3	do.....	2.02	8.2	5.3
Mar. 11	J. E. Stewart.....	1.50	.95	.6
Apr. 7	M. H. Carson.....	1.55	1.35	.9
May 6	J. E. Stewart.....	1.98	6.6	4.3
June 6	M. H. Carson.....	1.59	1.75	1.15

⁵ Estimate revised from that published in Water-Supply Paper 516.

Discharge, in million gallons per day, of Right Branch of North Fork of Kauhakua Stream near Wahiawa, Oahu, for the year ending June 30, 1921.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1.....	1.5	3.3	22	1.7	6.9	3.5	3.1	7.5	1.3	0.7	9.5	1.8
2.....	1.5	1.8	5.3	12.6	6.2	2.8	6.5	5.8	1.7	.6	14.4	1.7
3.....	1.7	3.3	4.0	2.8	11.6	2.8	5.6	5.6	1.3	.6	14.3	1.5
4.....	1.1	2.1	3.3	2.0	5.9	6.9	3.8	6.2	1.2	1.5	14.2	1.4
5.....	1.4	1.7	3.0	1.9	3.0	3.0	45	5.3	1.1	1.8	6.5	1.3
6.....	1.1	1.6	5.0	4.9	3.3	4.2	28	5.9	1.1	3.0	4.6	1.2
7.....	.9	1.7	15.2	7.6	3.3	3.7	25	6.0	1.0	1.2	3.6	2.5
8.....	1.1	1.4	3.5	1.9	5.9	11.4	56	4.4	.9	27	3.0	1.3
9.....	1.1	1.3	3.1	1.6	2.8	6.8	18.1	3.6	.9	3.5	2.7	1.2
10.....	1.9	1.3	8.0	1.5	2.2	3.5	9.4	3.4	.8	1.6	2.4	1.0
11.....	2.2	1.1	9.8	2.8	1.8	3.5	7.2	3.7	.8	1.2	2.2	1.0
12.....	17.0	2.4	8.4	5.8	1.7	12.3	15.5	3.0	.8	1.2	2.1	1.0
13.....	3.3	1.7	4.0	4.5	1.6	46	16.5	2.8	.8	1.3	2.0	1.0
14.....	1.8	19.4	3.8	3.0	1.5	6.2	91	2.8	.7	1.0	2.7	1.0
15.....	2.9	2.0	4.2	11.8	1.4	4.5	53	8.8	.8	.9	2.3	3.4
16.....	1.6	1.7	7.0	4.3	1.4	3.6	230	3.1	.8	2.8	3.0	1.2
17.....	1.6	1.7	3.6	25	1.4	3.1	133	2.6	1.5	1.0	11.0	3.1
18.....	1.2	1.4	3.5	14.8	1.3	2.5	60	5.4	.9	.8	8.3	1.1
19.....	3.8	1.2	3.6	11.6	1.5	2.2	36	2.5	.8	.8	8.1	1.0
20.....	3.1	2.0	3.6	7.6	7.9	1.8	18.4	2.4	.8	15.7	7.3	1.0
21.....	3.6	4.2	3.5	4.6	26	1.8	17.2	3.0	5.0	2.6	23	.8
22.....	1.6	6.6	3.5	3.9	11.9	1.5	18.6	2.9	1.1	2.0	5.8	.8
23.....	1.3	19.6	4.2	3.3	5.6	40	13.2	2.0	.9	2.1	3.6	.9
24.....	1.2	13.6	3.6	3.1	3.0	35	9.2	1.8	4.4	17.7	24	.8
25.....	7.0	26	3.3	3.3	3.2	22	72	1.7	1.0	6.7	4.9	.7
26.....	3.1	8.0	4.0	2.7	12.4	5.1	53	1.6	.7	23	3.5	.7
27.....	4.8	5.7	6.2	2.5	3.2	3.8	33	1.4	.7	32	3.0	.9
28.....	12.9	4.2	2.7	2.2	23	3.1	17.5	1.4	.6	24	2.6	1.0
29.....	6.8	4.0	2.2	2.4	5.6	2.5	12.5	.6	.6	43	2.3	.8
30.....	2.7	17.3	1.9	2.1	5.9	2.0	12.2	.6	5.3	40	2.1	2.0
31.....	2.2	17.3	4.2	4.2	1.7	1.7	9.0	1.1	1.1	1.9	1.9	.....

Monthly discharge of Right Branch of North Fork of Kauhakua Stream near Wahiawa, Oahu, for the year ending June 30, 1921.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-foot (mean).	Million gallons.	Acre-foot.
	Maximum.	Minimum.	Mean.			
July.....	17.0	0.9	3.19	4.94	99.0	303
August.....	26	1.1	5.83	9.02	181	555
September.....	22	1.9	5.50	8.51	165	506
October.....	25	1.5	5.29	8.18	164	503
November.....	26	1.3	5.75	8.90	172	523
December.....	46	1.5	8.15	12.6	253	775
January.....	230	3.1	38.0	58.8	1,180	3,680
February.....	8.8	1.4	3.81	5.89	107	327
March.....	5.8	.6	1.35	2.09	41.9	128
April.....	43	.6	8.71	13.5	261	802
May.....	24	1.9	6.48	10	201	616
June.....	3.4	.7	1.30	2.01	39.1	120
The year.....	230	.6	7.84	12.1	2,890	8,780

LEFT BRANCH OF NORTH FORK OF KAUKONAHUA STREAM NEAR WAHIAWA, OAHU.

LOCATION.—100 feet above intake of Wahiawa Water Co.'s tunnel, which is at confluence of Right and Left branches or two main branches of North Fork, 8 miles northeast of Wahiawa.

RECORDS AVAILABLE.—May 25, 1913, to June 30, 1921.

GAGE.—Stevens continuous water-stage recorder.

DISCHARGE MEASUREMENTS.—Made by wading.

CHANNEL AND CONTROL.—Channel straight for 100 feet above and below gage; fairly uniform in cross section, with high, wooded banks; only one channel at all stages. Stream bed composed of boulders and gravel. Control composed of large boulders; fairly permanent.

EXTREMES OF DISCHARGE.—Maximum stage recorded, 9.60 feet at 4.30 a. m. January 16 (discharge, 3,460 million gallons per day or 5,350 second-feet); minimum discharge recorded during the year, 1.15 feet at 8.30 p. m. April 3 (discharge, 0.9 million gallons per day, or 1.4 second-feet).

1913-1921: Maximum discharge recorded in January, 1921; minimum discharge recorded 4 a. m. February 18 and 11.30 p. m. March 5, 1920, (0.1 million gallons per day, or 0.16 second-foot).

DIVERSIONS.—None.

REGULATION.—None.

OBJECT OF STATION.—To determine amount of water diverted from Territorial land by Wahiawa Water Co. Water all rises on Territorial lands.

UTILIZATION.—Wahiawa Water Co.'s tunnel diverts entire low-water flow of both Right and Left branches of North Fork, for domestic water supply and for irrigation in vicinity of Wahiawa. All water, except the low flow from North Fork of Kaukonahua Stream is impounded in Wahiawa reservoir for irrigation of sugar cane on Waiialua plantation.

ACCURACY.—Stage-discharge relation changed by floods of December 24 and January 16. Rating curve used July 1 to December 23 well defined between 0.2 and 200 million gallons per day. Rating curve used December 24 to January 15 not well defined. Rating used January 16 to June 30 well defined below 50 million gallons per day. Extension of all curves up to 200 million gallons per day are parallel. Extreme high water determined by logarithmic extension and checked by one slope computation at a stage of 8.82 feet. Operation of water-stage recorder satisfactory, except as noted in footnote to table of daily discharge. Records good when recorder was operating.

Discharge measurements of Left Branch of North Fork of Kaukonahua Stream near Wahiawa, Oahu, during the year ending June 30, 1921.

Date.	Made by—	Gage height (feet).	Discharge.	
			Second-feet.	Million gallons per day.
July 3	J. E. Stewart.....	1.19	4.0	2.6
31	B. F. Rush.....	1.39	6.9	4.5
Sept. 9	J. E. Stewart.....	1.36	5.9	3.8
Oct. 16	M. H. Carson.....	1.42	8.4	5.4
Nov. 8	do.....	1.48	9.5	6.2
Dec. 4	J. E. Stewart.....	1.45	7.7	5.0
Jan. 4	M. H. Carson.....	1.53	12.5	8.1
Feb. 3	do.....	1.64	13.0	8.4
Mar. 11	J. E. Stewart.....	1.19	1.35	.9
Apr. 7	M. H. Carson.....	1.30	4.4	2.8
May 6	J. E. Stewart.....	1.49	6.6	4.2
June 6	M. H. Carson.....	1.26	3.1	2.0

Discharge, in million gallons per day, of Left Branch of North Fork of Kaukonahua Stream near Wahiawa, Oahu, for the year ending June 30, 1921.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	2.0			2.4	17.9	5.4	5.0	11.0		1.5	8.8	2.5
2	2.0			25	13.9	4.2	14.2	10.4		1.2	7.6	2.4
3	2.2			4.4	23	4.8	22			1.1	7.9	2.0
4	2.0			3.5	5.1	10.6	7.7			6.3	10.8	1.8
5	2.3			5.2	4.0	4.3	147			4.4	7.0	1.7
6	1.9			12.0	4.0	9.0	105			8.6	5.1	1.6
7	1.8			13.9	3.9	9.8	67			3.4	4.4	7.2
8	1.8			3.9	8.4	31	103			64	3.7	2.4
9	1.8			3.3	3.5	19.0	38			9.3	3.6	2.2
10	3.2		14.0	3.2	3.4	7.8	15.5			4.6	3.4	1.5
11	7.3		14.8	6.3	2.7	8.0	12.2			3.6	3.2	1.3
12	35		13.8	13.8	2.3	13.2	25		1.3	3.0	3.0	1.8
13	5.1		6.5	5.4	2.3	36	24		1.2	3.4	2.5	2.3
14	2.8		5.6	4.0	2.2	8.6	289		1.2	2.5	3.9	2.4
15	6.5		4.8	19.0	2.1	6.5	162		1.4	2.5	3.6	7.0
16	3.0		9.4	6.0	2.0	5.4	597		1.3	10.7	7.0	2.3
17	3.5		3.7	31	1.8	4.6	270		3.8	3.2	10.1	3.4
18	2.3		3.4	35	1.8	4.3	70		1.5	2.4	19.4	1.8
19	10.9		3.2	17.7	4.3	3.9	42		1.8	2.2	13.6	1.8
20	5.8		5.5	8.8	13.4	3.4	24		3.2	15.7	9.3	1.7
21	1.8		6.5	5.8	66	3.3	19.5		18.7	4.4	23	1.4
22	3.8		3.8	4.9	38	3.2	18.4		2.8	5.1	11.2	1.3
23	2.9		4.7	4.0	15.7	101	14.9		4.5	3.9	6.6	1.3
24	2.6		4.6	3.7	6.3	69	12.4		8.8	16.9	36	1.3
25	12.4		14.6	3.8	6.1	43	171		2.4	11.9	6.8	1.1
26			4.6	3.2	32	8.9	95		1.7	12.7	5.2	2.1
27			4.7	3.0	5.8	6.6	85		1.3	26	4.7	2.2
28			3.2	2.7	44	5.4	25		1.3	23	4.0	1.7
29			2.9	3.1	10.5	5.2	17.3		1.1	30	3.2	1.7
30			2.6	2.5	10.7	4.7	17.7		13.3	44	3.0	3.7
31			2.6	8.1		4.2	13.0		2.5		2.9	

NOTE.—No record and discharge in million gallons per day estimated by comparison with Right Branch of North Fork of Kaukonahua Stream as follows: July 26-31, 7.5; Aug. 1-5, 3.9; Aug. 6-10, 2.5; Aug. 11-15, 8; Aug. 16-20, 6.5; Aug. 21-25, 21; Aug. 26-31, 14; Sept. 1-5, 11; Sept. 6-9, 10; Feb. 3-5, 8; Feb. 6-10, 7; Feb. 11-15, 6; Feb. 16-20, 5; Feb. 21-25, 3.5; Feb. 26-28, 2.5; Mar. 1-5, 2.0; Mar. 6-11, 1.4.

Monthly discharge of Left Branch of North Fork of Kaukonahua Stream near Wahiawa, Oahu, for the year ending June 30, 1921.

Month.	Discharge.			Second-foot (mean).	Total run-off.	
	Million gallons per day.				Million gallons.	Acre-foot.
	Maximum.	Minimum.	Mean.			
July	35	1.8	5.86	9.07	182	557
August			9.47	14.7	204	901
September		2.6	7.73	12.0	232	712
October	35	2.4	8.66	13.4	269	824
November	66	1.8	11.9	18.4	357	1,100
December	101	3.2	16.3	25.2	504	1,550
January	597	5.0	81.6	126	2,530	7,760
February			5.73	8.87	160	492
March	18.7		3.02	4.67	93.5	287
April	64	1.1	11.0	17.0	332	1,010
May	36	2.5	7.89	12.2	244	751
June	7.2	1.1	2.30	3.56	68.9	212
The year	597		14.4	22.3	5,260	16,200

MISCELLANEOUS MEASUREMENTS.

A measurement of Punahou Springs at Honolulu, March 19, 1921, showed a discharge of 0.55 second-foot, or 0.35 million gallons per day.

ISLAND OF MOLOKAI.

HALAWA STREAM NEAR HALAWA, MOLOKAI.

LOCATION.—250 feet below confluence of two main branches and 2 miles above mouth of stream and Halawa school house.

RECORDS AVAILABLE.—August 28, 1917, to June 30, 1921.

GAGE.—Stevens continuous water-stage recorder.

DISCHARGE MEASUREMENTS.—Made by wading.

CHANNEL AND CONTROL.—One channel at all stages; straight for 150 feet above and 100 feet below gage; banks high and steep. Control composed of large boulders; fairly permanent.

EXTREMES OF DISCHARGE.—Maximum stage recorded during the year, about 9.5 feet around noon of December 24 (discharge, 1,310 million gallons per day or 2,030 second-feet); minimum stage recorded during year, 0.16 foot, 12.20 a. m. July 8 (discharge, 1.7 million gallons per day, or 2.6 second-feet).

1917-1921: Maximum stage recorded, 9.75 feet at 8.15 a. m. January 17, 1920 (discharge, 1,360 million gallons per day or 2,100 second-feet); minimum discharge recorded at stage 0.35 foot, October 13-15 and 19, 1917 (discharge, 0.8 million gallons per day or 1.2 second-feet).

DIVERSIONS.—None.

REGULATION.—None.

OBJECT OF STATION.—To determine feasibility of water-supply project for Halawa village and amount of water available for irrigation on leeward side of island.

UTILIZATION.—For irrigation of taro and for domestic supply.

ACCURACY.—Stage-discharge relation not permanent. Shift October 17 changed rating below 2-foot stage. Two rating curves used are well defined below 150 million gallons per day. High-water extension of new rating revised on basis of fuller information. Operation of water-stage recorder unsatisfactory. Records good when recorder was operating, fair for estimated periods.

Discharge measurements of Halawa Stream near Halawa, Molokai, during the year ending June 30, 1921.

Date.	Made by—	Gage height (feet).	Discharge.	
			Second-feet.	Million gallons per day.
July 7	B. F. Rush.....	0.17	2.5	1.6
Aug. 9	do.....	.34	3.6	2.4
Sept. 13	M. H. Carson.....	1.33	32	20.8
Oct. 26	do.....	.67	14.1	9.1
Dec. 1	do.....	1.27	36.5	23.7
Jan. 24	do.....	2.30	126	81
Mar. 9	E. M. Pickop.....	.10	6.0	3.9
Apr. 18	do.....	.48	10.9	7.1
May 25	J. E. Stewart.....	.77	17.6	11.4

Discharge, in million gallons per day, of Halawa Stream near Halawa, Molokai, for the year ending June 30, 1921.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.
1	13.2	5.0	34	3.0	13.0	27		14.0	4.9		
2	5.1	13.7	8.2	5.2	25	15.2		12.9	7.5		5.1
3	3.2	10.7	6.5	4.4	20.0	12.0		14.0	5.0		29
4	2.6	8.3	5.3	3.8	15.4	10.9		17.5	4.5		10.9
5	2.2	5.1	5.0	5.3	13.2	19.3		11.8	4.5		37
6	2.2	4.2	9.9	5.1	8.5	34		18.0	4.2		10.9
7	1.7	3.6	29	14.6	7.8	15.2		15.2	4.2		7.8
8	2.5	3.2	7.7	4.6	20	15.2		10.0	3.8		7.8
9	3.8	2.9	5.3	3.4	10.9	19.3		10.9	3.8		6.7
10	10.8	2.7	12.8	2.9	9.2	12.0		15.6	3.8		5.8
11	2.9	2.5	14.4	18.7	13.9	14.0		23	3.7		5.3
12	6.1	17.8	14.6	25	14.4	10.0		9.2	3.7		5.3
13	2.8	11.8	16.4	5.1	8.5	25		7.8	3.6		5.3
14	2.7	16.0	9.5	3.9	7.8	17.6		7.2	3.5		4.9
15	6.6	6.2	7.4	10.4	7.2	12.9	268	9.2	3.5		5.3
16	7.8	4.5	9.7	8.9	6.7	9.2		7.2	3.7		6.7
17	28	3.4	6.1	13.8	6.2	8.5		6.7	3.7		12.4
18	5.2	3.0	5.4	82	5.8	7.8	91	12.9	3.6		9.8
19	4.4	2.7	4.7	19.0	5.8	7.2	74	7.8	6.7	5.8	12.9
20	6.4	15.0	4.0	10.9	71	7.2	60	6.7	4.5		11.8
21	9.2	30	4.2	9.2	74	7.8	33	9.9	17.1		61
22	26	19.4	3.7	8.5	73	7.8	52	13.7	7.8		12.0
23	15.3	58	3.5	7.2	27	53	28	7.2	5.8		10
24	8.2	54	3.5	40	17.6		66	6.2	5.8		48
25	5.8	31	4.1	28	15.2		73	5.8	14.0		
26	5.4	22	5.0	10.0	27		51	5.8			
27	17.7	40	4.3	9.2	37		85	5.3			
28	17.2	17.7	3.2	10.0	55		29	4.9			
29	6.1	18.9	3.2	7.8	33		26				
30	8.4	7.2	3.9	7.8	64		30				
31	5.7	17.0		18.2			15.2				

NOTE.—Recorder not working properly and discharge estimated in million gallons per day as follows: Dec. 24-26, 130; Dec. 27-31, 12; Jan. 1-5, 30; Jan. 6-10, 50; Jan. 11-14, 125; Jan. 16-17, 240; Mar. 26-31, 20; Apr. 1-5, 7; Apr. 6-10, 40; Apr. 11-15, 8; Apr. 16-18, 15; Apr. 20-30, 15; May 1, 6; May 25, 11; May 26-31, 4; June 1-14, 2; June 15-20, 3.5; June 21-26, 2; June 27-30, 15. Estimates based on comparison with flow of Papalana Stream.

Monthly discharge of Halawa Stream near Halawa, Molokai, for the year ending June 30, 1921.

Month.	Discharge.			Total run-off.		
	Million gallons per day.			Second-foot (mean).	Million gallons.	Acre-foot.
	Maximum.	Minimum.	Mean.			
July	28	1.7	7.89	12.2	245	751
August	58	2.5	14.4	22.3	448	1,370
September	34	3.2	8.47	13.1	254	780
October	82	2.9	12.9	20.0	401	1,230
November	74	5.8	24.1	37.3	722	2,220
December			26.7	41.3	829	2,540
January			76.2	118	2,360	7,350
February	23	4.9	10.6	10.4	206	611
March		3.5	9.98	15.4	309	949
April			16.4	25.4	491	1,510
May	61		12.1	18.7	377	1,150
June			4.03	6.24	121	371
The year			18.8	29.1	6,850	21,000

PAPALAUA STREAM NEAR WAILAU, MOLOKAI

LOCATION.—One-quarter mile above mouth of stream, 2 miles east of Wailau Landing, 5 miles by foot trail west of Halawa village, and 6½ miles due north of Pukoo village.

RECORDS AVAILABLE.—September 17, 1919, to June 30, 1921.

GAGE.—Stevens continuous water-stage recorder installed May 22, 1920. Prior to this Gurley printing water-stage recorder was used.

DISCHARGE MEASUREMENTS.—Made by wading or from suspension footbridge near station.

CHANNEL AND CONTROL.—Rocky and boulder strewn bed with high rocky banks. Control large boulders and gravel. Shifts during floods.

EXTREMES OF DISCHARGE.—Maximum stage recorded, 8.58 feet at 10.20 a. m. December 24 (discharge, 1,050 million gallons per day or 1,620 second-feet); minimum stage recorded, 0.68 foot June 25 (discharge, 1.4 million gallons per day or 2.2 second-feet).

1919-1921. Maximum discharge recorded as above. Minimum discharge recorded at 1.02 feet Feb. 26 and 27, 1920 (1.0 million gallons per day or 1.6 second-feet).

DIVERSIONS.—None.

REGULATION.—None.

OBJECT OF STATION.—To determine amount of water in stream available for irrigation on leeward side of island.

UTILIZATION.—Entire flow now wastes into sea.

ACCURACY.—Stage-discharge relation not permanent. Two rating curves used are fairly well defined below 200 million gallons per day. Operation of water-stage recorder satisfactory. Records good except for extreme low flow for February, March, and April. Accumulation of mud in well during this period makes the record a partial estimate.

Discharge measurements of Papalaua Stream near Wailau, Molokai, during the year ending June 30, 1921.

Date.	Made by—	Gage height (feet).	Discharge.	
			Second-feet.	Million gallons per day.
July 6	B. F. Rush.....	1.18	2.3	1.5
Aug. 8	do.....	1.22	2.1	1.4
Sept. 13	do.....	1.47	8.0	5.2
Oct. 26	M. H. Carson.....	1.44	7.2	4.7
Dec. 2	do.....	1.50	8.5	5.5
Jan. 23	do.....	1.51	19.0	12.3
Mar. 10	do.....	.74	2.5	1.65
Apr. 18	E. M. Pickop.....	1.12	6.0	3.9
May 25	W. C. Renshaw.....	1.23	9.5	6.1

Discharge, in million gallons per day, of Papalaua Stream near Wailau, Molokai, for the year ending June 30, 1921.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1.....	8.8	3.1	34	2.1	11.5	18.5	9.8	6.2	2.3	5.4	4.4	2.2
2.....	3.1	7.7	5.0	4.4	21	6.0	12.4	5.0	6.4	5.0	13.6	2.2
3.....	2.2	5.9	4.0	3.2	9.5	6.4	12.5	12.6	2.2	5.0	40	2.1
4.....	2.0	6.4	3.4	2.5	9.4	10.8	13.9	12.7	1.8	5.0	31	1.9
5.....	1.8	3.4	3.2	3.5	5.0	12.0	52	6.9	1.8	4.9	36	1.8
6.....	1.6	2.5	12.0	5.9	3.4	25	134	17.2	1.8	124	6.9	1.8
7.....	1.6	2.2	28	11.3	2.8	7.8	30	10.8	1.8	17.0	5.4	3.0
8.....	2.2	2.5	4.6	3.1	32	13.0	23	6.0	1.7	33	5.6	2.1
9.....	4.5	2.0	3.6	2.3	5.2	10.6	24	6.0	1.6	11.6	4.7	1.9
10.....	6.6	1.8	11.4	2.1	3.9	8.6	9.1	14.4	1.8	7.1	3.5	1.7
11.....	2.1	1.9	14.2	22	13.3	7.5	10.0	21	1.8	6.6	3.0	1.6
12.....	5.3	15.6	8.9	16.4	6.0	10.5	21	5.4	1.8	5.9	3.1	1.6
13.....	2.1	8.7	16.1	3.1	3.9	22	64	4.8	1.8	6.6	2.9	1.6
14.....	2.1	15.0	5.8	2.4	3.2	10.3	286	4.7	1.7	6.7	2.5	1.8
15.....	6.3	3.9	4.8	9.5	2.7	6.4	200	8.6	1.6	5.0	3.9	5.4
16.....	8.6	2.6	6.2	6.7	2.2	4.4	208	4.9	1.6	26	4.0	2.4
17.....	20.0	2.3	3.5	18.7	1.9	3.6	178	4.0	1.6	10.9	11.3	2.0
18.....	3.4	2.0	3.2	90	2.1	3.2	55	14.7	1.6	5.2	10.0	1.8
19.....	4.9	1.9	2.6	9.5	2.1	3.0	65	6.0	4.9	3.5	10.0	2.6
20.....	5.6	16.1	2.3	4.6	82	3.0	40	4.9	2.5	39	9.7	4.8
21.....	7.7	21	2.4	3.9	72	3.7	17.8	6.2	18.0	5.3	52	2.1
22.....	24	30	2.2	3.6	61	3.3	14.7	6.9	6.4	4.4	8.4	1.8
23.....	16.8	34	2.2	2.7	12.7	48	15.6	4.0	6.1	5.4	6.9	1.6
24.....	7.1	48	2.2	43.	8.0	208	23	3.5	88	38	50	1.5
25.....	5.8	24	2.7	19.7	8.3	147	77	3.2	12.2	6.0	6.7	1.6
26.....	2.8	15.1	3.1	4.2	16.2	11.1	57	3.0	55	4.4	4.7	2.0
27.....	18.5	33	2.6	4.6	46	7.4	102	2.7	8.9	15.8	3.7	36
28.....	12.8	9.4	2.0	4.2	39	6.6	22	2.4	6.7	4.9	3.2	7.9
29.....	3.7	5.0	2.3	3.2	29	5.6	12.1	.....	4.7	12.6	2.9	18.2
30.....	5.6	7.2	2.8	3.6	53	5.3	8.9	.....	33	26	2.6	4.7
31.....	3.4	12.2	.....	8.9	.....	5.0	7.2	.....	8.0	.....	2.4	.....

NOTE.—Records for following days partly estimated: Dec. 29-31; Jan. 1, Feb. 1-3, 8-28; Mar. 1-23, 28, 29, 31; Apr. 1-6, 10-26, 28, 29; May 1.

Monthly discharge of Papalaua Stream near Wailau, Molokai, for the year ending June 30, 1921.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-foot (mean).	Million gallons.	Acre-foot.
	Maximum.	Minimum.	Mean.			
July.....	24	1.6	6.55	10.1	203	623
August.....	48	1.8	11.2	17.3	346	1,070
September.....	34	2.0	6.71	10.4	201	618
October.....	90	2.1	10.5	16.2	325	999
November.....	82	1.9	18.9	29.2	368	1,740
December.....	208	3.0	20.8	32.2	644	1,980
January.....	286	7.2	58.2	90.0	1,800	5,540
February.....	21	2.4	7.45	11.5	209	640
March.....	33	1.6	9.39	14.5	291	893
April.....	124	3.5	15.2	23.5	456	1,400
May.....	52	2.4	11.4	17.6	355	1,080
June.....	36	1.5	4.12	6.37	124	379
The year.....	286	1.5	15.1	23.4	5,520	17,000

WAIAKEAKUA STREAM NEAR WAILAU, MOLOKAI.

LOCATION.—Half a mile above confluence with Pulena Stream, 3 miles south of Wailau landing, and 4 miles northwest of Pukoo village.

RECORDS AVAILABLE.—October 30, 1919, to June 30, 1921.

GAGE.—Stevens continuous water-stage recorder.

DISCHARGE MEASUREMENTS.—Made by wading or from footbridge at the station.

CHANNEL AND CONTROL.—Stream bed rocky and boulder strewn. Banks steep, high, and covered with vegetation. Control formed of boulders, cobblestones, and gravel. Not likely to shift.

EXTREMES OF DISCHARGE.—Maximum stage recorded, 5.20 feet at noon December 24 (discharge, 348 million gallons per day or 538 second-feet); minimum stage recorded, 0.98 foot at 5 p. m. July 13 (discharge, 1.6 million gallons per day or 2.5 second-feet).

1919-1921. Maximum stage recorded as above. Minimum stage recorded, 0.92 foot March 7, 1920 (discharge, 1.3 million gallons per day or 2.0 second-feet).

DIVERSIONS.—None.

REGULATION.—None.

OBJECT OF STATION.—To determine amount of water available for irrigation of west end of Molokai.

UTILIZATION.—Small amount being used for irrigation of taro. Most of flow wastes into sea.

ACCURACY.—Stage-discharge relation shifts only during severe floods. Shift December 24, 1920, changed rating below stage 1.7 feet. Rating above stage 2 feet revised on basis of later measurements. Two rating curves used are well defined below 150 million gallons per day. Operation of water-stage recorder satisfactory. Records good.

Discharge measurements of Waiakeakua Stream near Wailau, Molokai, during the year ending June 30, 1921.

Date.	Made by—	Gage height (feet).	Discharge.	
			Second-feet.	Million gallons per day.
July 3	B. F. Rush.....	1.06	2.7	1.8
Aug. 4	M. H. Merry.....	1.22	4.3	2.8
Sept. 8	B. F. Rush.....	1.30	6.5	4.2
Oct. 20	M. H. Carson.....	1.20	5.2	3.4
Dec. 3	.....do.....	1.40	7.8	5.0
Jan. 13	.....do.....	2.08	28	18.2
Mar. 3	.....do.....	1.29	6.6	4.3
Apr. 13	E. M. Pickop.....	1.29	6.0	3.8
May 27	J. E. Stewart.....	1.30	6.8	4.4

Discharge, in million gallons per day, of Waiakeakua Stream near Wailau, Molokai, for the year ending June 30, 1921.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1.....	5.8	3.3	7.4	3.1	3.6	10.5	7.3	9.7	4.8	4.2	5.4	3.5
2.....	2.5	3.5	3.8	4.0	8.4	6.7	8.6	9.1	8.2	3.9	5.4	3.4
3.....	2.1	4.2	3.4	8.0	5.7	6.3	8.4	9.2	4.8	3.8	6.8	3.3
4.....	1.9	3.6	3.1	6.1	4.5	5.8	8.9	8.9	4.3	3.7	10.8	3.2
5.....	1.9	2.9	3.2	6.3	3.6	7.0	21	7.8	4.1	3.7	13.9	3.1
6.....	1.8	2.6	6.1	9.2	3.1	10.0	58	11.1	4.0	15.8	7.1	3.1
7.....	1.7	2.5	7.7	7.0	2.9	5.4	18.6	8.7	4.0	14.2	6.1	3.7
8.....	2.0	2.2	3.9	3.1	15.8	7.4	12.8	7.5	3.9	10.3	5.7	3.1
9.....	2.3	2.1	3.6	2.5	5.5	6.1	15.1	7.3	3.8	8.7	4.8	3.6
10.....	2.3	2.0	4.1	2.2	4.8	5.5	10.7	9.8	3.7	5.9	4.4	2.9
11.....	1.8	2.3	8.7	2.0	3.8	4.8	10.1	10.0	3.6	5.2	4.1	2.9
12.....	1.8	5.2	6.2	.....	3.5	4.3	10.3	7.3	3.6	5.0	4.0	2.9
13.....	1.6	3.4	5.8	.....	3.2	6.0	22	6.8	3.5	4.6	4.1	2.8
14.....	1.8	5.8	4.8	.....	3.0	6.0	99	6.7	3.4	4.3	3.8	3.1
15.....	1.8	2.9	4.3	.....	2.8	4.4	72	7.7	3.4	4.0	3.9	3.8
16.....	2.4	2.2	4.3	.....	2.6	3.8	80	6.6	3.4	7.7	3.9	3.0
17.....	6.9	2.2	3.8	.....	2.5	3.5	80	6.2	3.4	5.0	4.8	2.9
18.....	2.4	2.0	3.6	.....	2.5	3.3	30	6.6	3.5	4.2	4.8	2.7
19.....	2.3	1.9	3.4	.....	2.4	3.1	28	6.0	3.7	3.8	4.1	3.2
20.....	2.5	7.4	3.4	3.3	19.8	3.3	17.5	5.9	3.6	12.7	4.4	2.7
21.....	3.4	6.3	3.6	3.0	21	3.1	15.0	6.9	4.1	5.6	13.0	2.7
22.....	6.4	7.8	3.1	2.9	22	2.9	13.0	7.1	4.3	5.2	6.8	2.6
23.....	4.8	9.7	3.2	2.5	9.2	9.8	13.4	5.9	3.7	5.3	6.0	2.6
24.....	3.2	12.4	3.1	3.9	6.1	84	15.0	5.6	8.8	15.5	12.4	2.6
25.....	3.4	9.4	3.2	4.1	6.0	71	29	5.4	5.1	7.0	6.2	2.6
26.....	3.1	8.0	3.1	2.6	9.2	15.0	26	5.3	4.3	5.7	5.2	2.7
27.....	7.4	15.9	3.0	3.1	7.6	10.7	47	5.2	3.8	6.7	4.5	10.7
28.....	5.8	8.0	2.9	2.7	11.3	10.1	17.5	5.0	3.6	5.1	4.3	3.8
29.....	3.8	5.5	2.9	2.4	12.4	8.0	13.8	.....	3.5	6.6	4.1	6.7
30.....	5.0	4.7	2.8	2.5	26	7.4	11.9	.....	7.2	10.2	3.8	3.5
31.....	3.5	4.7	.....	3.3	.....	7.0	10.7	.....	7.9	.....	3.7	.....

NOTE.—Record paper exhausted and discharge estimated in million gallons per day as follows: Oct. 12-14, 2; Oct. 15-19, 10. Obtained by comparison with flow of Left Branch of Wailau Stream.

Monthly discharge of Waiakeakua Stream near Wailau, Molokai, for the year ending June 30, 1921.

Month.	Discharge.			Total run-off.		
	Million gallons per day.			Second-foot (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July.....	7.4	1.6	3.21	4.97	99.4	305
August.....	15.9	1.9	5.05	7.81	157	480
September.....	8.7	2.8	4.18	6.47	126	385
October.....	.....	.....	4.70	7.27	146	447
November.....	26	2.4	7.83	12.1	235	721
December.....	84	2.9	11.0	17.0	341	1,060
January.....	7.4	7.6	26.8	41.5	831	2,550
February.....	11.1	5.0	7.33	11.3	205	630
March.....	8.8	3.4	4.42	6.84	137	420
April.....	15.8	3.7	6.77	10.5	203	623
May.....	13.9	3.7	5.88	9.10	182	559
June.....	10.7	2.6	3.43	5.31	103	316
The year.....	99	1.6	7.32	11.3	2,670	8,490

PULENA STREAM NEAR WAILAU, MOLOKAI.

LOCATION.—Half a mile above confluence with Waiakeakua Stream, 3 miles south of Wailau landing, and 4 miles northwest of Pukoo village.

RECORDS AVAILABLE.—October 30, 1919, to June 30, 1921.

GAGE.—Stevens continuous water-stage recorder.

DISCHARGE MEASUREMENTS.—Made by wading or from footbridge near station.

CHANNEL AND CONTROL.—Channel rocky and boulder strewn. Banks steep, high, and fairly clean. Control boulders and gravel, fairly permanent.

EXTREMES OF DISCHARGE.—Maximum stage recorded, 11.5 feet about noon December 24 (discharge, roughly estimated 1,000 million gallons per day or 1,500 second-feet); minimum stage recorded 0.89 foot at 12.40 a. m. July 14 (discharge, 3.0 million gallons per day or 4.6 second-feet).

1919-1921.—Maximum stage recorded as above. Minimum stage recorded as above and also June 28, 1920.

DIVERSIONS.—None.

REGULATION.—None.

OBJECT OF STATION.—To determine amount of water available for irrigation on west end of Molokai.

UTILIZATION.—Small amount being used for irrigation of taro. Most of flow wastes into sea.

ACCURACY.—Stage-discharge relation shifts during floods. Rating curve used July 1 to December 23, 1920, fairly well defined below 200 million gallons. Rating curve used December 24, 1920, to June 30, 1921, poorly defined throughout. Operation of water-stage recorder satisfactory except for two periods where record paper was torn and ensuing record lost. Another period of record had to be corrected for difference in stage between the stilling well and river. Records fair except for period of corrected record which is poor. Estimates for periods of lost record are only approximate.

Discharge measurements of Pulena Stream near Wailau, Molokai, during the year ending June 30, 1921.

Date.	Made by—	Gage height (feet).	Discharge.	
			Second-feet.	Million gallons per day.
July 3	B. F. Rush	0.96	5.9	3.8
Aug. 4	do	1.36	15.5	10.0
Sept. 8	do	1.35	15.2	9.8
Oct. 21	M. H. Carson	1.23	12.8	8.3
Dec. 4	do	1.69	31.5	20.4
Jan. 14	do	2.66	116	75
Mar. 3	E. M. Pickop	1.48	13.1	8.5
Apr. 14	do	1.62	21	12.6
May 27	J. E. Stewart	1.49	12.4	8.0

Discharge, in million gallons per day, of Pulena Stream near Wailau, Molokai, for the year ending June 30, 1921.

Day.	July.	Aug.	Sept.	Oct.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1.....	15.6	9.2	13.9	5.0	-----	-----	14.5	8.4	10.2	14.9	6.6
2.....	5.2	11.1	8.4	5.4	-----	-----	13.6	14.2	8.6	14.2	6.8
3.....	4.1	13.6	7.4	6.2	-----	-----	12.4	9.3	8.4	17.5	6.8
4.....	3.8	12.1	6.8	5.4	-----	-----	13.3	8.0	17.4	37	6.6
5.....	3.9	7.6	8.4	5.2	27	-----	11.8	7.0	10.2	24	6.2
6.....	3.4	7.8	16.3	8.6	39	-----	13.6	6.3	61	16.2	6.0
7.....	3.3	5.6	32	7.4	21	-----	12.1	6.0	42	15.2	7.6
8.....	4.1	5.1	11.8	4.5	38	-----	10.2	6.3	48	14.5	6.5
9.....	4.0	4.6	10.2	5.1	35	-----	10.0	6.5	31	11.8	5.8
10.....	4.8	4.1	12.1	5.5	24	-----	10.7	6.5	21	10.0	5.2
11.....	3.3	4.2	32	5.6	19.5	-----	11.8	6.2	16.2	9.5	5.2
12.....	3.9	8.4	25	5.5	16.9	-----	9.0	6.2	14.9	9.0	5.2
13.....	3.3	9.6	18.0	5.4	22	-----	8.6	6.2	12.4	8.0	5.1
14.....	3.4	12.5	13.2	4.8	31	212	9.0	6.3	11.0	7.4	6.3
15.....	3.9	5.8	11.1	13.8	22	194	13.9	6.3	9.3	8.2	9.4
16.....	5.6	4.7	11.3	25	15.9	175	9.3	6.6	21	8.2	5.8
17.....	22	4.5	8.6	14.0	13.2	222	8.8	6.8	13.9	11.5	5.2
18.....	5.2	4.1	8.0	34	11.8	103	10.2	6.6	11.0	13.9	4.9
19.....	6.2	4.1	7.4	16.2	10.8	62	9.0	7.8	8.8	11.0	7.8
20.....	6.3	22	6.6	8.6	10.6	48	9.0	7.4	33	10.0	5.5
21.....	9.7	25	7.2	7.0	13.5	41	14.2	11.8	16.5	19.1	4.9
22.....	15.9	23	6.4	6.4	9.9	38	14.5	7.8	15.2	13.6	4.6
23.....	13.1	34	6.4	6.1	61	30	10.7	7.8	15.5	11.8	4.5
24.....	7.4	29	6.1	9.9	145	25	10.0	18.6	30	20.0	4.4
25.....	6.1	35	6.0	-----	-----	61	9.8	10.2	18.9	14.2	4.4
26.....	7.2	29	6.0	-----	-----	52	9.5	7.8	16.8	11.2	9.6
27.....	11.4	57	5.8	-----	-----	48	9.0	7.8	12.4	9.0	20.0
28.....	15.4	27	5.0	-----	-----	30	8.8	7.4	8.4	8.2	12.0
29.....	9.3	16.2	5.8	-----	-----	22	-----	9.3	18.5	8.4	9.9
30.....	13.6	12.1	6.6	-----	-----	18.2	-----	17.2	30	7.6	6.8
31.....	7.6	10.2	-----	-----	-----	16.2	-----	13.6	-----	7.0	-----

NOTE.—Record paper torn and discharge estimated in million gallons per day as follows: October 25-31, 7; Nov. 1-3, 25; Nov. 4-7, 6; Nov. 8-10, 25; Nov. 11-19, 7; Nov. 20-22, 80; Nov. 23-30, 24; Dec. 1-4, 24; Dec. 25-31, 36; Jan. 1-4, 17; and Jan. 5-13, 40.

Recorded difference in stage between stilling well and river assumed to have occurred as follows: Increase; in stage of well over river of 0.05 foot per day from January 18 until maximum of 0.65 foot and constant thereafter until April 1. A similar constant difference of 0.05 foot from April 5-14. Gradual increase thereafter to 0.16 foot reached May 24. Estimates obtained and corrections checked with flow of adjacent streams.

Monthly discharge of Pulena Stream near Wailau, Molokai for the year ending June 30, 1921.

Month.	Discharge.			Second-foot (mean).	Total run-off.	
	Million gallons per day.				Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July.....	22	3.3	7.48	11.6	232	713
August.....	57	4.1	14.8	22.9	458	1,410
September.....	32	5.0	11.0	17.0	330	1,010
October.....	34	4.5	8.70	13.5	270	828
November.....	-----	-----	22.3	34.5	669	2,050
December.....	-----	9.9	30.1	46.6	933	2,880
January.....	222	-----	58.9	91.1	1,830	5,600
February.....	14.5	8.6	11.0	17.0	307	945
March.....	18.6	6.0	8.52	13.2	264	811
April.....	61	8.4	19.7	30.5	592	1,810
May.....	27	7.0	12.6	19.5	392	1,200
June.....	20.0	4.4	6.85	10.6	206	631
The year.....	222	3.3	17.7	27.4	6,480	19,900

PELEKUNU STREAM NEAR PELEKUNU, MOLOKAI.

LOCATION.—Half a mile above confluence with Lanipuni Stream, 2 miles south of Pelekunu Landing, 6 miles north of Kamalo village, and 12 miles by trail northwest of Pukoo village.

RECORDS AVAILABLE.—December 1, 1919, to June 30, 1921.

GAGE.—Stevens continuous water-stage recorder.

DISCHARGE MEASUREMENTS.—Made by wading or from suspension footbridge 1,000 feet below station.

CHANNEL AND CONTROL.—Stream bed rocky with scattered boulders. Banks steep and rocky. Control large boulders wedged into cleft in rock ledge; seldom shifts.

EXTREMES OF DISCHARGE.—Maximum stage recorded, 8.35 feet at 10.20 a. m. December 24 (discharge, 1,020 million gallons per day or 1,580 second-feet); minimum stage recorded, 1.65 feet from 5 to 9 p. m. July 13 (discharge, 1.8 million gallons per day or 2.8 second-feet).

1919-1921: Maximum and minimum stages as recorded above, minimum stage also occurred March 7, 1920, 5 p. m. to 9 p. m.

DIVERSIONS.—None.

REGULATION.—None.

OBJECT OF STATION.—To determine amount of water available for irrigating West Molokai.

UTILIZATION.—Small amount being used for irrigation of taro. Most of flow wastes into sea.

ACCURACY.—Stage-discharge relation changed owing to boulders washing out of control. Rating curve used July 1 to December 23, well defined below 60 million gallons. New rating fairly well defined up to 250 million gallons. Operation of water-stage recorder fairly satisfactory. Records good when recorder was working. Estimates of missing record fair.

Discharge measurements of Pelekunu Stream near Pelekunu, Molokai, during the year ending June 30, 1921.

Date.	Made by—	Gage height (feet).	Discharge.	
			Second-feet.	Million gallons per day.
July 3	B. F. Rush	1.73	3.4	2.2
Aug. 6	M. H. Merry	1.99	6.9	4.4
Sept. 10	B. F. Rush	2.12	9.4	6.0
Oct. 22	M. H. Carson	1.87	5.0	3.2
Dec. 5	do	2.57	29	18.8
6	do	2.82	41	26.5
6	do	2.78	38	24.6
Jan. 15	do	4.30	317	205
15	do	4.20	286	185
15	do	3.65	220	142
15	do	3.62	192	124
Mar. 5	E. M. Pickop	.98	7.1	4.6
Apr. 30	do	1.30	14.6	9.4
May 27	J. E. Stewart	.95	5.7	3.7

Discharge, in million gallons per day, of Pelekunu Stream near Pelekunu, Molokai, for the year ending June 30, 1921.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Mar.	Apr.	May.	June.
1.....	4.0	3.8	4.0	2.9	7.1	.....	12.8	.....	6.2	8.0	3.1
2.....	2.5	4.4	3.3	3.4	15.6	.....	15.7	.....	5.1	7.8	3.0
3.....	2.2	5.7	3.0	3.6	14.6	.....	18.5	.....	4.5	9.6	2.9
4.....	2.0	5.1	2.9	2.9	7.3	.....	21	.....	9.1	9.2	2.8
5.....	2.1	3.4	3.0	2.9	5.4	.....	68	.....	8.5	8.0	2.8
6.....	2.0	3.9	4.8	3.3	4.5	.....	138	3.9	8.5	6.5	2.8
7.....	2.0	2.9	13.0	3.7	5.0	11.3	70	3.6	50	6.2	3.2
8.....	2.3	2.7	4.5	2.9	69	18.4	42	3.3	44	6.0	3.0
9.....	2.2	2.5	4.2	2.8	27	17.5	50	3.2	30.0	5.0	2.9
10.....	2.3	2.3	5.4	3.2	12.1	13.5	31	3.2	17.6	4.5	2.8
11.....	2.0	2.3	10.0	10.6	8.2	10.3	2.8	3.0	12.3	4.4	2.8
12.....	2.2	2.9	8.2	9.2	6.5	8.9	24	2.9	12.8	4.3	2.8
13.....	2.0	3.4	6.7	3.8	5.6	13.2	32	2.8	10.4	4.3	2.8
14.....	2.0	3.8	5.1	3.0	5.0	25	153	2.8	8.0	4.0	3.6
15.....	2.2	2.6	4.4	3.8	4.4	15.6	171	2.8	6.5	3.9	4.7
16.....	2.4	2.3	4.3	6.1	4.1	10.8	100	2.8	15.7	3.8	3.1
17.....	6.5	2.2	3.6	5.7	3.9	8.7	116	2.8	8.3	4.0	2.8
18.....	2.8	2.0	3.3	13.0	3.6	7.6	52	2.8	6.5	4.8	2.8
19.....	3.2	2.2	3.2	5.1	3.3	6.9	.....	3.0	5.5	5.0	3.3
20.....	3.7	9.6	2.9	4.0	8.7	6.5	.....	2.8	23	6.5	2.8
21.....	4.8	10.1	3.0	3.5	24	6.7	.....	5.9	10.6	9.4	2.6
22.....	6.1	6.8	2.9	3.3	30	6.0	.....	3.2	12.8	5.2	2.5
23.....	5.1	11.1	3.1	3.2	15.3	44	.....	4.2	13.2	4.5	2.4
24.....	3.3	8.8	2.9	9.4	12.1	231	.....	25	19.5	7.7	2.4
25.....	2.6	12.5	3.2	8.0	.....	258	.....	6.9	13	4.4	2.5
26.....	2.6	10.3	3.2	4.3	.....	64	.....	4.5	12.5	3.9	5.3
27.....	3.6	18.4	3.1	3.9	.....	33	.....	4.4	8.5	3.7	9.3
28.....	4.6	9.6	2.8	3.6	.....	23	.....	3.9	7.1	3.6	6.1
29.....	3.9	6.0	3.4	3.3	.....	17.3	.....	8.4	8.3	3.6	3.7
30.....	4.8	4.6	3.3	3.2	.....	13.5	.....	23	17.5	3.3	3.0
31.....	3.2	3.9	.....	3.4	.....	11.6	.....	10.6	.....	3.1	.....

NOTE.—Water-stage recorder not working and discharge estimated in million gallons per day as follows: Nov. 25-30, 35; Dec. 1-6, 15; Jan. 19-24, 15; Jan. 25-31, 35; Feb. 1-5, 10; Feb. 6-15, 8; Feb. 16-26, 6; Feb. 28-28, 5; Mar. 1-5, 8. Obtained by comparison with flow of Lanipuni Stream.

Monthly discharge of Pelekunu Stream near Pelekunu, Molokai, for the year ending June 30, 1921.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-foot (mean).	Million gallons.	Acre-foot.
	Maximum.	Minimum.	Mean.			
July.....	6.5	2.0	3.14	4.86	97.2	299
August.....	18.4	2.0	5.55	8.59	172	528
September.....	13.0	2.8	4.36	6.75	131	401
October.....	13.0	2.8	4.68	7.24	145	445
November.....	.....	3.3	17.1	26.5	512	1,570
December.....	258	6.0	31.4	48.6	972	2,960
January.....	171	.....	47.8	74.0	1,480	4,550
February.....	.....	.....	7.32	11.3	205	629
March.....	25	2.8	5.99	9.27	186	570
April.....	85	4.5	16.4	25.4	492	1,510
May.....	9.6	3.1	5.43	8.40	168	517
June.....	9.3	2.4	3.35	5.18	101	308
The year.....	258	2.0	12.8	19.8	4,660	14,300

LANIPUNI STREAM NEAR PELEKUNU, MOLOKAI.

LOCATION.—Half a mile above junction with Pelekunu Stream, 2 miles south of Pelekunu landing, 6 miles north of Kamalo village, and 13 miles by trail northwest of Pukoo village.

RECORDS AVAILABLE.—December 1, 1919, to June 30, 1921.

GAGE.—Stevens continuous water-stage recorder.

DISCHARGE MEASUREMENTS.—Made by wading or from suspension footbridge 200 feet below gage.

CHANNEL AND CONTROL.—Channel rocky and boulder strewn, banks high and rocky. Control boulders and gravel. Shifts during extreme floods.

EXTREMES OF DISCHARGE.—Maximum stage recorded, 5.90 feet at 10 a. m. December 24 (discharge, about 1,250 million gallons per day or 1,930 second-feet); minimum stage recorded, 0.68 foot at 3.30 p. m. July 13, 1920 (discharge, 1.9 million gallons per day or 2.9 second-feet).

1919-1921: Maximum and minimum stages for this period as above.

DIVERSIONS.—None.

REGULATION.—None.

OBJECT OF STATION.—To determine amount of water available for irrigating West Molokai.

UTILIZATION.—Small amount being used for irrigation of taro. Most of flow wastes into sea.

ACCURACY.—Stage-discharge relation changed during December flood. Two rating curves used fairly well defined between 2 and 100 million gallons. Operation of water-stage recorder satisfactory. Records fairly good.

Discharge measurements of Lanipuni Stream near Pelekunu, Molokai, during the year ending June 30, 1921.

Date.	Made by—	Gage height (feet).	Discharge.	
			Second-feet.	Million gallons per day.
July 2	B. F. Rush	0.73	3.5	2.3
Aug. 6	M. H. Merry	.79	5.2	3.4
Sept. 9	M. H. Carson	.80	5.5	3.6
Oct. 22	do	.78	4.9	3.2
Dec. 5	do	1.05	14.2	9.2
Jan. 15	do	2.22	242	156
Mar. 6	E. M. Pickop	.70	6.7	4.3
May 1	do	.83	10.0	6.5
May 26	W. C. Renshaw	.71	6.9	4.5

Discharge, in million gallons per day, of Lanipuni Stream near Pelekunu, Molokai, for the year ending June 30, 1921.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	3.6	4.0	3.6	2.7	9.5	15.6	7.1	7.8	4.4	6.0	6.4	3.9
2	2.7	5.0	3.3	3.0	16.7	7.9	13.0	7.5	22	5.2	7.1	3.9
3	2.6	4.9	3.2	3.0	12.6	8.0	11.7	7.3	6.2	5.0	9.3	3.8
4	2.4	4.9	3.0	2.7	6.4	8.0	17.9	7.5	5.2	6.2	8.7	3.8
5	2.4	3.6	3.2	2.7	4.9	7.9	50	6.7	4.9	5.7	6.7	3.8
6	2.1	3.4	4.9	3.0	4.5	14.5	131	7.8	4.6	96	5.7	3.8
7	2.2	3.0	11.5	3.4	4.7	7.4	49	6.9	4.4	66	5.4	4.2
8	2.6	2.8	4.3	2.8	34	17.7	32	6.7	4.4	67	7.2	3.9
9	2.6	2.7	4.0	2.7	12.2	11.3	26	5.8	4.3	32	5.2	3.8
10	2.6	2.6	5.2	3.0	7.9	8.2	16.0	6.0	4.2	13.0	4.9	3.8
11	2.1	2.7	12.8	14.8	5.9	6.6	15.0	6.7	4.2	8.8	4.7	3.8
12	2.4	3.4	7.4	12.3	5.0	6.4	13.4	5.7	4.0	9.5	4.7	3.8
13	2.0	3.4	6.4	3.6	4.7	8.2	18.8	5.5	3.9	8.2	4.6	3.8
14	2.0	4.0	4.7	3.0	4.3	8.8	157	6.2	3.9	7.1	4.4	4.9
15	2.6	3.2	4.3	3.4	4.1	6.9	139	10.4	3.9	6.7	4.6	4.6
16	3.0	2.8	4.1	4.5	4.0	5.4	101	6.4	3.9	19.0	4.4	4.0
17	5.9	2.6	3.4	7.1	3.8	5.0	152	5.7	4.0	8.2	4.6	3.8
18	2.7	2.6	3.3	32	3.8	4.7	47	6.7	3.9	6.7	7.7	3.9
19	3.2	2.8	3.2	5.4	3.8	4.5	23	5.4	4.3	5.8	5.8	4.6
20	3.2	9.5	3.0	4.1	15.6	4.5	16.0	5.2	3.9	22	3.3	3.8
21	3.6	8.3	2.8	3.6	35	4.3	13.0	6.0	5.4	8.8	10.2	3.8
22	6.7	10.6	2.8	3.3	36	4.3	14.2	5.5	4.3	9.4	6.2	3.7
23	5.2	12.1	2.7	3.2	11.3	18.5	11.1	5.0	8.1	11.1	5.7	3.6
24	3.8	11.6	2.7	21	7.4	163	9.8	4.9	32	17.0	10.3	3.6
25	3.3	13.2	3.0	11.9	8.2	131	68	4.7	7.1	9.8	5.5	3.7
26	3.2	8.8	2.8	5.2	12.7	23	50	4.7	5.4	9.8	4.9	6.3
27	4.3	18.5	2.7	3.0	12.3	12.6	22	4.6	5.4	7.3	4.0	12.2
28	5.0	7.2	2.6	4.3	16.0	9.5	15.0	4.6	4.9	6.0	4.4	7.8
29	4.6	4.9	3.3	4.1	15.4	8.0	11.8	7.5	7.5	7.3	4.4	7.0
30	4.8	4.0	3.0	4.1	72	6.9	10.1	27	18.1	4.0	4.0	4.9
31	3.4	3.6		4.5		6.9	9.2		8.8		4.0	

Monthly discharge of Lanipuni Stream near Pelekunu, Molokai, for the year ending June 30, 1921.

Month.	Discharge.			Total run-off.		
	Million gallons per day.			Second-foot (mean).	Million gallons.	Acres-foot.
	Maximum.	Minimum.	Mean.			
July	6.7	2.0	3.30	5.11	102	314
August	18.5	2.6	5.70	8.82	177	542
September	12.8	2.6	4.24	6.56	127	390
October	32	2.7	6.13	9.48	190	583
November	72	3.8	13.2	20.4	395	1,220
December	165	4.3	18.0	27.9	558	1,710
January	157	7.1	41.0	63.4	1,270	3,900
February	10.4	4.6	6.21	9.61	174	534
March	32	3.9	7.12	11.0	221	677
April	96	5.0	17.0	26.3	509	1,570
May	10.3	4.0	5.94	9.19	184	565
June	12.2	3.6	4.49	6.95	135	413
The year	165	2.0	11.1	17.2	4,040	12,400

WAIKOLU STREAM AT ELEVATION 650 FEET, NEAR KALAUPAPA, MOLOKAI.

LOCATION.—2 miles above mouth of stream and 5 miles southeast of Kalaupapa.

RECORDS AVAILABLE.—July 1, 1920, to June 30, 1921.

GAGE.—Stevens continuous water-stage recorder.

DISCHARGE MEASUREMENTS.—Made from bridge or by wading.

CHANNEL AND CONTROL.—Stream bed of gravel and boulders, right bank vertical rock. Left bank sloping and formed of loose material. Control formed of unstable boulders.

EXTREMES OF DISCHARGE.—Maximum stage recorded, about 13.0 feet at 10.20 a. m. December 24 (data insufficient to estimate discharge); minimum stage recorded, 1.95 feet at noon October 2 (discharge, 2.4 million gallons per day or 3.7 second-feet.)

DIVERSIONS.—None.

REGULATION.—None.

OBJECT OF STATION.—To determine the amount of water available for proposed power and irrigation project for leper settlement and for irrigation of the west end of Molokai.

UTILIZATION.—Part of water used for water supply of leper settlement and for irrigation of taro. Rest wastes into sea.

ACCURACY.—Stage-discharge relation not permanent. Three rating curves used; the ones applicable July 1 to December 24 and from January 26 to June 30 are fairly well defined up to 250 million gallons per day; the one from December 25 to January 25 defined by one measurement as a parallel rating. Operation of recorder fairly satisfactory. Records good except for two periods that are partly estimated.

Discharge measurements of Waikolu Stream at elevation 650 feet, near Kalaupapa, Molokai, during the year ending June 30, 1921.

Date.	Made by—	Gage height (feet).	Discharge.	
			Second-feet.	Million gallons per day.
Sept. 12	M. H. Carson.....	2.18	7.3	4.7
Oct. 25	.....do.....	2.45	17.1	11.1
Dec. 11	.....do.....	2.12	6.9	4.4
Jan. 20	.....do.....	2.04	12.2	7.9
Mar. 11	E. M. Pickop.....	1.75	6.5	4.2
May 26	W. C. Renshaw.....	1.73	5.6	3.6

Discharge, in million gallons per day, of Waikolu Stream at elevation 650 feet, near Kalaupapa, Molokai, for the year ending June 30, 1921.

Day.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1.....		2.8	2.4	3.4	9.5		6.0	5.6	4.4	4.1	3.4
2.....		2.7	2.4	12.2	4.5		6.0	21	4.1	4.0	3.4
3.....		2.7	2.4	11.7	3.9		6.1	7.3	3.9	4.7	3.4
4.....		2.6	2.4	4.0	7.3		6.0	5.9	7.2	4.2	3.4
5.....		2.6	2.4	3.5	5.6		6.0	5.5	6.6	4.1	3.4
6.....		2.6	2.5	3.2	14.4		6.0	5.1	10.2	4.0	3.4
7.....		3.0	2.4	3.1	5.1		6.1	4.8	22	3.9	3.4
8.....		3.8	2.4	43	8.7		6.1	4.6	23	2.9	3.4
9.....	2.6	3.0	2.4	10.0	9.0		8.2	4.2	9.5	3.9	3.4
10.....	2.6	3.2	2.4	9.1	5.7		6.3	4.0	4.7	3.8	3.3
11.....	2.6	7.6	4.7	4.4	4.4		6.4	3.8	4.2	3.7	3.3
12.....	2.6	5.0	10.3	3.6	3.7		6.4	4.0	3.4	3.7	3.3
13.....	2.6	3.7	3.0	3.5	6.1		6.4	4.0	6.2	3.3	3.3
14.....	2.7	3.7	2.6	3.4	11.7		6.6	3.9	4.6	3.9	3.3
15.....	2.9	2.9	2.6	3.2	8.6		7.7	3.9	4.2	3.7	3.4
16.....	2.8	2.7	2.9	3.1	3.8		7.6	3.9	9.0	3.6	3.4
17.....	2.7	2.6	3.6	3.0	3.4		6.9	3.9	5.3	3.6	3.4
18.....	2.7	2.6	21	3.0	3.2		9.8	3.9	4.4	3.6	3.3
19.....	2.7	2.6	3.7	3.0	3.1		7.4	3.9	4.1	3.9	3.4
20.....	7.7	2.5	2.9	11.2	3.1	8.1	6.6	3.9	9.2	4.4	3.4
21.....	9.7	2.5	2.7	17.2	3.0	7.4	11.2	4.0	5.4	4.9	3.4
22.....	6.9	2.5	2.6	16.2	3.0	8.4	14.1	4.0	6.3	4.1	3.3
23.....	12.6	2.5	2.6	7.1	34	7.7	7.3	4.7	8.9	3.9	3.3
24.....	9.4	2.5	32	4.5		7.5	6.2	31	7.9	5.0	3.3
25.....	7.5	2.5	17.3	4.2		16.5	5.8	6.0	5.4	4.0	3.3
26.....	6.5	2.5	4.5	11.8		22	5.7	5.2	4.7	3.7	3.4
27.....	13.9	2.4	3.5	6.2		9.0	5.6	4.9	4.4	3.6	5.3
28.....	5.0	2.4	3.4	15.3		6.6	5.6	4.8	4.1	3.5	6.4
29.....	3.4	2.4	3.2	11.4		6.1		11.7	4.0	3.6	3.8
30.....	3.0	2.4	3.5	53		6.0		30	5.0	3.5	3.6
31.....	2.8		3.4			6.1		6.1		3.5	

NOTE.—Record of stage unreliable July 1 to Aug. 8. No record Dec. 24 to Jan. 20. Record corrected on assumption of a gradual filling float Jan. 20 to Mar. 11. Discharge in million gallons per day estimated by comparison with flow at lower station as follows: July 1-20, 3; July 21-31, 4; Aug. 1-8, 3; Dec. 24-26, 80; Dec. 27-31, 3; Jan. 1-4, 6; Jan. 5-7, 35; Jan. 8-12, 7; Jan. 13-18, 60; Jan. 19, 8.

Monthly discharge of Waikolu Stream near Kalaupapa, Molokai, at elevation 650 feet, for the year ending June 30, 1921.

Month.	Discharge.			Second-foot (mean).	Total run-off.	
	Million gallons per day.				Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July.....			3.35	5.18	104	319
August.....	13.9		4.56	7.06	141	434
September.....	8.0	2.4	3.15	4.87	94.5	290
October.....	32	2.4	5.16	7.98	160	491
November.....	53	3.0	9.72	15.0	292	895
December.....			13.5	20.9	420	1,280
January.....			20.8	32.2	643	1,980
February.....	14.1	5.6	6.93	10.7	194	595
March.....	31	3.8	7.08	11.0	220	674
April.....	102	3.9	10.0	15.5	300	921
May.....	5.0	3.5	3.93	6.08	122	374
June.....	6.4	3.3	3.55	5.49	106	327
The year.....			7.66	11.9	2,800	8,580

WAIKOLU STREAM AT PIPE-LINE CROSSING, NEAR KALAUPAPA, MOLOKAI.

LOCATION.—At 300-foot elevation, 1 mile above mouth of stream and 4 miles east-southeast of Kalaupapa.

RECORDS AVAILABLE.—June 2, 1919, to June 30, 1921.

GAGE.—Stevens continuous water-stage recorder.

DISCHARGE MEASUREMENTS.—Made by wading.

CHANNEL AND CONTROL.—Stream bed sand, gravel, and boulders. Right bank steep and rocky. Left bank is overflowed at high stages. Control is concrete casing to 8-inch water main and is permanent.

EXTREMES OF DISCHARGE.—Maximum stage recorded, 10.20 feet at 10.30 a. m. December 24 (discharge, 1,270 million gallons per day or 1,960 second-feet); minimum stage recorded, 3.89 feet at 10 a. m. December 22 (discharge, 3.5 million gallons per day or 5.4 second-feet.)

1919-1920: Both maximum and minimum stages recorded for period same as above.

DIVERSIONS.—Intake ditch to Kalaupapa water supply diverts about 2.5 million gallons per day at about 500 foot elevation. Some of this water returns to the stream just below the station.

REGULATION.—By diversion only.

OBJECT OF STATION. To determine amount of water available for proposed power and irrigation project for leper settlement.

UTILIZATION.—Part of water used for irrigation of taro. Remainder wastes into sea.

ACCURACY.—Stage-discharge relation permanent. Rating curve well defined between 4 and 50 million gallons per day. Operation of water-stage recorder satisfactory except for period where it was stopped. Records good except for this estimated period.

Discharge measurements of Waikolu Stream at pipe-line crossing, near Kalaupapa, Molokai, during the year ending June 30, 1921.

Date.	Made by—	Gage height (feet).	Discharge.	
			Second-feet.	Million gallons per day.
Dec. 11	M. H. Carson.....	3.96	8.7	5.6
Jan. 21	do.....	4.08	17.0	11.0
Mar. 12	do.....	3.98	9.3	6.0
May 26	J. E. Stewart.....	3.98	8.9	5.7

Discharge, in million gallons per day, of Waikolu Stream at pipe-line crossing, near Kalaupapa, Molokai, for the year ending June 30, 1921.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	5.7	5.1	5.4	5.1			3.5	9.4	6.4	9.0	6.4	5.4
2	5.4	5.4	5.4	5.1			7.0	9.4	20.0	8.3	6.4	5.4
3	4.8	7.1	5.1	5.1			13.2	8.3	9.4	7.9	7.9	5.4
4	4.8	6.7	5.1	5.1			13.2	8.3	7.1	12.5	7.1	5.4
5	4.8	5.7	5.1	5.1			31	7.9	6.7	12.4	7.1	5.4
6	5.1	5.1	5.4	5.4			64	7.9	6.4	83	7.1	5.4
7	5.1	5.1	9.8	3.1			28	7.9	6.1	39	7.1	5.4
8	5.1	5.1	6.7	5.1			11.5	7.5	6.1	29	7.5	5.4
9	5.1	5.1	5.4	5.1			13.7	7.5	6.1	18.0	7.1	5.4
10	5.1	5.1	5.4	5.1			8.6	7.5	6.1	10.2	7.1	5.4
11	6.1	5.1	8.6	7.7		5.1	11.9	7.1	6.1	9.0	7.1	5.4
12	9.0	5.1	9.8	14.3		4.8	10.1	7.1	6.1	9.8	7.1	5.4
13	5.1	5.1	6.1	5.7		6.4	16.5	6.7	5.7	11.9	6.4	5.4
14	5.1	5.4	6.4	5.1		11.0	181	6.7	5.7	8.6	6.1	5.4
15	5.1	5.1	5.4	5.1		9.0	75	7.9	5.7	7.9	5.4	5.4
16	5.1	5.1	5.4	5.4		4.8	53	7.9	5.7	12.8	5.7	5.4
17	7.5	5.1	5.1	7.0		4.1	59	7.1	5.7	8.3	5.7	5.4
18	6.1	5.1	5.1	31		3.8	24	10.2	6.1	6.7	5.7	5.4
19	5.1	5.1	5.1	7.1		3.5	12.8	7.5	6.1	6.4	5.7	5.4
20	5.7	8.6	5.1	5.7		3.5	11.0	6.7	6.4	12.1	7.1	5.4
21	9.4	14.1	5.1	5.4		3.5	10.2	10.9	6.7	8.3	7.5	5.1
22	9.8	7.5	5.1	5.1		3.5	11.5	14.1	6.7	9.4	6.4	5.1
23	9.0	17.5	5.1	5.1		27	10.2	8.3	9.0	12.8	5.7	5.1
24	6.7	12.4	5.1	34		113	9.4	7.1	32	11.9	7.5	5.1
25	5.4	11.9	5.1			149	18.3	6.7	11.9	7.9	6.7	5.1
26	5.4	9.4	5.1			14.1	34	6.7	9.8	7.1	6.1	5.1
27	5.4	16.5	5.1			9.4	15.0	6.4	9.4	6.7	6.1	7.3
28	6.1	8.3	5.1			7.1	10.6	6.4	9.4	6.1	5.7	10.3
29	6.4	6.1	5.1			4.1	10.2		14.0	6.1	5.7	6.1
30	6.7	5.4	5.1			3.8	9.4		32	7.9	5.7	5.4
31	5.4	5.4				3.5	9.8		11.9		5.7	

NOTE.—Recorder stopped Oct. 25 to Dec. 10, 1920. Discharge estimated in million gallons per day by comparison with flow at upper station as follows: Oct. 25-31, 6.5; Nov. 1-5, 10; Nov. 6-10, 18; Nov. 11-19, 6; Nov. 20-25, 15; Nov. 26-30, 25; Dec. 1-5, 10; Dec. 6-10, 12.

Monthly discharge of Waikolu Stream at pipe-line crossing, near Kalaupapa, Molokai, for the year ending June 30, 1921.

Month.	Discharge.			Second-feet (mean).	Total run-off.	
	Million gallons per day.				Million gallons.	Acres-feet.
	Maximum.	Minimum.	Mean.			
July	9.8	4.8	6.02	9.31	187	573
August	17.5	5.1	7.25	11.2	225	690
September	9.8	5.1	5.73	8.87	172	528
October	34	5.1	7.76	12.0	240	738
November			13.6	21.0	409	1,250
December	149	3.5	16.3	25.2	504	1,550
January	181	3.5	25.4	39.3	787	2,420
February	14.1	6.1	7.96	12.3	223	684
March	32	5.7	9.44	14.6	292	898
April	83	6.1	13.2	20.4	397	1,220
May	7.9	5.4	6.50	10.1	202	618
June	10.3	5.1	5.59	8.65	168	515
The year	181		10.4	16.1	3,810	11,700

MISCELLANEOUS MEASUREMENTS

Measurements of streams and ditches on the Island of Molokai at points other than regular gaging stations are listed below.

Miscellaneous discharge measurements on Molokai during the year ending June 30, 1921.

Date.	Stream.	Tributary to—	Locality.	Gage height.	Discharge.	Million gallons per day.
				<i>Feet.</i>	<i>Sec.-ft.</i>	
July 6	Right Branch of Papalaua.	Papalaua	Near Wallau		0.25	0.15
Aug. 8	do	do	do		.30	.2
Sept. 13	do	do	do		.45	.3
Oct. 26	do	do	do		1.05	.7
Jan. 23	do	do	do		1.85	1.2
Mar. 10	do	do	do		.35	.2
Apr. 19	do	do	do		.4	.25
May 25	do	do	do		.85	.55
July 4	Wallau	Pacific Ocean	$\frac{1}{2}$ mile above highest taro ditch, near Wallau.		15.0	9.7
Aug. 5	do	do	do		.27	17.3
Sept. 8	do	do	do		.34	22.1
Oct. 21	do	do	do		.26	16.8
Dec. 4	do	do	do		.53	34.6
Jan. 13	do	do	do		.131	85
Mar. 4	do	do	do		.32	20.7
Apr. 13	do	do	do		44.5	28.5
May 27	do	do	do		.38	24.6
July 2	Pelekunu	do	200 feet above highest taro ditch, near Pelekunu.		10.0	6.5
Aug. 6	do	do	do		13.6	8.8
Sept. 10	do	do	do		19.7	12.7
Oct. 23	do	do	do		14.8	9.6
Mar. 6	do	do	do		19.7	12.7
Apr. 30	do	do	do		35.5	23.1
May 26	do	do	do		20.1	13.0
Jan. 21	Waikolu	Pacific Ocean	Below springs at elevation 450 feet near Kalaupapa.		12.6	8.1
20	do	do	200 feet above diversion for Kalaupapa water supply, near Kalaupapa.		13.0	8.4
20	do	do	50 feet below return waters from Kalaupapa water supply diversion, near Kalaupapa.		13.9	9.0
21	do	do	do		12.4	8.0
July 2	do	do	Below Big Springs, near Kalaupapa.		13.8	8.9
Dec. 11	do	do	do		18.2	11.8
Jan. 21	do	do	do		.26	17.0
Mar. 12	do	do	do		18.5	12.0
May 26	do	do	do		14.6	9.4
Jan. 20	Diversion from Waikolu Stream for Kalaupapa water supply.	Kalaupapa water supply.	50 feet below diversion, near Kalaupapa.		3.5	3.5
20	do	do	40 feet above flume intake, near Kalaupapa.		7.7	5.0
21	Kalaupapa water supply flume.	do	Pipe-line intake, near Kalaupapa.		3.1	2.0
21	Waste from Kalaupapa water supply flume.	Waikolu Stream	Near Kalaupapa		1.4	.9
Mar. 12	do	do	do		.7	.45
Dec. 11	Stream from left just below pipe-line crossing.	do	do		1.35	.85
Jan. 21	Mauka Branch of Big Springs.	do	Elevation 250 feet, near Kalaupapa.		1.65	1.05
21	Mauka Middle Branch of Big Springs.	do	do		.5	.35
21	Middle Branch of Big Springs.	do	do		.45	.3
21	Makai Branch of Big Springs.	do	Elevation 340 feet, near Kalaupapa.		.08	.05

ISLAND OF MAUI.

HONOKAHAU STREAM NEAR HONOKAHAU, MAUI.

LOCATION.—1,000 feet above intake of Honokahau ditch and 6 miles southeast of Honokahau, at elevation 910 feet.

RECORDS AVAILABLE.—March 12, 1913, to September 19, 1920 (after which station was discontinued), and staff readings at old site on diversion dam August 13 to December 31, 1911.

GAGE.—Stevens continuous water-stage recorder.

DISCHARGE MEASUREMENTS.—Made by wading or from cable 400 feet below gage.

CHANNEL AND CONTROL.—One channel at all stages; straight for 100 feet below gage but makes sharp bend 50 feet above gage; right bank rises gently; left bank is vertical wall of rock. Control composed of large boulders; seldom shifts.

EXTREMES OF DISCHARGE.—Maximum stage recorded during period, 4.12 feet at 7.10 p. m. September 11 (discharge, approximately 280 million gallons per day or 433 second-feet); minimum stage recorded, 1.19 feet from 10 a. m. to 2 p. m. August 11 (discharge, 5.1 million gallons per day or 7.9 second-feet).

1913-1920: Maximum stage recorded, 8.25 feet at 7.30 a. m. January 18, 1916 (discharge computed from extension of rating curve, approximately 1,900 million gallons per day or 2,940 second-feet); minimum stage recorded in August, 1920.

DIVERSIONS.—None.

REGULATION.—None.

OBJECT OF STATION.—To determine resources of stream.

UTILIZATION.—Low flow of stream all diverted by Honokahau ditch for irrigation of sugar cane and for power development.

ACCURACY.—Stage-discharge relation permanent. Rating curve well defined between 10 and 100 million gallons per day. Operation of water-stage recorder satisfactory except as given in footnote to table of daily discharge. Records good when water-stage recorder was operating.

Discharge measurements of Honokahau Stream near Honokahau, Maui, during the year ending June 30, 1921.

Date.	Made by—	Gage height (feet).	Discharge.	
			Second-foot.	Million gallons per day.
July 8	Reid Jerman	1.36	11.1	7.2
21	R. H. Remington	2.05	47	30.5
Sept. 5	do	1.44	12.5	8.1
Nov. 1	do	1.44	12.2	7.9

Discharge, in million gallons per day, of Honokahau Stream near Honokahau, Maui, for the year ending June 30, 1921.

Day.	July.	Aug.	Sept.	Day.	July.	Aug.	Sept.	Day.	July.	Aug.	Sept.
1	16.3		11.5	11	8.2	5.3	67	21	28	9.8	
2	10.0		11.9	12	8.0	15.2	21	22	28	9.3	
3	8.0		8.6	13	8.0	22	13.3	23	22	11.6	
4	7.4		7.7	14	7.6	30	11.2	24	16.6	21	
5	6.8	6.6	9.4	15	12.2	6.8	9.6	25	12.2	25	
6	6.8	6.3	48	16	8.4	6.3	9.2	26	9.4	18.2	
7	6.9	5.8	35	17	24	5.6	8.4	27	22	44	
8	7.6	5.6	10.4	18	14.9	6.5	8.4	28	14.0	11.0	
9	7.7	5.5	9.8	19	13.4	5.5	8.4	29	12.5	9.4	
10	8.8	5.2	9.0	20	19.6	23		30	12.2	7.6	
								31	8.4	7.6	

NOTE.—Discharge estimated as 11 million gallons per day Aug. 1-4 by comparison with records of Honokahau ditch and Lahainaluna Stream using extreme range indicated on record. No record of any value obtained after Sept. 20.

Monthly discharge of Honokahau Stream near Honokahau, Maui, for the year ending June 30, 1921.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-foot (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July.....	28	6.8	12.6	19.5	391	1,200
August.....	44	5.2	12.2	18.9	380	1,160
September 1-19.....	67	7.7	17.0	26.3	323	991
The period (81 days).....					1,090	3,860

HONOKAWAI DITCH NEAR LAHAINA, MAUI.

LOCATION.—At downstream portal of long tunnel on Honokawai ditch, $1\frac{1}{2}$ miles below intake and $1\frac{1}{2}$ miles northeast of Puukolii until May 27, 1921. On May 28, 1921, station was moved $1\frac{1}{2}$ miles upstream to a point 75 feet below ditch intake, at elevation 1,530 feet.

RECORDS AVAILABLE.—May 28, 1921, to June 30, 1921, at present location; November 14, 1918, to May 27, 1921, at downstream portal of long tunnel $1\frac{1}{2}$ miles downstream; and from July 1, 1912, to December 31, 1917, at old location about half a mile downstream on former ditch line.

GAGE.—Gurley weekly water-stage recorder installed April 15, 1919. Stevens continuous water-stage recorder November 14, 1918, to April 15, 1919. Staff gage prior to that.

DISCHARGE MEASUREMENTS.—Made from plank across ditch.

CHANNEL AND CONTROL.—Channel at lower station is concrete-lined ditch station straight for 100 feet above and below gage. At new station channel is concrete-lined tunnel straight for about 30 feet above and nearly a quarter of a mile below the gage. Control is bottom of tunnel, not well defined, and subject to back-water from collection of gravel at wide section 500 feet below gage.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 5.65 feet at 10.30 a. m. November 8 at lower station (discharge, 30 million gallons per day or 46 second-feet); minimum stage recorded, 3.71 feet at 8. a. m. April 9 (discharge, 1.4 million gallons per day or 2.2 second-feet).

1912-1921: Maximum stage recorded, 5.88 feet at 6 a. m. September 3, 1919 (discharge, 33.5 million gallons per day, or 52 second-feet). Minimum stage recorded, 0.22 foot at 9 p. m. November 14, 1918 (discharge, 0.32 million gallons per day or 0.5 second-foot.)

DIVERSIONS.—Flood water diversion ditch about 50 feet below intake to well of lower station diverts part of flood water above gage height of 3.95 feet when flood gates are open. Gates 30 feet above new station may also be used to divert flood water.

REGULATION.—Flow controlled by head gates at ditch intake and by flood gates just below recorder well intake at old station and just above recorder well intake at new station.

OBJECT OF STATION.—Most of drainage area in Territorial lands. Data valuable in relation to Territorial lease to Pioneer Mill Co.

UTILIZATION.—Water used for development and irrigation of sugar cane.

ACCURACY.—Stage-discharge relation not permanent. Rating curve used July 1 to August 25 and April 8 to May 27 well defined between 2 and 15 million gallons per day. Rating curves used August 26 to April 7 and May 28 to June 30 not well defined. Operation of water-stage recorder satisfactory. Records fair.

Discharge measurements of Honokawai ditch near Lahaina, Maui, during the year ending June 30, 1921.

Date.	Made by—	Gage height (feet).	Discharge.	
			Second-foot.	Million gallons per day.
July 7	Reid Jerman	3.82	3.7	2.4
22	B. H. Remington	4.48	18.1	11.7
Sept. 6	do.	3.78	3.8	2.5
Oct. 18	do.	4.40	17.2	11.1
Feb. 1	J. E. Stewart	3.80	4.8	3.1
Apr. 18	W. C. Renshaw	3.95	6.6	4.3

Discharge, in million gallons per day, of Honokawai ditch near Lahaina, Maui, for the year ending June 30, 1921.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	6.0	2.3	3.0	3.2	4.4	7.1	2.8	2.9	2.2	3.0	3.5	3.6
2	3.5	2.3	4.0	2.9	7.8	3.6	3.7	2.4	7.8	2.8	2.9	3.6
3	2.9	4.6	5.1	2.9	6.3	3.6	3.8	2.3	3.5	2.9	5.7	3.6
4	2.9	5.8	2.6	2.8	3.5	6.4	5.3	2.2	2.5	2.8	2.7	3.5
5	2.7	2.7	3.0	2.8	2.8	7.3	6.4	2.2	2.3	2.8	2.4	3.5
6	2.7	2.2	8.3	3.3	2.6	9.1	7.1	2.3	2.3	12.9	2.4	3.5
7	2.5	2.1	11.1	5.7	2.6	3.8	6.4	2.2	2.0	20.0	2.4	3.5
8	2.5	2.1	4.0	3.1	20.0	9.9	4.3	2.2	2.0	8.8	2.4	3.5
9	2.5	2.1	3.1	2.9	11.6	7.4	3.6	2.2	1.9	4.7	2.4	3.4
10	2.3	2.1	2.9	2.8	6.7	6.6	4.5	2.0	1.9	3.8	2.4	3.4
11	2.3	2.0	10.5	9.8	5.0	3.6	-----	2.0	1.9	3.8	2.4	3.5
12	2.3	5.1	6.9	6.3	3.2	3.0	-----	2.2	1.9	5.5	2.4	3.5
13	2.3	8.1	5.8	3.4	3.0	7.4	-----	2.3	1.9	4.3	1.8	3.5
14	2.3	7.7	3.8	2.9	3.0	13.3	-----	2.3	1.9	4.5	1.8	3.5
15	2.3	2.5	3.0	4.8	3.9	5.6	-----	6.7	1.9	3.3	1.8	4.2
16	2.5	2.1	3.0	7.8	2.9	3.4	10.5	5.0	2.0	10.5	1.8	3.7
17	8.1	2.0	2.8	6.5	2.9	2.9	14.8	2.8	2.0	4.3	2.0	3.5
18	4.8	2.0	2.8	9.1	3.0	2.8	10.5	4.8	3.1	2.9	7.0	3.5
19	4.6	2.0	2.8	3.7	3.0	2.6	6.3	3.8	4.3	3.1	2.0	4.2
20	7.0	7.4	2.8	2.9	13.8	2.6	5.2	2.6	2.9	4.1	9.1	3.6
21	9.8	4.6	2.8	2.8	18.5	2.5	4.3	2.3	6.0	3.9	4.6	3.6
22	8.7	3.5	2.6	2.8	16.2	2.5	3.8	2.3	2.6	5.3	2.4	3.6
23	6.7	5.9	2.6	2.8	6.6	7.5	3.7	2.3	2.2	8.4	2.4	3.5
24	4.0	7.2	2.6	3.8	5.2	17.7	3.5	2.2	7.3	7.0	8.1	3.5
25	4.3	9.7	2.6	9.4	6.2	5.9	12.6	2.0	4.5	7.4	2.4	3.5
26	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
28	3.1	7.7	3.2	3.8	7.7	5.6	13.3	2.0	2.6	8.1	1.6	3.9
27	4.3	12.6	4.2	3.6	4.1	3.8	7.1	2.3	2.6	4.1	1.6	4.0
28	4.8	4.8	2.9	3.6	4.5	3.0	4.6	2.2	2.8	3.3	1.6	15.0
29	4.1	4.2	2.8	2.8	7.0	2.6	3.5	-----	2.5	2.2	3.6	7.4
30	4.3	3.0	3.0	2.6	18.5	2.6	3.0	-----	6.2	8.1	3.6	4.4
31	2.5	2.8	-----	2.6	-----	2.4	5.3	-----	4.6	-----	3.6	-----

NOTE.—Discharge estimated at 6 million gallons per day January 11-15 by comparison with record of Lahainaluna Stream and observers' record.

Monthly discharge of Honokawai ditch near Lahaina, Maui, for the year ending June 30, 1921.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-foot (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July.....	9.8	2.3	4.05	6.27	126	385
August.....	12.6	2.0	4.34	6.71	135	413
September.....	11.1	2.6	3.95	6.11	118	364
October.....	9.8	2.6	4.18	6.47	130	398
November.....	20.0	2.6	6.85	10.6	206	631
December.....	17.7	2.4	5.42	8.39	168	516
January.....	14.8	2.8	6.13	9.48	190	583
February.....	6.7	2.0	2.68	4.15	75.0	230
March.....	7.8	1.9	3.10	4.80	96.1	295
April.....	20.0	2.2	5.65	8.74	170	520
May.....	9.1	1.6	3.12	4.83	96.8	297
June.....	15.0	3.4	4.14	6.41	124	381
The year.....	20.0	1.6	4.48	6.93	1,630	5,010

LAHAINALUNA STREAM ABOVE PIPE-LINE INTAKE, NEAR LAHAINA, MAUI.

LOCATION.—200 feet above intake of pipe line supplying Lahaina and Lahainaluna school and 2½ miles northeast of Lahaina, at elevation 1,057 feet.

RECORDS AVAILABLE.—February 29, 1916, to June 30, 1921, at this station and from August 5, 1911, to January 18, 1916, at a station about a mile downstream from present site.

GAGE.—Stevens continuous water-stage recorder installed August 27, 1919, to replace Gurley printing water-stage recorder previously used.

DISCHARGE MEASUREMENTS.—Made by wading.

CHANNEL AND CONTROL.—One channel at all stages; fairly straight in vicinity of gage; filled with large boulders; banks steep and high. Control composed of large boulders; fairly permanent.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 3.91 feet at 3 a. m. December 25 (discharge, approximately 120 million gallons per day, or 186 second-foot); minimum stage recorded, 0.92 foot August 9 to 11 and 17 to 19 (discharge, 1.8 million gallons per day or 2.8 second-foot).

1916-1921: Maximum stage recorded, 3.79 feet at 10.30 a. m. November 26, 1918 (discharge, 314 million gallons per day or 486 second-foot); minimum stage recorded August, 1920.

DIVERSIONS.—None.

REGULATIONS.—None.

OBJECT OF STATION.—Data valuable in relation to Territorial agreement with Pioneer Mill Co. pertaining to division of water.

UTILIZATION.—Water used for domestic purposes, power development, and irrigation of sugar cane.

ACCURACY.—Stage-discharge relation permanent. Rating curve fairly well defined between 2 and 50 million gallons per day. Operation of water-stage recorder satisfactory. Records good.

Discharge measurements of Lahainaluna Stream above pipe-line intake, near Lahaina, Maui, during the year ending June 30, 1921.

Date.	Made by—	Gage height (feet).	Discharge.	
			Second-feet.	Million gallons per day.
July 7	Reid Jerman	0.94	2.3	1.5
22	R. H. Remington	1.12	5.2	3.3
Sept. 6	do.	.95	2.5	1.6
Oct. 18	do.	1.05	3.8	2.4
Dec. 13	M. H. Carson	.99	4.2	2.7
Jan. 23	J. E. Stewart	1.03	5.2	3.3
Apr. 20	W. C. Renshaw	1.18	8.2	5.3

Discharge, in million gallons per day, of Lahainaluna Stream above pipe-line intake near Lahaina, Maui, for the year ending June 30, 1921.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1.	7.1	1.9	2.0	2.1	3.4	11.8	1.9	2.7	2.2	2.1	2.1	1.9
2.	2.7	1.9	2.2	2.1		2.9	2.4	2.5	12.0	1.9	2.9	1.9
3.	2.1	3.2	2.1	2.1		2.7	4.0	2.7	3.0	1.8	2.3	1.9
4.	2.1	3.1	2.0	2.1	2.5	3.2	12.0	2.7	2.3	1.8	2.1	1.9
5.	2.1	1.9	2.2	2.1	2.2	3.6	2.2	2.5	2.2	2.0	2.1	1.9
6.	2.1	1.9	5.9	2.1	2.2	12.6	31	2.5	2.2	10.2	2.1	1.9
7.	1.9	1.9	12.6	2.2	4.6	4.0	36	2.5	2.2	16.0	2.1	1.9
8.	1.9	1.9	2.5	2.1	39	8.5	5.1	2.5	2.2	21	2.0	1.9
9.	2.0	1.8	2.2	2.1		15.1	4.2	2.5	2.2	6.3	2.0	1.9
10.	2.0	1.8	2.1	2.1		6.7	12.2	2.5	2.2	2.3	2.0	2.1
11.	2.0	1.8	10.7	9.9	2.8	2.8	4.8	2.4	2.2	3.4	2.0	2.4
12.	1.9	3.2	5.4	7.7	2.2	2.2	3.5	2.4	2.2	5.3	2.0	1.9
13.	1.9	4.7	3.0	2.3	2.2	2.8	3.4	2.4	2.1	3.4	2.0	1.9
14.	1.9	3.5	2.3	2.0	2.1	19.6	8.0	2.4	2.1	2.4	2.0	3.3
15.	2.7	2.9	2.2	3.4	2.1	4.4	14.3	5.3	2.1	2.9	2.1	2.6
16.	3.0	1.9	2.2	10.4	2.0	2.5	14.4	3.1	2.1	6.9	2.1	2.0
17.	10.6	1.8	2.1	5.0	2.0	2.3	43	2.4	2.1	2.4	2.7	1.9
18.	4.0	1.8	2.1	4.0	2.0	2.3	5.8	3.8	3.2	2.2	9.4	1.9
19.	3.0	1.8	2.1	2.2	2.6	2.2	3.4	2.9	3.8	2.1	3.1	3.6
20.	5.7	4.1	2.0	2.2	10.3	2.2	3.0	2.4	2.2	3.1	5.1	2.0
21.	9.9	2.4	2.0	2.1	17.4	2.2	2.9	2.4	5.1	2.5	2.7	1.9
22.	11.2	4.9	2.1	2.1	14.8	2.3	2.8	2.7	2.2	5.6	2.1	1.9
23.	3.6	3.0	2.1	2.1	3.6	6.8	2.7	2.4	2.1	9.4	2.1	1.9
24.	2.1	5.7	2.2	2.1	2.5	2.2	2.7	2.3	2.2	5.5	3.3	1.9
25.	2.1	5.8	2.1	2.3	2.6	2.5	2.2	2.3	2.4	4.4	2.1	1.9
26.	2.1	5.5	2.1	2.2	7.1	2.8	11.2	2.2	2.1	3.7	1.9	4.2
27.	2.3	18.0	2.1	2.2	2.5	2.2	3.1	2.2	2.1	2.2	1.9	6.7
28.	2.4	2.4	2.0	2.2	2.4	2.1	2.8	2.2	2.1	2.1	1.9	13.6
29.	4.2	2.1	2.0	2.1	4.0	2.0	2.8		2.1	2.1	2.0	3.5
30.	2.6	2.1	2.6	2.1	2.4	1.9	2.7		2.1	6.0	2.0	
31.	1.9	2.0		2.2		1.9	3.5		2.1		1.9	

NOTE.—Discharge estimated in million gallons per day by comparison with flow of Honokawai ditch, as follows: Nov. 2-3, 5; Nov. 9-10, 15; June 30, 21.

Monthly discharge of Lahainaluna Stream above pipe-line intake, near Lahaina, Maui, for the year ending June 30, 1921.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-foot (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July.....	11.2	1.9	3.45	5.34	107	328
August.....	18.0	1.8	3.28	5.07	102	314
September.....	12.6	2.0	3.04	4.70	91.2	290
October.....	10.4	2.0	3.00	4.64	93.0	295
November.....	39	2.0	6.32	10.6	204	626
December.....	25	1.9	5.97	9.24	185	568
January.....	43	1.9	9.47	14.7	294	901
February.....	5.3	2.2	2.64	4.08	73.8	227
March.....	12.0	2.1	2.69	4.16	83.4	256
April.....	21	1.8	4.77	7.38	143	439
May.....	9.4	1.9	2.52	3.90	78.1	249
June.....	13.6	1.9	2.74	4.24	82.3	252
The year.....	43	1.8	4.21	6.51	1,540	4,720

OLOWALU DITCH NEAR OLOWALU, MAUI.

LOCATION.—425 feet above intake to penstock of hydroelectric power station, 1 mile above Olowalu, and 7 miles east of Lahaina.

RECORDS AVAILABLE.—July 28, 1916, to June 30, 1921. Replaces old station in tail-race from power house, for which records are available August 12, 1911, to June 30, 1916.

GAGE.—Stevens continuous water-stage recorder installed June 9, 1919, to replace staff gage installed July 28, 1916.

DISCHARGE MEASUREMENTS.—Made by wading.

CHANNEL AND CONTROL.—Channel about 3.5 feet wide cut in earth and rock; straight for 50 feet above and below gage. Control not well defined.

EXTREMES OF DISCHARGE.—1916-1921: Maximum stage recorded, 1.53 feet 3 a. m., December 25, 1920 (discharge, 18 million gallons per day, or 28 second-feet); minimum stage recorded, ditch occasionally dry.

DIVERSIONS.—None.

REGULATION.—None.

OBJECT OF STATION.—Data valuable in relation to Territorial lease to Olowalu Co.

UTILIZATION.—After passing through power house water is used for irrigation of sugar cane. A small amount is sometimes diverted for irrigation at higher levels and does not pass through power house.

ACCURACY.—Stage-discharge relation not permanent. Rating curves fairly well defined between 1 and 8 million gallons per day used as follows: July 23 to September 7; January 17 to May 5, and May 6 to June 30. Shifting-control method used in computing discharge July 1 to 22 and September 8 to January 16. Operation of water-stage recorder unsatisfactory September 4 to October 31. Records fair.

Discharge measurements of Olowahu ditch near Olowahu, Maui, during the year ending June 30, 1921.

Date.	Made by—	Gage height (feet).	Discharge.	
			Second-feet.	Million gallons per day.
July 6	Reld Jerman.....	0.08	3.0	1.95
23	R. H. Remington.....	.32	4.8	3.1
Sept. 4	do.....	.08	2.3	1.45
Oct. 16	do.....	.20	4.0	2.6
Dec. 13	M. H. Carson.....	.32	6.3	4.1
Jan. 23	J. E. Stewart.....	.67	8.9	5.7
Feb. 2	W. C. Renshaw.....	.69	9.6	6.2
Mar. 15	E. M. Pickop.....	.28	4.8	3.1
Apr. 18	W. C. Renshaw.....	.39	5.6	3.6

Discharge, in million gallons per day, of Olowahu ditch near Olowahu, Maui, for the year ending June 30, 1921.

Day.	July.	Aug.	Sept.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1.....	2.7	1.9	1.9	2.5	8.1	4.7	7.3	3.5	2.0	3.4	2.3
2.....	2.4	1.8	1.9	3.0	5.9	4.3	6.3	6.0	2.8	4.0	2.3
3.....	2.2	2.0	1.7	2.8	4.8	3.9	5.8	4.6	2.8	4.3	2.3
4.....	2.1	2.6	.....	2.6	4.4	5.2	5.3	3.9	2.7	3.6	2.3
5.....	2.0	2.0	.....	2.5	4.1	6.9	5.0	3.7	3.5	5.0	2.2
6.....	2.0	1.8	.....	2.4	5.1	11.0	4.8	3.5	6.2	3.7	2.2
7.....	2.0	1.8	.....	2.6	3.8	12.8	5.6	3.5	11.0	3.1	2.8
8.....	2.2	1.7	.....	10.2	4.8	4.0	6.8	3.3	7.3	2.9	2.8
9.....	2.0	1.7	.....	10.4	7.0	2.9	6.1	3.2	5.9	2.8	2.2
10.....	2.0	1.6	.....	6.5	6.0	9.8	5.8	3.1	4.1	2.7	2.3
11.....	1.8	1.7	.....	4.8	4.9	10.4	5.8	3.1	3.5	2.6	2.3
12.....	1.8	1.9	.....	4.0	4.2	8.6	5.3	3.0	3.1	2.6	2.2
13.....	1.8	2.3	.....	3.8	4.8	10.4	5.1	3.0	3.9	2.6	2.2
14.....	1.7	5.1	.....	3.3	12.2	11.6	5.0	2.9	4.4	2.5	2.3
15.....	1.8	2.4	.....	3.0	11.6	11.0	5.1	2.8	4.0	2.6	2.3
16.....	1.6	2.0	.....	2.7	8.6	11.0	5.1	3.0	5.5	2.6	2.3
17.....	2.1	1.8	.....	2.6	6.5	8.3	4.8	2.8	4.3	2.6	2.2
18.....	2.4	1.7	.....	2.3	5.3	5.4	5.2	3.2	3.9	3.6	2.2
19.....	1.8	1.7	.....	2.2	4.7	6.3	5.1	2.8	3.5	3.2	2.3
20.....	1.9	2.4	.....	6.6	4.2	6.8	4.5	2.6	3.5	3.4	2.3
21.....	3.1	2.4	.....	9.2	3.8	8.8	4.7	2.7	3.4	3.5	2.2
22.....	3.0	2.2	.....	8.6	3.6	7.3	5.2	2.6	3.4	2.9	2.8
23.....	2.9	2.1	.....	6.4	6.0	6.3	4.5	2.5	4.2	3.0	2.3
24.....	2.4	2.1	.....	4.9	6.7	5.7	4.2	2.6	4.5	5.6	2.3
25.....	2.1	3.0	.....	4.4	1.3	7.8	4.0	3.2	4.5	4.0	2.3
26.....	1.9	3.4	.....	4.0	.....	5.8	3.8	2.9	5.1	3.2	2.5
27.....	2.1	7.3	.....	1.2	3.5	2.6	3.7	2.8	4.1	2.9	3.2
28.....	2.3	4.4	.....	1.7	8.6	4.7	3.6	2.7	3.6	2.6	6.6
29.....	2.2	2.8	.....	4.1	6.7	8.8	.....	2.7	3.5	2.5	4.0
30.....	2.6	2.3	.....	9.8	5.9	7.8	.....	3.1	3.9	2.5	2.8
31.....	2.0	2.1	.....	.....	5.2	8.8	.....	3.0	.....	2.4	.....

NOTE.—Discharge computed by shifting-control method Nov. 1 to Jan. 16. Discharge interpolated Mar. 14. No record for days when discharge is not given.

Monthly discharge of Olowalu ditch near Olowalu, Maui, for the year ending June 30, 1921.

Month.	Discharge.				Total run-off.	
	Million gallons per day:			Second-foot (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July.....	3.1	1.6	2.16	3.94	66.9	205
August.....	7.3	1.6	2.45	3.79	78.0	233
September.....						
October.....						
November.....	10.4	1.2	4.50	6.96	135	414
December.....	12.2	1.3	5.74	8.88	172	528
January.....	12.8	2.6	7.41	11.5	230	705
February.....	7.3	3.6	5.12	7.92	144	440
March.....	6.3	2.5	3.18	4.92	98.6	303
April.....	11.0	2.7	4.30	6.65	129	396
May.....	5.6	2.4	3.19	4.94	98.8	303
June.....	6.6	2.2	2.53	3.91	75.8	233

KOOLAU DITCH NEAR KEANAE, MAUI.

LOCATION.—25 feet above portal of tunnel in west side of Keanae Valley, a quarter of a mile above ditchman's house, and 3 miles southwest of Keanae post office.

RECORDS AVAILABLE.—January 1, 1910, to December 31, 1912, and November 2, 1917, to June 30, 1921.

GAGE.—Friez water-stage recorder installed November 2, 1917. East Maui Irrigation Co. has obtained staff gage readings at this location since about 1904.

DISCHARGE MEASUREMENTS.—Made from plank at gage.

CHANNEL AND CONTROL.—Concrete-lined ditch; straight for 100 feet, above gage; control not well defined, but probably permanent as ditch enters long tunnel 25 feet below gage.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 5.55 feet at 10 p. m. March 29 (discharge, 145 million gallons per day or 224 second-feet); minimum stage recorded, 0.30 foot from 5 a. m. January 13 to 5 p. m. January 14 (discharge, 1.2 million gallons per day or 1.9 second-feet).

1910-1912 and 1917-1921: Maximum stage recorded, 6.06 feet at 6 a. m. November 30, 1917 (discharge, 163 million gallons per day⁶ or 252 second-feet); minimum stage recorded, water occasionally shut off.

DIVERSION.—Ditch diverts water from all streams from Makapipi to Keanae, inclusive.

REGULATION.—By gates at intervals.

OBJECT OF STATION.—To determine water diverted by ditch from Territorial lands.

UTILIZATION.—Water used for irrigation of sugar cane.

ACCURACY.—Stage-discharge relation affected for short periods by trash gathering on trash rack below gage; also affected by opening of waste gates above gage. Rating curve well defined between 5 and 125 million gallons per day. Operation of water-stage recorder satisfactory except as noted in footnote to table of daily discharge. Staff-gage readings twice daily used to determine discharge July 10-15, January 8 to February 11, February 18 to March 12, and June 26 to 29. Records fair where staff-gage readings were used and good where gage height was determined from recorder gage.

⁶ Supersedes figure published in Water-Supply Paper 485.

Discharge measurements of Koolau ditch near Keanae, Maui, during the year ending June 30, 1921.

Date.	Made by—	Gage height (feet).	Discharge.	
			Second-feet.	Million gallons per day.
July 17	R. H. Remington.....	3.21	100	65
31	do.....	2.25	60	39
Sept. 15	do.....	3.52	111	72
Oct. 26	do.....	4.72	174	112
Apr. 17	W. C. Renshaw.....	4.31	158	102

Discharge, in million gallons per day, of Koolau ditch near Keanae, Maui, for the year ending June 30, 1921.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	12.6	36	36	36	48	116	93	1.2	24	76	54	25
2	16.8	39	36	36	83	106	106	.5	66	76	66	24
3	8.9	54	33	39	102	99	96	.5	72	79	63	23
4	8.3	54	39	32	76	89	65	.7	48	63	57	22
5	7.7	36	48	30	60	93		.5	34	60	57	21
6	7.2	32	69	36	48	122		.3	30	96	51	21
7	6.6	29	99	42	54	105		.3	28	105	45	20.0
8	6.3	27	102	33	105	132	8.2	.3	25	83	45	20.0
9	6.6	24	102	28	112	132	7.4	.8	26	76	39	19.0
10	7.4	23	89	28	119	126	3.9	18.0	24	96	36	20.0
11	7.6	22	105	54	116	119	2.4	48	23	99	36	20.0
12	7.6	28	105	99	102	109	5.2	54	22	109	39	18.0
13	7.6	106	112	67	86	119	1.2	34	22	112	38	17.0
14	7.2	93	93	39	76	119	1.2	36	21	93	30	17.0
15	10.0	45	79	93	66	112	7.4	57	21	99	30	16.0
16	8.9	33	66	99	60	109	24	54	20.0	112	29	16.0
17	46	29	69	99	54	96	24	39	19.0	99	39	17.0
18	27	26	60	96	48	86	9.1	39	30	89	76	17.0
19	17.0	25	54	99	45	76	4.2	34	33	79	63	25
20	25	51	48	86	98	72	3.9	34	24	99	72	16.0
21	60	76	42	72	119	66	3.6	32	34	83	48	14.0
22	112	49	39	60	116	63	3.0	29	23	93	51	13.6
23	86	51	39	51	116		2.6	28	22	116	54	13.2
24	76	45	36		98		2.1	27	79	105	46	12.6
25	51	51	33		96		2.8	27	63	89	36	17.8
26	34	63	30	96	126		5.2	26	50	96	33	13.6
27	32	119	28	72	99		3.4	25	116	79	32	17.0
28	36	72	27	63	93		2.4	24	162	69	30	96
29	34	48	28	57	112		2.1		106	63	28	57
30	39	45	62	64	78		2.0		105	66	27	17.0
31	36	39		51		45	1.9		102		24	

NOTE.—Record of stage determined from mean of two daily staff gage readings by ditchman July 10-15, Jan. 8 to Feb. 11, Feb. 13 to Mar. 12, June 28-29. Discharge estimated in million gallons per day by comparison with flow of Honomanu Stream, as follows: Oct. 24-25, 116; Dec. 23-25, 80; Dec. 26-28, 5; Jan. 5-7, 25. Discharge partly estimated July 3-5, 7-9, 16-17, Oct. 23, and Jan. 4.

Monthly discharge of Koolau ditch near Keanae, Maui, for the year ending June 30, 1921.

Month.	Discharge.			Second-feet (mean).	Total run-off.	
	Million gallons per day.				Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July.....	112	6.3	27.0	41.8	836	2,570
August.....	119	22	47.5	73.5	1,470	4,520
September.....	112	27	60.3	93.3	1,810	5,550
October.....	.....	28	63.1	97.6	1,960	6,000
November.....	126	45	86.9	134	2,610	8,000
December.....	132	.....	83.1	129	2,580	7,910
January.....	105	1.2	18.3	28.3	567	1,740
February.....	57	.3	23.9	37.0	670	2,050
March.....	116	19.0	45.3	70.1	1,400	4,310
April.....	119	60	88.7	137	2,660	8,170
May.....	76	26	43.9	67.9	1,360	4,180
June.....	99	12.6	22.3	34.5	669	2,050
The year.....	.....	.3	50.9	78.8	18,600	57,000

HONOMANU STREAM AT HAIKU-UKA BOUNDARY, NEAR KAILIILI, MAUI.

LOCATION.—At end of Haiku-uka boundary-line trail, 8 miles east of Kailiili.

RECORDS AVAILABLE.—October 9, 1919, to June 30, 1921.

GAGE.—Stevens continuous water-stage recorder.

DISCHARGE MEASUREMENTS.—Made from suspension footbridge or by wading.

CHANNEL AND CONTROL.—One channel at all stages; straight for 50 feet above and below station; narrows into a gorge below station. Control composed of 2-man boulders, subject to shifts.

EXTREMES OF DISCHARGE.—Maximum stage recorded during the year, 9.00 feet at 7.20 p. m. January 16, 1921 (discharge estimated by comparison with Honomanu Stream near Huelo at 1,200 million gallons per day or 1,860 second-feet). Minimum stage recorded during year, 0.53 foot at 12.20 a. m. June 26 (discharge, 0.23 million gallons per day or 0.36 second-foot).

1919-1921: Maximum stage recorded in January, 1921: Minimum stage recorded 0.28 foot at 10 a. m. April 3 and noon April 5, 1920 (discharge, 0.03 million gallons per day or 0.05 second-foot).

DIVERSIONS.—None.

REGULATION.—None.

OBJECT OF STATION.—To determine discharge of stream at boundary between fee simple land above and Territorial lands below.

UTILIZATION.—Water picked up below by East Maui Irrigation Co.'s ditches for irrigation of sugar cane.

ACCURACY.—Stage-discharge relation shifts slightly. Rating curve fairly well defined between 1 and 80 million gallons per day. Operation of water-stage recorder satisfactory. Records good.

Discharge measurements of Honomanu Stream at Haiku-uka boundary, near Kailiki, Maui, during the year ending June 30, 1921.

Date.	Made by—	Gage height (feet).	Discharge.	
			Second-feet.	Million gallons per day.
July 2	Reid Jerman.....	0.58	0.4	0.25
26	R. H. Remington.....	.84	1.8	1.15
Sept. 10	do.....	.97	3.3	2.2
Oct. 30	do.....	.80	1.2	.8
Jan. 28	W. C. Renshaw.....	1.27	9.8	6.4
Apr. 29	do.....	.76	.7	.45

Discharge, in million gallons per day, of Honomanu Stream at Haiku-uka boundary, near Kailiki, Maui, for the year ending June 30, 1921.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1.....	0.3	1.05	0.8	1.8	0.65	7.1	0.8	3.1	0.45	1.8	0.85	0.15
2.....	.3	1.95	1.6	1.25	3.1	2.6	1.05	2.3	57	1.3	.75	.15
3.....	.25	3.0	1.4	.9	2.5	1.7	6.0	1.4	8.0	1.06	1.4	.1
4.....	.25	3.3	1.4	.6	1.05	1.4	19.7	1.15	2.8	1.0	1.05	.09
5.....	.2	1.1	1.7	.5	.7	1.9	73	1.05	1.8	1.15	1.1	.08
6.....	.2	.75	8.0	1.0	.5	10.4	161	1.0	1.05	218	1.3	.09
7.....	.2	.6	10.2	2.6	1.25	4.9	102	1.0	.75	392	.85	.08
8.....	.2	.45	5.6	.9	270	68	13.6	.85	.65	39	.65	.09
9.....	.2	.35	4.8	.5	58	29	21	.75	.55	18.6	.55	.08
10.....	.2	.3	2.4	.7	15.1	32	36	.7	.5	4.9	.5	.2
11.....	.2	.25	19.4	33	7.6	6.0	48	.65	.5	3.5	.5	.35
12.....	.2	.25	8.4	6.4	3.2	2.9	13.1	.55	.35	6.4	.5	.2
13.....	.2	12.3	4.7	1.25	1.7	7.7	18.8	.5	.35	6.0	.45	.08
14.....	.15	9.5	2.5	.8	1.15	192	65	.45	.3	3.0	.35	.1
15.....	.65	1.25	1.7	39	.9	19.4	125	.9	.25	2.1	.4	.09
16.....	.45	.7	1.3	23	.7	5.5	219	1.3	.25	6.2	.4	.08
17.....	13.1	.45	1.25	5.0	.65	3.1	216	1.15	.2	3.0	.8	.09
18.....	2.2	.4	.95	7.3	.55	1.9	21	.95	.7	2.0	1.75	.08
19.....	.9	.35	.8	3.2	.5	1.15	10.9	1.2	1.0	1.3	1.35	.25
20.....	.75	7.7	.7	1.35	32	.85	8.4	.7	.85	1.2	1.25	.15
21.....	3.9	-----	.6	.9	27	.75	9.4	.55	1.0	1.1	.7	.08
22.....	12.9	-----	.5	.7	21	.7	5.5	.5	.65	1.15	1.05	.07
23.....	7.6	-----	.45	.55	7.5	9.9	4.7	.45	.6	2.9	1.2	.35
24.....	4.0	-----	.45	1.0	3.0	122	4.6	.4	5.9	1.5	3.1	.2
25.....	2.3	-----	.4	17.8	3.1	203	80	.4	4.5	1.15	1.25	.07
26.....	1.2	5.5	.3	4.5	12.4	11.6	56	.35	2.0	1.0	.6	.07
27.....	.8	14.6	.3	3.3	2.6	6.5	11.4	.35	13.5	.9	.45	1.7
28.....	1.1	2.9	.25	2.5	2.0	3.4	7.1	.35	4.6	.75	.3	9.5
29.....	1.1	1.4	.35	1.1	7.8	1.9	5.2	-----	4.2	.7	.25	2.5
30.....	2.4	.95	5.4	.85	84	1.1	3.1	-----	36	1.15	.2	.75
31.....	1.1	.9	-----	.7	-----	.8	5.2	-----	7.2	-----	.15	-----

NOTE.—Aug. 20-25, no record; discharge estimated by comparison with flow at lower station and of adjacent streams at 3 million gallons per day.

Monthly discharge of Honomanu Stream at Haiku-uka boundary, near Kailiili, Maui, for the year ending June 30, 1921.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-foot ₈ (mean).	Million gallons.	Acro-feet.
	Maximum.	Minimum.	Mean.			
July.....	13.1	0.15	1.92	2.97	59.5	153
August.....	14.6	.25	2.81	4.35	87.2	267
September.....	19.4	.25	2.95	4.56	88.6	272
October.....	39	.5	5.32	8.23	165	506
November.....	270	.5	19.1	29.6	572	1,760
December.....	203	.7	24.6	38.1	761	2,340
January.....	219	.8	44.2	68.4	1,370	4,200
February.....	3.1	.35	.893	1.38	25.0	77
March.....	57	.2	5.11	7.91	158	486
April.....	392	.7	24.2	37.4	726	2,230
May.....	3.1	.15	.839	1.30	26	80
June.....	9.5	.07	.597	.924	17.9	55
The year.....	392	.07	11.1	17.2	4,060	12,500

HONOMANU STREAM NEAR KEANAE, MAUI.

LOCATION.—500 feet above Spreckels ditch intake and trail bridge and 6 miles south of Keanal post office.

RECORDS AVAILABLE.—November 15, 1913, to June 30, 1921.

GAGE.—Stevens continuous water-stage recorder.

DISCHARGE MEASUREMENTS.—Made by wading or from footbridge at gage.

CHANNEL AND CONTROL.—One channel at all stages; straight for 200 feet above and below gage; stream bed filled with large boulders and very rough; right bank vertical wall of rock; left bank steep and high. Control composed of large boulders; fairly permanent.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 9.64 feet at 9.40 p. m. January 16 (discharge, about 1,250 million gallons per day or 1,930 second-foot); minimum stage recorded, 1.77 feet July 14 (discharge, 0.17 million gallons per day or 0.26 second-foot).

1913-1921: Maximum stage recorded, 9.9 feet at 9 p. m. May 1, 1916 (discharge, 1,500 million gallons per day or 2,320 second-foot); minimum stage recorded in July, 1920.

DIVERSIONS.—None.

REGULATION.—None.

OBJECT OF STATION.—Data valuable in relation to Territorial water licenses to ditch company.

UTILIZATION.—Ordinary flow is diverted by Spreckels ditch for irrigation of sugar cane.

ACCURACY.—Stage-discharge relation shifts slightly. Rating curves fairly well defined between 1 and 500 million gallons per day. Operation of water-stage recorder unsatisfactory at times. Record good when recorder was operating.

Discharge measurements of Honomanu Stream near Keanae, Maui, during the year ending June 30, 1921.

Date.	Made by—	Gage height (feet).	Discharge.	
			Second-feet.	Million gallons per day.
July 15	R. H. Remington	2.16	3.2	2.0
28	do.	2.26	3.2	2.1
Sept. 15	do.	2.41	6.0	3.9
Oct. 26	do.	2.78	12.4	8.0
Nov. 8	J. E. Stewart	6.52	711	460
Jan. 31	do.	2.71	12.5	8.1
May 2	W. C. Renshaw	2.25	2.6	1.7

Discharge, in million gallons per day, of Honomanu Stream near Keanae, Maui, for the year ending June 30, 1921.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1.		2.7	2.8		1.6	13.8	1.7	5.0	1.6	4.7	1.6	0.6
2.		12.6	3.0		4.7	4.5	1.9	4.4	68	3.5	1.5	.6
3.		5.9	3.2		5.0	3.4	9.8	3.6	13.7	3.0	2.2	.5
4.		6.0	3.5		2.4	2.6	33	3.2	5.2	2.9	1.8	.4
5.		3.2	3.6		1.7	3.2	97	2.9	3.6	2.7	3.4	.4
6.		2.5	16.0		1.4	21	184	2.7	2.4	205	2.4	.4
7.		2.0	25		1.4	6.5	150	2.6	1.9	361	1.6	.4
8.		1.9	13.8		299	81	32	2.5	1.7	117	1.3	.4
9.		1.6	11.2		88	52	43	2.3	1.7	55	1.1	.4
10.		1.5	5.6		36	65	60	2.3	1.6	8.7	1.0	.5
11.		1.4	44		14.4	9.6	66	2.2	1.4	5.9	1.0	.6
12.		1.8	17.2		5.8	4.7	32	2.2	1.4	92	1.0	.4
13.		28	9.2		3.5	12.5	32	1.9	1.2	15.2	.9	.3
14.		22	5.6		2.4	167	41	1.8	1.2	6.2	.8	.3
15.	1.4	3.4	4.3		2.0	34	200	5.3	1.2	5.8	.9	.3
16.	1.2	2.5	3.8	48	1.7	7.0	194	3.3	1.2	17.6	.8	.2
17.	24	2.1	3.1	10.7	1.6	4.1		3.0	1.2	5.9	1.1	.3
18.	4.4	1.9	2.7	22	1.4	2.9		3.0	2.7	4.2	4.7	.3
19.	2.2	1.9	2.5	6.7	1.3	2.4		3.2	3.2	2.8	2.8	.6
20.	1.9	15.2	2.2	3.0	50	2.0		2.3	2.4	2.6	3.4	.3
21.	8.0	12.2	2.1	2.2	59	1.7		1.9	3.1	2.3	1.6	.3
22.	31	4.7	2.1		46	1.6		1.7	1.8	2.6	1.7	.2
23.	16.2	5.8	2.0		12.6	17.4		1.7	1.7	8.2	2.8	.3
24.	18.3	10.1	1.9		4.7	102		1.6	15.2	3.8	9.3	.4
25.	5.4	5.8	1.7		4.5	193		1.5	8.8	2.5	2.5	.3
26.	3.4	10.2		7.0	23	21	126	1.4	5.1	2.2	1.6	.3
27.	2.6	30		4.4	3.8	10.1	19.8	1.4	32	1.7	1.3	3.2
28.	2.5	6.1		3.5	3.5	5.0	10.1	1.4	11.0	1.6	1.1	25
29.	2.5	3.6		2.2	14.8	3.2	7.4		16.3	1.5	.9	5.0
30.	4.3	3.4		1.9	106	2.3	5.2		37	2.5	.8	1.4
31.	3.3	2.7		1.7		1.9	6.5		17.7		.7	

NOTE.—Discharge estimated in million gallons per day by comparison with flow of Haipuaena Stream as follows: July 1-5, 0.6; July 6-14, 0.4; Sept. 26 to Oct. 5, 2.5; Oct. 6-10, 2.0.; Oct. 11-15, 35; Oct. 22-25, 1.2 Jan. 17-20, 120; Jan. 21-25, 30.

Monthly discharge of Honomanu Stream near Huelo, Maui, for the year ending June 30, 1921.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-foot (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July.....	31	.....	4.49	6.95	139	427
August.....	30	1.4	6.93	10.7	215	659
September.....	44	.....	6.81	10.5	204	627
October.....	.....	.....	11.6	17.9	359	1,100
November.....	299	1.3	26.8	41.5	803	2,470
December.....	193	1.6	27.7	42.9	858	2,640
January.....	200	1.7	63.9	98.9	1,980	6,080
February.....	5.3	1.4	2.58	3.99	72.3	222
March.....	87	1.2	10.3	15.9	318	980
April.....	361	1.5	31.7	49.0	961	2,920
May.....	9.3	.7	1.92	2.97	59.6	183
June.....	25	.2	1.49	2.31	44.6	137
The year.....	.....	.....	16.5	25.5	6,010	18,400

HAIPUAENA STREAM AT HAIKU-UKA BOUNDARY, NEAR KAILIILI, MAUI.

LOCATION.—300 feet upstream from Haiku-uka boundary-line trail crossing and $7\frac{1}{2}$ miles by trail east of Kailiili.

RECORDS AVAILABLE.—May 27, 1919, to June 30, 1921.

GAGE.—Stevens continuous water-stage recorder.

DISCHARGE MEASUREMENTS.—Made from suspension footbridge or by wading.

CHANNEL AND CONTROL.—Channel is pool at base of 60-foot falls. Control is solid rock ledge at lower end of pool. Practically permanent and the same for all stages.

EXTREMES OF DISCHARGE.—Maximum stage occurred on January 16, 1921. Float ribbon disengaged and exact height not determined but was higher than 3.65 feet (discharge more than 100 million gallons per day or 155 second-foot); minimum stage recorded, 0.17 foot at 4 p. m. July 14, 1920 (discharge, 0.08 million gallons per day or 0.12 second-foot).

1919-1921: Maximum stage occurred in January, 1921; minimum stage recorded 0.15 foot at 1.30 p. m. May 27, 1920 (discharge, 0.06 million gallons per day or 0.09 second-foot).

DIVERSIONS.—None.

REGULATION.—None.

OBJECT OF STATION.—To determine discharge of stream at boundary between fee simple land above and Territorial lands below.

UTILIZATION.—Water picked up below by East Maui Irrigation Co.'s ditches for the irrigation of sugar cane.

ACCURACY.—Stage-discharge relation changed by flood of January 16. Rating curves fairly well defined between 1 and 25 million gallons per day, used July 1 to January 16 and January 17 to June 30. Operation of water-stage recorder unsatisfactory. Records fair when water-stage recorder was operating.

Discharge measurements of Haiipuaena Stream at Haku-uka boundary, near Kaihili, Maui, during the year ending June 30, 1921.

Date.	Made by—	Gage height (feet).	Discharge.	
			Second-feet.	Million gallons per day.
July 2	Reid Jerman	0.29	0.15	0.1
26	R. H. Remington	.46	1.35	.9
Sept. 10	do	.58	2.2	1.45
Oct. 30	do	.45	1.15	.75
Jan. 28	W. C. Renshaw	.62	3.6	2.3
Apr. 29	do	.36	.85	.55
May 20	do	.40	1.05	.7

Discharge, in million gallons per day, of Haiipuaena Stream at Haku-uka boundary, near Kaihili, Maui, for the year ending June 30, 1921.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	0.3	0.9	0.8	1.1	0.7		2.3		0.4	1.1	0.7	0.4
2	.2	1.4	1.2	.9	2.2		7.2			.9	.7	.4
3	.2	2.0	1.0	.7	1.8		2.8			.9	1.1	.4
4	.1	2.2	1.0	.6	.9		16.5			.9	.8	.4
5	.1	.8	1.1	.5	.7		19.7			.9	.8	.3
6	.1	.6	4.8	.8	.5		53				1.0	.3
7	.1	.6	7.2	1.6	1.4		25				.7	.3
8	.1	.5	3.5	.7			7.7	0.8			.6	.3
9	.1	.5	2.9	.5			10.7	.7			.6	.2
10	.1	.4	2.4	.9			16.9	.7			.6	.3
11	.1	.4	13.3				9.7	.7			.5	.4
12	.1	.5	4.6				6.0	.6			.5	.2
13	.1	8.4	2.2				8.8	.6			.5	.2
14	.1	5.8	1.4					.6			.5	.2
15	.8	.8	1.2					.9			.5	.2
16	.6	.6	1.1					1.1			.5	.2
17	9.4	.5	1.2					.9			.5	.2
18	1.5	.5	.8					.9			1.2	.2
19	.7	.5	.9					.8	.7		1.1	.3
20	.7	5.6	.8					.6	.6		.9	.2
21	3.2	3.8	.8			0.8		.5	.7		.6	.2
22	10.6	1.2	.7			.7		.5	.5		.8	.1
23	4.5	1.7	.7			4.9		.4	.5		.9	.3
24	2.9	3.2	.7			19.1		.4	3.0		2.4	.2
25	1.6	1.8	.6			32		.4	2.5		1.0	.1
26	.8	3.8	.5			6.0		.4	1.2		.6	.1
27	.7	9.2	.5			1.1		.4	6.3		.5	1.4
28	.7	1.8	.4	1.2		1.6		.4	2.2		.4	5.2
29	.9	1.0	.5	.8		11.6			3.6		.4	1.4
30	1.4	.9	4.6	.8		2.3			15.0	1.0	.4	.5
31	.8	.9		.8		1.7			3.0		.4	

NOTE.—Discharge estimated in million gallons per day by comparison with flow of adjacent streams at same elevation as follows: Oct. 11-14, 4.5; Oct. 15-23, 4; Oct. 24-27, 3.5; Nov. 8-19, 7.5; Nov. 20-24, 7; Nov. 25-30, 6.5; Dec. 1-4, 2.1; Dec. 5-12, 0.8; Dec. 13-20, 8.5; Jan. 14-20, 30; Jan. 21-31, 7; Feb. 1-7, 1.1; Mar. 2-5, 6.5; Mar. 6-12, 0.6; Mar. 13-18, 0.4; Apr. 6-11, 27; Apr. 12-21, 2.2; Apr. 22-29, 1.0.

Monthly discharge of Haipuaena Stream at Haiku-uka boundary, near Kaitiiki, Maui, for the year ending June 30, 1921.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-foot (mean).	Million gallons.	Acre-foot.
	Maximum.	Minimum.	Mean.			
July.....	10.6	0.1	1.41	2.18	43.6	134
August.....	9.2	.4	2.03	3.14	62.8	193
September.....	13.3	.4	2.11	3.26	63.4	194
October.....			2.58	3.99	79.9	245
November.....			5.74	8.88	172	528
December.....			5.31	8.22	165	505
January.....			15.3	23.7	473	1,460
February.....		.4	.75	1.16	21.0	64
March.....			2.35	3.64	72.8	224
April.....			6.59	10.2	198	607
May.....	2.4	.4	.73	1.13	22.7	69
June.....	5.2	.1	.50	.77	15.1	46
The year.....			3.81	5.89	1,390	4,270

HAIPUAENA STREAM NEAR HUELO, MAUI.

LOCATION.—200 feet above inflow of Spreckels ditch and 7 miles by trail east of Huelo.

RECORDS AVAILABLE.—October 19, 1913, to June 30, 1921; also records of combined flow of stream and Spreckels ditch at staff-gage station 600 feet below present site December 18, 1910, to September 30, 1913.

GAGE.—Stevens continuous water-stage recorder installed June 16, 1914, to replace original Friez recorder.

DISCHARGE MEASUREMENTS.—Made by wading or from footbridge.

CHANNEL AND CONTROL.—One channel at all stages; straight for 200 feet above and below gage; right bank high with steep slope; left bank nearly vertical. Control composed of large boulders; fairly permanent.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 5.67 feet at 7.40 p. m. January 16 (discharge, 530 million gallons per day or 820 second-foot); minimum stage recorded during year, 0.22 foot at 10.20 a. m. July 12 (discharge, 0.34 million gallons per day or 0.53 second-foot.)

1913-1921: Maximum stage recorded, January 16, 1921. Minimum stage recorded 0.20 foot frequently during December, 1919 (discharge, 0.3 million gallons per day or 0.5 second-foot).

DIVERSIONS.—None.

REGULATION.—None.

OBJECT OF STATION.—Data valuable in relation to water valuation appraisal under Territorial lease to ditch company.

UTILIZATION.—Ordinary flow diverted by ditches of East Maui Irrigation Co. for irrigation of sugar cane.

ACCURACY.—Stage-discharge relation permanent. Rating curve used is a slight revision of the previous curve and is fairly well defined between 1 and 150 million gallons per day. Operation of water-stage recorder satisfactory. Records fair.

Discharge measurements of Hoipuaena Stream near Huelo, Maui, during the year ending June 30, 1921.

Date.	Made by—	Gage height (feet).	Discharge.	
			Second-feet.	Million gallons per day.
July 15	R. H. Remington	0.66	3.9	2.5
16	do.	.40	1.5	.95
30	do.	.84	6.6	4.3
Sept. 16	do.	.80	5.3	3.4
Oct. 22	do.	.70	5.0	3.2
Jan. 31	J. E. Stewart	.94	7.6	4.9
Feb. 9	W. C. Renshaw	.64	4.4	2.8
May 5	do.	.66	3.4	2.2

Discharge, in million gallons per day, of Hoipuaena Stream near Huelo, Maui, for the year ending June 30, 1921.

Day	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	0.8	3.4	3.2	3.8	2.8	11.6	2.8	4.6	1.6	5.8	3.1	1.7
2	.7	3.7	3.4	3.1	5.1	5.8	3.1	4.0	38	4.7	3.1	1.6
3	.5	5.7	3.4	2.8	5.7	5.0	7.0	3.6	7.1	4.0	3.4	1.6
4	.5	6.0	3.4	2.7	3.8	4.3	16.0	3.4	4.2	3.7	3.1	1.4
5	.4	3.7	3.7	2.5	3.3	4.6	41	3.0	3.5	3.7	3.7	1.3
6	.4	3.2	12.6	2.6	2.8	13.4	109	2.9	2.8	73	3.6	1.1
7	.4	2.8	17.0	3.8	2.8	6.1	82	2.8	2.4	133	3.0	1.1
8	.4	2.4	9.8	2.8	96	37	20.0	2.6	2.2	41	2.6	1.1
9	.4	2.1	9.2	2.4	30	26	21	2.5	2.0	28	2.4	1.3
10	.4	1.9	6.1	2.4	15.1	30	19.6	2.4	1.8	8.6	2.2	1.4
11	.4	1.8	29	25	8.8	8.2	19.7	2.4	1.8	8.0	2.1	1.9
12	.4	2.3	13.2	8.7	5.6	5.8	17.4	2.3	1.6	10.5	2.1	1.4
13	.4	14.5	9.2	3.6	4.4	8.7	15.4	2.1	1.5	11.9	1.9	1.1
14	.4	13.4	6.6	3.0	3.7	59	40	1.9	1.5	7.8	1.7	1.3
15	1.8	3.6	5.3	33	3.4	15.5	97	4.2	1.4	7.7	1.8	1.4
16	1.3	2.9	4.6	25	3.0	5.7	117	3.4	1.4	14.2	1.8	1.1
17	10.7	2.5	4.8	8.8	2.8	4.7	124	3.0	1.3	7.8	1.9	1.1
18	3.4	2.3	4.1	14.0	2.6	4.0	24	3.8	3.2	6.4	6.6	1.4
19	1.8	2.2	3.7	6.6	2.4	3.5	10.8	3.1	3.4	5.0	4.1	2.3
20	2.0	7.8	3.4	4.6	29	3.3	7.8	2.4	2.7	5.4	5.2	1.7
21	6.4	7.5	3.2	3.8	33	3.1	8.0	2.1	3.3	4.7	3.4	.8
22	17.8	4.1	2.8	3.2	25	2.8	5.8	1.9	2.4	5.6	3.2	.7
23	9.9	4.8	2.7	3.0	9.4	7.9	5.3	1.8	2.1	10.1	3.9	.8
24	11.6	5.8	2.7	3.6	5.8	21	5.1	1.8	11.4	6.0	10.1	.8
25	4.6	5.1	2.5	18.4	5.1	60	45	1.6	6.9	4.6	4.2	.7
26	3.1	7.4	2.3	8.0	12.5	8.2	50	1.6	6.8	4.2	3.2	.7
27	2.7	17.4	2.3	4.6	4.9	5.7	10.2	1.5	19.0	3.6	2.8	3.0
28	2.4	5.8	2.3	4.3	4.3	4.1	6.9	1.5	8.4	3.3	2.4	16.3
29	3.3	4.2	2.3	8.5	13.0	3.5	5.7	.....	16.3	3.2	2.2	5.5
30	4.0	4.1	8.9	3.4	65	3.2	4.8	.....	53	3.9	2.0	2.5
31	3.5	3.5	.....	3.0	.....	2.9	5.1	.....	13.5	.....	1.8	.....

NOTE.—Discharge Nov. 8-10 estimated by comparison with flow of Honomanu Stream.

Monthly discharge of Haipuaena Stream near Huelo, Maui, for the year ending June 30, 1921.

Month.	Discharge.			Total run-off.		
	Million gallons per day.			Second-foot (mean).	Million gallons.	Acre-foot.
	Maximum.	Minimum.	Mean.			
July.....	17.8	0.4	3.12	4.83	96.8	297
August.....	17.4	1.8	5.09	7.88	158	484
September.....	29	2.3	6.26	9.69	188	576
October.....	33	2.4	7.10	11.0	220	675
November.....	96	2.4	13.7	21.2	411	1,260
December.....	60	2.8	12.4	19.2	385	1,180
January.....	124	2.8	30.5	47.2	946	2,900
February.....	4.6	1.5	2.65	4.10	74.2	228
March.....	53	1.3	7.37	11.4	228	701
April.....	133	3.2	14.6	22.6	437	1,340
May.....	10.1	1.7	3.18	4.92	98.6	303
June.....	16.3	.7	2.00	3.09	60.1	184
The year.....	133	.4	9.05	14.0	3,300	10,100

PUOHAKAMOA STREAM NEAR HUELO, MAUI.

LOCATION.—150 feet above Spreckels ditch inflow and trail crossing and 7 miles east of Huelo.

RECORDS AVAILABLE.—June 13, 1913, to June 30, 1921 (new station); December 18, 1910, to June 18, 1913 (old station).

GAGE.—Stevens continuous water-stage recorder installed November 23, 1917, replacing Barrett and Lawrence water-stage recorder installed June 13, 1913. Old staff gage station was 150 feet downstream at trail bridge below inflow from Spreckels ditch.

DISCHARGE MEASUREMENTS.—Made by wading or from footbridge 200 feet above gage. Inflow of Spreckels ditch must be deducted from measurements made at trail bridge at old station.

CHANNEL AND CONTROL.—One channel at all stages; straight for 100 feet above and below gage; banks steep and high; stream bed is very rough and steep. Control composed of large boulders; shifts slightly.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 7.20 feet at 3 a. m. January 17 (discharge, 930 million gallons per day, or 1,440 second-feet); minimum discharge recorded at 0.60 foot from 6 p. m. to midnight June 25 (discharge, 0.5 million gallons per day, or 0.8 second-foot).

1910-1921: Maximum stage recorded January 17, 1921; minimum stage recorded, 0.25 foot October 26, 1917 (discharge, 0.4 million gallons per day, or 0.6 second-foot).

DIVERSION.—Kula pipe line diverts small amount of water above station at elevation 4,300 feet.

REGULATION.—None.

OBJECT OF STATION.—To furnish data for water valuation appraisal in connection with Territorial water license to ditch company.

UTILIZATION.—Ordinary flow of stream is diverted by East Maui Irrigation Co.'s ditches for irrigation of sugar cane.

ACCURACY.—Stage-discharge relation changed by flood of January 16. Curve used July 1 to January 16 well defined between 1 and 100 million gallons per day. Curve used January 17 to June 30 not well defined. Operation of water-stage recorder unsatisfactory November 18 to December 17 and January 17 to March 16. Records good when recorder was working properly.

Discharge measurements of Puohakamoa Stream near Huelo, Maui, during the year ending June 30, 1921.

Date.	Made by—	Gage height (feet).	Discharge.	
			Second-feet.	Million gallons per day.
July 16	R. H. Remington	0.66	2.2	1.4
29	Reid Jerman	1.20	6.4	4.1
Sept. 16	R. H. Remington	1.64	12.7	8.2
Oct. 22	do.	1.46	10.2	6.6
Jan. 31	J. E. Stewart	2.22	19.0	12.3
Feb. 5	W. C. Renshaw	1.76	8.5	5.5
May 5	do.	1.47	7.2	4.6

Discharge, in million gallons per day, of Puohakamoa Stream near Huelo, Maui, for the year ending June 30, 1921.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	1.7	6.0	6.0	6.7	5.3	.....	6.0	9.8	.....	10.5	5.9	2.5
2	1.5	6.7	6.0	5.3	9.0	.....	6.4	8.6	.....	8.1	5.9	2.4
3	1.0	10.4	6.0	5.3	9.4	.....	14.0	8.1	.....	6.7	6.3	2.2
4	.9	10.9	6.7	5.0	6.4	.....	19.5	7.6	.....	6.7	5.5	2.0
5	.8	6.7	6.7	4.4	5.3	.....	68	7.1	.....	6.3	5.9	1.8
6	.8	5.6	23	4.7	5.0	.....	180	6.7	.....	139	5.9	1.7
7	.7	5.0	38	6.7	5.0	.....	214	6.3	.....	280	4.8	1.7
8	.7	4.4	17.6	5.0	193	.....	51	5.9	.....	99	4.2	1.7
9	.8	3.9	19.7	4.0	62	.....	42	5.5	.....	54	3.9	1.7
10	.7	3.6	10.9	3.9	30	.....	33	5.2	.....	16.5	3.6	1.7
11	.7	3.3	59	43	16.8	.....	30	.....	.....	17.2	3.6	2.3
12	.6	4.4	23	17.0	10.9	.....	40	.....	.....	24	3.4	1.7
13	.6	23	18.0	6.7	9.0	.....	28	.....	.....	25	3.2	1.3
14	.6	26	11.4	5.6	7.8	.....	27	.....	.....	14.0	3.0	1.5
15	3.2	7.0	9.4	53	7.4	.....	212	.....	.....	16.3	3.5	1.5
16	1.9	5.3	7.8	44	6.7	.....	82	.....	.....	33	3.4	1.3
17	20.0	4.7	8.2	17.4	6.0	.....	.....	.....	2.4	14.0	3.2	1.2
18	7.0	4.1	7.0	27	.....	8.6	.....	.....	5.4	11.3	11.8	1.3
19	4.0	3.9	6.4	12.9	.....	7.8	.....	.....	5.5	9.2	7.1	1.9
20	3.8	9.9	5.6	8.6	.....	7.0	.....	.....	4.2	9.2	9.0	1.3
21	14.9	14.0	5.3	7.4	.....	6.7	.....	.....	5.4	8.1	5.2	.9
22	43	7.0	4.7	6.4	.....	6.4	.....	.....	3.5	9.8	4.8	.8
23	19.2	9.0	5.0	5.6	.....	12.6	.....	.....	3.3	22	5.9	.9
24	32	8.6	4.7	5.8	.....	28	.....	.....	22	12.1	19.8	.9
25	9.9	9.4	4.1	32	.....	83	.....	.....	10.8	9.2	6.7	.6
26	6.7	12.7	3.8	14.4	.....	14.5	.....	.....	11.0	8.6	4.8	.6
27	5.6	32	3.5	8.2	.....	11.4	.....	.....	37	7.1	3.9	3.3
28	5.3	10.4	3.3	7.4	.....	8.6	.....	.....	13.8	7.1	3.6	33
29	5.6	7.4	3.6	6.7	.....	7.4	.....	.....	49	7.1	3.3	8.0
30	7.4	7.4	15.5	6.0	.....	6.7	.....	.....	104	8.1	3.0	2.8
31	6.4	6.4	.....	5.3	.....	6.4	.....	.....	26	.....	2.7	.....

NOTE.—Discharge estimated in million gallons per day by comparison with flow of adjacent streams as follows: Nov. 18-19, 5; Nov. 20-30, 40; Dec. 1-5, 10; Dec. 6-10, 50; Dec. 11-15, 40; Dec. 16-17, 10; Jan. 17-18, 120; Jan. 19-24, 15; Jan. 25-26, 80; Jan. 27-31, 15; Feb. 11-15, 5; Feb. 16-20, 6; Feb. 21-28, 3; Mar. 1-5, 20; Mar. 6-16, 3.

Monthly discharge of Puohakamoa Stream near Huelo, Maui, for the year ending June 30, 1921.

Month.	Discharge.			Total run-off.		
	Million gallons per day.			Second-foot (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July.....	43	0.6	6.71	10.4	208	638
August.....	32	3.3	9.00	13.9	279	856
September.....	59	3.3	11.7	18.1	350	1,089
October.....	53	3.9	12.6	19.5	391	1,200
November.....	193	.....	28.2	43.6	845	2,606
December.....	.....	.....	23.7	36.7	735	2,250
January.....	.....	6.0	52.2	80.8	1,620	4,970
February.....	.....	.....	5.35	8.28	150	460
March.....	104	.....	14.1	21.8	436	1,340
April.....	280	6.3	30.0	46.4	899	2,760
May.....	19.8	2.7	5.28	8.32	167	512
June.....	33	.6	2.88	4.46	86.5	265
The year.....	280	.6	16.9	26.1	6,170	18,900

EAST BRANCH OF PUOHAKAMOA STREAM AT HAIKU-UKA BOUNDARY, NEAR KAILIILI, MAUI.

LOCATION.—On left bank of stream 200 yards downstream from trail crossing and 7 miles by trail southeast of Kailiili.

RECORDS AVAILABLE.—October 9, 1919, to June 30, 1921.

GAGE.—Stevens continuous water-stage recorder.

DISCHARGE MEASUREMENTS.—Made by wading or from suspension footbridge 5 feet below gage.

CHANNEL AND CONTROL.—Channel high steep banks with boulder-strewn bed. Pool at station 20 feet wide by 35 feet long, clear and smooth. Control large boulders; subject to shift during floods.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 5.76 feet at 4.30 p. m. January 16 (discharge, about 48 million gallons per day or 74 second-feet); minimum stage recorded during year, 3.81 feet at 9.40 p. m. July 14 (discharge, 0.0).

1919-1921: Maximum stage estimated by comparison with West and Middle branches of Puohakamoa Stream 3.27 feet old datum March 22, 1920 (discharge, about 102 million gallons per day or 158 second-feet); minimum stage, no discharge March 22 and July 14, 1920.

DIVERSIONS.—None.

REGULATION.—None.

OBJECT OF STATION.—To determine discharge of stream at boundary between fee simple land above and Territorial lands below.

UTILIZATION.—Water picked up below by East Maui Irrigation Co.'s ditches for irrigation of sugar cane.

ACCURACY.—Stage-discharge relation permanent. Rating curve fairly well defined between 0.1 and 10 million gallons per day. Operation of water-stage recorder satisfactory. Records fair.

Discharge measurements of East Branch of Puohakamoa Stream at Haiku-uka boundary, near Kailiili, Maui, during the year ending June 30, 1921.

Date.	Made by—	Gage height (feet).	Discharge.	
			Second-feet.	Million gallons per day.
July 2	Reid Jerman.....	3.95	0.15	0.08
25	R. H. Remington.....	4.12	.55	.35
Sept. 10	do.....	4.27	.65	.4
Oct. 30	do.....	4.07	.4	.25
Jan. 28	J. E. Stewart.....	4.22	1.4	.9
Apr. 29	W. C. Renshaw.....	4.07	.5	.35
May 20	do.....	4.07	.6	.4

Discharge, in million gallons per day, of East Branch of Puohakamoa Stream at Haiku-uka boundary, near Kailiili, Maui, for the year ending June 30, 1921.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1.....	0.09	0.2	0.3	0.3	0.2	1.0	0.2	0.5	0.1	0.5	0.3	0.08
2.....	.08	.4	.4	.2	.5	.5	.6	.5	3.8	.4	.3	.08
3.....	.08	.5	.3	.2	.6	.5	.7	.5	.5	.3	.3	.08
4.....	.07	.5	.5	.2	.3	.5	2.6	.4	.4	.3	.2	.07
5.....	.07	.2	.5	.2	.3	.5	3.2	.4	.3	.3	.3	.07
6.....	.06	.2	1.8	.2	.2	1.6	14.1	.3	.2	7.8	.3	.06
7.....	.06	.1	2.1	.3	.1	.9	7.1	.3	.1	16.3	.2	.06
8.....	.08	.1	2.1	.2	10.8	3.6	2.4	.2	.1	5.5	.2	.07
9.....	.07	.1	1.1	.2	4.0	2.9	2.3	.2	.1	3.0	.2	.07
10.....	.06	.09	4.2	.3	2.2	3.7	1.5	.2	.1	1.3	.1	.1
11.....	.06	.08	3.1	3.4	1.4	1.3	1.5	.2	.1	1.3	.2	.09
12.....	.06	.2	1.3	1.0	.8	.9	2.1	.2	.1	2.0	.1	.08
13.....	.05	1.6	.9	.4	.6	1.4	1.7	.2	.1	1.7	.1	.08
14.....	.04	1.4	.6	.3	.5	4.5	6.7	.2	.1	.9	.1	.08
15.....	.3	.2	.5	3.4	.3	1.8	6.3	.5	.1	.8	.1	.08
16.....	.1	.2	.3	2.8	.3	1.0	12.0	.3	.1	1.7	.1	.07
17.....	1.7	.1	.3	1.0	.2	.9	12.4	.2	.1	.9	.1	.08
18.....	.4	.1	.3	1.6	.2	.8	2.8	.2	4.1	.7	.5	.08
19.....	.2	.1	.2	.7	.2	.7	1.7	.2	.3	.5	.3	.1
20.....	.2	.7	.2	.4	3.0	.5	1.3	.2	.2	.5	.3	.08
21.....	1.0	.7	.1	.3	2.6	.4	1.2	.1	.3	.5	.2	.07
22.....	3.1	.4	.1	.3	2.0	.3	.8	.1	.2	.5	.2	.06
23.....	1.0	.4	.1	.2	.7	.8	.7	.1	.2	1.1	.3	.06
24.....	2.0	.9	.1	.3	.5	1.8	.7	.1	1.1	.5	1.1	.06
25.....	.5	.5	.1	2.4	.6	4.5	7.0	.1	.7	.5	.3	.05
26.....	.3	1.2	.09	.7	1.0	.9	4.6	.1	.6	4.1	.2	.06
27.....	.2	2.1	.08	.5	.3	.6	1.3	.1	2.2	.3	.1	.6
28.....	.2	.6	.08	.4	.4	.4	.9	.1	.9	.3	.1	1.8
29.....	.2	.4	.09	.3	1.8	.3	.8	.....	2.0	.3	.1	.4
30.....	.2	.3	1.4	.2	5.3	.3	.7	.....	5.5	.4	.09	.1
31.....	.2	.3	.....	.2	.....	.2	.7	.....	1.2	.....	.08	.....

NOTE.—Discharge estimated for Aug. 24 and 25.

Monthly discharge of East Branch of Puohakamoa Stream at Haiku-uka boundary, near Kailili, Maui, for the year ending June 30, 1921.

Month.	Discharge.			Total run-off.		
	Million gallons per day.			Second-foot (mean).	Million gallons.	Acre-foot.
	Maximum.	Minimum.	Mean.			
July.....	3.1	0.04	0.413	0.639	12.8	39
August.....	2.1	.08	.480	.743	14.9	46
September.....	4.2	.08	.775	1.20	23.2	71
October.....	3.4	.2	.75	1.16	23.1	71
November.....	10.8	.1	1.40	2.17	41.9	129
December.....	4.5	.2	1.29	2.00	40.0	122
January.....	14.1	.2	3.31	5.12	103	315
February.....	.5	.1	.24	.371	6.7	21
March.....	5.5	.1	.84	1.30	25.9	80
April.....	16.3	.3	1.84	2.85	55.2	169
May.....	1.1	.08	.228	.353	7.07	22
June.....	1.8	.05	.161	.249	4.82	15
The year.....	16.3	.04	.981	1.52	358	1,100

MIDDLE BRANCH OF PUOHAKAMO A STREAM AT HAIKU-UKA BOUNDARY, NEAR KAILILI, MAUI.

LOCATION.—At trail crossing 200 feet above Haiku-uka boundary line and 3¼ miles southeast of Kailili.

RECORDS AVAILABLE.—November 22, 1918, to June 30, 1921.

GAGE.—Stevens continuous water-stage recorder.

DISCHARGE MEASUREMENTS.—By wading or from suspension bridge just above gage.

CHANNEL AND CONTROL.—One channel at all stages; channel straight 25 feet above and below control; right bank vertical; left bank 1½ on 1 slope; stream bed composed of gravel and boulders; control probably shifting.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 7.87 feet at 8.20 p. m. January 16 (discharge, 144 million gallons per day or 223 second-feet). Minimum stage recorded during year, 4.06 feet from 7 p. m. to 9 p. m. July 14 (discharge, 0.06 million gallons per day or 0.09 second-foot).

1918-1921: Maximum stage recorded, 8.47 feet at 5 p. m. March 22, 1920 (discharge, 207 million gallons per day or 320 second-feet); minimum stage recorded, 3.91 feet at noon December 22, 1919 (discharge, 0.06 million gallons per day or 0.09 second-foot).

DIVERSIONS.—None.

REGULATION.—None.

OBJECT OF STATION.—To determine discharge of stream at boundary between fee simple land above and Territorial lands below.

UTILIZATION.—Water picked up below by East Maui Irrigation Co.'s ditches for irrigation of sugar cane.

ACCURACY.—Stage-discharge relation not permanent. Rating curve used July 1 to 16 and April 7 to June 30 well defined between 0.2 and 16 million gallons per day. Curve used July 17 to April 6 not well defined. Operation of water-stage recorder satisfactory. Records good.

Discharge measurements of Middle Branch of Puohakamoa Stream at Haiku-uka boundary, near Kailili, Maui, during the year ending June 30, 1921.

Date.	Made by—	Gage height (feet).	Discharge.	
			Second-feet.	Million gallons per day.
July 1	Reid Jerman.....	4.18	0.3	0.2
25	do.....	4.44	1.95	1.25
Sept. 9	R. H. Remington.....	4.48	3.1	2.0
Oct. 29	do.....	4.32	1.1	.7
Jan. 28	W. C. Renshaw.....	4.50	3.4	2.2
Mar. 18	J. E. Stewart.....	4.24	.75	.5
Apr. 29	W. C. Renshaw.....	4.28	.55	.35
May 20	do.....	4.30	.6	.4

Discharge, in million gallons per day, of Middle Branch of Puohakamoa Stream at Haiku-uka boundary, near Kailili, Maui, for the year ending June 30, 1921.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1.....	0.2	0.9	0.7	1.3	0.7	3.5	1.1	1.3	0.4	1.2	0.7	0.3
2.....	.2	1.3	1.0	1.0	1.7	1.9	1.1	1.2	12.7	.9	.7	.3
3.....	.2	1.9	1.0	.8	1.8	1.6	3.2	1.1	2.6	.7	1.1	.3
4.....	.1	2.0	1.1	.7	.9	1.5	8.1	.9	1.2	.7	.9	.3
5.....	.1	.9	1.1	.6	.7	1.6	18.4	.9	.9	.8	.7	.3
6.....	.1	.7	3.8	.8	.6	4.3	32	.8	.6	24	.9	.2
7.....	.1	.6	4.7	1.8	.9	2.0	29	.8	.5	48	.7	.2
8.....	.1	.5	2.7	.8	40	13.8	6.5	.8	.4	13.2	.6	.3
9.....	.1	.5	2.6	.6	14.7	9.4	9.3	.7	.4	7.4	.5	.3
10.....	.1	.4	1.7	.7	5.9	12.8	8.9	.7	.4	2.4	.5	.4
11.....	.1	.3	7.6	10.4	3.1	2.5	8.7	.6	.4	2.1	.5	.4
12.....	.1	.6	3.4	2.6	1.9	1.8	5.1	.6	.3	2.8	.5	.3
13.....	.1	5.6	2.5	.9	1.5	2.8	5.6	.5	.3	3.0	.5	.3
14.....	.1	4.4	1.8	.7	1.2	22	9.5	.5	.3	2.0	.5	.3
15.....	.4	1.1	1.3	9.7	1.1	5.7	26	.8	.3	1.6	.5	.3
16.....	.2	.7	1.1	7.6	1.1	1.9	29	.8	.3	3.0	.5	.3
17.....	5.7	.6	1.1	2.5	1.0	1.6	35	.8	.3	1.9	.5	.3
18.....	1.5	.5	.9	3.5	.9	1.4	6.9	.8	.5	1.6	.9	.3
19.....	.7	.5	.8	1.8	.9	1.2	3.9	.8	.5	1.2	1.0	.4
20.....	.6	3.3	.8	1.1	12.6	1.2	2.7	.5	.5	1.2	.8	.3
21.....	2.5	2.6	.7	1.0	12.9	1.1	3.1	.5	.5	1.1	.6	.2
22.....	6.8	1.3	.6	.8	10.2	1.1	1.9	.4	.3	1.2	.5	.2
23.....	3.9	1.7	.7	.8	3.0	3.6	1.8	.4	.3	1.6	.9	.4
24.....	2.5	2.4	.6	.....	1.9	7.5	1.7	.4	2.0	1.3	1.8	.2
25.....	1.6	1.8	.6	.....	2.1	21	13.4	.4	2.0	1.1	.9	.....
26.....	1.0	2.8	.5	.....	5.2	3.1	15.6	.4	.8	.9	.6	.....
27.....	.8	5.2	.5	.....	1.6	2.3	3.4	.4	4.8	.8	.5	.....
28.....	.9	1.6	.5	1.5	1.5	1.5	2.4	.3	2.1	.8	.4	.....
29.....	.9	1.1	.6	.9	4.3	1.2	1.9	.....	2.2	.7	.4	.....
30.....	1.7	.9	3.6	.8	20.0	1.1	1.5	.....	13.1	1.0	.3	.....
31.....	.9	.8	.....	.7	.....	1.0	2.0	.....	3.3	.....	.3	.....

NOTE.—Discharge estimated in million gallons per day by comparison with flow of adjacent streams as follows: October 24-27, 3; and June 25-30, 1.

Monthly discharge of Middle Branch of Puohakamoa Stream at Haiku-uka boundary, near Kailiili, Maui, for the year ending June 30, 1921.

Month.	Discharge.			Total run-off.		
	Million gallons per day.			Second-foot (mean).	Million gallons.	Acre-foot.
	Maximum.	Minimum.	Mean.			
July.....	6.8	0.1	1.11	1.72	34.3	106
August.....	5.6	.3	1.60	2.48	49.5	152
September.....	7.6	.5	1.69	2.61	50.6	156
October.....	10.4	.6	2.21	3.42	68.4	210
November.....	40	.6	5.20	8.05	156	479
December.....	22	1.0	4.48	6.93	139	426
January.....	35	1.1	9.64	14.9	299	917
February.....	1.3	.3	.68	1.05	19.1	58
March.....	13.1	.3	1.78	2.75	55.2	169
April.....	48	.7	4.34	6.71	130	400
May.....	1.8	.3	.67	1.04	20.7	64
June.....	.....	.2	.44	.68	13.1	40
The year.....	48	.1	2.83	4.83	1,030	3,180

WEST BRANCH OF PUOHAKAMOEA STREAM AT HAIKU-UKA BOUNDARY, NEAR KAILIILI, MAUI.

LOCATION.—At trail crossing 500 feet above Haiku-uka boundary line and 3½ miles by horse trail southeast of Kailiili.

RECORDS AVAILABLE.—March 14, 1919, to June 30, 1921.

GAGE.—Stevens continuous water-stage recorder.

DISCHARGE MEASUREMENTS.—By wading or from suspension bridge 200 feet below gage.

CHANNEL AND CONTROL.—One channel at all stages; channel straight 30 feet above and 50 feet below gage; right bank vertical; left bank 1 on 1½ slope; stream bed rock and gravel; control composed of large boulders; occasionally shifts.

EXTREMES OF DISCHARGE.—Maximum stage during year occurred at 7 p. m. January 16, gage height about 6.9 (discharge, about 180 million gallons per day or 279 second-feet); minimum stage during year, 3.43 feet at 7 p. m. July 14 (discharge, 0.16 million gallons per day or 0.25 second-feet).

1919-1921: Maximum stage occurred at 5.30 p. m. March 22, 1920. Float stuck at gage height 5.62 feet but from the shape of the graph and comparison with the Middle and East branches of the Puohakamoa, it is estimated that a stage of 8 feet was reached (discharge, about 250 million gallons per day or 387 second-feet). Minimum stage recorded during period of record, 3.48 feet at 8.30 a. m. December 22 and 2 a. m. December 23, 1919 (discharge, 0.08 million gallons per day or 0.12 second-foot).

DIVERSIONS.—Kula pipe line diverts water above station at elevation 4,300 feet.

REGULATION.—None.

OBJECT OF STATION.—To determine discharge of stream at boundary between fee simple lands above and Territorial lands below.

UTILIZATION.—Water diverted by ditches of East Maui Irrigation Co. for irrigation of sugar cane.

ACCURACY.—Stage-discharge relation shifts slightly. Rating curve used July 1 to January 16 fairly well defined between 0.4 and 20 million gallons per day. Curve used January 17 to June 30 well defined between 0.7 and 15 million gallons per day. Operation of water-stage recorder unsatisfactory at times. Records good when recorder was operating properly.

Discharge measurements of West Branch of Puohakamoa Stream at Haiku-uka boundary, near Kaihili, Maui, during the year ending June 30, 1921.

Date.	Made by—	Gage height (feet).	Discharge.	
			Second-feet.	Million gallons per day.
July. 1	Reid Jerman.....	3.55	0.7	0.45
25	do.....	3.78	3.0	1.95
Sept. 9	R. H. Remington.....	3.89	4.8	3.1
Oct. 29	do.....	3.67	1.45	.95
Jan. 29	W. C. Renshaw.....	3.91	4.0	2.6
Apr. 29	do.....	3.71	.6	.4
May 21	do.....	3.60	.9	.6

Discharge, in million gallons per day, of West Branch of Puohakamoa Stream at Haiku-uka boundary, near Kaihili, Maui, for the year ending June 30, 1921.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May
1.....	0.5	1.2	1.0	1.2	1.0	3.9	1.0	1.6	0.6	1.7	0.9
2.....	.4	1.6	1.4	1.0	1.9	2.1	1.3	1.4	19.9	1.2	.9
3.....	.3	2.4	1.2	.9	2.0	1.8	3.4	1.2	3.3	1.1	1.2
4.....	.3	2.6	1.4	.8	1.2	1.7	7.9	1.2	2.0	1.1	.....
5.....	.2	1.2	1.4	.8	1.0	2.1	17.5	1.1	1.2	1.1	.....
6.....	.2	1.0	5.0	1.0	.8	5.9	42	1.0	.9	37	.....
7.....	.2	.8	5.8	.....	1.0	2.8	33	1.0	.7	72	.....
8.....	.3	.8	4.0	.....	47	17.6	6.6	.9	.7	19.8	.....
9.....	.2	.7	3.4	.....	14.7	10.7	7.7	.9	.....	12.0	.....
10.....	.2	.6	2.3	.....	6.2	13.8	7.8	.8	.....	3.4	.....
11.....	.2	.6	10.3	.....	3.4	3.2	8.3	.8	.....	3.3	.....
12.....	.2	.8	4.5	.....	2.1	2.2	5.2	.8	.....	5.4	.....
13.....	.2	5.7	3.5	.....	1.6	4.3	6.9	.7	.....	4.7	.....
14.....	.2	4.8	2.4	.....	1.4	28	15.5	.7	.....	3.0	.....
15.....	1.1	1.1	1.8	.....	1.2	5.4	28	1.2	.....	2.3	.....
16.....	.6	.9	1.4	.....	1.1	2.3	39	1.2	.....	5.0	.....
17.....	6.1	.8	1.3	.....	1.0	1.8	48	1.0	.....	2.4	.....
18.....	1.6	.8	1.2	.....	1.0	1.5	8.0	1.2	.....	1.9	.....
19.....	.8	.7	1.0	.....	1.0	1.4	4.0	1.0	1.0	1.4	.....
20.....	.9	3.7	.9	.....	12.4	1.2	3.1	.7	.9	1.4	.....
21.....	2.9	3.5	.9	.....	11.0	1.2	3.3	.7	1.1	1.3	.7
22.....	7.9	1.7	.8	.....	9.0	1.0	2.2	.6	.7	1.5	.9
23.....	3.9	2.1	.8	.....	3.7	3.4	2.0	.6	.7	3.3	1.1
24.....	4.0	2.5	.8	.....	2.1	9.8	1.9	.6	3.5	1.7	3.1
25.....	1.8	2.0	.7	.....	2.2	23	22	.6	2.8	1.3	1.2
26.....	1.2	4.0	.7	.....	5.5	2.6	18.6	.6	1.6	1.1	.8
27.....	1.0	7.4	.6	.....	1.8	2.0	4.4	.6	6.5	.9	.6
28.....	1.0	2.1	.6	1.6	1.7	1.4	3.0	.6	2.7	.9	.....
29.....	1.2	1.3	.7	1.1	5.2	1.2	2.3	.....	3.4	.9	.....
30.....	1.6	1.2	4.5	1.0	23	1.2	1.9	.....	19.5	1.3	.....
31.....	1.2	1.0	.....	1.0	.....	1.0	2.2	.....	4.1	.....	.....

NOTE.—Discharge estimated in million gallons per day by comparison with flow of adjacent streams, as follows: Oct. 7-14, 3; Oct. 15-18, 8; Oct. 19-27, 3; Mar. 9-11, 0.6; Mar. 12-18, 0.5; May 4-20, 0.9; May 28-31, 0.5.

Monthly discharge of West Branch of Puohakamoa Stream at Haiku-uka boundary, near Kaitiiki, Maui, for the year ending June 30, 1921.

Month.	Discharge.			Total run-off.		
	Million gallons per day.			Second-foot (mean).	Million gallons.	Acro-foot.
	Maximum.	Minimum.	Mean.			
July.....	7.9	0.2	1.37	2.12	42.4	130
August.....	7.4	.6	1.99	3.08	61.6	189
September.....	10.3	.6	2.21	3.42	66.3	203
October.....			3.01	4.66	93.4	286
November.....	47	.8	5.61	8.68	168	516
December.....	28	1.0	5.21	8.06	162	496
January.....	48	1.0	11.5	17.8	358	1,090
February.....	1.6	.6	.90	1.39	26.3	77
March.....	19.9		2.68	4.15	83.1	255
April.....	72	.9	6.51	10.1	195	599
May.....			.93	1.44	28.7	88
June.....			.57	.88	17	52
The year.....	72		3.56	5.51	1,300	3,930

NOTE.—Discharge for June estimated by comparison with Middle Branch of Puohakamoa Stream at Haiku-uka boundary.

MANUEL LUIS DITCH AT PUOHAKAMOA GULCH, NEAR HUELO, MAUI.

LOCATION.—In Puohakamoa Gulch at lower portal of tunnel between Haipuaena and Puohakamoa streams, 6 miles east of Huelo.

RECORDS AVAILABLE.—December 15, 1917, to June 30, 1921.

GAGE.—Stevens continuous water-stage recorder.

DISCHARGE MEASUREMENTS.—Made by rectangular sharp-crested weir 4.5 feet long set in concrete, with full contractions.

CHANNEL AND CONTROL.—Weir basin 25 feet long, 8.3 feet wide, and 1.9 feet deep below crest of weir; made by enlarging tunnel.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 4.35 feet, 9.50 p. m. January 16, 1921 (discharge, 93 million gallons per day, or 144 second-feet); minimum stage recorded, 0.04 foot from 3 p. m. to 9 p. m. July 14 (discharge, 0.08 million gallons per day, or 0.12 second-foot).

1919-1921: Maximum stage recorded in January, 1921; minimum stage recorded, 0.03 foot at 6.30 p. m. March 3, 1920 (discharge, 0.05 million gallons per day, or 0.08 second-foot).

DIVERSIONS.—Ditch is an extension of Center ditch and picks up water not diverted by Spreckels ditch, which is at higher elevation.

REGULATION.—By gates at frequent intervals.

OBJECT OF STATION.—To determine amount of water diverted by ditch from areas involved under Territorial water license.

UTILIZATION.—Water used for irrigation of sugar cane.

ACCURACY.—Stage-discharge relation permanent. Rating curve well defined between 1 and 70 million gallons per day. Operation of water-stage recorder satisfactory. Records excellent.

Discharge, in million gallons per day, of Manuel Luis ditch at Puohakamoa Gulch, near Huelo, Maui, for the year ending June 30, 1921.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1.....	0.2	0.5	1.1	0.7	0.9	11.5	1.5	3.4	0.5	6.1	1.2	0.5
2.....	.2	.4	.9	.5	2.3	7.6	1.5	1.9	22	5.5	1.6	.5
3.....	.1	.9	.9	.6	4.9	4.7	5.7	3.6	4.6	4.0	1.7	.5
4.....	.1	1.1	.7	.6	1.6	3.0	7.6	1.7	.8	2.3	1.1	.5
5.....	.1	.5	.9	.5	.9	2.9	21	1.5	.6	1.6	1.5	.5
6.....	.1	.4	5.8	.4	.7	10.6	40	1.3	.5	28	1.1	.4
7.....	.1	.4	10.9	.5	.7	6.6	40	1.2	.5	51	.8	.4
8.....	.1	.4	5.0	.4	37	18.9	14.7	1.1	.4	31	.7	.4
9.....	.1	.3	6.5	.4	23	18.8	13.6	1.0	.4	24	.6	.4
10.....	.1	.3	3.0	.4	10.8	19.2	7.7	.9	.4	6.7	.6	.4
11.....	.1	.4	17.9	8.9	8.8	9.4	7.4	.7	.4	6.7	.6	.4
12.....	.1	.7	8.6	5.7	5.6	7.7	11.0	.7	.4	11.5	.7	.3
13.....	.1	8.5	8.1	.9	2.0	.....	8.2	.6	.3	14.4	.6	.3
14.....	.1	8.0	3.5	.5	1.5	.....	11.1	.6	.3	6.2	.5	.3
15.....	.4	1.2	2.4	15.0	1.1	.....	48	1.6	.3	6.8	.5	.3
16.....	.2	.9	1.7	13.1	.9	.....	43	1.3	.3	19.2	.5	.3
17.....	.6	.8	1.6	6.1	.7	3.8	57	.7	.2	6.7	.5	.3
18.....	.3	.7	1.2	9.1	.6	2.2	31	2.3	.8	3.4	5.2	.3
19.....	.2	.6	1.0	3.7	.6	1.9	15.2	.9	.6	2.2	2.1	.5
20.....	.7	1.2	.9	2.7	13.5	1.6	11.5	.6	.3	5.8	4.3	.3
21.....	2.4	4.4	.7	1.7	24	1.3	11.5	.6	.8	2.6	1.6	.3
22.....	8.4	1.0	.7	1.3	16.6	1.2	6.3	.5	.4	6.1	.7	.3
23.....	4.4	1.6	.7	1.9	9.4	4.4	2.6	1.5	.3	13.1	.7	.3
24.....	3.6	1.2	.6	1.7	6.3	10.7	2.2	.5	11.4	8.1	8.6	.2
25.....	.9	2.1	.6	12.2	4.0	25	17.1	.5	3.1	3.7	1.8	.2
26.....	.5	2.8	.6	5.3	10.8	4.2	37	.5	6.6	5.3	.8	.3
27.....	.4	11.8	.5	2.0	4.5	3.8	13.0	.4	18.5	2.6	.7	1.2
28.....	.5	3.0	.5	1.6	3.2	2.3	6.3	.4	8.0	1.8	.7	16.0
29.....	.6	1.5	.5	1.1	8.7	1.9	4.6	.....	11.4	1.6	.6	4.7
30.....	.7	1.3	1.7	1.1	32	1.6	2.9	.....	34	2.6	.6	.4
31.....	.5	1.3	.....	.9	.....	1.4	2.9	.....	18.1	.....	.6	.....

NOTE.—Record lost Dec. 13-16 and discharge estimated by comparison with flow of Haipuaena Stream at 20 million gallons per day.

Monthly discharge of Manuel Luis ditch at Puohakamoa Gulch, near Huelo, Maui, for the year ending June 30, 1921.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-foot (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July.....	8.4	0.1	6.93	1.44	28.9	88
August.....	11.8	.3	3.94	3.00	60.2	185
September.....	17.9	.5	2.99	4.63	89.7	275
October.....	15.0	.4	3.25	5.03	101	309
November.....	37	.6	7.92	12.3	238	729
December.....	.....	1.2	8.72	13.5	270	830
January.....	57	1.5	16.2	25.1	503	1,540
February.....	3.6	.4	1.12	1.73	31.5	96
March.....	34	.2	4.63	7.19	144	442
April.....	51	1.5	9.70	15.0	291	893
May.....	8.6	.5	1.41	2.18	43.8	134
June.....	16.0	.2	1.05	1.62	31.6	97
The year.....	57	.1	5.02	7.77	1,830	5,620

WAIKAMOI STREAM NEAR HUELO, MAUI.

LOCATION.—500 feet above Spreckels ditch intake and 5 miles by trail east of Huelo post office.

RECORDS AVAILABLE.—December 18, 1910, to June 30, 1921.

GAGE.—Stevens continuous water-stage recorder installed April 20, 1920. Friez water-stage recorder October 14, 1913, to April 20, 1920, prior to which, original staff gage at different datum was read twice a day.

DISCHARGE MEASUREMENTS.—Made by wading or from footbridge at gage.

CHANNEL AND CONTROL.—One channel at all stages; straight for 100 feet above and below gage; banks high and covered with vegetation. Water drops over a fall at control which is rock ledge covered with boulders. Shifts due to changes in position and number of boulders.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 3.90 feet at 5.20 a. m. December 25 (discharge, 760 million gallons per day or 1,180 second-feet); minimum stage recorded during year —0.40 foot from 1 p. m. to 4 p. m. July 14 (discharge, 0.2 million gallons per day, or 0.3 second-foot).

1910-1921: Maximum stage recorded, 7.57 feet at 5 a. m. January 18, 1916 (discharge, computed from extension of rating curve, approximately 1,800 million gallons per day, or 2,780 second-feet); minimum stage recorded in July, 1920.

DIVERSIONS.—A small amount of water is diverted by Kula pipe line above station at elevation 4,300 feet.

REGULATION.—None.

OBJECT OF STATION.—To determine feasibility of additional diversions or flood storage; also to assist valuation appraisers in relation to Territorial water license to ditch company.

UTILIZATION.—Low water is all diverted by ditches of East Maui Irrigation Co. for irrigation of sugar cane.

ACCURACY.—Stage-discharge relation not permanent. Two rating curves fairly well defined below 250 million gallons per day used as follows: July 1 to January 16 and January 17 to June 30. Operation of water-stage recorder satisfactory except as noted in footnote to table of daily discharge. Records good when water-stage recorder was operating. At medium and high stages, and especially while it is raining there is water spilled into the stream above the station from New Hamakua ditch. Except for low flow, therefore, the flow at this station is not the true flow of the stream.

Discharge measurements of Waikamoi Stream near Huelo, Maui, during the year ending June 30, 1921.

Date.	Made by—	Gage height (feet).	Discharge.	
			Second-feet.	Million gallons per day.
July 14	R. H. Remington.....	—0.38	0.4	0.25
29	Reid Jerman.....	.30	3.4	2.2
Sept. 14	R. H. Remington.....	1.05	35	22.5
Oct. 21	.....do.....	.51	6.8	4.4
Jan. 31	J. E. Stewart.....	.80	11.6	7.5
May 6	W. C. Renshaw.....	.60	4.2	2.7
10	.....do.....	.51	2.7	1.75

Discharge, in million gallons per day, of Waikamoi Stream near Huelo, Maui, for the year ending June 30, 1921.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1.....	0.8	3.4	3.1	4.8	2.7	46	4.6	6.1	1.3	16.1	3.3	1.3
2.....	.8	3.9	3.1	2.5	14.8	28	4.8	4.6	64	10.8	5.2	1.3
3.....	.6	9.0	3.7	2.4	21	23	.....	4.2	21	10.9	6.4	1.2
4.....	.5	11.7	3.6	1.9	6.3	20.0	.....	4.0	5.3	5.8	3.7	1.1
5.....	.4	4.3	4.2	1.6	3.1	21	.....	3.7	3.7	4.6	4.9	1.0
6.....	.4	3.0	23	1.8	2.5	42	.....	3.5	2.5	109	2.8	.9
7.....	.3	2.4	56	3.3	3.2	28	.....	3.2	2.0	156	1.6	.9
8.....	.3	2.0	27	2.4	166	74	.....	2.9	1.6	68	1.6	.8
9.....	.3	1.7	29	1.6	79	68	.....	2.7	1.5	48	1.6	.9
10.....	.4	1.6	16.9	1.4	55	77	.....	2.4	1.5	24	1.6	.9
11.....	.3	1.5	69	40	39	35	.....	2.2	1.4	27	1.6	1.4
12.....	.3	2.2	44	30	24	26	.....	1.9	1.3	33	1.6	1.1
13.....	.2	42	33	4.4	17.3	27	.....	1.6	1.2	29	1.5	.8
14.....	.2	35	22	2.7	12.1	112	.....	1.5	1.1	25	1.4	.8
15.....	1.8	5.2	11.4	54	7.7	52	.....	4.1	1.1	23	1.4	.9
16.....	1.4	2.8	5.6	64	5.8	27	.....	3.5	1.0	39	1.5	.8
17.....	26	2.3	6.3	32	5.2	22	.....	2.8	1.0	25	1.4	.7
18.....	6.7	2.0	3.6	35	4.6	18.7	.....	3.7	2.2	19.0	13.2	.8
19.....	2.4	1.8	2.9	21	4.0	14.4	.....	3.3	2.9	12.6	7.1	1.0
20.....	3.2	10.6	2.4	11.8	55	10.7	.....	2.2	2.0	16.6	12.5	.9
21.....	10.9	23	2.3	4.4	100	8.5	.....	1.9	2.6	12.2	3.5	.....
22.....	56	5.8	2.0	3.1	88	7.7	.....	1.5	1.9	16.6	2.6	.....
23.....	35	8.0	2.0	2.7	56	26	.....	1.4	1.5	30	3.5	.....
24.....	29	8.9	1.9	7.5	40	112	.....	1.4	29	22	21	.....
25.....	8.7	10.8	1.6	57	35	199	54	1.4	14.3	16.6	6.1	.....
26.....	4.3	18.1	1.4	29	56	27	90	1.3	14.1	18.0	3.1	.....
27.....	3.2	56	1.3	11.0	33	14.4	29	1.2	47	10.2	2.4	.....
28.....	3.1	15.5	1.1	7.7	28	9.0	18.0	1.2	27	5.8	2.0	.....
29.....	3.0	6.0	1.3	4.8	41	6.7	14.7	.....	39	3.8	1.7	.....
30.....	5.6	4.8	17.1	3.3	131	5.6	9.2	.....	94	9.3	1.5	.....
31.....	3.7	3.7	.....	2.9	.....	4.8	8.1	.....	39	.....	1.4	.....

NOTE.—Discharge estimated in million gallons per day by comparison with flow of Puohakamoa Stream as follows: Jan. 3-4, 30; Jan. 5-7, 150; Jan. 8-17, 70; Jan. 18-24, 10; June 21-27, 0.9; June 28-30, 2.5. Discharge interpolated Feb. 4-11.

Monthly discharge of Waikamoi Stream near Huelo, Maui, for the year ending June 30, 1921.

Month.	Discharge.			Total run-off.		
	Million gallons per day.			Second-foot (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July.....	56	0.2	7.06	10.9	219	672
August.....	56	1.5	9.97	15.4	309	948
September.....	69	1.1	13.4	20.7	402	1,230
October.....	64	1.4	14.6	22.6	452	1,390
November.....	166	2.5	37.9	58.6	1,140	3,490
December.....	199	4.8	38.5	59.6	1,190	3,660
January.....	.....	4.6	48.8	75.5	1,510	4,640
February.....	6.1	1.2	2.69	4.16	75.4	231
March.....	94	1.0	13.8	21.4	429	1,310
April.....	156	3.8	28.2	43.6	847	2,600
May.....	21	1.4	4.02	6.22	125	382
June.....	.....	.....	1.11	1.72	33.3	102
The year.....	.....	.....	.2	18.4	6,730	20,700

**EAST BRANCH OF WAIKAMOI STREAM AT HAIKU-UKA BOUNDARY, NEAR
KAILIILI, MAUI.**

LOCATION.—200 feet above Haiku-uka boundary-line trail crossing, at elevation 3,020 feet, 5½ miles east of Kailiili.

RECORDS AVAILABLE.—May 28, 1918, to June 30, 1921.

GAGE.—Stevens continuous water-stage recorder.

DISCHARGE MEASUREMENTS.—Made by wading or from suspension footbridge just above control.

CHANNEL AND CONTROL.—Channel has gravel and boulder bed with steep high banks of hardpan. Control is composed of large boulders and gravel and may shift during large floods.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 7.15 feet at 7.30 p. m. January 16 (discharge, 160 million gallons per day or 248 second-feet); minimum stage recorded during year, 4.00 feet at 10 a. m. June 26 (discharge, 0.1 million gallons per day or 0.15 second-foot).

1918–1921: Maximum stage recorded during period of record, 7.92 feet at 5.20 p. m. March 22, 1920 (discharge, 230 million gallons per day or 356 second-feet); minimum stage recorded, 3.77 feet April 15, 1919 (discharge, 0.07 million gallons per day or 0.11 second-foot or less).

DIVERSIONS.—A little water is diverted above station by Kula pipe line.

REGULATION.—None.

OBJECT OF STATION.—To determine discharge of stream at boundary between fee simple lands above and territorial lands below.

UTILIZATION.—Water diverted by ditches of East Maui Irrigation Co. for irrigation of sugar cane.

ACCURACY.—Stage-discharge relation not permanent. Rating curve used July 1 to January 16 fairly well defined between 0.4 and 10 million gallons per day. Rating curve used January 17 to June 30 fairly well defined between 0.5 and 5 millions per day. Extensions of both curves drawn parallel to previous ratings.

Discharge measurements of East Branch of Waikamoi Stream at Haiku-uka boundary, near Kailiili, Maui, during the year ending June 30, 1921.

Date.	Made by—	Gage height (feet).	Discharge.	
			Second-feet.	Million gallons per day.
July 1	Reid Jerman	4.16	0.4	0.25
25	R. H. Remington	4.42	2.3	1.5
Sept. 9	.....do.....	4.46	3.3	2.1
Oct. 29	.....do.....	4.27	1.25	.8
Jan. 29	W. C. Renshaw	4.33	3.6	2.3
Mar. 18	J. E. Stewart	4.14	.8	.5
Apr. 30	W. C. Renshaw	4.30	3.1	2.0
May 21	.....do.....	4.15	.9	.6

Discharge, in million gallons per day, of East Branch of Waikamoi Stream at Haiku-uka boundary, near Kailiili, Maui, for the year ending June 30, 1921.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1.....	0.4	1.0	0.8	1.0	0.7	2.9	0.6	1.6	0.3	1.6	0.9	0.3
2.....	.4	1.6	1.1	.8	2.0	1.3	1.1	1.5	17.5	1.2	.8	.3
3.....	.3	2.2	1.0	.7	1.8	1.2	3.2	1.2	3.5	.9	1.7	.3
4.....	.2	2.2	1.3	.6	.9	1.0	8.6	1.2	2.2	.9	1.2	.3
5.....	.2	.9	1.2	.6	.7	1.3	4.5	1.0	1.1	1.1	.9	.3
6.....	.2	.7	6.0	.8	.6	4.7	39	1.0	.6	32	1.1	.2
7.....	.2	.7	5.4	1.5	.8	1.9	30	.9	.5	58	.8	.2
8.....	.2	.6	3.8	.7	37	15.0	6.0	.9	.4	20.0	.6	.2
9.....	.2	.6	2.4	.6	12.3	9.2	6.8	.8	.3	8.8	.5	.2
10.....	.2	.5	1.7	.9	4.8	12.8	5.0	.6	.3	3.0	.5	.4
11.....	.2	.5	10.2	13.6	2.1	2.0	4.8	.6	.3	3.3	.5	.6
12.....	.2	.8	3.2	2.2	1.3	1.4	4.9	.6	.3	6.0	.4	.3
13.....	.2	5.5	2.5	.8	1.0	2.4	4.9	.5	.2	4.7	.4	.2
14.....	.2	4.5	1.7	.7	.8	18.8	11.7	.4	.2	2.2	.3	.3
15.....	1.0	.9	1.2	10.7	.8	4.8	26	1.1	.2	2.2	.4	.3
16.....	.8	.7	1.0	8.6	.7	1.5	30	1.2	.2	5.5	.3	.2
17.....	6.7	.6	1.0	2.2	.6	1.2	44	1.0	.2	2.8	.4	.2
18.....	1.5	.6	.9	3.8	.6	1.0	7.1	1.5	.6	1.9	1.6	.2
19.....	.7	.6	.8	1.5	.5	.9	4.1	1.1	.8	1.4	1.4	.4
20.....	.8	3.2	.7	1.0	13.6	.8	3.6	.6	.6	1.3	1.3	.3
21.....	3.0	2.8	.7	.9	10.4	.7	3.7	.5	.9	1.2	.8	.2
22.....	9.9	1.4	.7	.8	8.1	.7	2.8	.4	.4	1.4	1.2	.3
23.....	3.1	1.6	.7	.7	2.4	2.4	2.3	3	.4	3.6	1.3	.5
24.....	4.6	2.1	.6	2.6	1.5	6.7	2.2	.3	3.8	1.6	4.0	.2
25.....	1.7	1.7	.6	.....	1.6	18.4	21	.3	2.6	1.2	1.4	.2
26.....	1.0	3.6	.5	.....	4.5	2.0	16.6	.3	1.5	1.1	.8	.2
27.....	.8	6.4	.5	.....	1.2	1.5	3.8	.3	6.5	1.0	.6	2.5
28.....	1.0	1.5	.5	1.3	1.1	1.0	2.8	.3	2.7	.9	.5	10.0
29.....	1.0	1.0	.5	.8	4.9	.7	2.2	.....	6.2	.9	.4	2.5
30.....	1.5	.9	5.6	.7	22	.7	1.7	.....	17.1	1.6	.4	.7
31.....	1.0	.8	.....	.7	.....	.6	2.4	.....	3.4	.....	.3	.....

NOTE.—Discharge estimated Oct. 25-27 as 8 million gallons per day by comparison with flow of Waikamoi Stream near Huelo, Maui.

Monthly discharge of East Branch of Waikamoi Stream at Haiku-uka boundary, near Kailiili, Maui, for the year ending June 30, 1921.

Month.	Discharge.			Total run-off.		
	Million gallons per day.			Second-foot (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July.....	9.9	0.2	1.40	2.17	43.4	133
August.....	6.4	.5	1.70	2.63	52.7	162
September.....	10.2	.5	1.96	3.03	53.8	180
October.....	13.6	.6	2.77	4.29	85.8	264
November.....	37	.5	4.71	7.29	141	434
December.....	18.8	.6	3.92	6.07	122	373
January.....	44	.6	9.92	15.3	307	944
February.....	1.6	.3	.79	1.22	22.0	68
March.....	17.5	.2	2.45	3.79	75.8	233
April.....	58	.9	5.80	8.97	174	534
May.....	4.0	.3	.90	1.39	27.9	86
June.....	10.0	.2	.77	1.19	23.0	71
The year.....	58	.2	3.11	4.81	1,130	3,480

**WEST BRANCH OF WAIKAMOI STREAM AT HAIKU-UKA BOUNDARY, NEAR
KAILIHI, MAUI.**

LOCATION.—At Haiku-uka boundary-line trail crossing, at elevation 3,000 feet, about 5 miles east of Kailihi.

RECORDS AVAILABLE.—May 28, 1918, to June 30, 1921.

GAGE.—Stevens continuous water-stage recorder.

DISCHARGE MEASUREMENTS.—Made by wading or from suspension footbridge 35 feet above gage.

CHANNEL AND CONTROL.—Channel is solid rock with steep rock and hardpan banks. Control is solid rock ledge.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 4.70 feet at 9 p. m. January 16 (discharge, 550 million gallons per day or 851 second-feet); minimum stage recorded during year, 0.34 foot from 12 to 1 a. m. July 15 (discharge, 0.07 million gallons per day or 0.11 second-foot).

1918-1921: Maximum stage recorded during period of record, 9.85 feet at noon December 6, 1918 (discharge, 2,020 million gallons per day or 3,130 second-feet); minimum stage recorded, 0.33 foot at 8.30 p. m. December 22, 1919 (discharge, 0.06 million gallons per day or 0.09 second-foot).

DIVERSIONS.—A small amount of water is diverted by Kula pipe line above station at elevation 4,300 feet.

REGULATION.—None.

OBJECT OF STATION.—To determine discharge of stream at boundary between fee simple lands above and Territorial lands below.

UTILIZATION.—Water diverted by ditches of East Maui Irrigation Co. for irrigation of sugar cane.

ACCURACY.—Stage-discharge relation permanent. Rating curve well defined between 1 and 150 million gallons per day. Operation of water-stage recorder satisfactory except as noted in footnote to table of daily discharge. Records good.

Discharge measurements of West Branch of Waikamoi Stream at Haiku-uka boundary, near Kailihi, Maui, during the year ending June 30, 1921.

Date.	Made by—	Gage height (feet).	Discharge.	
			Second-feet.	Million gallons per day.
July 2	Reid Jerman	0.41	0.3	0.2
24	do	.92	15.2	9.8
Sept. 9	R. H. Remington	.76	7.6	4.9
Oct. 28	do	.61	2.6	1.65
Jan. 28	W. C. Renshaw	.80	9.4	6.0
Apr. 30	do	.58	2.1	1.35

Discharge, in million gallons per day, of West Branch of Waikamoi Stream at Haiku-uka boundary, near Kaihili, Maui, for the year ending June 30, 1921.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	0.4	1.1		1.6	1.0	7.5	1.2	3.0	1.0	2.5	1.2	0.8
2	.3	1.5		1.2	1.8	3.2	1.4	2.3	41	4.6	1.2	.5
3	.2	2.6		1.6	2.8	2.3	6.6	1.7	7.6	1.4	1.6	.5
4	.2	3.6		.8	1.5	1.8	18.7	1.6	3.2	1.4	1.5	.4
5	.1	1.4		.7	1.1	2.1	53	1.4	1.8	1.3	1.2	.4
6	.1	1.1		.8	.9	11.0	102	1.4	1.4	80	1.2	.4
7	.7	.9		1.4	.9	5.0	81	1.4	1.2	172	1.1	.4
8	.2	.7		1.1	148	41	14.3	1.3	1.1	40	1.0	.4
9	.2	.7	4.8	.7	42	30	21	1.2	1.0	24	.8	.4
10	.1	.7	2.6	.8	14.3	38	35	1.2		6.0	.8	.5
11	.1	.6	17.3	22	6.0	6.9	42	1.2		4.5	.8	.7
12	.1	.8	9.5	9.1	3.2	3.8	13.4	1.1		7.6	.8	.4
13	.1	9.6	5.0	1.6	2.1	6.3	19.2	1.0		7.9	.7	.3
14	.1	7.8	3.5	1.2	1.6	93	30	.9		4.5	.7	.4
15	.9	1.4	2.1	20.0	1.4	22	86	1.3		3.0	.7	.4
16	.6	.9	1.6	16.8	1.3	5.2	97	1.3		7.6	.7	.3
17	9.6	.8	1.4	3.5	1.2	3.3	139	1.2		4.5	.7	.3
18	2.0	.7	1.2	4.5	1.1	2.3	19.8	1.6		3.0	1.5	.3
19	1.0	.8	1.1	3.2	1.0	2.0	9.5	1.4	1.0	2.1	1.4	.4
20	.8	4.8	1.0	1.8	27	1.5	6.9	1.0	.8	1.8	1.2	.3
21		3.1	5.4	.9	.9	29	1.4	7.6	.9	1.1	1.7	.9
22		14.6	1.7	.8	1.2	23	1.2	4.8	.7	.8	1.7	1.0
23		7.8	2.0	.8	1.1	7.9	8.0	3.3	.8	.7	3.7	1.2
24		5.0	2.6	.7	1.1	3.8	116	2.8	.8	3.7	2.1	8.4
25		2.1	3.1	.7	14.1	3.5	174	41	.8	3.4	1.7	1.7
26		1.3	5.3	.7	6.3	13.0	14.1	44	.8	1.6	1.5	1.0
27		1.0	15.9	.6	4.6	3.0	6.3	9.9	.8	10.2	1.2	.7
28		1.1	4.1	.6	3.0	2.3	3.0	6.0	.8	4.8	1.2	.7
29		1.2	1.8	.6	1.4	6.4	1.7	4.8		3.5	1.2	.6
30		1.8	1.4	5.0	1.1	57	1.4	3.2		30	1.6	.6
31		1.2		1.1			1.2	4.5		8.7	.6	

NOTE.—Discharge estimated by comparison with flow of adjacent streams Aug. 31 to Sept. 5 as 1 and Sept. 6-8 as 9 million gallons per day. Discharge interpolated Oct. 27-28 and partly estimated Mar. 10-18.

Monthly discharge of West Branch of Waikamoi Stream at Haiku-uka boundary, near Kaihili, Maui, for the year ending June 30, 1921.

Month.	Discharge.			Second-foot (mean).	Total run-off.	
	Million gallons per day.				Million gallons.	Acre-foot.
	Maximum.	Minimum.	Mean.			
July	14.6	0.1	1.85	2.86	57.4	176
August	15.9	.6	2.80	4.33	86.8	264
September	17.3	.6	3.15	4.87	94.5	280
October	22	.7	4.25	6.58	132	404
November	148	.9	13.6	21.0	409	1,250
December	174	1.2	19.9	30.8	616	1,890
January	139	1.2	30.0	46.4	929	2,850
February	3.0	.7	1.24	1.92	34.8	107
March	41		4.40	6.81	136	419
April	172	1.2	13.1	20.3	394	1,210
May	3.4	.6	1.07	1.66	33.2	102
June	9.2	.2	.80	1.24	24.1	74
The year	174	.1	8.08	12.5	2,950	9,040

ALO STREAM NEAR HUELO, MAUI.

LOCATION.—300 feet above Spreckels ditch inflow and trail crossing and 5 miles east of Huelo.

RECORDS AVAILABLE.—December 18, 1910, to June 30, 1921.

GAGE.—Friez water-stage recorder installed June 18, 1914. Prior to June 18, 1914, vertical staff at trail bridge 300 feet downstream from present site.

DISCHARGE MEASUREMENTS.—Made by wading or from footbridge at gage.

CHANNEL AND CONTROL.—Channel at gage in a fairly large pool at foot of rapids; banks steep and high. Control at outlet of pool composed of rock ledge and large boulders; probably permanent.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 4.30 feet January 16 (discharge, 620 million gallons per day or 959 second-foot); minimum stage recorded, 0.34 foot at 1 a. m. July 12 (discharge, 0.3 million gallons per day or 0.45 second-foot).

1910-1921: Maximum stage recorded, 4.35 feet at 7 p. m. December 9, 1916 (discharge, computed from extension of rating curve, approximately 638 million gallons per day, or 987 second-foot); minimum stage recorded, 1.34 feet (old datum November 4, 1911 (discharge, 0.06 million gallons per day, or 0.1 second-foot).

DIVERSIONS.—None.

REGULATION.—None.

OBJECT OF STATION.—To furnish data for appraisal of water value under Territorial lease to ditch company.

UTILIZATION.—Ordinary flow diverted by ditches of East Maui Irrigation Co. for irrigation of sugar cane.

ACCURACY.—Stage-discharge relation practically permanent. Rating curve well defined between 2 and 60 million gallons per day. Operation of water-stage record unsatisfactory up to March 15. Records good between 0.5 and 60 million gallons per day, fair above and below these limits after March 16.

Discharge measurements of Alo Stream near Huelo, Maui, during the year ending June 30, 1921.

Date.	Made by—	Gage height (feet).	Discharge.	
			Second-foot.	Million gallons per day.
July 16	Reid Jerman.....	0.40	0.3	0.2
29	R. H. Remington.....	.57	1.35	.85
Sept. 14	do.....	.86	7.1	4.6
Oct. 21	do.....	.66	2.7	1.75
Jan. 26	J. E. Stewart.....	1.14	13.2	8.5
Feb. 5	W. C. Renshaw.....	.59	1.85	1.2
May 5	do.....	.68	3.5	2.3

Discharge, in million gallons per day, of Alo Stream near Huelo, Maui, for the year ending June 30, 1921.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	0.6	2.0			1.4			2.1		3.2	2.0	0.9
2	.5	1.8			3.2			1.9		2.6	2.4	.8
3	.4	4.2			3.0			2.4		2.1	2.3	.8
4	.4		1.8		2.0			1.7		2.0	1.8	.8
5	.4		1.9		1.6			1.5		1.9	2.3	.7
6	.4		10.6		1.4			1.4		14.9	1.9	.7
7	.4				1.5			1.3		9.4	1.5	.6
8	.4				18.3			1.2		13.0	1.4	.6
9	.4				4.9			1.1		9.0	1.2	.6
10	.4				4.3			1.0		3.9	1.2	.6
11	.3				3.3					3.1	1.1	.7
12	.9				2.6					3.8	1.1	.6
13	.5									3.8	.9	.5
14	.4		4.2							3.2	.8	.6
15	.4		3.2							5.3	.9	.6
16	.5		2.7	9.3					0.6	7.6	.8	.5
17	2.6		3.0	3.9					.6	3.8	1.0	.6
18	1.3		2.2	9.4		2.1			1.4	3.3	5.4	.6
19	.8		2.0			1.9			1.6	2.6	2.7	.9
20	3.1		1.8			1.6			.8	3.8	4.9	.6
21	6.1		1.6			1.5			1.6	2.7	2.4	.4
22	10.7		1.5	2.0		1.3			.8	4.5	2.0	.4
23	4.9		1.5	1.7		2.6			.7	7.9	1.9	.4
24	3.0			4.5		3.6			11.1	4.6	6.5	.4
25	2.2			6.8		12.0			3.0	3.3	2.1	.4
26	1.8			3.3		3.6			9.5	3.9	1.8	.4
27	1.8			2.2		2.5	4.9		11.2	2.8	1.6	2.1
28	1.7			2.0			3.4		3.8	2.4	1.3	4.8
29	2.6			2.0					30	2.2	1.2	1.8
30	2.0			1.8					23	3.2	1.1	.7
31	1.9			1.4					6.1		.9	

NOTE.—Discharge estimated in million gallons per day by comparison with flow of Waikamoi and Nadihale streams as follows: Aug. 4-11, 3; Aug. 12-19, 4; Aug. 20-26, 5; Aug. 27-31, 4; Sept. 1-3, 1.5; Sept. 7-13, 8; Sept. 24-29, 5; Oct. 1-10, 1.5; Oct. 11-15, 6; Oct. 19-21, 4; Nov. 13-19, 2; Nov. 20-30, 7; Dec. 1-6, 4.5; Dec. 7-12, 6.5; Dec. 13-17, 5.5; Dec. 28-31, 1.8; Jan. 1-4, 6; Jan. 5-8, 4.5; Jan. 9-14, 4.5; Jan. 15-18, 40; Jan. 19-26, 7; Jan. 29-31, 2.7; Feb. 11-14, 1; Feb. 15-19, 1.5; Feb. 20-28, 0.8; Mar. 1-4, 9; Mar. 5-10, 1.5; Mar. 11-15, 0.8.

Monthly discharge of Alo Stream near Huelo, Maui, for the year ending June 30, 1921.

Month.	Discharge.			Second-foot (mean).	Total run-off.	
	Million gallons per day.				Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July	10.7	0.3	1.74	2.69	53.8	166
August			3.84	5.94	119	365
September			3.69	5.71	111	340
October			3.46	5.35	107	329
November			4.62	7.15	133	425
December			4.30	6.65	133	409
January			14.9	23.1	463	1,420
February			1.22	1.89	34.3	105
March	30		5.00	7.74	155	476
April	14.9	1.9	4.66	7.21	140	429
May	6.5	.8	1.95	3.02	60.4	186
June	4.8	.4	.84	1.30	25.1	77
The year			4.22	6.53	1,540	4,730

SPRECKELS DITCH BELOW KAAIEA GULCH, NEAR HUELO, MAUI.

LOCATION.—1,000 feet below intake in Kaaiea Stream and $2\frac{1}{2}$ miles by trail southeast of ditch superintendent's house at Huelo.

RECORDS AVAILABLE.—December 15, 1917, to June 30, 1921.

GAGE.—Stevens continuous water-stage recorder.

DISCHARGE MEASUREMENTS.—Made from plank at gage.

CHANNEL AND CONTROL.—Ditch section below gage. During heavy rains stage-discharge relation is affected by two small streams which enter ditch a short distance below gage.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 5.65 feet at 7.30 p. m. January 16 (discharge, 110 million gallons per day, or 170 second-feet); minimum stage recorded, 0.50 foot from 9 a. m. to 2 p. m. February 9 (discharge; 1.1 million gallons per day, or 1.7 second-feet).

1917-1921: Maximum stage recorded in January, 1921; minimum stage recorded (water occasionally shut off).

DIVERSIONS.—Ditch diverts water from a dozen or more streams east of Naililihalee.

REGULATION.—By gates at frequent intervals.

OBJECT OF STATION.—To determine discharge of ditch at boundary between Territorial lands above and fee simple lands below.

UTILIZATION.—Water used for irrigation of sugar cane.

ACCURACY.—Stage-discharge relation changed by flood of January 16. Rating curve used July 1 to January 16 well defined between 2 and 40 million gallons per day. Rating curves used January 17 to June 30, fairly well defined below 25 million gallons per day. Operation of water-stage recorder satisfactory except as given in footnote to table of daily discharge. Records good when water-stage recorder was working.

Discharge measurements of Spreckels ditch below Kaaiea Gulch, near Huelo, Maui, during the year ending June 30, 1921.

Date.	Made by—	Gage height (feet).	Discharge.	
			Second-feet.	Million gallons per day.
July 16	Reid Jerman	0.84	7.0	4.6
29	R. H. Remington	1.25	16.1	10.4
Sept. 13	.....do.....	2.60	54	35
Oct. 21	.....do.....	2.10	39.5	25.5
Jan. 31	W. C. Renshaw .....	.62	2.6	1.7
May 3	.....do.....	2.08	36	23.3

Discharge, in million gallons per day, of Spreckels ditch below Kaaiea Gulch, near Huelo, Maui, for the year ending June 30, 1921.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1.....	4.3	13.6	14.5	17.1	14.5	24	19.8	1.6	2.9	25	13.3	5.1
2.....	4.0	14.5	14.5	13.6	29	22	20.0	1.6	18.1	23	18.2	4.7
3.....	3.4	25	14.5	14.5	31	20.0	25	2.2	22	22	21	4.4
4.....	3.2	25	15.4	11.2	23	19.8	27	1.3	10.9	16.5	14.1	4.3
5.....	2.9	15.4	18.0	10.4	16.2	25	29	1.2	6.8	13.3	14.8	4.2
6.....	2.8	12.8	23	12.0	13.6	27	35	1.2	4.4	19.1	12.5	4.0
7.....	2.8	11.2	35	15.4	15.4	25	31	1.2	3.8	21	.....	4.0
8.....	2.9	10.4	31	12.0	31	27	27	1.2	3.4	21	.....	3.9
9.....	2.8	9.4	31	9.6	27	29	27	1.2	3.2	22	.....	3.9
10.....	2.8	8.7	29	9.4	27	27	23	2.4	3.0	23	.....	4.2
11.....	2.6	8.4	37	24	27	27	22	4.0	2.9	25	.....	5.1
12.....	2.5	11.2	35	27	25	27	24	2.2	2.8	25	.....	4.2
13.....	2.5	33	35	18.0	29	27	27	1.4	2.7	17.4	3.9	3.7
14.....	2.4	31	33	12.8	25	29	29	1.2	2.6	16.5	3.7	4.0
15.....	6.1	18.0	31	31	21	27	50	8.6	2.6	16.5	4.2	4.2
16.....	4.5	12.8	25	35	17.1	25	48	13.3	2.5	16.5	4.3	4.0
17.....	22	11.2	27	31	14.5	25	40	6.8	2.5	16.5	4.7	4.0
18.....	14.5	10.4	20.0	35	13.6	24	14.1	9.6	6.2	22	24	4.3
19.....	7.5	9.6	17.1	31	12.0	23	7.2	6.5	8.2	19.1	21	5.8
20.....	7.6	25	15.4	29	24	21	5.1	4.4	4.5	28	25	4.3
21.....	29	29	14.5	24	37	18.9	3.9	3.7	8.4	26	13.3	3.7
22.....	31	19.8	12.8	19.8	31	18.0	3.1	3.2	4.3	28	8.9	3.7
23.....	31	24	12.8	16.2	27	23	2.5	3.0	3.7	30	10.9	4.0
24.....	24	21	12.8	18.2	27	25	2.5	2.9	28	28	26.0	4.0
25.....	23	27	11.2	35	29	29	5.9	2.8	25	28	14.1	3.7
26.....	14.5	31	10.4	31	31	25	9.6	2.7	18.0	28	8.6	3.8
27.....	12.0	35	10.4	27	29	23	3.7	2.7	30	25	7.2	6.8
28.....	12.0	31	9.4	24	29	21	2.6	2.7	28	20.0	6.5	28
29.....	13.6	21	10.4	19.8	27	18.9	2.3	.....	30	16.5	6.1	18.2
30.....	17.1	19.8	20.0	18.0	29	18.0	2.0	.....	28	24	5.7	3.9
31.....	13.6	16.2	.....	15.4	.....	18.0	1.8	.....	25	.....	5.4	.....

NOTE.—Recorder working unsatisfactorily May 7-17. Discharge estimated May 7-12, at 5 million gallons per day.

Monthly discharge of Spreckels ditch below Kaaiea Gulch, near Huelo, Maui, for the year ending June 30, 1921.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-foot (mean).	Million gallons.	Acro-feet.
	Maximum.	Minimum.	Mean.			
July.....	31	2.4	10.5	16.2	325	999
August.....	35	8.4	19.1	29.6	591	1,829
September.....	37	9.4	20.9	32.3	626	1,920
October.....	35	9.4	20.9	32.3	647	1,990
November.....	37	12.0	24.4	37.8	732	2,250
December.....	29	18.0	23.8	36.8	739	2,260
January.....	50	1.8	18.4	28.5	570	1,750
February.....	13.3	1.2	3.46	5.35	96.8	297
March.....	30	2.5	11.1	17.2	344	1,060
April.....	30	13.3	22.1	34.2	662	2,030
May.....	28	.....	10.6	16.4	327	1,010
June.....	28	3.7	5.54	8.57	166	510
The year.....	50	1.2	16.0	24.8	5,830	17,900

CENTER DITCH AT WAIKAMOI, NEAR HUELO, MAUI.

LOCATION.—250 feet below intake in Waikamoi Stream and 4 miles by trail east of Huelo.

RECORDS AVAILABLE.—March 6, 1918, to June 30, 1921.

GAGE.—Stevens continuous water-stage recorder.

DISCHARGE MEASUREMENTS.—Made from plank at gage.

CHANNEL AND CONTROL.—Trapezoidal section of ditch; sides and bottom of hardpan and rock; straight for 30 feet above and 10 feet below gage. Control is plank set on edge in bottom of ditch 5 feet below gage.

EXTREMES OF DISCHARGE.—1918-1921: Maximum stage recorded, 4.10 feet at 5 a. m. December 25, 1920 (discharge, 94 million gallons per day, or 14.5 second-feet); minimum stage recorded, ditch dry December 4, 1918, and January 16, 1919; minimum stage recorded during year, 0.14 foot from 9 a. m. to 3 p. m. July 13 (discharge, 0.32 million gallons per day or 0.50 second-foot).

DIVERSIONS.—Ditch diverts water that arises below or passes Spreckels ditch.

REGULATION.—By gates at frequent intervals.

OBJECT OF STATION.—Discharge at this station less discharge at the Manuel Luis ditch station shows water diverted from Territorial lands under water license No. 974.

UTILIZATION.—Water used for irrigation of sugar cane.

ACCURACY.—Stage-discharge relation changed by flood of December 25. Rating curve used July 1 to December 24 well defined between 1 and 50 million gallons per day. Rating curve used December 25 to June 30 well defined below 15 million gallons per day above which it is parallel to the preceding curve. Operation of water-stage recorder satisfactory. Records excellent.

Discharge measurements of Center ditch at Waikamoi, near Huelo, Maui, during the year ending June 30, 1921.

Date.	Made by—	Gage height (feet).	Discharge.	
			Second-feet.	Million gallons per day.
July 17	Reid Jerman.....	2.29	72	47
31	do.....	.38	2.8	1.8
Sept. 15	R. H. Remington.....	1.12	20.5	12.2
Oct. 25	do.....	2.74	80	52
Jan. 31	W. C. Renshaw.....	1.35	22.4	14.5
Feb. 9	do.....	.53	3.1	2.0
May 2	do.....	.82	8.3	5.4

Discharge, in million gallons per day, of Center ditch at Waikamoi, near Huelo, Maui, for the year ending June 30, 1921.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1.....	0.7	2.2	3.9	3.9	3.9	60	3.2	12.4	1.2	13.9	3.6	1.5
2.....	.6	2.0	3.4	2.2	11.8	38	3.3	10.3	33	10.4	4.6	1.4
3.....	.6	3.7	3.2	2.6	21	29	31	11.0	14.6	8.3	4.8	1.4
4.....	.5	8.3	3.1	2.2	5.8	16.4	35	6.6	2.6	5.4	3.5	1.3
5.....	.4	2.4	3.4	2.0	4.0	19.9	70	4.6	2.0	4.3	4.0	1.2
6.....	.4	2.0	22	2.0	3.6	57	67	2.7	1.6	33	3.4	1.2
7.....	.4	1.9	66	2.3	3.4	38	55	2.5	1.5	52	2.7	1.1
8.....	.4	1.6	39	2.0	68	69	36	2.3	1.4	43	2.5	1.1
9.....	.4	1.4	45	1.7	72	69	36	2.1	1.4	37	2.4	1.1
10.....	.4	1.3	25	1.6	63	69	36	1.8	1.3	27	2.2	1.1
11.....	.4	1.3	65	17.8	45	54	37	1.7	1.3	28	2.0	1.1
12.....	.4	2.5	60	36	24	38	30	1.7	1.2	36	2.3	1.0
13.....	.4	47	54	3.1	9.2	48	30	1.7	1.2	43	2.0	1.0
14.....	.4	38	33	2.1	5.7	84	30	1.6	1.2	27	1.9	1.0
15.....	1.2	3.9	12.0	45	4.3	63	52	5.0	1.3	25	1.8	1.0
16.....	.7	3.0	6.8	66	3.6	38	46	4.7	1.2	49	1.8	1.0
17.....	22	2.6	6.8	42	3.1	25	27	1.8	1.2	28	1.9	1.0
18.....	1.7	2.3	5.4	40	2.8	12.2	28	1.7	2.6	15.6	17.4	1.1
19.....	1.0	2.1	4.5	16.0	2.7	7.4	18.0	1.6	2.7	16.8	4.6	1.4
20.....	1.2	7.4	4.0	10.7	39	6.2	12.0	1.4	1.3	16.7	14.3	1.0
21.....	24	31	3.6	5.8	72	5.3	12.8	1.4	2.8	7.6	3.3	1.0
22.....	43	3.6	3.2	4.8	72	4.9	9.9	1.3	1.5	17.5	2.2	.9
23.....	38	5.7	3.2	4.0	54	35	8.8	1.3	1.3	40	2.3	.9
24.....	25	8.1	2.9	8.9	34	58	9.0	1.3	32	28	24	.9
25.....	6.1	8.9	2.5	58	26	79	29	1.3	12.1	12.2	3.4	.9
26.....	2.3	18.6	2.3	36	54	28	52	1.2	17.3	15.1	2.2	.9
27.....	2.0	66	2.1	7.2	25	10.0	26	1.2	52	7.0	2.0	1.7
28.....	2.0	19.3	2.0	5.8	16.3	4.3	18.0	1.2	30	4.8	1.8	49
29.....	2.2	5.4	2.6	4.8	38	3.6	15.6	.....	21	4.3	1.7	11.4
30.....	2.7	5.0	20.0	4.7	72	3.1	12.4	.....	55	6.5	1.6	1.3
31.....	2.0	4.4	.....	4.0	.....	3.0	14.5	.....	43	.....	1.6	.....

Monthly discharge of Center ditch at Waikamoi, near Huelo, Maui, for the year ending June 30, 1921.

Month.	Discharge.			Total run-off.		
	Million gallons per day.			Second-foot (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July.....	43	0.4	5.92	9.16	184	563
August.....	66	1.3	10.1	15.6	313	961
September.....	66	2.0	17.0	26.3	510	1,570
October.....	66	1.6	14.4	22.3	445	1,370
November.....	72	2.7	28.6	44.3	859	2,630
December.....	84	3.0	34.7	53.7	1,080	3,300
January.....	70	3.2	28.7	44.4	890	2,730
February.....	12.4	1.2	3.19	4.94	89.4	274
March.....	55	1.2	11.1	17.2	344	1,060
April.....	52	4.3	22.1	34.2	662	2,030
May.....	24	1.6	4.19	6.48	130	399
June.....	49	.9	3.06	4.73	91.9	282
The year.....	84	.4	15.3	23.7	5,590	17,200

NAILILIHAELE STREAM NEAR HUELO, MAUI.

LOCATION.—300 feet above New Hamakua ditch and 3 miles south of Huelo.

RECORDS AVAILABLE.—October 8, 1913, to June 30, 1918, and August 6, 1919, to June 30, 1921. Also at old staff-gage station below New Hamakua ditch from December 9, 1910, to December 31, 1912.

GAGE.—Stevens continuous water-stage recorder installed December 13, 1917, replacing original Barrett and Lawrence water-stage recorder.

DISCHARGE MEASUREMENTS.—Made by wading or from footbridge 150 feet below gage.

CHANNEL AND CONTROL.—One channel at all stages; straight for 100 feet above and below gage; stream bed very rough and steep; banks steep and high and covered with dense vegetation. Control concrete and large boulders; permanent.

EXTREMES OF DISCHARGE.—Maximum stage during year occurred about 10 p. m. January 16; the instrument did not record the peak of this flood, but it is estimated that it reached a stage of 3.40 feet (discharge, 494 million gallons per day, or 764 second-feet); minimum stage recorded, -0.52 foot from 11 a. m. to 7 p. m. July 14 (discharge, 0.46 million gallons per day or 0.71 second-foot).

1913-1921: Maximum stage recorded, 6.3 feet at 6.30 p. m. May 1, 1916 (discharge, computed from extension of rating curve, approximately 1,800 million gallons per day or 2,780 second-feet); minimum stage recorded in July, 1920.

DIVERSIONS.—Low flow of left branch of stream diverted above station by Old Hamakua ditch since about March 1, 1918.

REGULATION.—None.

OBJECT OF STATION.—To determine feasibility of additional diversions or flood storage. Also to assist valuation appraisers in relation to Territorial water license of ditch company.

UTILIZATION.—Ordinary flow is diverted by ditches of East Maui Irrigation Co. for irrigation of sugar cane.

ACCURACY.—Stage-discharge relation permanent. Rating curve well defined between 0.5 and 80 million gallons per day. Operation of water-stage recorder unsatisfactory at times. Records good when recorder was working.

Discharge measurements of Naililihale Stream near Huelo, Maui, during the year ending June 30, 1921.

Date.	Made by—	Gage height (feet).	Discharge.	
			Second-feet.	Million gallons per day.
July 12	Reid Jerman.....	-0.50	0.65	0.45
Sept. 19	R. H. Remington.....	- .35	1.5	.95
.....	do.....	.38	36.5	23.5
Oct. 22	do.....	.03	8.9	5.8
Jan. 26	J. E. Stewart.....	.95	107	69
Apr. 22	E. M. Pickop.....	.29	24.9	16.1

Discharge, in million gallons per day, of Naivikihale Stream near Huelo, Maui, for the year ending June 30, 1921.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.
1.....	1.0	4.8	-----	-----	5.3	28	6.1	8.2	3.7	9.8	7.0
2.....	.9	4.8	-----	-----	8.5	14.1	7.0	7.0	43	7.0	7.3
3.....	.9	12.1	-----	-----	12.1	10.3	14.6	7.6	9.4	5.8	7.6
4.....	.9	11.6	-----	-----	7.6	9.0	16.7	6.4	5.5	7.5	5.5
5.....	.8	5.5	-----	-----	5.8	9.4	37	5.8	4.6	5.8	5.5
6.....	.8	4.6	-----	-----	5.3	23	131	5.5	3.0	62	5.3
7.....	.7	4.0	-----	-----	5.0	12.1	115	5.2	2.5	80	4.8
8.....	.7	3.4	-----	-----	78	40	44	4.5	2.4	58	4.1
9.....	.6	3.0	-----	-----	33	34	37	4.1	2.3	39	3.8
10.....	.6	2.8	-----	-----	21	34	26	4.0	2.1	15.1	3.7
11.....	.6	2.8	-----	-----	15.1	18.3	18.3	4.3	1.8	14.6	3.5
12.....	.5	4.3	-----	-----	9.8	13.0	36	3.7	1.6	19.4	3.4
13.....	.5	25	19.4	-----	8.5	15.9	26	3.3	1.4	21	3.2
14.....	.5	19.7	14.6	-----	7.3	36	30	3.0	1.3	13.5	2.8
15.....	1.2	6.1	12.6	-----	6.4	20.0	147	36	1.2	20.0	2.9
16.....	.6	4.8	9.8	30	5.8	12.6	-----	8.2	1.0	33	2.9
17.....	6.6	4.1	8.5	14.1	5.3	9.4	-----	4.5	.9	16.2	3.0
18.....	2.5	3.8	8.2	28	4.6	8.5	64	6.7	3.1	13.5	16.6
19.....	1.1	3.5	7.0	13.5	3.7	8.2	32	4.6	3.4	10.3	9.4
20.....	4.4	12.6	5.8	9.0	27	6.7	22	3.7	2.0	12.1	15.8
21.....	17.3	13.5	5.2	8.2	53	5.8	18.3	3.3	3.4	9.0	7.6
22.....	35	6.7	4.6	7.0	37	5.5	15.1	3.7	1.5	12.6	5.3
23.....	18.7	9.0	4.3	6.4	17.2	9.8	12.6	3.8	1.3	24	5.8
24.....	19.5	8.5	4.1	8.2	12.1	17.9	11.6	3.8	26	17.2	21
25.....	8.2	11.6	3.8	26	10.3	51	-----	3.8	7.3	12.6	-----
26.....	4.5	16.7	3.4	14.1	18.3	15.6	-----	3.7	17.4	13.5	-----
27.....	3.8	30	3.7	9.4	9.0	12.6	18.9	3.6	30	9.8	-----
28.....	3.3	13.0	8.2	8.5	9.0	9.0	14.1	3.6	11.2	8.2	-----
29.....	4.1	9.8	-----	7.6	17.9	8.2	11.6	-----	48	7.3	-----
30.....	4.8	-----	-----	6.7	93	7.6	9.8	-----	65	11.6	-----
31.....	4.6	-----	-----	5.5	-----	6.4	10.3	-----	21	-----	-----

NOTE.—Discharge estimated in million gallons per day by comparison with flow of Kailua and Waikamoi streams near Huelo as follows: Aug. 30-31, 9; Sept. 1-5, 5; Sept. 6-12, 30; Sept. 23-30, 7; Oct. 1-5, 7; Oct. 6-10, 4; Oct. 11-15, 20; Jan. 16, 110; Jan. 17, 220; Jan. 25-26, 100; May 25-31, 4.

Monthly discharge of Naivikihale Stream near Huelo, Maui, for the year ending June 30, 1921.

Month.	Discharge.			Total run-off.		
	Million gallons per day.			Second-foot (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July.....	35	0.5	4.85	7.50	150	461
August.....	30	2.8	9.04	14.0	280	860
September.....	-----	-----	12.4	19.2	371	1,149
October.....	-----	-----	11.5	17.8	357	1,080
November.....	93	3.7	18.4	28.5	557	1,680
December.....	51	5.5	16.5	25.5	512	1,570
January.....	83	6.1	47.2	73.0	1,460	4,460
February.....	83	3.0	7.70	11.9	216	662
March.....	65	.9	10.6	16.4	328	1,010
April.....	80	5.8	19.6	30.3	589	1,800
May.....	21	-----	5.99	9.27	186	570
June.....	-----	-----	2.00	3.09	60	184
The year.....	-----	-----	13.9	21.5	5,060	15,500

^a Total for June estimated by comparison with Kailua Stream near Huelo.

KAILUA STREAM AT HAIKU-UKA BOUNDARY, NEAR KAILILI, MAUI.

LOCATION.—100 feet above trail crossing at Haiku-uka boundary line and $1\frac{1}{2}$ miles by horse trail southeast of Kailili.

RECORDS AVAILABLE.—July 11, 1918, to June 30, 1921.

GAGE.—Stevens continuous water-stage recorder.

DISCHARGE MEASUREMENTS.—Made by wading or from footbridge.

CHANNEL AND CONTROL.—One channel at all stages; straight for 25 feet above and 50 feet below bridge. Right bank low; left bank steep. Control is concrete slab 1.5 feet thick across stream 15 feet below gage. Permanent.

EXTREMES OF DISCHARGE.—1918-1921: Maximum stage recorded, about 9.6 feet, January 16, 1921 (discharge, about 500 million gallons per day or 770 second-feet); minimum stage recorded at 2.20 p. m., July 13, 1920, and also at 1 a. m. and 1.50 p. m., December 22, 1919 (discharge, 0.002 million gallons per day or 0.003 second-foot).

DIVERSIONS.—None.

REGULATION.—None.

OBJECT OF STATION.—To determine discharge of stream at boundary between fee simple lands above and Territorial lands below.

UTILIZATION.—Water picked up by East Maui Irrigation Co.'s ditches for the irrigation of cane lands.

ACCURACY.—Stage-discharge relation permanent. Rating curve fairly well defined up to 80 million gallons per day. Operation of water-stage recorder satisfactory except as noted in footnote to table of daily discharge. Records good.

Discharge measurements of Kailua Stream at Haiku-uka boundary, near Kailili, Maui, during the year ending June 30, 1921.

Date.	Made by—	Gage height (feet).	Discharge.	
			Second-feet.	Million gallons per day.
July 3	Reid Jerman	4.17	0.01	0.005
24	R. H. Remington	4.44	5.5	3.6
Sept. 8	.....do.....	4.35	2.4	1.5
Oct. 28	.....do.....	4.30	1.05	.65
Jan. 27	J. E. Stewart.....	4.46	6.8	4.4
Apr. 30	W. C. Renshaw	4.28	.35	.2
May 21	.....do.....	4.23	.15	.08

Discharge, in million gallons per day, of Kailua Stream at Haiku-uka boundary, near Kailiili, Maui, for the year ending June 30, 1921.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1.....	0.05	0.3	0.3	0.6	0.3	5.5	0.6	1.4	0.09	1.1	0.4	0.07
2.....	.02	.5	.3	.3	.6	2.1	.9	1.2	22	-6	.3	.07
3.....	.01	.9	.3	.2	1.1	1.4	2.6	1.1	5.3	.5	.4	.07
4.....	.01	1.2	.4	.2	.6	1.2	11.8	.9	1.1	.4	.4	.07
5.....	.01	.5	.3	.15	.5	1.2	40	.8	.5	.4	.4	.05
6.....	.005	.3	2.0	.15	.3	4.9	74	.8	.3	53	.3	.05
7.....	.005	.2	6.4	.3	.4	2.6	60	.6	.2	110	.3	.03
8.....	.01	.15	2.1	.3	102	32	10.0	.5	.15	30	.2	.03
9.....	.01	.09	1.9	.2	29	22	14.6	.5	.2	17.1	.2	.03
10.....	.005	.09	1.1	.2	9.6	28	22	.4	.15	2.8	.15	.05
11.....	.005	.09	8.2	11.8	3.4	4.3	26	.4	.15	1.9	.09	.07
12.....	.005	.15	4.8	8.1	1.4	2.1	8.1	.3	.15	3.4	.09	.03
13.....	.005	2.2	2.1	.9	1.1	2.9	13.3	.3	.09	3.1	.09	.03
14.....	.005	3.1	1.4	.5	.9	68	29	.3	.09	1.4	.07	.03
15.....	.07	.5	.9	11.5	.8	17.2	.....	.4	.09	.9	.07	.03
16.....	.05	.3	.6	9.6	.5	2.8	.....	.4	.07	2.8	.07	.03
17.....	2.6	.2	.5	3.4	.5	1.6	.....	.3	.07	1.4	.07	.03
18.....	.9	.15	.4	1.9	.4	1.1	.....	.6	.09	.9	.15	.02
19.....	.3	.09	.3	1.2	.3	.9	.....	.4	.09	.8	.15	.03
20.....	.15	.9	.3	.9	13.1	.8	.....	.3	.07	.6	.15	.03
21.....	.8	2.3	.2	.8	24	.8	.....	.2	.09	.6	.09	.02
22.....	7.8	.8	.2	.6	18.3	.8	.....	.15	.07	.6	.15	.02
23.....	5.2	.6	.2	.5	5.2	6.0	.....	.15	.05	1.4	.2	.03
24.....	2.6	.8	.2	.....	2.3	30	.....	.15	1.1	.9	.9	.02
25.....	.8	1.1	.15	.....	1.9	82	.....	.15	.9	.6	.6	.01
26.....	.4	2.0	.15	.....	6.7	8.1	.....	.09	.5	.5	.4	.01
27.....	.3	9.1	.09	.....	1.9	3.4	.....	.09	4.4	.5	.2	.05
28.....	.2	1.9	.09	.8	1.4	1.6	2.8	.09	1.9	.4	.15	2.9
29.....	.3	.6	.09	.5	2.8	1.1	1.9	.....	2.6	.3	.09	.9
30.....	.4	.5	1.8	.4	43	.8	1.4	.....	18.6	.5	.09	.3
31.....	.4	.4	.....	.4	.....	.6	2.3	.....	5.5	.....	.09	.....

NOTE.—Discharge estimated in million gallons per day by comparison with flow of adjacent streams as follows: Oct. 24-27, 4; Jan. 15-18, 60; Jan. 19-24, 5; Jan. 25-27, 25.

Monthly discharge of Kailua Stream at Haiku-uka boundary, near Kailiili, Maui, for the year ending June 30, 1921.

Month.	Discharge.			Total run-off.		
	Million gallons per day.			Second-foot (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July.....	7.8	0.005	0.756	1.17	23.4	72
August.....	9.1	.09	1.03	1.59	32.0	98
September.....	8.2	.09	1.26	1.95	37.8	116
October.....	11.8	.15	2.34	3.62	72.4	223
November.....	102	.3	9.14	14.1	274	841
December.....	82	.6	10.9	16.9	338	1,040
January.....	.....	.6	21.5	33.3	666	2,050
February.....	1.4	.09	.463	.716	13.0	40
March.....	22	.05	2.15	3.33	66.7	205
April.....	110	.3	7.98	12.3	239	735
May.....	.9	.07	.226	.350	7.01	22
June.....	2.9	.01	.170	.263	5.11	16
The year.....	.....	.005	4.86	7.52	1,780	5,460

KAILUA STREAM NEAR HUELO, MAUI.

LOCATION.—800 feet above New Hamakua ditch crossing and 1 mile south of Huelo.

RECORDS AVAILABLE.—December 8, 1910, to June 30, 1918, and July 1, 1919, to June 30, 1921.

GAGE.—Stevens continuous water-stage recorder installed March 7, 1918, replacing Barrett and Lawrence water-stage recorder installed October 8, 1913, at same location and datum as original staff gage.

DISCHARGE MEASUREMENTS.—Made by wading or from footbridge at gage.

CHANNEL AND CONTROL.—Channel at gage is a large, deep pool with high, sloping banks, at foot of low waterfall. Control at outlet of pool is solid rock ledge and large boulders; seldom shifts.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 7.52 feet at 8.10 p. m. January 16 (discharge, 630 million gallons per day, or 975 second-feet), minimum stage recorded, 0.57 foot from 3 to 4 a. m. June 27 (discharge, 0.07 million gallons per day, or 0.11 second-foot).

1910-1921: Maximum stage recorded, 9.5 feet May 1, 1916 (discharge computed from extension of the rating curve, approximately 1,000 million gallons per day, or 1,550 second-feet); minimum stage recorded in June, 1921.

DIVERSIONS.—Nearly all low-water flow diverted by Old Hamakua ditch above station after February 5, 1918.

REGULATION.—By diversion only.

OBJECT OF STATION.—Data valuable in connection with Territorial water leases to ditch company.

UTILIZATION.—Ordinary flow of stream is diverted by ditches of East Maui Irrigation Co. for irrigation of sugar cane.

ACCURACY.—Stage-discharge relation not permanent. Three rating curves fairly well defined below 150 million gallons per day used July 1 to September 11, September 12 to April 7, and April 8 to June 30. Operation of water-stage recorder unsatisfactory September 16 to November 11. Records good when recorder was working properly.

Discharge measurements of Kailua Stream near Huelo, Maui, during the year ending June 30, 1921.

Date.	Made by—	Gage height (feet).	Discharge.	
			Second-feet.	Million gallons per day.
July 12	Reid Jerman.....	0.62	0.2	0.1
19	R. H. Remington.....	.66	.25	.15
Sept. 12	do.....	1.66	18.0	11.6
Oct. 26	do.....	1.06	3.4	2.2
Jan. 26	J. E. Stewart.....	2.37	67	43.5
May 7	W. C. Renshaw.....	.67	.35	.25

Discharge, in million gallons per day, of Kailua Stream near Huelo, Maui, for the year ending June 30, 1921.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1.....	0.2	0.3	0.3			20.0	0.2	5.9	0.1	7.6	1.7	0.1
2.....	.1	.3	.4			2.6	.3	4.5	52	4.6	1.6	.1
3.....	.2	2.9	.3			1.0	1.8	3.6	10.8	3.0	1.7	.1
4.....	.2	5.2	.3			.8	13.3	2.6	1.9	5.3	.8	.1
5.....	.2	.4	.4			.8	62	2.6	.8	3.3	.5	.1
6.....	.2	.3	13.2			11.4	189	1.3	.2	115	.4	.1
7.....	.2	.3	32			2.5	160	.8	.1	227	.3	.1
8.....	.2	.3	8.9			54	38	.4	.1	94	.3	.1
9.....	.2	.3	9.5			44	30	.2	.1	44		.1
10.....	.2	.2	1.2			54	22	.2	.1	12.5		.1
11.....	.2	.2	36			6.2	25	.2	.1	10.2		.1
12.....	.2	.3	14.0		0.5	1.0	29	.2	.1	17.4		.1
13.....	.2	7.6	1.2		.4	1.9	19.3	.2	.1	18.3		.1
14.....	.2	14.6	.5		.4	85	42	.2	.1	10.2		.2
15.....	.3	1.2	.5		.4	23	163	2.2	.1	10.6	.2	.1
16.....	.2	.3			.3	1.2	154	1.9	.1	24	.1	.1
17.....	3.2	.3		3.1	.3	.6	252	.4	.2	9.0	.2	.1
18.....	.4	.3		4.5	.4	.5	63	1.1	.2	6.3	3.4	.1
19.....	.2	.2		.8	.3	.4	26	.6	.2	4.1	2.1	.1
20.....	.3	3.3		.4	32	.3	16.5	.2	.2	4.6	3.8	.1
21.....	8.2	2.1		.4	71	.3	14.4	.1	.5	3.4	1.4	.1
22.....	32	.4		.3	49	.3	10.9	.1	.2	4.9	.3	.1
23.....	27	.5		.3	9.0	1.9	8.7	.1	.2	16.3	.2	.1
24.....	5.8	.5		.5	1.2	26	7.4	.1	20.0	7.1	.3	.1
25.....	1.3	.6		16.5	1.0	126	63	.1	7.4	4.6	10.6	.1
26.....	.3	5.3			6.7	7.1	103	.1	9.3	4.4	1.0	.1
27.....	.3	30			1.0	1.0	19.3	.1	28	3.0	.3	.1
28.....	.3	2.8			.7	.4	12.4	.1	10.0	2.2	.2	
29.....	.3	.4			6.2	.3	9.1		36	1.7	.2	
30.....	.3	.4			123	.3	7.4		83	4.4	.2	
31.....	.3	.4				.2	8.2		22		.2	

NOTE.—Discharge estimated in million gallons per day by comparison with flow of Naillihalee Stream near Huelo and Kailua Stream at Haiku-uka boundary as follows: Sept. 16-30, 0.3; Oct. 1-10, 0.2; Oct. 11-16, 10; Oct. 26-31, 4; Nov. 1-5, 2.5; Nov. 6-11, 30; May 9-11, 0.3; May 12-14, 0.2; June 28-30, 1.5.

Monthly discharge of Kailua Stream near Huelo, Maui, for the year ending June 30, 1921.

Month.	Discharge.			Total run-off.		
	Million gallons per day.			Second-foot (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July.....	32	0.1	2.69	4.16	83.4	256
August.....	30	.2	2.65	4.10	82.2	252
September.....	36		4.11	6.36	123	378
October.....			3.61	5.59	112	343
November.....	123	.3	16.5	25.5	496	1,520
December.....	126	.2	15.3	23.7	475	1,460
January.....	252	.2	50.7	78.4	1,570	4,820
February.....	5.9	.1	1.08	1.67	30.1	93
March.....	83	.1	9.18	14.2	285	873
April.....	227	1.7	23.1	35.7	694	2,130
May.....	10.6		1.08	1.67	33.5	103
June.....		.1	.24	.37	7.3	22
The year.....	252	.1	10.9	16.9	3,990	12,200

OLD HAMAKUA DITCH AT KAILUA, NEAR HUELO, MAUI.

LOCATION.—250 yards above intake of penstock to hydroelectric plant on Old Hamakua ditch $1\frac{1}{4}$ miles southwest of Kailua on left side of valley, 83 feet above bed of Kailua Stream.

RECORDS AVAILABLE.—July 22, 1919, to June 30, 1921.

GAGE.—Stevens continuous water-stage recorder.

DISCHARGE MEASUREMENTS.—Made by wading or from plank footbridge.

CHANNEL AND CONTROL.—Channel-ditch section in gravel and hardpan; straight for 10 feet above and 75 feet below station. Control ditch bottom fairly permanent.

EXTREMES OF DISCHARGE.—1919–1921: Maximum stage recorded 3.22 feet at 4 a. m. January 7, 1921 (discharge, 24 million gallons per day or 37 second-feet); minimum stage recorded, 0.30 foot from December 13 to 15, 1919 (discharge, 0.2 million gallons per day or 0.3 second-foot). Minimum stage recorded during year, 0.53 foot at noon July 13 (discharge, 0.5 million gallons per day or 0.8 second-foot).

DIVERSIONS.—None.

REGULATION.—By head gates.

OBJECT OF STATION.—In conjunction with the two stream stations, this station gives the total flow of the Kailua and Naililihaele streams.

UTILIZATION.—Water used for power, domestic, and other purposes at Wailoa ditch camp.

ACCURACY.—Stage-discharge relation practically permanent. Rating curve well defined. Operation of water-stage recorder unsatisfactory. Records generally good when water-stage recorder was operating.

Discharge measurements of Old Hamakua ditch at Kailua, near Huelo, Maui, during the year ending June 30, 1921.

Date.	Made by—	Gage height (feet).	Discharge.	
			Second-feet.	Million gallons per day.
July 12	Reid Jerman	0.56	1.5	1.0
19	R. H. Remington	1.09	7.2	4.7
Sept. 12	.....do.....	2.04	21.3	13.8
Oct. 20	.....do.....	1.60	12.2	7.9
Jan. 26	J. E. Stewart.....	1.34	10.6	6.8
Apr. 15	W. C. Renshaw	1.36	11.2	7.2

Discharge, in million gallons per day, of Old Hamakua ditch at Kailua, near Huelo, Maui, for the year ending June 30, 1921.

Day.	July.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	1.7				15.5	9.0	6.7	3.4	6.2	7.2	4.7
2	1.6				13.5	9.0	6.7	6.7	6.2	7.2	4.3
3	1.4				12.5	15.5	6.7	7.2	6.2	7.2	4.1
4	1.3				15.5	14.5	6.7	6.7	6.2	7.2	4.0
5	1.2				15.5	20.0	6.7	6.7	6.2	7.2	3.9
6	1.2				17.5	22	6.2	6.2	8.5	7.2	3.5
7	1.1				21	21	6.7	5.6	10.5	6.7	3.5
8	1.2				21	17.5	6.2	5.3	8.5	6.2	5.3
9	1.2				19.5	17.5	6.2	4.7	8.0	6.2	6.4
10	1.3				17.5	16.5	5.8	4.7	7.2	5.5	4.0
11	1.2			16.5	16.5	16.5	5.8	4.5	7.2	5.4	3.5
12	1.1			13.5	16.5	17.5	5.6	4.0	7.6	5.1	3.3
13	1.0			11.0	17.5	16.5	5.0	3.9	7.6	4.7	2.7
14				10.0	17.5	17.5	4.7	3.7	7.2	4.5	2.7
15			10.0	9.0	20.0	20.0	5.6	3.5	7.2	4.6	2.6
16			15.5	8.0		17.5	6.2	3.4	7.6	4.4	
17			16.5	7.6		10.5	5.8	3.1	7.6		
18			15.5	7.6	12.5	7.6	5.7	4.9	7.2		
19		8.0	13.5	7.6	11.0	7.2	6.2	6.2	7.2	8.0	
20		7.2	10.0	16.5	9.5	5.8	5.2	5.1	7.2	8.0	
21		6.2	8.5	17.5	8.5	6.2	4.7	5.8	7.2	7.6	2.4
22		5.8	7.6	18.5	8.0	6.7	4.3	4.6	7.2	6.7	2.4
23		5.8	6.7	14.5	13.5	6.7	4.0	4.1	7.6	6.7	2.4
24		5.3	7.2	17.5	16.5	6.7	4.0	6.2	7.6	8.0	2.4
25		5.0	13.5	16.5	21	7.2	3.9	6.2	7.2	8.0	2.2
26		4.7	10.5	13.5	18.5	7.6	3.8	6.2	7.2	7.6	2.3
27		4.3	10.0	12.0	16.5	6.7	3.6	6.7	7.2	6.7	3.7
28			8.5	19.5	12.5	6.7	3.4	6.7	7.6	5.8	9.5
29			7.6	16.5	11.0	6.7		6.7	7.2	5.7	9.0
30			6.7	15.5	10.0	6.7		7.2	7.2	5.2	6.7
31			5.8		9.0	6.2		6.2		4.9	

NOTE.—Discharge estimated in million gallons per day by comparison with flow of Waikamoi Stream near Huelo as follows: July 14-20, 4.5; July 21-24, 12; July 25-31, 7; Aug. 1-4, 10; Aug. 5-9, 8; Aug. 10-20, 9; Aug. 21-26, 12; Aug. 27-31, 10; Sept. 1-6, 8; Sept. 7-12, 14; Sept. 13-18, 11; Sept. 28-30, 6; Oct. 1-7, 6; Oct. 8-14, 9; Nov. 1-10, 12; Dec. 12-17, 16; May 17-18, 5; June 16-20, 2.5.

Monthly discharge of Old Hamakua ditch at Kailua, near Huelo, Maui, for the year ending June 30, 1921.

Month.	Discharge.			Total run-off.		
	Million gallons per day.			Second-foot (mean).	Million gallons.	Acre-foot.
	Maximum.	Minimum.	Mean.			
July			4.68	7.24	145	445
August			9.71	15.0	301	924
September			8.94	13.8	268	823
October			8.99	13.9	279	855
November			13.0	20.1	389	1,200
December		21	14.8	22.9	460	1,410
January		22	5.8	12.0	373	1,140
February	6.7		3.4	5.43	152	467
March	7.2		3.1	5.36	166	510
April	10.5		6.2	7.35	220	677
May	8.0			6.30	195	599
June	9.5			3.80	114	350
The year				8.39	3,060	9,400

HOOLAWALILII STREAM NEAR HUELO, MAUI.

LOCATION.—400 feet above New Hamakua ditch crossing and 4 miles by trail west of Huelo.

RECORDS AVAILABLE.—April 6, 1911, to June 30, 1921.

GAGE.—Stevens continuous water-stage recorder installed June 19, 1914, at same location and datum as original staff gage.

DISCHARGE MEASUREMENTS.—Made by wading or from footbridge at gage.

CHANNEL AND CONTROL.—Channel at gage is a pool about 100 feet long and 20 feet wide formed by concrete control about 20 feet long over which water makes a drop of about 50 feet; banks slope gently and are covered with dense growth of vegetation.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 3.64 feet at 7.40 p. m. January 16 (discharge, about 340 million gallons per day, or 526 second-foot); minimum stage recorded, 0.04 foot from 3 p. m. to 5 p. m. July 14 (discharge, 0.62 million gallons per day or 0.94 second-foot).

1911–1921: Maximum stage recorded in January, 1921; minimum stage recorded, 0.02 foot at 9 p. m. December 11, 1919 (discharge, 0.5 million gallons per day or 0.8 second-foot).

DIVERSIONS.—None.

REGULATIONS.—None.

OBJECT OF STATION.—To furnish data for appraisal of water value under Territorial lease to ditch company.

UTILIZATION.—All water during low and medium stages picked up by ditches of East Maui Irrigation Co. for irrigation of sugar cane.

ACCURACY.—Stage-discharge relation changed by flood of January 16. Rating curve used July 1 to January 16 well defined between 0.5 and 20 million gallons per day. Rating curve used January 17 to June 30 fairly well defined below 20 million gallons per day. Operation of water-stage recorder satisfactory except as given in footnote to table of daily discharge. Records excellent for discharge below 20 million gallons per day.

Discharge measurements of Hoolawalilii Stream near Huelo, Maui, during the year ending June 30, 1921.

Date.	Made by—	Gage height (feet).	Discharge.	
			Second-foot.	Million gallons per day.
July 10	Reid Jerman.....	0.05	0.75	0.5
18	do.....	.06	.85	.55
Sept. 17	R. H. Remington.....	.20	5.2	3.4
Oct. 27	do.....	.20	5.4	3.5
Jan. 30	J. E. Stewart.....	.28	7.5	4.9
May 6	W. C. Renshaw.....	.20	4.0	2.6
11	do.....	.16	2.3	1.5

Discharge, in million gallons per day, of Hoolawalilili Stream near Huelo, Maui, for the year ending June 30, 1921.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1.....	0.8	1.45	2.4	2.2	2.2	20.0	4.2	4.3	0.95	6.4	3.4	1.65
2.....	.8	1.3	2.5	2.0	2.7	12.1	4.2	4.0	5.5	4.9	3.4	1.5
3.....	.8	1.65	2.2	2.2	2.9	9.3	4.6	3.4	1.8	4.0	3.4	1.5
4.....	.7	1.8	2.0	2.0	2.5	7.2	4.6	3.1	1.5	6.9	2.8	1.5
5.....	.7	1.65	2.2	2.0	2.4	6.7	6.2	2.8	1.5	4.9	2.5	1.5
6.....	.7	1.65	4.0	2.0	2.2	10.8	56	2.3	1.3	10.9	2.3	1.5
7.....	.7	1.45	4.9	2.0	2.2	7.8	56	2.2	1.15	15.2	2.3	1.5
8.....	.8	1.45	3.2	1.8	12.0	12.0	31	2.0	1.15	16.9	2.2	1.3
9.....	.8	1.45	3.2	1.8	5.9	14.2	23	2.0	1.15	12.1	2.2	1.3
10.....	.7	1.45	2.7	1.8	4.6	13.5	14.2	1.8	1.15	8.3	2.0	1.3
11.....	.7	1.45	8.8	2.2	3.9	10.4	10.4	1.8	1.15	6.9	2.0	1.3
12.....	.7	1.65	5.5	2.2	3.2	8.3	16.4	1.65	.95	6.4	1.8	1.3
13.....	.7	2.2	4.9	2.0	2.9	8.6	13.5	1.5	.95	6.0	1.8	1.3
14.....	.7	2.2	4.2	1.8	2.9	12.2	26	1.5	.95	5.2	1.65	1.3
15.....	.9	1.8	3.9	3.0	2.7	9.3	89	1.5	.95	5.2	1.65	1.15
16.....	.8	1.65	3.6	5.0	2.5	6.7	90	1.65	.95	7.8	1.65	1.15
17.....	.95	1.65	3.2	2.9	2.5	5.9	135	1.5	.95	5.5	1.65	1.15
18.....	.8	1.45	2.9	3.8	2.5	5.2	51	1.5	1.3	4.6	2.0	1.15
19.....	.8	1.45	2.9	3.2	2.4	4.9	25	1.3	1.3	4.0	2.2	1.15
20.....	.95	2.2	2.7	2.5	4.6	4.6	15.6	1.3	.95	4.6	3.1	.95
21.....	1.65	2.5	2.5	2.4	12.5	4.2	10.9	1.15	1.15	4.0	2.5	.8
22.....	3.0	2.0	2.5	2.2	12.3	3.9	8.3	.95	1.15	4.6	2.2	.8
23.....	2.2	2.0	2.5	2.2	7.2	5.0	6.4	.95	1.15	7.0	2.2	.....
24.....	1.45	2.0	2.4	3.4	5.5	5.5	5.2	.95	16.2	6.0	3.8	.....
25.....	1.3	2.4	2.4	4.6	5.2	17.0	14.7	.95	3.1	4.9	2.3	.....
26.....	1.3	2.7	2.2	3.2	6.2	7.8	35	.95	5.2	6.0	2.0	.....
27.....	1.3	4.9	2.2	2.9	5.5	6.2	12.9	.95	9.6	4.6	2.0	.....
28.....	1.1	2.9	2.0	2.5	4.9	5.2	9.3	.95	4.3	4.0	1.8	.....
29.....	1.45	2.5	2.2	2.4	8.1	4.9	7.4	.....	19.1	3.7	1.8	.....
30.....	1.45	2.5	2.2	2.4	49	4.6	6.0	.....	25	4.0	1.65	.....
31.....	1.3	2.4	.....	2.2	.....	4.2	5.2	.....	10.8	.....	1.65	.....

NOTE.—Clock stopped June 23-30; discharge estimated in million gallons per day from recorded range in stage by comparison with flow of adjacent streams as follows: June 23-27, 0.8; June 28-30, 1.4.

Monthly discharge of Hoolawalilili Stream near Huelo, Maui, for the year ending June 30, 1921.

Month.	Discharge.			Second-foot (mean).	Total run-off.	
	Million gallons per day.				Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July.....	3.0	0.7	1.06	1.64	33.0	101
August.....	4.9	1.3	1.99	3.08	61.8	189
September.....	8.8	2.0	3.17	4.90	95.0	292
October.....	5.0	1.8	2.54	3.93	78.8	242
November.....	49.	2.2	6.20	9.59	186	571
December.....	20.0	3.9	8.33	12.9	258	792
January.....	135	4.2	25.7	39.8	797	2,440
February.....	4.3	.95	1.82	2.82	50.9	156
March.....	25	.95	4.01	6.20	124	381
April.....	16.9	3.7	6.52	10.1	196	600
May.....	3.8	1.65	2.25	3.48	69.9	214
June.....	.....	.....	1.21	1.87	36.2	111
The year.....	135	.....	5.44	8.42	1,990	6,090

HOOLOWANUI STREAM NEAR HUELO, MAUI.

LOCATION.—500 feet above crossing of New Hamakua ditch and 5 miles by trail west of Huelo, at elevation 1,240 feet.

RECORDS AVAILABLE.—December 12, 1910, to June 30, 1921.

GAGE.—Stevens continuous water-stage recorder installed June 20, 1914, 200 feet upstream from original staff, which it replaced.

DISCHARGE MEASUREMENTS.—Made by wading or from footbridge at gage.

CHANNEL AND CONTROL.—Stream drops over a low waterfall into a large circular pool with gently sloping banks. Control at outlet of pool composed of boulders; probably permanent.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 4.78 feet at 8.10 p. m. January 16 (discharge, 354 million gallons per day or 548 second-foot) minimum stage recorded -0.12 foot from 1 p. m. to 6 p. m. July 10 (discharge, 0.36 million gallons per day, or 0.56 second-foot).

1910-1921: Maximum stage recorded, 5.4 feet at 11.30 p. m. May 1, 1916 (discharge, computed from extension of rating curve, approximately 440 million gallons per day or 680 second-foot); minimum stage recorded -0.19 foot at 7 p. m. October 25, 1917 (discharge, 0.15 million gallons per day or 0.2 second-foot).

DIVERSIONS.—None.

REGULATION.—None.

OBJECT OF STATION.—To furnish data for appraisal of water value under Territorial lease to ditch company.

UTILIZATION.—All water during low and medium stages picked up by ditches of East Maui Irrigation Co. for irrigation of sugar cane.

ACCURACY.—Stage-discharge relation practically permanent. Rating curve well defined between 0.5 and 40 million gallons per day. Operation of water-stage recorder satisfactory. Records excellent below 40 million gallons per day.

Discharge measurements of Hoolawanui Stream near Huelo, Maui, during the year ending June 30, 1921.

Date.	Made by—	Gage height (feet).	Discharge.	
			Second-foot.	Million gallons per day.
July 10	Reid Jerman.....	-0.12	0.45	0.3
Aug. 2	.....do.....	.02	1.1	.7
Sept. 17	R. H. Remington.....	.31	4.2	2.7
Oct. 27	.....do.....	.27	2.9	1.85
Jan. 30	J. E. Stewart.....	.59	11.3	7.3
Feb. 10	W. C. Renshaw.....	.28	4.2	2.7
May 6	.....do.....	.33	5.2	3.4
14	.....do.....	.20	1.5	.95

Discharge, in million gallons per day, of Hoolawanui Stream near Huelo, Maui, for the year ending June 30, 1921.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1.....	0.5	1.2	1.8	2.0	2.2	16.3	3.7	6.0	1.8	7.0	4.6	1.9
2.....	.5	1.0	1.8	1.7	2.7	10.6	3.7	5.2	10.8	5.6	4.6	1.8
3.....	.4	1.5	1.7	1.8	2.8	8.3	4.8	4.8	3.6	4.9	4.3	1.8
4.....	.4	1.8	1.7	1.6	2.4	7.0	5.2	4.3	2.6	7.3	3.8	1.8
5.....	.4	1.3	1.8	1.5	2.2	6.4	11.4	4.0	2.4	5.6	3.6	1.8
6.....	.4	1.1	3.7	1.5	2.0	9.3	63	3.7	2.2	25	3.5	1.8
7.....	.4	1.0	6.6	1.5	2.0	7.0	76	3.5	2.0	45	3.4	1.7
8.....	.4	.9	3.7	1.3	27	15.2	31	3.2	2.0	41	3.1	1.7
9.....	.4	.8	4.1	1.2	14.6	17.9	22	3.0	2.0	30	2.9	1.7
10.....	.4	.8	3.1	1.3	9.3	19.6	15.7	2.8	1.9	15.7	2.7	1.6
11.....	.4	.8	8.4	3.3	6.4	13.1	12.0	2.8	1.8	12.0	2.6	1.8
12.....	.4	1.0	6.2	3.8	4.8	9.5	17.9	2.6	1.8	12.2	2.6	1.6
13.....	.4	1.6	4.6	2.0	4.0	9.3	14.4	2.6	1.7	12.5	2.5	1.5
14.....	.4	1.9	4.0	1.7	3.5	15.0	25	2.5	1.7	10.3	2.3	1.6
15.....	.8	1.2	3.6	5.8	3.2	11.4	83	3.1	1.6	10.6	2.2	1.6
16.....	.5	1.0	3.4	6.5	2.9	8.8	86	3.0	1.6	14.7	2.1	1.5
17.....	.9	.9	3.2	3.8	2.7	7.2	136	2.6	1.4	10.3	2.1	1.5
18.....	.7	.9	2.9	3.6	2.6	6.0	47	2.7	1.9	8.6	3.1	1.5
19.....	.6	.8	2.7	2.6	2.5	5.3	24	2.5	1.9	7.0	2.9	1.6
20.....	.7	1.6	2.6	2.6	5.8	4.8	16.3	2.3	1.5	7.2	3.8	1.4
21.....	1.8	1.9	2.4	2.4	17.0	4.3	12.5	2.1	1.7	6.0	2.8	1.2
22.....	4.9	1.3	2.3	2.3	15.4	4.0	9.8	2.0	1.5	7.2	2.4	1.1
23.....	3.3	1.4	2.2	2.2	9.0	5.3	8.1	1.9	1.3	11.1	2.4	1.0
24.....	2.0	1.3	2.1	2.9	6.4	6.7	6.8	1.9	9.4	8.3	4.0	1.0
25.....	1.9	1.6	2.0	5.2	5.5	24	18.7	1.9	3.6	6.8	2.7	1.0
26.....	1.3	2.0	1.9	3.7	6.8	9.8	37	1.8	4.0	6.8	2.5	1.0
27.....	1.2	5.5	1.8	2.8	5.2	7.6	13.8	1.8	9.3	5.5	2.3	.....
28.....	1.1	2.7	1.7	2.6	4.6	5.6	10.8	1.8	4.6	5.2	2.1	.....
29.....	1.2	2.2	1.8	2.4	6.5	4.9	8.6	.....	17.2	4.9	2.0	.....
30.....	1.3	2.0	2.3	2.4	45	4.2	7.4	.....	29	5.8	2.0	.....
31.....	1.2	1.9	.....	2.3	.....	3.8	7.4	.....	10.8	.....	1.9	.....

NOTE.—Discharge estimated June 27-30 by comparison with flow of Kailua Stream at Haku-uka boundary as 1.6 million gallons per day.

Monthly discharge of Hoolawanui Stream near Huelo, Maui, for the year ending June 30, 1921.

Month.	Discharge.			Total run-off.		
	Million gallons per day.			Second-foot (mean).	Million gallons.	Acre-foot.
	Maximum.	Minimum.	Mean.			
July.....	4.9	0.4	1.01	1.56	31.2	96
August.....	5.5	.8	1.51	2.34	46.9	144
September.....	8.4	1.7	3.07	4.75	92.1	283
October.....	6.5	1.2	2.65	4.10	82.3	252
November.....	45	2.0	7.57	11.7	227	697
December.....	24	3.8	9.30	14.4	288	885
January.....	136	3.7	27.1	41.9	839	2,580
February.....	6.0	1.8	2.94	4.55	82.4	253
March.....	29	1.3	4.54	7.02	141	432
April.....	45	4.9	12.0	18.6	360	1,100
May.....	4.6	1.9	2.90	4.49	89.8	276
June.....	.....	1.0	1.53	2.37	45.9	141
The year.....	136	.4	6.34	9.81	2,330	7,100

HONOPOU STREAM NEAR HUELO, MAUI.

LOCATION.—200 feet above New Hamakua ditch crossing and 6 miles west of Huelo, at elevation 1,250 feet.

RECORDS AVAILABLE.—December 12, 1910, to June 30, 1921.

GAGE.—Stevens continuous water-stage recorder; installed June 19, 1914, at same site as original staff.

DISCHARGE MEASUREMENTS.—Made by wading or from footbridge at gage.

CHANNEL AND CONTROL.—One channel at all stages; straight for 50 feet above and below gage; right bank is overflowed during floods; left bank steep and high. Control an old iron weir set in concrete; permanent.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 3.55 feet at 8 p. m. January 16 (discharge, 220 million gallons per day, or 340 second-feet); minimum stage recorded, 0.05 foot from 2 p. m. to 8 p. m. July 14 (discharge, 0.15 million gallons per day, or 0.23 second-foot).

1910–1921: Maximum stage recorded, 3.7 feet at 10 p. m. May 1, 1916 (discharge, based on curve applicable from January 19, 1917, 247 million gallons per day,⁷ or 382 second-feet); minimum stage recorded in July, 1920.

DIVERSIONS.—None.

REGULATION.—None.

OBJECT OF STATION.—To furnish data for appraisal of water value under Territorial lease to ditch company.

UTILIZATION.—Ordinary flow is diverted by ditches of East Maui Irrigation Co. for irrigation of sugar cane.

ACCURACY.—Stage-discharge relation practically permanent. Rating curve well defined above 1 million gallons per day. Operation of water-stage recorder satisfactory except as given in footnote to table of daily discharge. Records excellent.

Discharge measurements of Honopou Stream near Huelo, Maui, during the year ending June 30, 1921.

Date.	Made by—	Gage height (feet).	Discharge.	
			Second-feet.	Million gallons per day.
July 9	Reid Jerman.....	0.06	0.15	0.1
Aug. 2	R. H. Remington.....	.09	.5	.35
Sept. 17	.....do.....	.22	1.85	1.2
Oct. 27	.....do.....	.18	1.2	.8
Feb. 10	W. C. Renshaw.....	.24	1.75	1.1
May 3	.....do.....	.27	2.2	1.4

⁷Supersedes figure published in Water-Supply Papers 445, 465, and 485.

Discharge, in million gallons per day, of Honopou Stream near Huelo, Maui, for the year ending June 30, 1921.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1.....	0.2	0.3	0.9	0.7	0.7	8.3	2.3	3.4	0.5	3.1	2.0	0.5
2.....	.2	.3	.8	.7	.8	6.0	2.4	3.0	3.3	2.7	2.1	.5
3.....	.2	.4	.7	.7	1.1	5.1	2.6	2.7	1.0	2.4	1.8	.5
4.....	.2	.5	.7	.7	.9	4.3	2.4	2.4	.8	3.2	1.7	.5
5.....	.2	.5	.7	.7	.8	4.2	3.2	2.0	.8	2.4	1.6	.5
6.....	.2	.5	1.2	.7	.8	5.2	24	1.9	.8	3.6	1.5	.5
7.....	.2	.5	3.0	.7	.7	3.8	26	1.8	.7	6.1	1.4	.5
8.....	.2	.5	2.5	.7	5.0	5.2	14.7	1.7	.7	6.9	1.3	.4
9.....	.2	.5	1.9	.7	3.1	6.0	11.1	1.6	.7	7.9	1.3	.4
10.....	.2	.5	1.6	.7	2.4	5.9	7.9	1.4	.7	5.4	1.2	.4
11.....	.2	.5	4.2	.8	2.3	5.1	6.6	1.3	.6	4.8	1.1	.4
12.....	.2	.5	5.7	1.1	2.0	4.4	8.5	1.2	.5	4.4	1.0	.4
13.....	.2	.5	5.6	1.0	1.8	5.1	7.3	1.1	.5	4.0	1.0	.4
14.....	.2	.7	5.2	.7	1.7	5.9	13.7	1.0	.5	3.6	1.0	.4
15.....	.4	.7	5.1	.8	1.6	4.9	42	1.1	.5	3.6	1.0	.4
16.....	.3	.6	4.9	2.1	1.5	4.3	45	1.0	.5	4.4	1.0	.4
17.....	.3	.5	2.6	2.5	1.4	4.0	70	.8	.4	3.6	1.0	.4
18.....	.3	.4	1.2	2.5	1.3	3.6	27	1.0	.6	3.1	1.0	.3
19.....	.3	.3	1.1	2.5	1.2	3.2	15.9	.8	.6	2.9	.9	.3
20.....	.3	.6	1.1	2.5	2.2	3.0	10.9	.8	.5	3.0	1.5	.3
21.....	.7	1.1	1.1	2.5	5.4	2.7	8.3	.7	.5	2.5	1.0	.3
22.....	1.6	.8	.9	2.5	5.4	2.4	6.6	.7	.5	2.9	.8	.3
23.....	.8	.7	.8	2.5	3.6	3.0	5.4	.6	.5	3.7	.7	.3
24.....	.5	.6	.9	2.6	3.0	4.0	4.6	.6	7.1	3.1	1.5	.2
25.....	.5	.7	.8	4.3	3.0	9.1	8.2	.6	1.6	2.5	.8	.2
26.....	.4	.8	.5	4.3	3.2	4.6	14.6	.5	1.5	3.1	.8	.2
27.....	.4	3.2	.5	2.4	2.7	3.8	7.2	.5	3.3	2.4	.7	.3
28.....	.4	3.4	.5	.9	2.6	3.2	5.9	.5	1.5	2.1	.7	.7
29.....	.3	3.0	.5	.7	4.8	2.9	5.1	.....	5.6	2.1	.6	.5
30.....	.3	2.1	.7	.7	20.0	2.6	4.4	.....	6.9	2.4	.6	.5
31.....	.3	1.1	.....	.7	.....	2.4	4.2	.....	4.3	.....	.5	.....

NOTE.—No record and discharge interpolated February 7-10, May 13-18, and June 29-30.

Monthly discharge of Honopou Stream near Huelo, Maui, for the year ending June 30, 1921.

Month.	Discharge.			Total run-off.		
	Million gallons per day.			Second-foot (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July.....	1.6	0.2	0.35	0.54	10.9	33
August.....	3.4	.3	.88	1.36	27.3	84
September.....	5.7	.5	1.93	2.99	57.9	178
October.....	4.3	.7	1.54	2.38	47.6	147
November.....	20.0	.7	2.90	4.49	87.0	267
December.....	9.1	2.4	4.46	6.90	138	424
January.....	70	2.3	13.5	20.9	418	1,280
February.....	3.4	.5	1.31	2.03	36.7	113
March.....	7.1	.4	1.56	2.41	48.5	148
April.....	7.9	2.1	3.60	5.57	108	331
May.....	2.1	.5	1.13	1.75	35.1	108
June.....	.7	.2	.40	.62	11.9	37
The year.....	70	.2	2.81	4.35	1,030	3,150

NEW HAMAKUA DITCH AT HONOPOU, NEAR HUELO, MAUI.

LOCATION.—300 feet below Honopou Stream crossing and 7 miles by road and trail west of Huelo. Station was moved May 13, 1921, to point 600 feet below Honopou Stream crossing and 15 feet above tunnel entrance.

RECORDS AVAILABLE.—January 25, 1918, to June 30, 1921.

GAGE.—Stevens continuous water-stage recorder.

DISCHARGE MEASUREMENTS.—Made from plank at old gage and from lehua logs across ditch at new station.

CHANNEL AND CONTROL.—Sides and bottom of ditch, hardpan and fairly smooth; banks steep, straight for 75 feet above and 25 feet below old site and 25 feet above and 1,000 feet, more or less, below new site. No well-defined control; stage discharge may be affected by collection of mud and gravel on bottom of ditch.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 5.29 feet at 7.45 p. m. January 16 (discharge, 113 million gallons per day or 175 second-feet); minimum stage recorded during year, 1.03 feet midnight to 4 a. m. July 15 (discharge, 10.0 million gallons per day or 15.5 second-feet).

1918-1921: Maximum stage recorded in January, 1921; minimum stage recorded, 0.62 foot at 12.40 p. m. August 25, 1918 (discharge, 7.7 million gallons per day, or 11.9 second-feet).

DIVERSIONS.—Ditch received greater part of flow of Koolau ditch at Alo division weir and diverts water from streams west of that point.

REGULATION.—By gates at frequent intervals.

OBJECT OF STATION.—To determine amount of water diverted from Territorial lands above to fee simple lands below.

UTILIZATION.—Water used for irrigation of sugar cane.

ACCURACY.—Stage-discharge relation changed December 27 by débris sliding into ditch, and May 13 by moving the station 300 feet downstream. All rating curves fairly well defined below 80 million gallons per day. Operation of water-stage recorder satisfactory. Records good.

Discharge measurements of New Hamakua ditch at Honopou, near Huelo, Maui, during the year ending June 30, 1921.

Date.	Made by—	Gage height (feet).	Discharge.	
			Second-feet.	Million gallons per day.
July 9	Reid Jerman.....	1.14	17.5	11.3
10	do.....	1.12	16.4	10.6
Aug. 2	do.....	2.96	83	54
Sept. 17	R. H. Remington.....	3.63	102	66
Oct. 27	do.....	3.62	108	70
Jan. 30	J. E. Stewart.....	2.76	63	41
Feb. 10	W. C. Renshaw.....	2.26	44.5	28.5
Mar. 17	E. M. Pickop.....	2.26	48.5	31.5
May 1	W. C. Renshaw.....	3.72	104	67
11	do.....	3.22	86	56

Discharge, in million gallons per day, of New Hamakua ditch at Honopou, near Huelo, Maui, for the year ending June 30, 1921.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	17.0	52	58	58	61	88	67	37	37	54	67	44
2	15.2	52	58	52	70	88	67	33	59	48	70	44
3	13.6	64	55	52	76	85	78	36	59	67	67	41
4	12.8	67	55	47	67	85	75	36	56	70	64	38
5	12.8	58	61	44	64	85	81	38	54	67	64	36
6	12.0	52	64	44	61	88	87	38	48	75	64	34
7	12.0	47	82	52	61	85	84	36	46	78	62	34
8	11.3	42	79	47	82	88	81	33	43	36	59	33
9	11.3	38	79	39	85	88	78	32	41	41	59	32
10	10.6	36	76	38	82	88	73	30	38	64	56	33
11	10.6	34	82	58	82	82	51	30	37	81	54	37
12	10.0	44	85	70	79	88	59	32	36	81	54	30
13	10.0	70	82	58	73	82	48	54	33	81	54	28
14	10.0	76	79	52	70	85	50	54	32	75	54	30
15	18.0	61	73	64	70	82	87	56	32	75	54	29
16	15.2	52	70	79	67	79	75	59	31	81	52	27
17	42	47	70	79	64	79	84	59	30	78	54	28
18	44	44	70	73	61	76	73	59	43	75	69	28
19	26	39	64	42	58	73	70	59	54	70	69	38
20	26	64	64	44	73	70	59	54	41	73	75	28
21	64	73	61	44	88	70	38	51	48	70	72	23
22	76	61	55	47	88	67	32	51	38	73	66	22
23	70	67	55	61	85	76	34	48	34	81	66	22
24	61	61	55	61	85	82	32	46	70	81	78	21
25	61	70	50	73	82	82	48	38	64	75	69	20.0
26	52	73	47	70	88	37	64	37	62	78	63	21
27	47	82	42	70	85	30	43	37	75	73	60	28
28	47	70	39	67	82	10.8	43	36	64	70	57	66
29	47	64	42	64	82	14.8	48	-----	67	70	54	63
30	58	64	55	64	91	18.1	43	-----	81	73	49	44
31	52	61	-----	61	-----	34	43	-----	78	-----	46	-----

Monthly discharge of New Hamakua ditch at Huelo, Maui, for the year ending June 30, 1921.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July	76	10.0	31.5	48.7	975	3,000
August	82	34	57.6	89.1	1,780	5,480
September	85	39	63.6	98.4	1,910	5,860
October	79	38	57.2	88.5	1,770	5,440
November	91	58	75.4	117	2,260	6,940
December	88	10.8	70.5	109	2,190	6,710
January	87	32	61.1	94.5	1,900	5,810
February	59	30	43.2	66.8	1,210	3,710
March	81	30	49.4	76.4	1,530	4,700
April	81	36	70.5	109	2,110	6,490
May	78	46	61.3	94.8	1,900	5,830
June	66	20.0	33.4	51.7	1,000	3,080
The year	91	10.0	56.3	87.1	20,500	63,000

OLD HAMAKUA DITCH AT HONOPOU, NEAR HUELO, MAUI.

LOCATION.—250 feet below intake in Honopou Stream and 7 miles by road and trail west of Huelo.

RECORDS AVAILABLE.—January 25, 1918, to June 30, 1921.

GAGE.—Stevens continuous water-stage recorder.

DISCHARGE MEASUREMENTS.—Made from plank at gage.

CHANNEL AND CONTROL.—Sides and bottom of ditch are hardpan with small amount of rock and gravel; banks high and steep; straight for 250 feet above and 150 feet below gage. Original concrete control has been completely covered by a bed of gravel.

EXTREMES OF DISCHARGE.—1918–1921: Maximum stage recorded, 3.25 feet at 8.10 p. m January 16, 1921 (discharge, 58 million gallons per day, or 90 second-feet); minimum stage recorded, ditch dry July 1 to 15, 1920, and frequently during April, May, and June, 1921.

DIVERSIONS.—Ditch heads at Nailiilihaele Stream and picks up water from streams west of that point.

REGULATION.—By gates at frequent intervals.

OBJECT OF STATION.—To determine amount of water diverted from Territorial lands.

UTILIZATION.—Water used for irrigation of sugar cane.

ACCURACY.—Stage-discharge relation shifting. Rating curves used July 1 to January 16 fairly well defined between 0.4 and 30 million gallons per day. Rating curve used January 17 to June 30 not well defined. Operation of water-stage recorder unsatisfactory. Records fair when water-stage recorder was operating.

Discharge measurements of Old Hamakua ditch at Honopou near Huelo, Maui, during the year ending June 30, 1921.

Date.	Made by—	Gage height (feet).	Discharge.	
			Second-feet.	Million gallons per day.
July 18	R. H. Remington	0.45	0.3	0.2
Aug. 2	do	.44	.2	.15
Sept. 17	do	.42	.2	.15
Oct. 27	do	.46	.4	.25
Jan. 30	J. E. Stewart	.57	.07	.04
May 11	W. C. Renshaw	.57	.05	.03

Discharge, in million gallons per day, of Old Hamakua ditch at Honopou, near Huelo, Maui, for the year ending June 30, 1921.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.
1			0.1	0.1	0.1	30	0.1	0.01	0.08		0.2
2			.09	.08	.3	13.3	.1	.04	.1		.2
3		0.6	.08	.09	.4	5.6	4.4	.05	.04		.2
4		.6		.08	.2	1.4	4.6	.1	.04		.15
5		.3		.07	.2	.9	23	.08	.04		.1
6		.2		.07	.1	12.8	39	.08	.04		.1
7		.1		.07	.08	4.7	38	.1	.04	0.02	.1
8		.09		.08	23	19.3	34	.1	.04	.01	.1
9		.09		.07	18.4	27	33	.08	.04		.05
10		.08		.06	11.5	27	21	.05	.04		.04
11		.08		.7	4.4	20.0	10.4	.04	.04		.02
12		.4		1.5	.6	8.3	19.3	.02	.02	.6	.01
13		1.0		.1	.4	12.5	15.3	.05	.02	1.2	.01
14		.4		.08	.2	26	19.4	.1	.02	.5	
15		.2		7.7	.2	19.3	39	.1	.01	.85	.01
16	0.1	.1		6.8	.2	11.5	36	.1	.01	5.9	
17	.1	.08		1.0	.1	3.5	26	.15	.01	2.2	
18	.2		.1	9.7	.1	.5	11.4	.15	.02	1.6	.1
19	.08		.1	18.1	.1	.3	7.2	.15	.05	1.4	.1
20	.08		.1	22	3.9	.3	5.2	.1	.04	1.9	.2
21	.7		.1	20.0	27	.2	.3	.1	.02	1.5	.15
22	2.6		.1	13.3	23	.2	.15	.1	.01	1.9	.05
23	1.0		.2	.3	12.4	2.5	.1	.1	.01	7.4	.05
24	.3		.2		5.2	6.8	.08	.08	.2	2.0	.9
25			.1		.8	28	.2	.05	.02	.45	
26			.09		9.9	30	.2	.05	.15	1.5	
27			.08		1.5	30	.08	.05	.3	.25	
28		.2	.08	.4	.5	21	.04	.04	.05	.2	
29		.1	.08	.2	4.2	20.0	.02		.01	.2	
30		.1	.09	.2	36	15.4	.01		.02	.3	
31		.1		.1		.09	.01				

NOTE.—Discharge estimated in million gallons per day as follows: July 25-31, 0.2; Aug. 1-2, 0.2; Aug. 18-27, 0.1; Sept. 4-17, 9; Oct. 24-27, 4; June 25-30, 0.0.

Monthly discharge of Old Hamakua ditch at Honopou, near Huelo, Maui, for the year ending June 30, 1921.

Month.	Discharge.			Total run-off.		
	Million gallons per day.			Second-foot (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July (16 days)	2.6	0.08	0.410	0.634	6.56	20
August	1.0		.201	.311	6.22	19
September		.08	4.26	6.59	128	392
October	22	.06	3.84	5.94	119	365
November	36	.08	6.17	9.55	185	568
December	30	.09	12.9	20.0	398	1,230
January	39	.01	12.5	19.3	388	1,190
February	.15	.01	.079	.122	2.22	7
March (30 days)	.3	.01	.051	.079	1.53	5
April (21 days)	7.4	.01	1.52	2.35	31.9	98
May (21 days)	.9	.01	.135	.209	2.84	9
The year (300 days)	39	.01	4.23	6.54	1,270	3,900

NOTE.—No flow in June.

NEW HAMAKUA DITCH AT HALEHAKU WEIR, NEAR HUELO, MAUI.

LOCATION.—Just above crossing of Halehaku Stream, 7 miles by trail west of Huelo post office.

RECORDS AVAILABLE.—January 1, 1910, to June 30, 1921.

GAGE.—Friez water-stage recorder.

DISCHARGE MEASUREMENTS.—Made by 25-foot Cippoletti weir.

CHANNEL AND CONTROL.—Large pool at weir.

EXTREMES OF DISCHARGE.—See monthly-discharge table.

DIVERSION.—None.

REGULATION.—By gates at frequent intervals.

OBJECT OF STATION.—Halehaku weir is one of four weirs which measure water diverted from Territorial lands by the Old and New Hamakua, Lowrie and Haiku ditches, by the East Maui Irrigation Co.

UTILIZATION.—Water used for irrigation of sugar cane.

ACCURACY.—Records good.

COOPERATION.—Daily-discharge records copied from records of East Maui Irrigation Co.

Discharge, in million gallons per day, of New Hamakua ditch at Halehaku weir, near Huelo, Maui, for the year ending June 30, 1921.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1.....	10.9	33.3	45.4	52.6	49.2	68.5	40.5	39.9	25.4	34.4	62.7	22.2
2.....	11.7	33.3	42.6	38.8	52.1	69.2	46.4	37.2	28.5	45.3	51.5	20.7
3.....	9.7	40.8	39.4	35.5	68.4	69.2	67.5	39.1	53.7	56.6	54.8	20.5
4.....	9.2	62.2	35.3	34.4	64.5	69.0	69.2	38.2	52.2	60.4	51.2	20.3
5.....	8.4	46.8	39.3	29.2	53.9	69.2	69.6	41.0	48.1	62.0	43.4	20.2
6.....	7.9	34.1	45.7	28.4	45.3	68.9	50.2	40.5	39.4	60.6	48.5	18.8
7.....	7.4	29.4	66.3	34.0	39.4	69.2	34.3	38.2	31.0	52.7	40.5	18.4
8.....	.....	26.4	68.6	33.1	61.1	69.4	33.6	35.3	28.2	36.8	36.7	17.8
9.....	.....	26.2	68.3	27.1	69.6	69.1	33.9	33.4	27.0	43.2	35.1	17.8
10.....	.....	23.1	66.7	24.0	68.7	68.0	36.1	32.5	23.1	47.6	32.6	17.1
11.....	.....	23.5	68.9	37.0	67.4	66.8	36.7	33.5	21.5	45.9	31.4	18.3
12.....	.....	25.3	70.3	66.0	67.5	68.9	43.4	35.1	21.9	45.9	30.8	17.2
13.....	.....	46.3	68.6	59.3	67.8	68.3	46.2	48.4	21.3	45.7	31.5	17.0
14.....	.....	7	67.4	69.2	45.6	62.5	70.2	47.9	47.6	20.4	50.0	27.2
15.....	.....	5.4	56.8	67.6	57.6	60.7	68.9	53.2	47.9	20.2	66.5	27.3
16.....	.....	13.4	47.2	66.2	68.1	59.1	68.9	54.3	55.2	20.0	68.4	27.8
17.....	.....	32.4	40.3	66.8	68.1	52.5	68.9	26.9	47.9	19.2	67.0	27.5
18.....	.....	38.9	31.1	66.4	50.3	43.8	69.8	13.1	42.3	20.8	64.3	40.2
19.....	.....	26.2	25.4	65.3	.....	37.5	68.6	9.3	44.3	36.2	63.4	59.0
20.....	.....	21.7	38.0	60.7	.....	51.5	68.1	17.8	37.4	31.5	67.1	61.7
21.....	.....	53.6	63.0	47.4	.....	69.5	64.3	40.3	33.1	30.2	61.5	60.7
22.....	.....	67.9	52.3	38.5	11.7	69.4	57.9	35.4	30.8	31.6	65.8	56.5
23.....	.....	65.3	56.8	35.5	57.9	68.5	60.0	36.5	29.5	21.7	67.5	42.7
24.....	.....	59.1	54.3	35.8	52.3	68.4	58.3	36.0	28.3	53.3	68.4	48.2
25.....	.....	58.8	60.7	40.9	63.2	68.1	17.7	43.2	27.5	53.7	67.3	56.2
26.....	.....	50.3	69.5	38.9	67.0	68.4	14.8	53.9	26.4	57.9	67.4	49.8
27.....	.....	40.6	68.2	36.6	65.8	68.4	7.6	47.8	24.9	66.4	68.0	38.3
28.....	.....	35.2	67.3	34.3	66.2	68.3	5.5	45.7	24.8	63.3	64.6	31.0
29.....	.....	27.7	61.6	33.7	63.8	67.1	5.6	48.4	.....	60.9	66.0	28.2
30.....	.....	41.6	57.3	45.9	59.4	66.9	5.8	44.2	.....	60.8	63.1	26.5
31.....	.....	34.0	53.9	.....	52.1	.....	18.4	45.5	.....	34.3	.....	24.7

NOTE.—No flow on days for which discharge is not given.

Monthly discharge of New Hamakua ditch at Halehaku weir, near Huelo, Maui, for the year ending June 30, 1921.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-foot (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July (25 days).....	67.9	0.7	29.5	45.6	738	2,260
August.....	69.5	23.1	45.9	71.0	1,420	4,370
September.....	70.3	33.7	52.5	81.2	1,580	4,830
October (28 days).....	68.1	11.7	48.2	74.6	1,350	4,140
November.....	69.6	37.5	60.8	94.1	1,830	5,600
December.....	70.2	5.5	54.6	84.5	1,690	5,190
January.....	69.6	9.3	42.2	65.3	1,310	4,010
February.....	55.2	24.8	37.2	57.6	1,040	3,200
March.....	66.4	19.2	36.3	56.2	1,120	3,450
April.....	68.4	34.4	58.1	89.9	1,740	5,350
May.....	62.7	24.7	41.4	64.1	1,280	3,940
June.....	56.4	11.3	19.2	29.7	576	1,770
The year (356 days).....	70.3	.7	44.0	68.1	15,700	48,100

KAUHIKOA DITCH AT OPANA WEIR, NEAR HUELO, MAUI.

LOCATION.—A short distance below crossing of Opana Stream and 8 miles by road west of Huelo post office.

RECORDS AVAILABLE.—January 1, 1910, to June 30, 1921.

GAGE.—Friez water-stage recorder.

DISCHARGE MEASUREMENTS.—Made by 25-foot sharp-crested weir.

CHANNEL AND CONTROL.—Large pool at weir.

EXTREMES OF DISCHARGE.—See monthly-discharge table.

DIVERSIONS.—None.

REGULATION.—By gates at frequent intervals.

OBJECT OF STATION.—Opana weir is one of four weirs which measure water diverted from Territorial lands by the Old and New Hamakua, Lowrie, and Haiku ditches, by the East Maui Irrigation Co.

UTILIZATION.—Water used for irrigation of sugar cane.

ACCURACY.—Records good.

COOPERATION.—Daily-discharge record copied from records of East Maui Irrigation Co.

Discharge, in million gallons per day, of Kauhikoa ditch at Opana weir, near Huelo, Maui, for the year ending June 30, 1921.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1.....	0.4	0.4	0.4	1.8	1.0	43.8	4.8	3.8	1.0	26.1	9.5	2.3
2.....	.4	.4	.4	1.2	1.4	27.8	4.8	3.2	4.4	8.0	7.0	2.3
3.....	.4	.4	.4	.8	2.6	17.9	7.9	2.7	9.1	7.0	6.7	2.0
4.....	.4	1.0	.4	.6	1.8	12.1	9.9	2.2	3.7	6.9	6.1	1.9
5.....	.4	.4	.4	.6	1.2	10.5	34.4	1.8	3.0	7.0	5.5	2.0
6.....	.4	.4	1.6	.6	.7	22.6	22.7	1.5	2.8	18.9	5.6	1.9
7.....	.4	.4	14.6	.6	.6	14.4	.4	1.4	2.6	34.6	5.2	1.9
8.....	3.3	.4	5.1	.6	42.8	32.0	.4	1.2	2.4	25.2	4.6	1.8
9.....	6.9	.4	5.4	.5	40.7	51.6	.4	1.1	2.1	15.6	4.5	1.8
10.....	6.7	.4	3.8	.5	24.1	52.1	.4	1.0	1.9	15.2	4.5	1.7
11.....	5.9	.4	16.3	.5	14.8	38.9	.4	1.0	1.7	15.7	4.4	1.8
12.....	5.6	.4	13.0	5.5	6.9	24.2	2.6	1.0	1.5	15.7	3.7	1.6
13.....	6.0	.4	8.3	.6	5.0	25.6	4.8	1.0	1.4	15.7	3.7	1.6
14.....	6.0	4.3	5.4	.7	3.8	53.0	4.8	1.0	1.4	15.5	3.4	1.6
15.....	6.9	.8	3.5	5.6	3.5	48.0	5.0	1.1	1.3	13.4	3.2	1.6
16.....	.0	.4	2.7	13.5	3.3	30.1	5.0	1.2	1.3	23.4	3.1	1.6
17.....	.6	.4	2.6	9.6	2.8	17.1	5.4	1.4	1.3	16.9	3.1	1.6
18.....	.4	.4	2.4	21.5	2.4	11.7	4.8	1.2	1.7	13.8	4.8	1.6
19.....	.2	.4	2.1	59.1	2.0	8.1	4.8	1.3	2.0	11.5	4.8	1.7
20.....	.6	.4	1.8	64.0	6.4	6.2	4.8	1.3	1.8	11.4	5.7	1.8
21.....	1.7	3.0	1.3	61.6	44.5	5.5	4.8	1.2	1.7	9.6	4.8	1.6
22.....	6.7	.8	1.0	51.0	40.5	4.9	4.7	1.2	1.2	10.4	4.1	1.5
23.....	3.9	.4	.8	1.7	26.8	10.5	4.8	1.2	1.2	18.3	3.3	1.5
24.....	1.4	.4	.8	1.3	13.7	26.9	4.7	1.2	12.5	16.9	7.1	1.5
25.....	1.6	1.1	.7	11.6	7.2	22.4	4.5	1.2	7.4	12.0	4.7	1.4
26.....	.6	2.4	.6	3.3	17.3	21.2	5.1	1.2	6.1	13.6	3.8	1.4
27.....	.3	13.9	.6	2.5	9.3	26.2	4.8	1.2	10.3	10.1	4.0	2.4
28.....	.4	4.6	.6	2.7	6.8	18.6	4.8	1.1	6.6	7.0	2.7	5.6
29.....	.4	.9	.6	2.1	7.6	18.6	4.6	.....	11.8	7.5	2.4	3.6
30.....	.4	.4	1.3	1.7	65.7	18.6	4.1	.....	38.2	9.7	2.4	2.6
31.....	.4	.4	.....	1.1	.....	13.9	4.1	.....	33.6	.....	2.4	.....

Monthly discharge of Kauhikoa ditch at Opana weir, near Huelo, Maui, for the year ending June 30, 1921.

Month.	Discharge.			Total run-off.		
	Million gallons per day.			Second-foot (mean).	Million gallons,	Acre-feet.
	Maximum.	Minimum.	Mean.			
July (30 days).....	6.9	0.2	2.32	3.59	69.7	214
August.....	13.9	.4	1.33	2.06	41.2	127
September.....	16.3	.4	3.30	5.11	98.9	304
October.....	64.0	.5	10.6	16.4	330	1,010
November.....	65.7	.6	13.6	21.0	497	1,250
December.....	53.0	4.9	23.7	36.7	735	2,250
January.....	34.4	.4	5.79	8.96	180	551
February.....	3.8	1.0	1.46	2.23	40.9	125
March.....	38.2	1.0	5.77	8.93	179	549
April.....	34.6	6.9	14.4	22.3	433	1,330
May.....	9.5	2.4	4.54	7.02	141	432
June.....	5.6	1.4	1.97	3.05	59.2	181
The year (364 days).....	65.7	.2	7.46	11.5	2,710	8,320

LOWRIE DITCH AT OPANA WEIR, NEAR HUELO, MAUI.

LOCATION.—A short distance west of Halehaku Gulch, and 8 miles by road northwest of Huelo post office.

RECORDS AVAILABLE.—January 1, 1910, to June 30, 1921.

GAGE.—Friez water-stage recorder.

DISCHARGE MEASUREMENTS.—Made by sharp-crested weir 16½ feet long, with bottom and end contractions.

CHANNEL AND CONTROL.—Large pool back of weir.

EXTREMES OF DISCHARGE.—See monthly-discharge table.

DIVERSIONS.—None.

REGULATION.—By gates at frequent intervals.

OBJECT OF STATION.—Opana weir is one of four weirs which measure water diverted from Territorial lands by the Old and New Hamakua, Lowrie, and Haiku ditches, by the East Maui Irrigation Co.

UTILIZATION.—Water used for irrigation of sugar cane.

ACCURACY.—Records good.

COOPERATION.—Daily-discharge record copied from records of East Maui Irrigation Co.

Discharge, in million gallons per day, of Lowrie ditch at Opana weir, near Huelo, Maui, for the year ending June 30, 1921.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1.....	14.2	38.1	43.6	44.1	50.2	55.3	53.9	25.7	29.4	54.3	51.6	29.3
2.....	12.2	38.9	41.9	42.6	53.1	55.2	55.6	27.0	46.7	54.4	54.3	29.1
3.....	11.0	53.5	44.7	42.7	54.4	55.1	55.4	32.6	54.7	54.4	54.4	27.2
4.....	9.6	53.0	45.0	34.9	52.5	55.1	55.8	24.2	42.9	54.4	53.2	25.6
5.....	9.7	38.4	51.9	32.7	56.0	55.1	56.6	21.8	49.3	54.6	51.2	24.6
6.....	8.9	37.7	52.4	37.4	45.9	55.1	58.1	19.6	41.6	54.7	49.6	24.2
7.....	8.8	32.8	53.9	44.1	48.5	55.1	56.9	18.2	32.5	55.1	49.1	23.5
8.....	8.4	30.3	54.2	35.3	54.2	55.4	56.7	16.7	30.0	55.0	48.4	23.2
9.....	6.4	20.5	54.4	30.7	54.4	55.9	56.4	15.9	27.5	54.6	44.1	23.0
10.....	6.1	26.4	54.4	29.0	55.4	55.8	56.4	15.0	24.9	54.9	40.2	22.6
11.....	6.1	23.1	54.7	32.4	55.2	53.3	56.4	20.2	27.8	55.2	37.7	25.4
12.....	6.2	36.1	54.2	54.3	55.1	55.2	56.4	23.9	26.0	55.2	43.5	20.8
13.....	6.2	51.7	55.7	37.5	55.9	55.2	56.3	36.4	24.7	55.3	40.4	16.4
14.....	6.0	54.7	55.7	50.5	55.1	55.5	57.3	41.5	24.4	55.1	34.7	21.1
15.....	14.5	42.6	55.2	53.2	54.5	55.4	59.0	49.6	23.9	54.7	35.7	19.5
16.....	12.3	47.7	53.6	55.1	55.2	55.4	58.7	54.2	23.1	55.0	33.0	18.9
17.....	38.6	35.0	54.2	54.7	44.7	55.2	57.4	45.3	22.5	55.0	35.0	18.7
18.....	33.2	29.7	47.9	54.9	43.4	55.1	55.6	47.7	33.8	55.5	51.4	18.6
19.....	24.6	29.4	44.2	53.6	44.4	55.1	55.2	43.8	46.5	55.4	52.2	30.0
20.....	13.1	51.5	47.0	54.2	50.9	55.1	52.0	39.2	25.7	55.2	52.5	16.3
21.....	51.5	55.0	50.3	53.2	55.1	54.8	44.9	36.1	37.3	54.8	49.3	15.5
22.....	50.8	44.6	40.7	47.9	55.1	54.9	39.2	34.0	22.1	54.8	52.1	15.8
23.....	54.4	54.5	43.0	37.9	55.1	56.2	32.0	33.0	25.9	54.4	49.5	16.0
24.....	45.5	46.2	41.6	45.3	55.1	55.9	28.3	31.9	51.6	54.4	54.5	15.7
25.....	49.9	52.9	32.1	54.7	55.1	56.5	36.1	30.4	54.0	54.4	47.8	14.6
26.....	49.4	53.8	29.7	54.3	55.1	53.8	55.2	28.5	47.4	54.4	47.8	15.5
27.....	37.7	54.9	28.5	54.1	55.1	49.6	46.5	28.4	54.7	54.4	42.3	20.6
28.....	32.6	54.6	26.0	53.2	55.0	55.5	28.9	28.6	54.2	54.1	37.2	51.1
29.....	31.5	53.2	27.3	45.0	54.8	51.0	29.2	.....	54.5	54.7	35.4	53.8
30.....	46.4	54.7	43.9	51.4	55.6	45.5	24.6	.....	54.7	54.4	33.9	32.6
31.....	38.6	51.2	.....	54.1	.....	41.5	27.1	.....	54.2	.....	41.7	.....

Monthly discharge of Lowrie ditch at Opana weir, near Huelo, Maui, for the year ending June 30, 1921.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-foot (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July.....	54.4	6.0	24.0	37.1	744	2,280
August.....	55.0	20.5	43.4	67.1	1,350	4,130
September.....	55.7	26.0	46.1	71.3	1,330	4,240
October.....	55.1	29.0	46.0	71.2	1,420	4,380
November.....	56.0	43.4	53.0	82.0	1,590	4,880
December.....	56.5	41.5	54.2	83.9	1,680	5,160
January.....	59.0	24.6	49.0	75.8	1,520	4,660
February.....	54.2	15.0	31.0	48.0	869	2,660
March.....	54.7	22.1	37.7	58.3	1,170	3,590
April.....	55.5	54.1	54.8	84.8	1,640	5,050
May.....	54.5	31.7	45.0	69.6	1,390	4,280
June.....	53.8	14.6	23.6	36.5	709	2,170
The year.....	59.0	6.0	42.4	65.6	15,500	47,500

HAIKU DITCH AT MANAWAI GULCH, NEAR PEAHI, MAUI.

LOCATION.—In bottom of western branch of Manawai Gulch just west of Keaaula Opana boundary, 8 miles by road northwest of Huelo post office.

RECORDS AVAILABLE.—January 1, 1910, to June 30, 1921.

GAGE.—Friez water-stage recorder.

DISCHARGE MEASUREMENT.—Made by sharp-crested weir, 16½ feet long with bottom and end contractions.

CHANNEL AND CONTROL.—Large pool at weir.

EXTREMES OF DISCHARGE.—See monthly-discharge table.

DIVERSIONS.—None.

REGULATION.—By gates at frequent intervals.

OBJECT OF STATION.—Peahi weir is one of four weirs which measure water diverted from Territorial lands by the Old and New Hamakua, Lowrie, and Haiku ditches, by the East Maui Irrigation Co.

UTILIZATION.—Water used for irrigation of sugar cane.

ACCURACY.—Records good.

COOPERATION.—Daily-discharge record copied from records of East Maui Irrigation Co.

Discharge, in million gallons per day, of Haiku ditch at Manawai Gulch, near Peahi, Maui, for the year ending June 30, 1921.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1.....	1.5	1.4	11.9	9.6	11.0	88.8	33.8	49.5	3.8	76.1	28.0	1.6
2.....	1.3	1.4	7.0	2.5	27.0	83.0	37.8	40.7	48.5	50.6	16.7	1.6
3.....	1.2	14.8	2.4	5.7	47.7	79.8	60.2	47.9	52.1	51.2	27.1	1.6
4.....	1.1	29.8	2.2	2.2	15.9	65.5	51.2	33.6	7.1	21.6	10.0	1.6
5.....	1.1	2.2	4.7	1.7	13.2	62.3	84.3	28.8	10.0	23.2	5.9	1.6
6.....	1.1	1.6	14.8	1.9	2.6	84.9	88.2	25.0	4.1	62.2	15.5	1.6
7.....	1.1	1.4	77.0	2.1	3.7	78.0	86.9	23.5	3.8	90.0	3.5	1.6
8.....	1.1	1.4	59.2	1.8	61.9	87.9	81.4	21.5	8.3	90.0	3.4	1.6
9.....	3.5	1.4	55.1	1.6	79.4	90.0	78.8	20.1	6.1	89.3	3.3	1.6
10.....	1.1	3.6	47.6	1.6	64.4	89.8	73.3	19.1	3.1	80.4	3.1	1.6
11.....	1.1	5.7	72.0	18.0	56.5	87.0	67.7	20.4	3.1	89.0	3.0	1.5
12.....	1.1	1.9	64.0	42.4	52.3	74.8	82.6	20.3	3.1	89.7	2.8	1.5
13.....	1.1	42.9	64.4	7.7	29.3	80.9	90.0	18.6	3.0	86.3	2.6	1.5
14.....	1.1	59.5	58.0	3.5	25.5	90.0	88.1	17.1	3.0	78.3	2.5	1.6
15.....	2.2	8.4	44.0	36.5	22.3	85.2	87.4	16.0	2.8	69.5	2.7	1.6
16.....	1.5	6.4	35.1	62.2	17.8	76.2	89.6	24.5	2.7	87.2	2.6	1.6
17.....	22.4	7.1	40.6	57.1	15.6	69.0	90.0	6.8	2.6	73.9	2.7	1.6
18.....	4.9	3.0	14.2	58.6	5.3	53.3	89.6	10.1	2.6	66.4	31.1	1.6
19.....	1.9	1.5	4.4	52.4	2.5	37.0	86.1	7.8	4.7	42.4	51.9	1.5
20.....	1.6	10.6	4.1	32.8	25.1	23.9	76.4	6.1	3.2	57.4	35.5	1.4
21.....	32.2	40.6	3.9	12.7	84.3	14.2	68.9	5.2	6.8	44.1	12.5	1.5
22.....	55.3	6.4	3.7	3.4	85.8	10.3	71.8	4.9	3.0	55.7	4.8	1.5
23.....	53.2	20.4	3.5	2.8	70.0	58.8	65.3	4.8	2.4	74.6	4.4	1.5
24.....	28.7	6.2	3.3	8.8	63.7	72.6	57.4	4.6	76.3	71.3	31.5	1.6
25.....	22.0	30.0	2.0	80.3	58.2	87.4	63.9	4.4	68.7	58.9	20.2	1.6
26.....	1.2	34.1	2.0	68.6	67.4	77.1	81.5	4.0	17.7	65.3	7.5	1.6
27.....	.6	69.7	2.0	24.4	62.4	61.2	53.6	3.8	87.9	35.1	2.9	1.6
29.....	.3	55.6	2.0	13.6	51.7	29.8	51.2	3.8	75.5	16.3	2.5	44.2
29.....	1.8	16.0	2.0	4.0	59.1	17.8	58.4	.....	64.8	34.0	2.5	34.1
30.....	6.2	15.4	16.2	5.5	88.5	15.6	59.6	.....	90.0	59.9	2.4	3.1
31.....	1.5	9.2	.....	10.8	.....	15.4	63.5	.....	90.0	.....	1.9	.....

Monthly discharge of Haiku ditch at Manawai Gulch, near Peahi, Maui, for the year ending June 30, 1921.

Month.	Discharge.			Second-foot (mean).	Total run-off.	
	Million gallons per day.				Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July.....	55.5	0.3	8.26	12.8	256	786
August.....	69.7	1.4	16.4	25.4	510	1,560
September.....	77.0	2.0	24.1	37.3	723	2,220
October.....	80.3	1.6	20.5	31.7	637	1,950
November.....	88.5	2.5	42.3	65.4	1,270	3,890
December.....	90.0	10.3	62.8	97.2	1,950	5,970
January.....	90.0	33.8	71.6	111	2,220	6,810
February.....	49.5	3.8	17.6	27.2	493	1,510
March.....	90.0	2.4	24.6	38.1	762	2,340
April.....	90.0	16.3	63.0	97.5	1,890	5,800
May.....	51.9	1.9	11.2	17.3	347	1,070
June.....	44.2	1.4	4.12	6.37	124	379
The year.....	90.0	.3	30.6	47.3	11,200	34,300

MISCELLANEOUS MEASUREMENTS.

Measurement of streams and ditches on the Island of Maui at points other than regular gaging stations are listed below.

Miscellaneous discharge measurements on Maui during the year ending June 30, 1921.

Date.	Stream.	Tributary to—	Locality.	Gage height.	Discharge.	Million gallons per day.
				Feet.	Second-feet.	Sq. miles
Dec. 22	Honokahau tunnel spillway.	H o n o k a h a u Stream.	Crosscut No. 15, near Honokahau.	.....	0.85	0.55
22	Honolua.....	Pacific Ocean.....	At Honolua ditch intake, near Honokahau.	.....	.95	.6
22	Honolua ditch.....	.....	200 feet below Honolua Stream, near Honokahau.	.....	12.2	7.9
22	.....do.....	.....	Crosscut No. 2, near Honokahau.	.....	15.9	10.3
22	Development tunnel ditch above intake of Honolua ditch.	.....	Near Honokahau.....	.....	2.9	1.85
Dec. 21	Honolua ditch.....	.....	Mailepai, near Honokahau..	.....	11.6	7.5
21	.....do.....	.....	Mahinahina weir, near Honokahau.	.....	9.7	6.2
July 6	Ukumehame ^a	Pacific Ocean.....	Near Olowalu.....	1.05	3.0	1.95
20	.....do ^a.....	.....do.....	.....do.....	1.06	3.3	2.1
Sept. 7	.....do ^a.....	.....do.....	.....do.....	1.17	7.4	4.8
Oct. 19	.....do ^a.....	.....do.....	.....do.....	1.07	3.8	2.5
Nov. 5	Nuanualoa.....	.....do.....	Near Kaupo.....	.....	.35	.25
5	Alelele.....	.....do.....	Near Kipahulu.....	.....	6.3	4.0
6	.....do.....	.....do.....	.....do.....	.....	2.7	1.75
6	.....do.....	.....do.....	.....do.....	.....	1.75	1.1
5	Lelekeoili.....	.....do.....	.....do.....	.....	7.0	4.5
5	Lelekeanu.....	.....do.....	.....do.....	.....	5.8	3.7
6	.....do.....	.....do.....	.....do.....	.....	.35	.25
5	Kuikuilua.....	.....do.....	.....do.....	.....	3.7	2.4
5	.....do.....	.....do.....	400 feet above trail crossing, near Kipahulu.	.....	1.55	1.0
7	.....do.....	.....do.....	.....do.....	.....	.2	.1
7	Oheo.....	.....do.....	Near Kipahulu.....	.....	3.0	1.95
6	Middle Branch of Oheo.	Oheo Stream.....	At elevation 1,700 feet, near Kipahulu.	.....	4.3	2.8
6	.....do.....	.....do.....	.....do.....	.....	3.8	2.5
7	Maluhonaiwi.....	Pacific Ocean.....	.....do.....	.....	.3	.2
7	Hahalawe.....	.....do.....	.....do.....	.....	1.75	1.1
7	Kaili.....	.....do.....	.....do.....	.....	.65	.45
7	Waieli.....	.....do.....	.....do.....	.....	.75	.5
7	Honolewa.....	.....do.....	.....do.....	.....	.95	.6
7	Manamana.....	.....do.....	.....do.....	.....	1.8	1.15
July 30	Koolau ditch.....do.....	At Nahiku weir, near Nahiku.	.47	14.0	9.1

^a Made at former gaging station.



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