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UNITED STATES GEOLOGICAL SURVEY
GEORGE OTIS SMITH, Director

Water-Supply Paper 445

SURFACE WATER SUPPLY OF HAWAII

JULY 1, 1915 TO JUNE 30, 1916

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Prepared in cooperation with the
TERRITORY OF HAWAII

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CONTENTS.

SURFACE WATER SUPPLY OF HAWAII, JULY 1, 1915, TO JUNE 30, 1916.

AUTHORITY FOR INVESTIGATIONS.

This volume contains results of measurements of the flow of certain streams and ditches and rainfall records of the Territory of Hawaii made during the year ending June 30, 1916. 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.

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 on 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 other-

wise, 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 on July 1, 1913.

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.

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; after this date it was represented by the Board of Commissioners of Agriculture and Forestry.

[1] The United States Geological Survey also cooperated with the Territory of Hawai'i in mapping several islands. The whole of the islands of Kauai and Oahu, and a part of the island of Hawai' have been mapped.

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 Federal 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 of class 4, in which responsibility for the accuracy of the records has not rested with the Survey, has been acknowledged in the descriptions of the various stations. Cooperation of the other classes is hereby gratefully acknowledged as follows: Island of Kauai—Hawaiian Sugar Co., Mr. Charles Rice, Makee Sugar Co., Kauai Electric Co., Waimea Sugar Co., and Lihue Plantation Co.; Island of Oahu—United States Army Constructing Quartermaster Department, Wahiawa Water Co., Kahuku Plantation, Laie Plantation, Koolau Agricultural Co. Waiahole Water Co., Kaneohe Ranch Co., and Maunawili Ranch; Island of Maui—Wailuku Sugar Co., Pioneer Mill Co., Olowalu Sugar Co., and Honolua Ranch.

SCOPE OF WORK.

The investigations of stream and ditch flow in 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 four 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 admit of definite conclusions.

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

Investigations of ditch seepage and other losses, in many localities, were made in cooperation with the United States Army and private corporations.

FIELD METHODS OF MEASURING STREAM FLOW.

BASE DATA.

In making plans for power, irrigation, municipal water supply, and other projects involving the use of water from surface streams it is necessary to have data from which both the total flow of the stream and its distribution from day to day throughout the year can be obtained. The data necessary for obtaining such information are daily gage-heights, which give the fluctuations of rise and fall of the stream, and measurements of discharge at various stages, from which a rating curve and table can be prepared, giving the discharge for any stage. Such a rating is possible from the fact that so long as the conditions at the controlling point in the stream remain the same there will be approximately the same discharge for any given gage height.

The determination of a discharge is termed a discharge measurement, and points at which discharge measurements are made and records of daily fluctuations of stage are kept for determining the daily flow are termed gaging stations.

Gaging stations may be divided into two classes, known as weir stations and velocity-area stations. At weir stations the head of water on the crest of the weir is measured and the discharge computed by means of a formula. The discharge at velocity-area stations is obtained by measuring the velocity of the current and the area of the cross section, the product of the two giving the discharge.

The data presented in this paper were collected at both weir and velocity-area stations.

WEIR MEASUREMENTS.

Unquestionably a weir properly constructed and of a type for which accurate coefficients have been determined is one of the most convenient and reliable means of measuring small quantities of water. In practice, however, weirs rarely conform to the requirements imposed by the experimenter who derived the coefficients. If the crest of the weir is sharp and clean and sufficiently high above the bottom of the leading channel and the end contractions are complete and the velocity of approach is wanting, or negligibly small, and, if the head on crest is measured at a distance back of the overfall of at least the weir crest length, the Francis formula will give good results.

On the other hand, if these essential conditions are not complied with, especially if the velocity of approach is considerable and the contractions are imperfect, the Francis formula will not give accurate results. This is particularly true if the weir is improperly constructed and there is leakage around and under it, as is so frequently the case in practice.

Observations made on various types of weirs in Hawaii show that of the weirs in use in the Territory not all are giving accurate results. If the error is known, so that corrections can be made, the trouble is largely mitigated, but faulty weir records are too often accepted without investigation as to their accuracy.

VELOCITY-AREA METHOD.

The velocity-area method of measurement consists of determining the mean or average velocity of the water past a given cross-section area. The area of the cross section at right angles to the direction of flow is determined by soundings which are taken at such distances apart as will develop the contour of the stream bed. The depths are recorded and also their distances from some arbitrarily chosen initial point on one side of the stream.

The method of making the soundings depends on the size and stage of the stream. On ditches and small streams, where the depths and velocities are not large, a graduated rod may be used to advantage; on large streams, which must be measured from bridges or cables, a lead weight and sounding line must be used. The weights are of different sizes—6½, 10, or 15 pounds—according to the swiftness of the current, and are torpedo shaped, so as to offer as little resistance as possible to the moving water.

On streams with beds which are permanent or nearly so a standard cross section is usually constructed from careful soundings and referred to the zero of the gage, so that the depths for any stage can be found by adding the gage height at that stage to the depths below the zero of the gage. This method is especially useful at high stages, when it is difficult to make accurate soundings.

After the cross-section area of the stream has been measured by soundings and horizontal distances the velocity is determined at a number of points. These measurements of velocity should be made at frequent intervals across the stream and close enough to take account of any abrupt change in the velocity. For convenience, the velocities are usually observed in the same verticals at which soundings are made. On some streams fairly good measurements of velocities may be made by means of subsurface floats. This method is applicable, however, only to channels of uniform cross-section area over a considerable distance, and is very unsatisfactory for use on natural streams like those of Hawaii.[1]

[1] Further information regarding the float method is given in Water-Supply Paper 95 and in textbooks on stream flow.

The velocity of flow is best determined by the current meter, which is a form of water wheel actuated by the current, and of such size and shape that it can easily be placed at any point in the stream.

The new type of penta-recording current meter consists of six cups attached to a vertical shaft which revolves on a conical hardened-steel point when immersed in moving water. The revolutions are indicated electrically or acoustically. The rating, or relation between the velocity of moving water and the revolutions of the wheel, is determined for each meter by drawing it through still water for a given distance at different speeds and noting the number of revolutions for each run. From these data a rating table is prepared which gives the velocity in feet per second of moving water for any number of revolutions in a given time interval. The ratio of revolutions per second to velocity of flow in feet per second is very nearly a constant for all speeds and is approximately 0.45.

Three classes of methods of measuring velocity with current meters are in general use—multiple-point, single-point, and integration.

The two principal multiple-point methods in general use are the vertical velocity curve and 0.2 and 0.8 depth.

In the vertical velocity-curve method a series of velocity determinations are made in each vertical at regular intervals, usually about 10 to 20 per cent of the depth apart. By plotting these velocities as abscissas and their depths as ordinates, and drawing a smooth curve among the resulting points, the vertical velocity curve is developed. This curve shows graphically the magnitude and changes in velocity from the surface to the bottom of the stream. The mean velocity in the vertical is then obtained by dividing the area bounded by this velocity curve and its axis by the depth. This method of obtaining the mean velocity in the vertical is probably the best known, but on account of the length of time required to make a complete measurement its use is largely limited to the determination of coefficients for purposes of comparison.

In the second multiple-point method the meter is held successively at 0.2 and 0.8 depth, and the mean of the velocities at these two points is taken as the mean velocity for that vertical. On the assumption that the vertical velocity curve is a common parabola with horizontal axis, the mean of velocities at 0.22 and 0.79 depth will give (closely) the mean velocity in the vertical. Actual observations under a wide range of conditions show that this multiple-point method gives the mean velocity very closely for open-water conditions and that in a completed measurement it seldom varies as much as 1 per cent from the value given by the vertical velocity-curve method. It is very extensively used in the regular practice of the United States Geological Survey.

The single-point method consists in holding the meter either at the depth of the thread of mean velocity or at an arbitrary depth for which the coefficient for reducing to mean velocity has been determined or must be assumed.

Extensive experiments by means of vertical velocity curves show that the thread of mean velocity generally occurs between 0.5 and 0.7 total depth. In general practice the thread of mean velocity is considered to be at 0.6 depth, and at this point the meter is held in most of the measurements made by the single-point method. A large number of vertical velocity curve measurements, taken on many streams and under varying conditions, show that the average coefficient for reducing the velocity obtained at 0.6 depth to mean velocity is practically unity. The variation of the coefficient from unity in individual cases is, however, greater than in the 0.2 and 0.8 method and the general results are not as satisfactory.

In the other principal single-point method the meter is held near the surface, usually 1 foot below, or low enough to be out of the effect of the wind or other disturbing influences. This is known as the subsurface method. The coefficient for reducing the velocity taken at the subsurface to the mean has been found to be in general from about 0.85 to 0.95, depending on the stage, velocity, and channel conditions. The higher the stage the larger the coefficient. This method is especially adapted for flood measurements, or for measurements when the velocity is so great that the meter can not be kept in the correct position for the other methods.

The vertical integration method consists in moving the meter at a slow but uniform speed from the surface to the bottom and back again to the surface and noting the number of revolutions and the time taken in the operation. This method has the advantage that the velocity at each point of the vertical is measured twice. It is useful as a check on the point methods. In using the Price meter great care should be taken that the vertical movement of the meter is not rapid enough to vitiate the accuracy of the resulting velocity determination.

In practical work on rough streams, such as exist in Hawaii, the meter should be held at 0.6 depth for depths of 1 foot or less. For greater depths the meter should be held at two points in the vertical, 0.2 and 0.8 from the surface.

When the mean velocities in the different verticals have been found, the average of two adjacent means is taken as the mean velocity for that individual section. The area of the section is computed by muliplying the width of the section by the mean depth. The discharge of each section is then the product of the area multiplied by the mean velocity, and the total discharge of the stream

results from summing up the discharge of the individual sections. In practice the work is tabulated in such a way as to render the computation very simple.[1]

Current-meter measurements are not practicable where there are eddies, cross currents, swirls, or passages for the water underneath stones. It is usually possible, however, to improve the channel by removing bowlders and rocks, so that a satisfactory measuring section amy be obtained, even on rough, steep streams such as exist in Hawaii.

Three kinds of velocity-area gaging stations are in general use in Hawaii, according to the means provided for making the observations of depth and velocity. They are wading, bridge, and cable stations.

A wading station is one at which measurements are made only by wading—that is, no means exist for getting above the water at any stage except by wading. Such stations are usually on ditches or wide, shallow streams, which do not fluctuate greatly in flow. Frequently, however, measurements are made at low stages by wading, even though other means exist for making measurements at higher stages.

A bridge station is one at which the meter is used from a bridge. In some places highway or other bridges are available from which to make measurements, but generally they are not at the right place on the stream. Special bridges are then built.

A cable station is one at which measurements are made from a cable spanning the stream. Cable stations are used on large streams, such as Hanapepe, Wailua, and Hanalei rivers on the island of Kauai, and Wailuku River on the island of Hawaii. The cable supports the car from which a man works above the water. Distances are marked off on the cable itself or on a small auxiliary cable stretched taut above it.

A suitable place for a gaging station having been selected, a staff gage is set in the edge of the stream, either vertical or inclined, but graduated into tenths, half-tenths, or hundredths of feet vertically. The gage is securely fastened to rocks or trees to prevent displacement by floods and is so placed that the zero, or reference datum, is well below extreme low water. The datum is also referred to a permanent bench mark as an additional precaution. A water-stage recorder is then installed or an observer is engaged to record the heights of water morning and evening, and the mean of the two readings is used as the mean gage height for the day. Owing to the rapid rise and fall of most of the streams in Hawaii, two gage-height readings a day will not as a rule give a true mean for the 24 hours. For this reason, and also owing to the fact that many of the gaging

[1] For a discussion of methods of computing the discharge of a stream see Engineering News, June 25, 1908.

stations are necessarily situated in the mountains at points remote from all habitations and difficult of access, it has generally been found necessary to use water-stage recorders. These instruments are of various types, some requiring weekly visits and others operating for a month without attention.

The essential features of water-stage recorders comprise a float free to rise and fall with fluctuations of the water surface, a device for transferring the motion of the float to the record sheet (either directly or through a reducing mechanism), the recording device, and the clock. The instruments may be designed for any range of stage. Those used by the United States Geological Survey in Hawaii are designed for ranges up to as high as 36 feet, but so far those having a 20-foot range have been found to be sufficient for any stage.

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 statutes 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 conserved 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 connection with the measurement of 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 million gallons 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.

CONVENIENT EQUIVALENTS.

The following is a list of convenient equivalents for use in hydraulic computations:

Table for converting discharge in second-feet into run-off in acre-feet.

Discharge (second-feet).	Run-off (acre-feet)				
	1 day.	28 days.	29 days.	30 days.	31 days.
1	1.983	55.54	57.52	59.50	61.49
2	3.967	111.1	115.0	119.0	123.0
3	5.950	166.6	172.6	178.5	184.5
4	7.934	222.1	230.1	238.0	246.0
5	9.917	277.7	287.6	297.5	307.4
6	11.90	333.2	345.1	357.0	368.9
7	13.88	388.8	402.6	416.5	430.4
8	15.87	444.3	460.2	476.0	491.9
9	17.85	499.8	517.7	535.5	553.4

NOTE.—For a part of a month multiply values for one day by the number of days.

1,000,000 United States gallons per day equals 1.55 second-feet.
1,000,000 United States gallons equal 3.07 acre-feet.
1 second-foot equals 7.48 United States gallons per second; equals 448.8 gallons per minute; equals 646,317 gallons for one day.
1 second-foot for one year (365 days) covers 1 square mile 1.131 feet or 13.572 inches deep.
1 second-foot for one year (365 days) equals 31,536,000 cubic feet.
1 second-foot for one year (365 days) equals 724 acre-feet.
1 second-foot equals about 1 acre-inch per hour.
1 second-foot for one day covers 1 square mile 0.03719 inch deep.
1 second -foot for one day equals 1.983 acre-feet.
1,000,000 cubic feet equals 22.95 acre-feet.
1 acre-foot equals 325,850 gallons.
1 inch deep on 1 square mile equals 2,323,200 cubic feet.
1 inch deep on 1 square mile equals 0.0737 second-foot per year.
1 foot equals 0.3048 meter.
1 mile equals 1.60935 kilometers.
1 mile equals 5,280 feet.
1 acre equals 0.4047 hectare.
1 acre equals 43,560 square feet.
1 acre equals 209 feet square, nearly.
1 square mile equals 2.59 square kilometers.
1 cubic foot equals 0.0283 cubic meter.
1 cubic foot equals 7.48 gallons.
1 cubic foot of water weighs 62.5 pounds.
1 cubic meter per minute equals 0.5886 second-foot.
1 horsepower equals 550 foot-pounds per second.
1 horsepower equals 76.0 kilogram-meters per second.
1 horsepower equals 746 watts.
1 horsepower equals 1 second-foot falling 8.80 feet.
1½ horsepower equals about 1 kilowatt.

To calculate water power quickly: $\frac{\text{Sec.-ft.} \times \text{fall in feet}}{11}$ = net horsepower on water wheel realizing 80 per cent of theoretical power.

OFFICE METHODS OF COMPUTING AND STUDYING DISCHARGE AND RUN-OFF.

At the end of each year the field or base data for current-meter gaging stations, consisting of water-stage record sheets, daily gage heights, discharge measurements, and notes from observers' books are assembled. The measurements are plotted on cross-section paper, and rating curves are drawn wherever feasible. The rating tables prepared from these curves are then applied to the tables of daily gage heights to obtain the daily discharge, and from these applications the tables of monthly discharge and run-off are computed.

Rating curves are drawn and studied with special reference to the class of channels which they represent. The discharge measurements for all classes of stations, when plotted with gage heights in feet as ordinates and discharges in million gallons per day as

abscissas, define rating curves which are generally more or less parabolic in form.

For every rating table the following assumptions are made for the period of application of the table: (*a*) That the discharge is a function of and increases gradually with the stage; (*b*) that the discharge is the same whenever the stream is at a given stage, and hence such changes in conditions of flow as may have occurred during the period of application are either compensating or negligible, except that the rating, as stated in the footnote of each table, is not applicable for periods during which the channel was obstructed; (*c*) that the increased and decreased discharge due to change of slope on rising and falling stages is either negligible or compensating.

As already stated, the gaging stations may be divided into several classes, as indicated in the following paragraphs:

The stations of class 1 represent the most favorable conditions for an accurate rating and are also the most economical to maintain. The bed of the stream is usually composed of rock and is not subject to the deposits of sediment and loose material. This class includes also many stations located in a pool below which is a permanent rocky riffle that controls the flow like a weir. Provided the control is sufficiently high and close to the gage to prevent cut and fill at the gaging point from materially affecting the slope of the water surface, the gage height will for all practical purposes be a true index of the discharge. Discharge measurements made at such stations usually plot within 2 or 3 per cent of the mean discharge curve, and the rating developed from that curve represents a very high degree of accuracy.

Class 2 comprises mainly stations on rough, mountainous streams with steep slopes. The beds of such streams are, as a rule, comparatively permanent during low and medium stages, and when the flow is sufficiently well defined by an adequate number of discharge measurements before and after each flood the stations of this class give nearly as good results as those of class 1. As it is seldom possible to make measurements covering the time of change at flood stage, the assumption is often made that the curves before and after the flood converged to a common point at the highest gage height recorded during the flood. Hence the only uncertain period occurs during the period of actual change in conditions of flow.

Class 3 includes those stations where the stream bed is of a shifting character, or the controlling section below the gage frequently changes, owing to cutting out by the current and the filling in of sand, gravel, and drift. In some cases in Hawaii changes are caused by the growth of vegetation in the stream bed. No absolute rule can be laid down for stations of this class. Each rating curve must be constructed mainly on the basis of the measurements of

the current year, the engineer being guided largely by the history of the station and the following general law: If all measurements ever made at a station of this class are plotted on cross-section paper, they will define a mean curve which may be called a standard curve. It has been found in practice that if after a change caused by high stage a relatively constant condition of flow occurs at medium and low stages, all measurements made after the change will plot on a smooth curve which is practically parallel to the standard curve with respect to ordinates or gage heights. This law of the parallelism of rating curves is the fundamental basis of all ratings and estimates at stations with semipermanent and shifting channels. It is not absolutely correct, but, with few exceptions, answers all the practical requirements of estimates made at low and medium stages after a change at a high stage. This law appears to hold equally true whether the change occurs at the measuring section or at some controlling point below. The change is, of course, fundamentally due to change in the channel caused by cut or fill, or both, at or near the measuring section. For all except small streams the changes in section usually occur at the bottom. The following simple but typical examples illustrate this law:

(*a*) If 0.5 foot of planking were to be nailed on the bottom of a well-rated wooden flume of rectangular section, there would result, other conditions of flow being equal, new curves of discharge, area, and velocity, each plotting 0.5 foot above the original curves when referred to the original gage. In other words, this condition would be analogous to a uniform fill or cut in a river channel which either reduces or increases all three values of discharge, area, and velocity for any gage height. In practice, however, such ideal conditions rarely exist.

(*b*) If a cut or fill occurs at the measuring section, there is a marked tendency toward decrease or increase, respectively, of the velocity. In other words, the velocity has a compensating effect, and if the compensation is exact at all stages the discharge at a given stage will be the same under both the new and the old conditions.

(*c*) If change along the crest of a weir or rocky control is uniform, the area curve will remain the same as before the change, and it can be shown that here again the change in velocity curve is such that it will produce a new discharge curve essentially parallel to the original discharge curve with respect to their ordinates.

In actual practice, of course, such simple changes of section do not occur. The changes are complicated and lack uniformity, a cut at one place being largely offset by a fill at another, and vice versa. If these changes are very radical and involve large percentages of the total area—as, for example, on small streams—there may result a wide departure from the law of parallelism of rating curves. In

complicated changes of section the corresponding changes in velocity which tend to produce a new parallel discharge curve may interfere with each other materially, causing eddies, boils, backwater, and radical changes in slope. In such extreme conditions, however, the measuring section would more properly fall under class 4 and would require very frequent measurements of discharge. Special stress is laid on the fact that in the lack of other data to the contrary the utilization of this law will yield the most probable results.

Slight changes at low or medium stages of an oscillating character are usually averaged by a mean curve drawn among them parallel to the standard curve, and if the individual measurements do not vary more than 5 per cent from the rating curve the results are considered good for stations of this class.

Class 4 comprises stations on streams that have soft, muddy, or sandy beds. Good results can be obtained from such sections only by frequent discharge measurements, the frequency ranging from a measurement every two or three weeks to a measurement every day, according to the rate of diurnal change in conditions of flow. These measurements are plotted and a mean or standard curve drawn among them. It is assumed that there is a different rating curve for every day of the year and that this rating is parallel to the standard curve with respect to their ordinates. On the day of a measurement the rating curve for that day passes through that measurement. For days between successive measurements it is assumed that the rate of change is uniform, and hence the ratings for the intervening days are equally spaced between the ratings passing through the two measurements. This method must be modified or abandoned altogether under special conditions. Personal judgment and a knowledge of the conditions involved can alone dictate the course to pursue in such cases.

After the computations have been completed they are entered in tables and carefully studied and intercompared to eliminate or account for all gross errors so far as possible. Missing periods are filled in, so far as feasible, by means of comparison with records for adjacent streams. The attempt is made to complete years or periods of discharge, thus eliminating fragmentary and disjointed records. Full notes accompanying such estimates follow the daily and monthly discharge tables.

EXPLANATION OF TABLES.

For each regular 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 mean flow, as determined from the rating table, for the day when the mean gage height was highest. As the gage height is the mean for the day, it does not indicate correctly the stage when the water surface was at crest height and the corresponding discharge was consequently larger than given in the maximum column. Likewise in the column of "Minimum" the quantity given is the mean flow for the day when the mean gage height was lowest. 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 such wide diversity in the character and porosity of the various 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 and (2) on the accuracy of observations of stage, measurements of discharge, and interpretation of data.

The accuracy, as stated, in the station description is based on the accuracy of the rating, the reliability of the gage-height record, the range of the fluctuation in stage, and knowledge of local conditions. Estimates rated as "good," "fair," "poor," or "approximate" are

considered as accurate within probable errors of 5, 10, 15, and 20 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 G. K. Larrison, district engineer, Honolulu, Hawaii, by C. T. Bailey, office engineer, W. V. Hardy, R. C. Rice, R. D. Klise, H. A. R. Austin, D. E. Horner, E. E. Goo, R. M. S. Goo, and John Kaheaku.

GAGING STATIONS MAINTAINED IN HAWAII.

The following list comprises the gaging stations maintained in Hawaii by the United States Geological Survey and cooperative parties. The stations are arranged by stream basins and appear in systematic order for the several islands, tributaries of main streams being indicated by indention. The date refers to the years or parts of years for which records are available. A dash following the date indicates that the station was being maintained June 30, 1916.

KAUAI ISLAND.

Waimea River near Waimea, 1910–
- Poomau River:
  - Kawaikoi Stream near Waimea, 1909–
    - Waiakoali Stream near Waimea, 1909–1912.
  - Mohihi Stream near Waimea, 1909–1912.
- Waiahulu Stream near Waimea, 1916–
- Waialae River near Waimea, 1910–1916.
- Kekaha ditch at Camp No. 1, near Waimea, 1910–1915.
- Kekaha ditch at flume No. 3, near Waimea, 1910–1912.
- Kekaha ditch at flume No. 4, near Waimea, 1916–
- Kekaha ditch at siphon, near Waimea, 1910–1912.
- Kekaha ditch at tunnel No. 12, near Waimea, 1910–1914.
- Waimea ditch near Waimea, 1911–1913, 1916–
- Kamenehune ditch near Waimea, 1911–
- Makaweli River near Waimea, 1911–
  - Halekua Stream near Waimea, 1912–13.
  - Olokele River near Waimea, 1915–
    - Olokele ditch at tunnel No. 12, near Makaweli, 1904–
    - Olokele ditch at weir, near Makaweli, 1912–
  - Poowaiomahaihai ditch near Waimea, 1911–1913.

Hanapepe River above Hanapepe Falls, near Eleele, 1911–12.

Hanapepe River at Koula, near Eleele, 1910–
- Hiloa ditch near Eleele, 1911–1915.
- East Branch Hanapepe River below Hanapepe Falls, near Eleele, 1911–12.
- Hanapepe ditch at Hanapepe Falls, near Eleele, 1911–1915.
- Hanapepe ditch at Koula, near Eleele, 1910–
- Hanapepe ditch at weir near Hanapepe, 1910–

Huleia River near Lihue, 1912–1915.
Hanamaulu River at Kapaia, near Lihue, 1911–1914.
Wailua River:
South Fork of Wailua River at siphon, near Lihue, 1910–11.
South Fork of Wailua River near Lihue, 1911–
Hanamaulu ditch near Lihue, 1910–
Lihue ditch near Lihue, 1910–
North Fork of Wailua River near Lihue, 1910–1914.
North Fork of Wailua River at 650-foot elevation, near Lihue, 1914–
Kanaha ditch near Lihue, 1910–
East Branch of North Fork of Wailua River near Lihue, 1912–
Uhau Iole Stream at 750-foot elevation, near Lihue, 1912.
Keahua Stream at 750-foot elevation, near Lihue, 1912.
Kawi Stream at 750-foot elevation, near Lihue, 1912.
Konohiki Stream at Makakualele weir (mauka) near Kapaa, 1911–1913.
Kaehulua Stream at Kuhinoa (mule stable) weir, near Kapaa, 1911–1913.
South Fork of Kaehulua Stream at Wainamuamu weir, near Kapaa, 1911–12.
North Fork of Kaehulua Stream at Wainamuamu weir, near Kapaa, 1911–1913.
Kapaa River near Kealia, 1910–
Akulikuli Spring near Kealia, 1911–1913.
Kapahi ditch at Kapahi, near Kealia, 1909–
Tunnel ditch at Kapahi, near Kapaa, 1909–1911.
Kapaa ditch at Kapahi, near Kapaa, 1909–1911.
Pipe ditch at Kapahi, near Kapaa, 1909–1911.
Kealia Stream:
Kaneha ditch near Kealia, 1909–1913.
Anahola River at 1,140-foot elevation, near Kealia, 1912.
Anahola River near Kealia, 1910. 1912–
Anahola River at Kiokala dam, near Kealia, 1910–1912.
Anahola ditch above Kaneha reservoir, near Kealia, 1914–
Anahola ditch at Kiokala, near Kealia, 1909–1914.
Anahola ditch at Makai weir, near Kealia, 1909–1911.
Kalihiwai River near Hanalei, 1914–
Kalihiwai River near Kilauea, 1912–1914.
Hanalei River at 625 feet elevation, near Hanalei, 1914–
Hanalei River near Hanalei, 1911–
China ditch near Hanalei, 1911–
Kuna ditch near Hanalei, 1912–13.
Lumahai River near Hanalei, 1914–
Lumahai River near Wainiha, 1912.
Waioli Stream near Hanalei, 1914–
Wainiha River near Hanalei, 1914–
Wainiha River, East Channel, near Wainiha, 1912–
Wainiha River, West Channel, near Wainiha, 1911–
Wainiha canal at intake, near Wainiha, 1910–
Wainiha canal at tunnel No. 18, near Wainiha, 1911.
Wainiha canal at tailrace, near Wainiha, 1911.

OAHU ISLAND.

Kalihi Stream near Honolulu, 1913–
Nuuanu Stream at Laukaha weir in upper Nuuanu Valley, near Honolulu, 1903, 1910–1913.
Nuuanu Stream below Reservoir No. 2 wasteway, near Honolulu, 1913–
Nuuanu Stream at Kuakini Street, near Honolulu, 1911–12.
Lulumaha ditch at upper Nuuanu Reservoir, near Honolulu, 1911–1913.

Pauoa Stream at upper Pauoa Valley, near Honolulu, 1911–1913.
Kahuawai Spring near Honolulu, 1912–1914.
Manoa Stream at upper Manoa Valley, near Honolulu, 1910–1913.
Manoa Stream at College of Hawaii, near Honolulu, 1909–
West Branch of Manoa Stream near Honolulu, 1913–
East Branch of Manoa Stream near Honolulu, 1913–
East Manoa ditch near Honolulu, 1915–
Palolo Stream:
Pukele Stream at Mahoe springs, near Honolulu, 1912–13.
Waiomao Stream at upper Palolo Valley, near Honolulu, 1911–1913.
Waiomao Stream above Pukele, near Honolulu, 1911–12.
Waimanalo ditch below main reservoir, near Waimanalo, 1912–13.
Pump ditch near Waimanalo, 1912.
Makawao ditch near Kailua, 1912–
Kailua Stream near Kailua, 1912–1916.
Wong Leong's ditch near Kailua, 1912–1916.
Makawao Stream near Kailua, 1912–1916.
Makawao Spring near Kailua, 1914–
Kaimi Stream near Kailua, 1912–1916.
Main Spring near Kailua, 1914–
Kamakalepo Stream near Kailua, 1912–1916.
Pohakea Stream near Kailua, 1912–1914.
Kahanaiki Stream in Kailua Valley, near Kailua, 1912.
Kahanaiki Stream near Kailua, 1914–1916.
South Branch of Kahanaiki Stream near Kailua, 1913–14.
North Branch of Kahanaiki Stream near Kailua, 1913–14.
Kahanaiki ditch in Kailua Valley, near Kailua, 1912–13.
Kaneohe Stream near Kaneohe, 1914–1916.
Young Mau ditch near Kaneohe, 1914–1916.
Ahlo ditch near Kaneohe, 1914–1916.
Hooleinaiwa Stream near Kaneohe, 1914–1916.
Piho Stream near Kaneohe, 1914–1916.
Kuou Stream near Kaneohe, 1914–1916.
Kuou ditch near Kaneohe, 1914–1916.
Luluku Stream near Kaneohe, 1914–1916.
North Luluku ditch near Kaneohe, 1914–1916.
Kawa Stream near Kaneohe, 1914–1916.
Heeia Stream:
Wing Wo Tai ditch near Heeia, 1914–1916.
Hop Tuck ditch near Heeia, 1914–1916.
Lee ditch near Heeia, 1914–1916.
Haiku stream near Heeia, 1914–
Reservoir ditch near Heeia, 1914–1916,
Waipio ditch near Heeia, 1914–1916.
Iolekaa Stream near Heeia, 1914–1916.
Waiahole Stream below power house, near Waiahole, 1915.
Waiahole Stream near Waiahole, 1911–
Waiahole Stream at Waiahole, near Waikane, 1911–12.
Waihi Stream near Waikane, 1911.
Halona Stream near Waikane, 1911.
Waianu Stream near Waikane, 1911.
Waikane Stream near Waikane, 1911–1912.
Kahana Stream near Kahana, 1914–
East Branch of Kahana Stream near Kahana, 1914–

Punaluu Stream at 539 feet elevation, near Punaluu, 1915–
Punaluu Stream at 250 feet elevation, near Punaluu, 1914–
Punaluu Stream near Hauula, 1906–7.
Kaluanui Stream near Hauula, 1906–
Kaipapau Stream near Hauula, 1906–7.
Koloa Stream near Laie, 1914–
Wailele Stream near Laie, 1914–
East Branch of Kahawainui Stream near Laie, 1914–
East Branch of Malaekahana Stream near Kahuku, 1914–
Middle Branch of Malaekahana Stream near Kahuku, 1914–
Kaukonahua Stream:
North Fork of Kaukonhua Stream near Wahiawa, 1911.
Right Branch of North Fork of Kaukonahua Stream near Wahiawa, 1913–
Left Branch of North Fork of Kaukonahua Stream near Wahiawa, 1913–
South Fork of Kaukonahua Stream above United States Army Reservoir, near Wahiawa, 1911, 1913–
United States Army ditch at reservoir, near Wahiawa, 1914–15.
South Fork of Kaukonahua Stream below United States Army Reservoir near Wahiawa, 1914–
Wahiawa Reservoir ditch near Wahiawa, 1910–11.

MAUI ISLAND.

West Maui.

Iao Stream near Wailuku, 1910–1915.
Maniania ditch near Wailuku, 1909–1913.
Waiehu Stream:
South Waiehu Stream near Wailuku, 1910–
South Waiehu ditch near Wailuku, 1912–1915.
North Waiehu Stream near Wailuku, 1912–
North Waiehu ditch near Wailuku, 1910–11.
Waihee Stream near Waihee, 1910–1912, 1913–
Waihee canal near Waihee, 1910–1912.
Waihee canal at weir, near Wailuku, 1911–12.
Spreckels ditch near Waihee, 1910–1913.
Spreckels ditch at Waiale weir, near Wailuku, 1910–11.
Kahakuloa Stream at Kahakuloa, near Waihee, 1912–13.
Kahakuloa Stream near Honokahau, 1913–14.
Honokahau Stream near Honokahau, 1913–
Honokahau ditch at intake, near Honokahau, 1907–1913.
Honokahau ditch above Honolua Stream, near Honokahau, 1910–11.
Honokahau ditch at Honokawai weir, near Lahaina, 1910–1912.
Honolua Stream at Honolua ranch, 1911.
Honolua Stream near Honokahau, 1913–
Honolua ditch near Honokahau, 1911–12.
Honokawai Stream near Lahaina, 1911; 1912–
Honokawai Stream at weir No. 1, near Lahaina, 1901.
Honokawai ditch near Lahaina, 1912–
Kahoma Stream near Lahaina, 1911–12; 1913–
Kahoma Stream at weir No. 1, near Lahaina, 1901.
Kahoma Stream at weir No. 2, near Lahaina, 1901.
Kahoma development tunnel near Lahaina, 1911–

Lahainaluna Stream near Lahaina, 1911–
Lahainaluna weir No. 1 near Lahaina, 1901.
Lahainaluna weir No. 2 near Lahaina, 1901.
Lahainaluna ditch near Lahaina, 1913–14.
Kauaula Stream near Lahaina, 1912; 1913–
Kauaula Stream at weir No. 3, near Lahaina, 1901.
Kauaula ditch near Lahaina, 1911–
Kauaula Stream, North Fork, at weir No. 1, near Lahaina, 1901.
Kauaula Stream, South Fork, at weir No. 2, near Lahaina, 1901.
Launiupoko Stream near Lahaina, 1911–
Olowalu Stream near Olowalu, 1913–1916.
Olowalu ditch near Olowalu, 1911–
Ukumehame Stream near Olowalu, 1911–12; 1913–
Waikapu Stream near Waikapu, 1910–
Palolo (Everett) ditch near Waikapu, 1910–
South Side Waikapu ditch near Waikapu, 1910–

East Maui.

Koolau ditch region:
Hanawi Stream near Nahiku, 1914–15.
West Kopiliula Stream near Keanae, 1914–
East Wailuaiki Stream near Keanae, 1913–
West Wailuaiki Stream near Keanae, 1914–
East Wailuanui Stream near Keanae, 1914–
West Wailuanui Stream near Keanae, 1913–
Koolau ditch near Keanae, 1910–1912.
Koolau ditch at Alo division weir, near Huelo, 1908–1911.
Spreckels ditch region:
Honomanu Stream near Keanae, 1913–
Haipuaena Stream near Huelo, 1910–
Puohakamoa Stream near Huelo, 1910–
Alo Stream near Huelo, 1910–
Waikamoi Stream near Huelo, 1910–
Oopuola Stream near Huelo, 1910–1915.
Spreckels ditch at station No. 1, near Huelo, 1910–1913.
Spreckels ditch at station No. 2, near Huelo, 1911–1913.
Spreckels ditch at station No. 3, near Huelo, 1910–1913.
Spreckels ditch at station No. 4, near Huelo, 1910–1913.
Spreckels ditch at station No. 5, near Huelo, 1911–1913.
Spreckels ditch at station No. 6, near Huelo, 1911–1913.
Spreckels ditch at station No. 7, near Huelo, 1911–12.
Spreckels ditch at station No. 8, near Huelo, 1911–1913.
Center ditch region:
Center ditch near Huelo, 1910–1912.
Hamakua ditch region:
Nailiilihaele Stream near Huelo, 1910–1912; 1913–
Kailua Stream near Huelo, 1910–1912; 1913–
Oanui Stream near Huelo, 1910–11; 1913–1916.
Hoolawaliilii Stream near Huelo, 1911–
Hoolawanui Stream near Huelo, 1911–
Honopou Stream near Huelo, 1910–
Halehaku Stream at dam, near Huelo, 1910–11.
Halehaku Stream weir near Huelo, 1910–1912.
Opana Stream near Huelo, 1910–1912.

Hamakua ditch region—Continued.
Opana ditch near Huelo, 1910–1912.
New Hamakua ditch at Nailiilihaele weir, near Huelo, 1910–1912.
New Hamakua ditch at Halehaku weir, near Huelo, 1910–
New Hamakua ditch at station No. 1, near Huelo, 1912.
New Hamakua ditch at station No. 2, near Huelo, 1912.
New Hamakua ditch at station No. 3, near Huelo, 1912.
New Hamakua ditch at station No. 4, near Huelo, 1912.
New Hamakua ditch at station No. 5, near Huelo, 1912.
Old Hamakua ditch at Opana weir, near Huelo, 1910–
Kaluanui ditch at Puuomalei, near Hamakuapoko, 1910–1912.
Lowrie ditch at Opana weir, near Huelo, 1910–
Haiku ditch at Peahi weir, near Huelo, 1910–

HAWAII ISLAND.

Hilo group:
81 stations at 2,700 feet elevation, in forest back of Hilo, 1911–1913.
Wailuku River near Hilo, 1911–1913.
Honolii River at Kaiwiki, near Hilo, 1911–1913.
Honolii ditch at Kaiwiki, near Hilo, 1911.
Kawainui River at Kawainui, near Pepeekeo, 1911–12.
4 stations at Piihonua, near Hilo, 1912.
Hamakua group:
Waipio River below Koiawe, near Waipio, 1911–12.
Waipio River below Waima, near Waipio, 1911–12.
Waipio River at 360 feet elevation, near Waipio, 1901–2.
New Hamakua ditch at Waima Stream, near Waipio, 1912.
Lower Hamakua ditch at main weir, near Kukiuhaele, 1910–
Upper Hamakua ditch at main weir, at Puualala, Waimea, 1913–
Kawainui Branch of Waipio River, near Waipio, 1911–12.
Kawainui Stream at 2,120 feet elevation, near Waipio, 1901–2.
Kawainui Stream at 1,435 feet elevation, near Waipio, 1901–2.
Kawainui Stream at 775 feet elevation, near Waipio, 1901–2.
Branch No. 3 of Kawainui Stream at 1,700 feet elevation, near Waipio, 1901–2.
Branch No. 2 of Kawainui Stream at 1,405 feet elevation, near Waipio, 1901–2.
Branch No. 1 of Kawainui Stream at 1,380 feet elevation, near Waipio, 1901–2.
Alakahi Stream at 1,200 feet elevation, near Waipio, 1901–2.
Alakahi Stream at 730 feet elevation, near Waipio, 1901–2.
Koiawe Stream at 1,120 feet elevation, near Waipio, 1901–2.
Koiawe Stream at 610 feet elevation, near Waipio, 1901–2.
Waima Stream at 790 feet elevation, near Waipio, 1901–2.
Waima Stream at 385 feet elevation, near Waipio, 1901–2.
Kohala group:
Honokane Stream:
East Branch of Honokane Stream at 1,300 feet elevation, near Honokane, 1901.
East Branch of Honokane Stream at 770 feet elevation, near Honokane, 1901.
West Branch of Honokane Stream at 1,370 feet elevation, near Honokane, 1901.
West Branch of Honokane Stream at 775 feet elevation, near Honokane, 1901.
Kohala ditch near Kohala, 1901–1913.
Kehana ditch at Honokane Mauka, near North Kohala, 1912–13.

GAGING-STATION RECORDS.

ISLAND OF KAUAI.

WAIMEA RIVER NEAR WAIMEA, KAUAI.

LOCATION.—250 feet above ford, about 2 miles north of Waimea.

RECORDS AVAILABLE.—July 9, 1910, to June 30, 1916.

GAGE.—Vertical and inclined staff installed October 5, 1911. July 9, 1910, to October 4, 1911, staff gage about 1 mile downstream.

DISCHARGE MEASUREMENTS.—May be wading or from footbridge.

CHANNEL AND CONTROL.—One channel at all stages; straight for 500 feet above and below gage; banks high; bed of stream sandy. Control composed of sand, gravel, and boulders; shifting.

EXTREMES OF DISCHARGE.—Maximum stage recorded during period of record, 18.8 feet at 4.30 p. m. January 25, 1916 (discharge, computed from extension of rating curve, approximately 10,700 million gallons per day, or 16,600 second-feet); channel practically dry at times, as all water diverted above.

DIVERSIONS.—Large number of diversions above station.

REGULATION.—By diversions.

UTILIZATION.—All water passing this station is wasted, as none is diverted below.

ACCURACY.—Gage read twice daily. Determinations July 1, 1915, to January 9, 1916, fair for all stages below 1,600 million gallons per day; those for January 10 to June 30, 1916, fair for stages below 2,000 million gallons per day.

Discharge measurements of Waimea River near Waimea, Kauai, during the year ending June 30, 1916.

Date.	Made by—	Gage height (feet).	Discharge.	
			Second-feet.	Million gallons per day.
Nov. 29	D. E. Horner	6.38	378	244
30	do	5.35	107	69
Dec. 30	do	5.26	96	62
28	do	8.48	1,660	1,070
29	do	7.42	950	614
29	do	7.18	825	533
Jan. 19	do	8.88	2,180	1,410
21	do	6.78	495	320
Apr. 28	W. V. Hardy	4.54	4.8	3.1
May 30	do	4.59	6.3	4.1
June 5	do	4.67	11	7.1
8	do	4.83	19	12

Daily discharge, in million gallons, of Waimea River near Waimea, Kauai, for the year ending June 30, 1916.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	3.0	3.0	6.5	46	325	39	168	348	23	12	300	12
2	3.0	2.2	2.2	23	1,360	39	168	365	67	8.0	215	31
3	3.0	1.5	1.5	23	330	30	168	255	105	8.0	174	27
4	4.0	1.5	3.0	21	1,210	26	158	194	1,740	6.5	3[illegible]	31
5	4.0	1.5	1.5	8.0	158	21	460	205	452	5.0	1,0[illegible]	73
6	4.0	4.0	1.5	8.0	80	122	280	174	1,320	5.0	2[illegible]	105
7	9.5	15	1.5	8.0	64	64	660	216	670	5.0	2[illegible]	35
8	15	74	1.5	6.5	36	28	2,120	285	285	5.0	79	12
9	8.0	30	2.2	6.5	202	13	3,200	205	228	5.0	79	105
10	5.0	5.0	3.0	5.0	93	9.5	2,760	194	194	5.0	79	20
11	5.0	3.0	1.5	4.0	202	5.0	970	184	145	5.0	1[illegible]	5.0
12	3.0	3.0	80	2.2	582	4.0	435	154	128	5.0	57	5.0
13	3.0	5.0	15	1.5	202	3.0	365	136	85	5.0	39	5.0
14	1.5	26	5.0	13	158	3.0	365	128	73	43	27	5.0
15	1.5	46	3.0	4.0	114	228	315	112	300	52	20	27
16	2.2	23	3.0	1.5	69	240	228	112	91	5.0	17	6.5
17	15	3.0	19	1.5	64	114	1,560	91	67	5.0	12	52
18	3.0	3.0	26	107	64	86	1,640	79	57	23	31	27
19	1.5	3.0	17	148	64	80	1,460	73	47	23	43	6.5
20	33	3.0	6.5	69	114	74	540	62	43	14	39	5.0
21	6.5	3.0	5.0	69	202	36	348	47	31	5.0	39	164
22	4.0	15	6.5	17	1,240	93	255	47	27	5.0	31	62
23	3.0	11	19	21	905	50	216	47	27	5.0	67	5.0
24	1.5	5.0	21	80	228	36	330	43	47	5.0	62	10
25	1.5	3.0	93	64	114	190	7,040	39	35	5.0	47	6.5
26	1.5	3.0	215	215	74	179	4,090	35	23	5.0	39	8.0
27	9.5	3.0	148	158	59	2,610	670	23	57	1,120	43	17
28	3.0	3.0	42	59	46	1,310	435	35	12	128	17	12
29	6.5	1.5	69	59	340	600	315	31	8.0	47	8.0	31
30	3.0	1.5	74	122	86	355	720	.....	8.0	470	5.0	67
31	2.2	42	.....	86	.....	252	400	.....	8.0	.....	5.0	.....

NOTE.—Discharge determined from rating curves applicable as follows: July 1, 1915, to Jan. 9, 1916, well defined below 1,600 million gallons per day. Jan. 10 to Jan. 30, 1916, fairly well defined below 2,000 million gallons per day.

Monthly discharge of Waimea River near Waimea, Kauai, for year ending June 30, 1916.

Month.	Discharge.				Run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July	33	1.5	5.46	8.45	16[illegible]	519
August	74	1.5	11.2	17.3	34[illegible]	1,070
September	215	1.5	29.8	46.1	89[illegible]	2,740
October	215	1.5	47.0	72.7	1,46[illegible]	4,470
November	1,360	36	310	480	9,28[illegible]	28,500
December	2,610	3.0	224	347	6,93[illegible]	21,300
January	7,040	158	1,060	1,640	32,80[illegible]	101,000
February	365	23	135	209	3,92[illegible]	12,000
March	1,740	8.0	207	320	6,40[illegible]	19,700
April	1,120	5.0	68.0	105	2,04[illegible]	6,260
May	1,060	5.0	119	184	3,68[illegible]	11,300
June	164	5.0	32.6	50.4	97[illegible]	3,000
The year	7,040	1.5	188	291	68,90[illegible]	212,000

KAWAIKOI STREAM NEAR WAIMEA, KAUAI.

LOCATION.—Eight miles northeast of Knudsen's mountain house and about 27 miles north of Waimea by horse trail.

RECORDS AVAILABLE.—April 13, 1909, to June 30, 1916.

GAGE.—Barrett & Lawrence 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 below station; banks high and wooded. Control composed of rock ledge and large boulders; shifting.

EXTREMES OF DISCHARGE.—1909-1916: Maximum stage recorded, 8.15 feet at 4 a. m. January 8, 1916 (discharge, computed from extension of rating curve, approximately 750 million gallons per day, or 1,160 second-feet); minimum stage recorded, 1.55 feet October 3 to 6, 1913 (discharge, 2.6 million gallons per day, or 4.0 second-feet).

Minimum stage recorded during year, 1.7 feet August 29 and 30, 1915 (discharge, 2.8 million gallons per day, or 4.3 second-feet.

DIVERSIONS.—None above station.

REGULATION.—None.

UTILIZATION.—Irrigation of sugar cane, rice, and taro; power development and domestic supply.

ACCURACY.—Records below 40 million gallons per day fair except those for January 9 to March 14, which are poor on account of insufficient measurements.

Discharge measurements of Kawaikoi Stream near Waimea, Kauai, during the year ending June 30, 1916.

Date.	Made by—	Gage height (feet).	Discharge.	
			Second-feet.	Million gallons per day.
Oct. 9	W. V. Hardy	1.86	8.4	5.4
10	do	2.10	17	11
Mar. 8	D. E. Horner	2.48	29	19
Apr. 5	do	1.92	9.6	6.2
May 31	do	2.05	12	7.8

Daily discharge, in million gallons, of Kawaikoi Stream near Waimea, Kauai, for the year ending June 30, 1916.

Date.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.
1	.....	5.0	17	60	.....	21	20	4.8	7.0	.....
2	.....	4.2	11	74	.....	27	24	5.5	8.0	57
3	.....	4.2	9.5	96	.....	29	18	7.5	12	92
4	.....	5.9	12	84	.....	74	14	152	7.0	117
5	.....	5.0	8.0	42	.....	88	36	29	5.9	264
6	.....	3.5	7.0	32	.....	54	18	137	5.9	122
7	12	3.5	7.0	27	.....	159	29	36	5.9	77
8	48	3.5	8.0	23	.....	286	20	20	5.9	45
9	12	7.0	8.0	42	16	252	26	14	5.9	36
10	7.0	5.0	11	63	14	308	14	13	5.9	.....
11	11	25	7.0	29	12	127	13	12	5.9	.....
12	19	23	7.0	36	11	60	10	10	5.9	.....
13	11	8.0	17	51	9.5	45	8.8	8.8	5.9	.....
14	36	8.0	21	27	9.5	45	7.5	84	57	.....
15	17	5.0	8.0	21	42	34	8.8	51	21	.....
16	8.0	4.2	12	16	29	29	10	21	9.5	.....
17	5.9	4.2	27	14	16	197	7.5	16	14	.....
18	5.0	7.0	92	17	23	122	6.5	14	.....	.....
19	4.2	5.9	45	51	48	117	6.5	12	.....	.....
20	5.0	5.0	42	42	29	51	6.5	11	.....	.....
21	11	25	23	19	19	32	5.5	11	.....	.....
22	7.0	17	12	17	34	24	5.5	9.5	.....	.....
23	5.0	7.0	27	14	17	20	4.8	11	.....	.....
24	5.0	17	42	.....	17	29	4.8	11	.....	.....
25	7.0	92	51	.....	140	152	4.8	8.0	.....	.....
26	5.0	70	48	.....	45	142	4.8	8.0	.....	.....
27	4.2	48	45	.....	174	34	13	7.0	.....	.....
28	3.5	27	32	.....	130	24	6.5	7.0	.....	.....
29	2.8	25	66	.....	74	18	4.8	7.0	.....	.....
30	2.8	45	45	.....	34	51	.....	7.0	.....	.....
31	11	.....	70	.....	25	29	.....	7.0	.....	.....

NOTE.—Discharge determined from rating curves applicable as follows: July 1, 1915, to Jan. 8, 1916, and Mar. 15 to June 30, 1916, fairly well defined below 40 million gallons per day. Jan. 9 to Mar. 14, 1916, poorly defined. No gage records on days for which discharge is not given.

Monthly discharge of Kawaikoi Stream near Waimea, Kauai, for the year ending June 30, 1916.

Month.	Discharge.				Run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
August 7–31	48	2.8	10.6	16.4	265	813
September	92	3.5	17.2	26.6	515	1,580
October	92	7.0	27.0	41.8	838	2,570
November 1–23	96	14	39.0	60.3	897	2,750
December 9–31	174	9.5	42.1	65.1	968	2,970
January	308	18	86.5	134	2,680	8,230
February	36	4.8	12.4	19.2	359	1,100
March	152	4.8	24.3	37.6	752	2,310
April 1–17	57	5.9	11.1	17.2	189	579
May 2–9	264	36	10.1	15.6	810	248

WAIAHULU STREAM NEAR WAIMEA, KAUAI.

LOCATION.—In Waimea Canyon, half a mile above confluence with Koaie Stream, 12 miles north of Waimea.

RECORDS AVAILABLE.—October 27, 1915, to June 30, 1916.

GAGE.—Gurley printing water-stage recorder.

DISCHARGE MEASUREMENTS.—Made from cable or by wading.

CHANNEL AND CONTROL.—One channel at all stages; straight for 200 feet above and below gage. Banks high. Control composed of large boulders; fairly permanent.

EXTREMES OF DISCHARGE.—Maximum stage recorded, 5.56 feet at 10.30 a. m. May 5, 1916 (discharge, computed from extension of rating curve, approximately 450 million gallons per day, or 696 second-feet); minimum stage recorded, 2.05 feet April, May, and June, 1916 (discharge, 17 million gallons per day, or 26 second-feet).

DIVERSIONS.—None above station.

REGULATION.—None.

UTILIZATION.—Water is wasted.

ACCURACY.—Records poor owing to lack of sufficient discharge measurements. Gage readings prior to February 25, 1916, unreliable.

Discharge measurements of Waiahulu Stream near Waimea, Kauai, during the year ending June 30, 1916.

Date.	Made by—	Gage height (feet).	Discharge.	
			Second-feet.	Million gallons per day.
Nov. 17	D. E. Horner	2.16	46	30
Dec. 2	....do	2.38	70	45
Feb. 25	W. V. Hardy	2.21	38	31
Mar. 16	....do	2.61	82	53
May 19	....do	2.50	65	42

Daily discharge, in million gallons, of Waiahulu Stream near Waimea, Kauai, for the year ending June 30, 1916.

Date.	Feb.	Mar.	Apr.	May.	June.	Date.	Feb.	Mar.	Apr.	May.	June.
1		33	24	136	24	16		61	19	22	19
2		33	22	74	24	17		48	22	22	30
3		36	27	124	36	18		44	24	24	22
4		333	24	130	48	19		36	22	44	22
5		190	22	333	36	20		36	22	44	52
6		361	22	178	40	21		33	19	40	84
7		235	22	124	22	22		33	22	44	33
8		136	19	70	30	23		33	22	40	22
9		103	19	56	30	24		30	17	33	17
10		88	19	52	19	25	33	30	17	33	17
11		79	19	66	17	26	33	27	22	30	24
12		70	19	36	17	27	40	27	184	24	22
13		66	19	33	17	28	36	27	48	24	44
14		124	61	27	24	29	33	24	30	19	24
15		142	30	24	27	30		24	98	17	56
						31		24		17	

NOTE.—Discharge determined from poorly defined rating curves.

Monthly discharge of Waiahulu Stream near Waimea, Kauai, for year ending June 30, 1916.

Month.	Discharge.				Run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
February 25–29	40	33	35.0	54.2	175	537
March	361	24	82.8	128	2,570	7,880
April	184	17	31.9	49.4	956	2,940
May	333	17	62.6	96.9	1,940	5,960
June	84	17	30.0	46.4	899	2,760

WAIALAE RIVER NEAR WAIMEA, KAUAI.

LOCATION.—Three miles northeast of F. Gay's mountain house and about 20 miles northeast of Waimea by horse trail.

RECORDS AVAILABLE.—August 1, 1910, to January 25, 1916, when station was discontinued.

GAGE.—Barrett & Lawrence water-stage recorder.

DISCHARGE MEASUREMENTS.—Made by wading or from cable.

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

EXTREMES OF DISCHARGE.—Maximum stage recorded during period of record, 5.1 feet at 4 a. m. January 17, 1916 (discharge, computed from extension of rating curve, approximately 350 million gallons per day, or 540 second-feet); minimum stage recorded, 0.75 foot March and April, 1915 (discharge, 1.4 million gallons per day, or 2.2 second-feet).

Minimum stage recorded during year, 0.8 foot July and August (discharge, 1.6 million gallons per day or 2.5 second-feet).

DIVERSIONS.—None above station.

REGULATION.—None.

UTILIZATION.—Irrigation of sugar cane, rice and taro, and for domestic supply.

ACCURACY.—Records below 40 million gallons per day good. Extension of rating curve above 40 million gallons per day not based on discharge measurements.

Discharge measurements of Waialae River near Waimea, Kauai, during the year ending June 30, 1916.

Date.	Made by—	Gage height (feet).	Discharge.	
			Second-feet.	Million gallons per day.
Aug. 10	D. E. Horner	1.03	6.3	4.1
Sept. 20	W. V. Hardy	1.06	7.1	4.6
Dec. 3	D. E. Horner	1.20	13	8.4
Feb. 9	.....do	1.26	22	14

Daily discharge, in million gallons, of Waialae River near Waimea, Kauai, for the year ending June 30, 1916.

Date.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.
1	3.0	1.6	7.0	17	33	.....	17
2	4.5	1.6	4.5	10	67	.....	17
3	5.5	1.6	4.5	8.4	148	.....	17
4	5.5	3.0	3.5	8.4	148	3.5	20
5	5.5	3.0	3.5	7.0	36	3.5	20
6	8.4	8.4	3.5	5.5	27	3?	20
7	8.4	3.5	3.5	5.5	22	1?	99
8	5.5	20	3.5	5.5	39	7.0	175
9	4.5	7.0	5.5	4.5	67	7.0	205
10	3.5	4.5	5.5	4.5	67	7.0	134
11	3.5	4.5	17	4.5	60	5.5	.....
12	3.5	8.4	30	4.5	60	5.5	.....
13	3.5	8.4	12	4.5	50	5.5	.....
14	2.4	15	7.0	4.5	42	5.5	27
15	2.4	15	5.5	4.5	27	42	22
16	5.5	8.4	4.5	3.5	20	3?	20
17	4.5	7.0	27	3.5	17	1?	107
18	3.0	7.0	33	20	15	17	56
19	8.4	5.5	.....	30	.....	12	75
20	5.5	4.5	4.5	50	.....	12	33
21	3.5	15	4.5	17	.....	15	20
22	3.0	12	4.5	8.4	.....	24	15
23	2.4	8.4	20	39	.....	12	10
24	2.0	5.5	12	17	.....	3?	17
25	1.6	4.5	30	20	.....	95	75
26	3.5	4.5	42	33	.....	4?	.....
27	4.5	4.5	39	30	.....	14?	.....
28	5.5	3.5	20	12	.....	11?	.....
29	3.5	3.5	24	22	.....	4?	.....
30	2.0	5.5	33	24	.....	3?	.....
31	2.0	22	.....	15	.....	22	.....

NOTE.—Discharge determined from rating curve well defined below 40 million gallons per day. No gage records for days on which discharge is not given.

Monthly discharge of Waialae River near Waimea, Kauai, for year ending June 30, 1916.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July	8.4	1.6	4.19	6.48	13?	399
August	22	1.6	7.32	11.3	227	696
October	50	3.5	14.3	22.1	44?	1,360
November 1-18	148	15	52.5	81.2	94?	2,900
December 4-31	143	3.5	28.6	44.3	80?	2,460

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KEKAHA DITCH AT FLUME NO. 4, NEAR WAIMEA, KAUAI.

LOCATION.—About 1 mile below intake, 7 miles, by trail, north of Waimea.
RECORDS AVAILABLE.—February 25 to June 30, 1916.
GAGE.—Vertical staff at lower end of flume No. 4.
DISCHARGE MEASUREMENTS.—Made from cross beam near lower end of flume.
CHANNEL AND CONTROL.—Straight wooden flume 8 feet wide and 4 feet deep.
EXTREMES OF DISCHARGE.—Maximum stage recorded, 3.1 feet March 18–24 (discharge, 62 million gallons per day, or 96 second-feet); minimum stage recorded, 2.35 feet May 28 (discharge, 37 million gallons per day, or 57 second-feet).
DIVERSIONS.—Ditch diverts from Waimea River.
REGULATION.—By head gates.
UTILIZATION.—Irrigation of sugar cane.
ACCURACY.—Gage read twice daily; records good; rating curve well defined.

Discharge measurements of Kekaha ditch at Flume No. 4, near Waimea, Kauai, during the year ending June 30, 1916.

Date.	Made by—	Gage height (feet).	Discharge.	
			Second-feet.	Million gallons per day.
Feb. 25	W. V. Hardy	3.06	93	60
May 18	do	3.02	91	59
18	do	2.91	85	55

Daily discharge, in million gallons, of Kekaha ditch, at Flume No. 4, near Waimea, Kauai, for the year ending June 30, 1916.

Date.	Mar.	Apr.	May.	June.	Date.	Mar.	Apr.	May.	June.
1		60	60	55	16		58	60	56
2		58	60	58	17		51	58	58
3		56	60	58	18	62	62	58	58
4		55	60	58	19	62	62	58	55
5		51	60	58	20	62	58	58	58
6		48	60	58	21	62	53	58	58
7		46	60	58	22	62	46	58	58
8		46	60	58	23	62	51	58	58
9		45	60	58	24	62	45	58	58
10		45	60	58	25	62	45	58	48
11		48	60	53	26	62	59	58	58
12		46	60	55	27	60	58	58	58
13		45	60	55	28	60	56	37	58
14		62	60	51	29	60	53	58	58
15		62	60	58	30	60	58	58	58
					31	60		55	

NOTE.—Discharge determined from well-defined rating curve.

Monthly discharge of Kekaha ditch, at Flume No. 4, near Waimea, Kauai, for year ending June 30, 1916.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
March 18–31	62	60	61.3	94.8	858	2,630
April	62	45	52.6	81.4	1,580	4,840
May	60	37	58.3	90.2	1,810	5,550
June	58	48	56.8	87.9	1,700	5,230
The period			56.6	87.6	5,950	18,200

WAIMEA DITCH NEAR WAIMEA, KAUAI.

LOCATION.—Half a mile below intake, at lower portal of tunnel No. 22, 2½ miles north of Waimea.

RECORDS AVAILABLE.—February 28 to June 30, 1916.

GAGE.—Vertical staff.

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

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

EXTREMES OF DISCHARGE.—Maximum stage recorded, 1.3 feet June 20, 1916 (discharge, 7.0 million gallons per day, or 11 second-feet); minimum stage recorded, 0.6 foot March 22, 1916 (discharge, 1.2 million gallons per day, or 1.9 second-feet).

DIVERSIONS.—Ditch diverts from Waimea River.

UTILIZATION.—Irrigation of sugar cane.

ACCURACY.—Gage read twice daily. Determinations good below 5 million gallons per day.

Discharge measurements of Waimea ditch near Waimea, Kauai, during the year ending June 30, 1916.

[Made by W. V. Hardy.]

Date.	Gage height (feet).	Discharge.		Date.	Gage height (feet).	Discharge.	
		Second-feet.	Million gallons per day.			Second-feet.	Million gallons per day.
Feb. 28	0.88	5.1	3.3	May 30	1.00	7.1	4.6
Mar. 18	.75	3.6	2.3	June 5	.99	6.0	3.9
Apr. 28	.84	4.8	3.1	June 27	.94	5.7	3.7

Daily discharge, in million gallons, of Waimea ditch near Waimea, Kauai, for the year ending June 30, 1916.

Date.	Mar.	Apr.	May.	June.	Date.	Mar.	Apr.	May.	June.
1	.....	3.9	4.3	4.8	16	.....	5.2	3.1	6.1
2	.....	3.5	4.3	5.2	17	.....	4.3	5.2	6.1
3	.....	4.3	5.6	5.2	18	.....	4.3	4.3	4.3
4	.....	4.8	4.3	5.2	19	.....	5.2	4.8	5.2
5	.....	3.9	5.2	5.2	20	2.3	3.5	5.2	7.0
6	.....	3.1	5.2	4.8	21	1.9	3.9	5.2	6.1
7	.....	2.7	3.9	4.8	22	1.2	3.9	5.2	5.2
8	.....	2.7	4.3	5.2	23	2.3	3.1	4.8	5.2
9	.....	2.7	4.3	5.2	24	2.7	2.7	5.2	4.3
10	.....	3.1	5.2	5.2	25	2.7	3.5	4.8	5.2
11	.....	3.1	4.3	5.4	26	2.3	2.7	4.3	6.1
12	.....	3.1	3.9	5.4	27	1.9	3.1	3.9	6.1
13	.....	2.7	3.5	5.6	28	1.9	3.1	4.3	6.1
14	.....	5.2	4.3	5.6	29	3.5	3.1	5.2	6.1
15	.....	5.2	3.5	5.6	30	3.5	3.5	5.2	6.1
					31	3.5	.....	5.0	.....

NOTE.—Discharge determined from rating curve well defined below 5 million gallons per day; interpolated Mar. 26, May 12, 30, June 11 and 12.

Monthly discharge of Waimea ditch near Waimea, Kauai, for year ending June 30, 1916.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
March 20–31	3.5	1.2	2.48	3.84	30	91
April	5.2	2.7	3.64	5.63	109	335
May	5.6	3.1	4.57	7.07	142	435
June	7.0	4.3	5.45	8.43	164	502

KAMENEHUNE DITCH NEAR WAIMEA, KAUAI.

LOCATION.—200 feet below wire suspension bridge across Waimea River, about 3 miles above Waimea; reached by wagon road up the right side of Waimea River.

RECORDS AVAILABLE.—October 9, 1911, to June 30, 1916.

GAGE.—Vertical staff on right bank.

DISCHARGE MEASUREMENTS.—Made from plank.

CHANNEL AND CONTROL.—Straight for 50 feet above and below gage; mud bottom. Control fairly permanent; stage-discharge relation affected by growth of grass and weeds in channel; current sluggish.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 1.94 feet at 4.30 p. m. November 22 (discharge, 4.4 million gallons per day, or 6.8 second-feet); ditch occasionally dry.

Maximum stage recorded during period of record, 1.9 feet January 14 and 27, 1914 (discharge, 5.2 million gallons per day, or 8.0 second-feet).

DIVERSIONS.—Diverts from Waimea River.

REGULATION.—By head gates.

UTILIZATION.—Irrigation of rice and taro.

ACCURACY.—Gage read twice daily. Determinations poor owing to instability of stage-discharge relation due to vegetable growth in channel and frequent cleaning of ditch.

Discharge measurement of Kamenehune ditch near Waimea, Kauai, during the year ending June 30, 1916.

Date.	Made by—	Gage height (feet).	Discharge.	
			Second-feet.	Million gallons per day.
Nov. 24	D. E. Horner	1.20	2.3	1.5
Jan. 21	do	1.37	2.9	1.9
Apr. 28	W. V. Hardy	1.21	2.5	1.6
May 30	do	1.19	2.6	1.7
June 5	do	.91	1.4	.9
7	do	1.14	2.5	1.6
26	do	1.02	1.7	1.1
27	do	.87	1.0	.65

Monthly discharge of Kamenehune ditch near Waimea, Kauai, for year ending June 30, 1916.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July 1–11, 13–19, 21–31	1.3	0.05	0.37	0.57	11	33
August 1–2, 5–31	1.6	.05	.47	.73	14	42
September	2.8	.4	1.16	1.80	35	107
October	3.6	.5	1.83	2.83	57	174
November	4.0	.7	2.26	3.50	68	208
December	4.0	.5	1.41	2.18	44	134
January	3.3	.1	2.00	3.09	62	190
February	2.0	.6	1.11	1.72	32	99
March 1–3, 5–31	2.3	.7	1.60	2.48	49	147
April	2.7	1.2	1.77	2.74	53	163
May	2.7	1.4	1.96	3.03	61	186
June	2.7	.9	1.76	2.72	52	162
The period	4.0	.05	1.49	2.31	538	1,640

NOTE.—Discharge determined from rating tables applicable as follows: July 1 to Aug. 2, 1915, Aug. 5, 1915, to Jan. 4, 1916, Jan. 5 to Mar. 3, Mar. 5 to June 30, 1916. No flow July 12, 20, Aug. 3 and 4, Mar. 4.

MAKAWELI RIVER NEAR WAIMEA, KAUAI.

LOCATION.—Half a mile above confluence with Waimea River and 2 miles northeast of Waimea. Reached by wagon road up Makaweli River.

RECORDS AVAILABLE.—October 6, 1911, to June 30, 1916.

GAGE.—Vertical staff on right bank.

DISCHARGE MEASUREMENTS.—Made by wading or from footbridge.

CHANNEL AND CONTROL.—One channel at all stages; straight for 500 feet above and below gage; banks low, with gentle slope; current swift. Control composed of boulders; fairly permanent between extreme floods.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 8.75 feet at noon December 25 (discharge, 2,440 million gallons per day, or 3,780 second-feet; minimum stage recorded, 2.8 feet October 31 (discharge, 5.0 million gallons per day, or 7.7 second-feet).

Maximum stage recorded during period of record, 10.7 feet at noon November 26, 1914 (discharge, approximately 4,300 million gallons per day, or 6,650 second-feet); minimum stage recorded, 3.0 feet December 16–19, 1912 (discharge, 1.9 million gallons per day, or 3.0 second-feet).

DIVERSIONS.—Several small ditches divert water above station for irrigation of sugar cane, rice, and taro.

UTILIZATION.—Water passing station is wasted.

ACCURACY.—Rating curves fairly well defined for low and medium stages; determinations below 500 million gallons per day fair; those for high and fluctuating stages probably considerably in error as gage read only once daily.

Discharge measurements of Makaweli River near Waimea, Kauai, during the year ending June 30, 1916.

Date.	Made by—	Gage height (feet).	Discharge.	
			Second-feet.	Million gallons per day.
Aug. 22	D. E. Horner	3.01	15	9.8
Nov. 24	....do	4.18	153	99
29	....do	4.40	214	138
30	....do	3.44	40	26
Jan. 18	....do	5.28	503	325
18	....do	5.15	444	287
18	....do	5.00	402	260
20	....do	4.48	243	157
May 17	W. V. Hardy	3.32	25	16
30	....do	3.68	63	41
June 6	....do	3.30	25	16

Daily discharge, in million gallons, of Makaweli River near Waimea, Kauai, for the year ending June 30, 1916.

Date.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	10	14	15	25	25	32	112	315	410	12	12	25
2	14	14	15	25	137	22	75	302	365	11	19	25
3	14	14	14	22	455	22	69	278	1,740	11	28	22
4	15	28	14	25	348	19	53	266	732	11	22	22
5	14	20	14	25	99	19	32	211	442	9.2	25	22
6	14	99	10	22	85	16	28	139	315	9.2	28	14
7	14	20	10	56	56	16	19	112	168	9.2	28	14
8	14	17	8.5	38	310	16	105	395	158	9.2	25	12
9	12	14	8.5	28	472	6.0	778	190	148	9.2	25	12
10	10	14	8.5	25	222	6.0	555	190	139	7.0	25	11
11	10	31	7.0	17	130	6.0	130	179	130	7.0	328	11
12	8.5	25	46	15	315	6.0	105	168	112	7.0	222	11
13	8.5	17	20	6.0	211	5.0	98	148	105	6.0	168	9.2
14	8.5	17	17	6.0	130	5.0	90	139	130	7.0	112	9.2
15	22	17	15	6.0	90	800	82	120	130	7.0	98	32
16	10	15	15	6.0	48	352	75	90	112	6.0	48	25
17	10	15	25	6.0	32	75	75	98	98	6.0	32	25
18	17	15	22	73	22	63	515	90	90	6.0	22	22
19	99	15	25	51	16	19	290	130	90	7.0	22	22
20	14	17	15	208	16	16	158	112	75	14	19	112
21	12	38	15	28	16	28	130	105	36	14	19	112
22	10	85	14	28	16	139	211	130	32	16	19	112
23	10	20	14	106	290	28	168	130	25	14	16	105
24	10	14	15	73	380	130	255	130	25	14	16	98
25	7.0	14	171	38	40	2,440	1,820	255	19	12	19	75
26	171	10	67	22	28	130	710	460	14	12	233	53
27	25	8.5	31	17	25	2,220	555	244	14	12	222	12
28	25	6.0	25	6.0	22	340	478	222	9.2	11	112	12
29	20	6.0	42	6.0	130	120	410	211	9.2	12	90	9.2
30	20	6.0	31	6.0	120	120	380	.....	8.1	12	75	16
31	17	122	.....	5.0	.....	112	365	.....	7.0	.....	36	.....

NOTE.—Discharge determined from rating curves applicable as follows: July 1 to Nov. 9, 1915, well defined below 500 million gallons per day; Nov. 10, 1915, to June 30, 1916, fairly well defined.

Monthly discharge of Makaweli River near Waimea, Kauai, for the year ending June 30, 1916.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July	171	7.0	21.5	33.3	666	2,050
August	122	6.0	24.8	38.4	768	2,360
September	171	7.0	25.0	38.7	750	2,300
October	208	5.0	32.9	50.9	1,020	3,130
November	472	16	143	221	4,290	13,200
December	2,440	5.0	236	365	7,330	22,500
January	1,820	19	288	446	8,930	27,400
February	460	90	192	297	5,560	17,100
March	1,740	7.0	190	294	5,890	18,100
April	16	6.0	10.0	15.5	300	921
May	328	12	69.8	108	2,160	6,640
June	112	9.2	35.4	54.8	1,060	3,260
The year	2,440	5.0	106	164	38,700	119,000

OLOKELE RIVER NEAR WAIMEA, KAUAI.

LOCATION.—A quarter of a mile below intake of Olokele ditch, 15 miles, by road and trail, northeast of Waimea.

RECORDS AVAILABLE.—July 18, 1915, to June 30, 1916.

GAGE.—Barrett & Lawrence water-stage recorder.

DISCHARGE MEASUREMENTS.—Made from cable or by wading.

CHANNEL AND CONTROL.—One channel at all stages; straight for 150 feet above and below gage. Banks steep, high, and covered with brush. Control composed of large boulders; probably permanent.

EXTREMES OF DISCHARGE.—Maximum stage recorded, 9.8 feet at 4.30 a. m. January 19, 1916 (discharge, computed from extension of rating curve, approximately 950 million gallons per day, or 1,470 second-feet); minimum stage recorded, 2.2 feet July, August, September, and October, 1915 (discharge, 0.4 million gallons per day, or 0.6 second-feet).

DIVERSIONS.—Olokele ditch diverts all low-water flow one-fourth mile above station.

REGULATION.—By diversion only.

UTILIZATION.—Small amount diverted near mouth for irrigation of rice.

ACCURACY.—Discharge ascertained from well-defined rating curve and continuous record of gage heights; record good for all stages.

Discharge measurements of Olokele River near Waimea, Kauai, during the year ending June 30, 1916.

Date.	Made by—	Gage height (feet).	Discharge.	
			Second-feet.	Million gallons per day.
Oct. 17	W. V. Hardy	2.16	0.6	0.4
Jan. 10	D. E. Horner	5.02	306	198
Apr. 14	W. V. Hardy	2.54	3.2	2.1
May 15	do	2.34	.85	.55
June 20	do	2.77	6.3	4.1

Daily discharge, in million gallons, of Olokele River near Waimea, Kauai, for the year ending June 30, 1916.

Date.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	.....	2.0	0.4	.....	13	0.8	.....	18	2.4	1.3	72	7.2
2	.....	4.6	.4	.....	.....	.5	.....	16	2.4	1.0	13	2.9
3	.....	3.4	2.4	.....	.....	1.3	.....	14	2.4	1.0	20	13
4	.....	4.6	.6	.....	.....	.5	.....	16	5.4	10	36	2.4
5	.....	1.3	.4	.....	.....	.5	.....	102	9.4	1.6	151	4.6
6	.....	8.2	.4	.....	.....	6.2	.....	.....	1.6	1.0	50	7.2
7	.....	6.2	.4	.....	.....	.5	.....	.....	1.6	.8	18	1.3
8	.....	40	.4	.....	.....	.5	.....	.....	1.6	.8	2.4	23
9	.....	.6	.4	.....	.....	1.0	.....	1.6	1.6	.8	13	16
10	.....	.5	.4	.....	.....	2.0	.....	1.6	1.0	.8	5.4	1.0
11	.....	.5	.....	.....	.....	.5	.....	1.6	1.3	.8	2.4	3.4
12	.....	.6	.....	.....	.....	.5	.....	1.6	2.4	1.0	1.3	2.9
13	.....	2.4	.....	.....	.....	.5	.....	1.6	5.4	1.0	1.0	.8
14	.....	.4	.....	.....	.....	.6	.....	1.6	6.2	2.4	1.0	2.9
15	.....	.4	.....	.....	.....	32	.....	1.3	1.6	1.0	1.6	1.6
16	.....	.4	.4	.....	.....	.....	132	1.3	1.0	1.0	.8	2.0
17	.....	.5	.....	.....	.....	.....	144	20	1.0	4.6	.8	1.0
18	1.6	.4	.....	18	.....	.....	32	8.2	1.0	9.4	4.6	1.0
19	4.0	.4	.....	18	23	2.0	4.6	14	1.0	1.6	15	8.2
20	.5	.6	.....	144	4.0	.5	3.4	90	1.0	2.4	20	13
21	.4	16	.....	.8	2.4	13	2.9	72	1.0	1.0	2.9	45
22	.5	2.4	.....	20	96	32	20	256	.8	1.0	9.4	7.2
23	.4	.4	.....	32	108	.....	200	158	1.0	1.0	10	2.4
24	.5	.5	.....	4.6	5.4	.....	263	32	1.0	.8	2.9	1.0
25	.8	.6	.....	8.2	.8	.....	72	200	.8	4.6	.8	5.4
26	36	1.3	.....	96	.8	.....	23	23	.8	13	23	1.0
27	1.6	.5	.....	16	.6	.....	20	4.6	1.0	16	4.6	1.0
28	4.6	.4	.....	.5	.....	.....	40	3.4	1.0	4.0	2.0	2.4
29	.5	.4	.....	7.2	.....	.....	18	2.9	1.0	2.0	2.0	1.3
30	.5	.5	.....	.4	.6	.....	55	.....	1.0	2.4	2.4	12
31	.5	2.0	.....	2.4	.....	.....	40	.....	1.0	.....	.8	.....

NOTE.—Discharge determined from well-defined rating curve; gage height not recorded on days for which discharge is not given.

Monthly discharge of Olokele River near Waimea, Kauai, for the year ending June 30, 1916.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July 18–31	35	0.4	3.74	5.79	52	161
August	40	.4	3.32	5.14	103	316
October 18–31	144	.4	26.3	40.7	368	1,130
January 16–31	263	2.9	66.9	104	1,070	3,280
March	9.4	.8	1.99	3.08	62	189
April	16	.8	3.00	4.64	90	276
May	151	.8	15.9	24.6	494	1,510
June	45	.8	6.47	10.0	194	596

OLOKELE DITCH AT TUNNEL NO. 12, NEAR MAKAWELI, KAUAI.

LOCATION.—About 2 miles below intake, 10 miles northeast of Makaweli.

RECORDS AVAILABLE.—July 24, 1904, to June 30, 1916.

GAGE.—Vertical staff.

DISCHARGE MEASUREMENTS.—Made from plank across ditch.

CHANNEL AND CONTROL.—Concrete flume of rectangular section; ditch mostly in rock tunnel; straight for 50 feet above and below gage. Control probably permanent.

EXTREMES OF DISCHARGE, 1904–1916.—Maximum stage recorded, 4.40 feet June 25, 1916 (discharge, 82 million gallons per day, or 127 second-feet); water sometimes shut off.

DIVERSIONS.—Ditch diverts all low-water flow of Olokele River.

REGULATION.—Flow regulated by head gates.

UTILIZATION.—Irrigation of sugar cane and for domestic supply

ACCURACY.—Gage read once daily. Discharge ascertained from rating curve well defined between 20 and 80 million gallons per day; determination good within these limits.

COOPERATION.—Gage-height records furnished by Hawaiian Sugar Co.

Discharge measurements of Olokele ditch at Tunnel No. 12, near Makaweli, Kauai, during the year ending June 30, 1916.

Date.	Made by—	Gage height (feet).	Discharge.	
			Second-feet.	Million gallons per day.
Aug. 14	D. E. Horner	2.76	60	39
Apr. 14	W. V. Hardy	3.52	97	63
May 15	....do	3.86	108	70

Daily discharge, in million gallons, of Olokele ditch at Tunnel No. 12, near Makaweli, Kauai, for the year ending June 30, 1916.

Date.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	48	50	35	72	72	50	28	28	50	50	72	72
2	57	68	35	72	72	50	28	28	50	46	70	68
3	68	41	37	72	74	54	28	39	50	50	72	72
4	54	68	35	66	72	48	28	39	50	48	70	66
5	50	39	37	46	61	50	28	39	17	46	72	54
6	39	68	50	50	72	72	39	39	28	46	72	70
7	50	46	37	50	61	48	39	39	39	46	72	52
8	41	68	50	50	72	46	39	39	39	46	57	50
9	50	68	61	41	72	48	39	39	39	46	72	72
10	68	41	35	48	61	72	39	39	39	50	63	54
11	68	39	68	37	28	46	39	39	39	59	70	72
12	61	61	68	37	28	43	39	39	39	50	52	68
13	50	46	50	37	28	43	39	39	50	48	50	50
14	37	61	37	37	28	48	17	39	50	68	46	48
15	68	41	35	35	57	72	28	39	72	54	68	30
16	61	35	32	32	63	28	28	39	52	48	48	72
17	39	61	39	32	48	28	28	39	50	68	46	72
18	32	39	46	72	52	28	28	50	50	68	46	37
19	46	37	46	72	72	28	28	28	50	59	70	.....
20	37	68	37	72	57	50	28	28	50	54	72	57
21	46	35	37	72	72	50	28	28	48	59	68	72
22	41	35	39	46	72	50	28	28	57	48	68	63
23	32	68	68	72	72	50	28	28	66	48	68	66
24	37	39	68	72	72	50	28	28	72	46	70	50
25	32	50	63	52	50	17	28	28	57	52	50	82
26	68	50	50	72	50	17	28	28	54	57	72	54
27	57	37	.....	72	48	17	.....	28	50	68	59	54
28	68	35	72	52	57	17	.....	28	48	54	59	61
29	41	35	72	57	72	28	17	28	48	50	57	61
30	35	46	72	61	57	28	28	.....	48	46	46	72
31	30	46	.....	59	.....	28	28	.....	48	.....	32	.....

NOTE.—Discharge determined from well-defined rating curve. Ditch dry on days for which discharge is not given.

Monthly discharge of Olokele ditch at Tunnel No. 12, near Makaweli, Kauai, for year ending June 30, 1916.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July	68	30	48.7	75.3	1,510	4,630
August	68	35	49.1	76.0	1,520	4,670
September	72	32	48.7	75.3	1,410	4,330
October	72	32	55.4	85.7	1,720	5,270
November	72	28	59.0	91.3	1,770	5,430
December	72	17	42.1	65.1	1,300	4,010
January 1–26, 29–31	39	17	30.3	46.9	878	2,700
February	50	28	34.4	53.2	999	3,060
March	72	17	48.4	74.9	1,500	4,600
April	68	46	52.6	81.4	1,580	4,840
May	72	32	61.6	95.3	1,910	5,860
June 1–18, 20–30	82	30	61.1	94.5	1,770	5,440
The period	82	17	49.4	76.4	17,900	54,800

OLOKELE DITCH AT WEIR, NEAR MAKAWELI, KAUAI.

LOCATION.—About 5 miles below intake and 7 miles northeast of Makaweli.

RECORDS AVAILABLE.—January 1, 1912, to June 30, 1916.

GAGE.—Vertical staff showing head on weir.

DISCHARGE MEASUREMENTS.—Made by 12-foot sharp-crested weir, with end contractions; computations checked by current-meter measurements.

CHANNEL AND CONTROL.—Pool at weir.

EXTREMES OF DISCHARGE.—Maximum stage recorded during period of record, 26½ inches May 27, 1916 (discharge, 84 million gallons per day, or 130 second-feet); ditch occasionally dry.

DIVERSIONS.—Diverts all low-water flow of Olokele River.

REGULATION.—By head gates.

UTILIZATION.—Irrigation of sugar cane and for domestic supply.

ACCURACY.—Conditions for measurement by weir good; determinations good for low and medium stages, but those for high stages may be in error as gage is read only once daily.

COOPERATION.—Gage height records copied from records of Hawaiian Sugar Co.

Daily discahrge, in million gallons, of Olokele ditch at weir, near Makaweli, Kauai, for the year ending June 30, 1916.

Date.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	36	34	42	63	59	47	19	.....	44	43	50	52
2	57	49	36	64	62	49	20	16	45	43	61	54
3	49	49	34	62	65	46	20	19	44	43	60	54
4	43	50	33	64	66	49	20	24	45	42	59	52
5	45	54	33	48	62	45	31	28	25	41	60	52
6	38	54	47	41	62	47	31	30	14	43	61	56
7	45	45	39	43	63	55	34	33	18	40	61	54
8	49	45	42	47	58	43	38	33	32	40	59	48
9	43	62	44	38	56	42	38	32	34	40	61	48
10	48	48	38	46	60	45	39	33	34	41	60	54
11	47	36	44	42	36	50	35	33	33	46	54	45
12	44	41	63	36	36	42	34	33	33	47	52	54
13	45	45	59	35	33	40	36	34	32	42	45	54
14	38	49	41	35	32	31	35	34	44	47	43	45
15	39	50	34	33	40	.....	21	33	51	49	45	51
16	48	46	31	31	60	42	24	34	49	44	49	49
17	49	39	36	34	51	31	26	33	45	46	41	61
18	34	45	43	42	55	.....	26	38	42	56	40	56
19	48	39	45	63	51	27	26	43	43	52	49	33
20	45	33	37	64	61	31	20	42	43	51	60	6.9
21	33	52	34	65	60	42	27	43	42	49	55	60
22	36	62	36	49	59	42	25	44	44	44	56	61
23	33	50	51	59	65	42	25	41	47	43	59	59
24	31	34	64	65	56	.....	26	43	56	41	60	54
25	33	49	63	60	49	27	28	42	56	42	51	46
26	39	38	60	60	47	18	32	42	49	52	48	60
27	61	34	31	64	44	21	51	44	44	51	84	51
28	56	29	24	60	46	26	.....	44	42	54	57	48
29	50	28	59	49	54	15	.....	43	42	47	54	56
30	36	28	64	60	58	29	.....	.....	41	43	56	52
31	36	56	.....	48	.....	19	.....	.....	41	.....	45	.....

NOTE.—No flow on days for which discharge is not given.

Monthly discharge of Olokele ditch at weir near Makaweli, Kauai, for year ending June 30, 1916.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July	61	31	43.0	66.5	1,330	4,090
August	62	28	44.3	68.5	1,370	4,210
September	64	24	43.6	67.5	1,310	4,010
October	65	31	50.6	78.3	1,570	4,810
November	66	32	53.5	82.8	1,610	4,930
December 1–14, 16–17, 19–23, 25–31	55	15	37.2	57.6	1,040	3,200
Jan. 1–27	51	19	29.1	45.0	787	2,410
Feb. 2–29	44	16	35.4	54.8	991	3,040
March	56	14	40.4	62.5	1,250	3,840
April	56	40	45.4	78.2	1,360	4,180
May	84	40	54.7	84.6	1,700	5,200
June	61	6.9	50.9	78.8	1,530	4,690
The period	84	6.9	44.3	68.5	15,800	48,600

HANAPEPE RIVER AT KOULA, NEAR ELEELE, KAUAI.

LOCATION.—200 feet above ford, half a mile above the siphon at Koula, and 5 miles north of Eleele.

RECORDS AVAILABLE.—August 18, 1910, to June 30, 1916.

GAGE.—Friez water-stage recorder.

DISCHARGE MEASUREMENTS.—Made by wading or from cable.

CHANNEL AND CONTROL.—One channel at all stages; straight for 200 feet above and 400 feet below gage; banks high and wooded. Control composed of boulders; fairly permanent.

EXTREMES OF DISCHARGE.—Maximum stage recorded during period of record, 9.0 feet at 11.30 p. m. September 26, 1914, and at 3 a. m. January 26, 1916 (discharge, computed from extension of rating curve, approximately 5,000 million gallons per day, or 7,740 second-feet); minimum stage recorded, 0.95 foot December 30 and 31, 1913 (discharge, 7.1 million gallons per day, or 11 second-feet).

Minimum stage recorded during year, 1.00 foot December 12 and 13 (discharge, 9 million gallons per day, or 1.4 second-feet).

DIVERSION.—Hanapepe ditch diverts part of flow above station.

REGULATION.—By diversions only.

UTILIZATION.—Flow at low stages is diverted for irrigation of sugar cane, rice, and taro.

ACCURACY.—Discharge July 1 to November 4, 1915, and January 27 to June 30, 1916, ascertained from fairly well defined rating curve and continuous gage-height record; determinations fair for all stages; those for November 5, 1915, to January 26, 1916, good below 100 million gallons per day and fair above that limit.

Discharge measurements of Hanapepe River at Koula, near Eleele, Kauai, during the year ending June 30, 1916.

Date.	Made by—	Gage height (feet).	Discharge.	
			Second-feet.	Million gallons per day.
Aug. 20	D. E. Horner	1.44	56	36
Sept. 21	W. V. Hardy	.97	17	11
Dec. 24	.....do	1.77	79	51
May 16	.....do	1.08	25	16
June 24	.....do	1.36	42	27

Daily discharge, in million gallons, of Hanapepe River at Koula, near Eleele, Kauai, for the year ending June 30, 1916.

Date.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	21	14	13	136	45	30	66	121	162	10	162	36
2	18	107	12	162	190	19	106	136	128	11	68	32
3	14	32	13	286	700	24	66	80	460	12	68	50
4	14	136	12	107	1,040	22	66	74	440	10	80	32
5	12	80	16	56	256	19	99	74	144	10	242	50
6	28	162	18	45	181	24	66	74	200	10	100	56
7	32	50	12	36	92	12	114	162	114	10	93	32
8	18	275	13	21	370	10	256	100	74	10	68	100
9	28	74	21	62	269	9	282	80	68	10	136	80
10	100	32	12	36	405	37	221	74	62	10	68	32
11	32	28	107	18	232	14	99	62	56	11	50	40
12	50	24	128	14	282	9	60	62	45	11	28	36
13	18	50	36	16	232	9	60	62	24	11	21	21
14	13	45	14	13	163	14	130	50	28	24	18	32
15	21	21	12	12	85	232	78	45	24	11	32	21
16	74	16	12	13	50	114	66	45	21	10	14	128
17	18	16	12	12	45	78	221	40	18	16	13	100
18	18	16	62	68	34	122	181	32	18	21	18	50
19	68	13	32	93	50	60	172	28	18	13	62	50
20	18	40	14	356	30	41	85	24	18	16	100	68
21	32	80	12	74	30	78	66	74	18	11	40	121
22	14	86	13	100	50	163	60	40	18	11	68	80
23	14	24	144	190	85	66	55	32	21	11	50	50
24	21	28	45	107	37	106	85	28	24	11	56	32
25	12	16	62	80	24	210	310	24	18	62	28	56
26	144	12	114	107	22	78	440	24	12	62	74	45
27	40	12	121	121	17	440	121	40	11	200	40	28
28	50	12	86	50	27	190	80	28	10	24	32	32
29	18	11	121	56	163	122	68	32	10	13	40	24
30	14	21	100	40	34	92	80	.....	10	13	36	56
31	18	24	.....	62	.....	78	74	.....	10	.....	24	.....

NOTE.—Discharge determined from rating curves applicable as follows: July 1 to Nov. 4, 1915, and Jan. 27 to June 30, 1916, fairly well defined. Nov. 5, 1915, to Jan. 26, 1916, well defined below 100,000,000 gallons per day.

Monthly discharge of Hanapepe River at Koula, near Eleele, Kauai, for year ending June 30, 1916.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July	144	12	32.0	49.5	992	3,040
August	275	11	50.2	77.7	1,560	4,780
September	144	12	46.3	71.6	1,390	4,260
October	356	12	82.2	127	2,550	7,820
November	1,040	17	175	271	5,240	16,100
December	440	9	81.4	126	2,520	7,740
January	440	55	127	196	3,930	12,100
February	162	24	60.2	93.1	1,750	5,360
March	460	10	73.7	114	2,280	7,010
April	200	10	22.2	34.3	665	2,040
May	242	13	62.2	96.2	1,930	5,920
June	128	21	52.3	80.9	1,570	4,820
The year	1,040	9	72.1	112	26,400	81,000

HILOA DITCH NEAR ELEELE, KAUAI.

LOCATION.—335 feet below intake, which is just above confluence of main and east branches of Hanapepe River, about 8 miles north of Eleele.

RECORDS AVAILABLE.—November 22, 1911, to September 30, 1915, when station was discontinued.

GAGE.—Vertical staff.

DISCHARGE MEASUREMENTS.—Made from plank across ditch at gage.

CHANNEL AND CONTROL.—Cut in clay and gravel; straight for 20 feet above and below gage; stage-discharge relation affected at times by backwater from confluence with Hanapepe ditch. Control shifting.

EXTREMES OF DISCHARGE.—Maximum stage recorded during period of record, 2.80 feet December 23, 1912 (discharge, 41 million gallons per day, or 63 second-feet); ditch occasionally dry.

DIVERSIONS.—Diverts all low flow of main branch of Hanapepe River above Hanapepe Falls.

REGULATION.—By head gates.

UTILIZATION.—Irrigation of sugar cane and domestic supply.

ACCURACY.—Discharge ascertained from fairly well defined rating curve, for low and medium stages; determinations for high stages probably somewhat in error owing to fluctuation in stage not shown by the one gage reading daily. Gage not read Sundays.

Discharge measurements of Hiloa ditch near Eleele, Kauai, during the year ending June 30, 1916.

Date.	Made by—	Gage height (feet).	Discharge.	
			Second-feet.	Million gallons per day.
Aug. 20	D. E. Horner	2.34	48	31
Sept. 22	W. V. Hardy	1.98	37	24

Monthly discharge of Hiloa ditch near Eleele, Kauai, for the year ending June 30, 1916

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July	38	24	30.5	47.2	945	2,900
August	36	22	30.7	47.5	951	2,920
September	36	22	27.5	42.5	825	2,530
The period	38	22	29.6	45.8	2,720	8,350

NOTE.—Discharge determined from fairly well defined rating curve.

HANAPEPE DITCH AT HANAPEPE FALLS, NEAR ELEELE, KAUAI.

LOCATION.—250 feet below intake, 345 feet above confluence with Hiloa ditch, and 8 miles northeast of Eleele.

RECORDS AVAILABLE.—January 21, 1914, to September 30, 1915, when station was discontinued. November 22, 1911, to January 20, 1914, at station 150 feet below present gage.

GAGE.—Vertical staff installed January 21, 1914. November 22, 1911, to January 20, 1914, vertical staff 150 feet below present gage at different datum.

DISCHARGE MEASUREMENTS.—Made in flume.

CHANNEL AND CONTROL.—Wooden flume; discharge relation affected at times by backwater caused by inflow of Hiloa ditch.

EXTREMES OF DISCHARGE.—Maximum stage recorded at present site, 2.1 feet at 8 a. m. September 23, 1915 (discharge, 18 million gallons per day, or 28 second-feet); ditch occasionally dry.

DIVERSIONS.—Diverts all low-water flow of East Branch of Hanapepe River.
REGULATION.—By head gates.
UTILIZATION.—Irrigation of sugar cane and for domestic supply.
ACCURACY.—Gage read once daily except Sundays. Rating curve fairly well defined and records fair.

The following discharge measurement was made by W. V. Hardy:
September 22, 1915: Gage height, 1.65 feet; discharge, 19 second-feet, or 12 million gallons per day.

Monthly discharge of Hanapepe ditch at Hanapepe Falls, near Eleele, Kauai, for year ending June 30, 1916.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July	16	12	12.4	19.2	383	1,180
August	16	11	12.8	19.8	398	1,120
September	18	10	11.9	18.4	356	1,100
The period	18	10	12.4	19.2	1,140	3,500

NOTE.—Discharge determined from fairly well defined rating curve.

HANAPEPE DITCH AT KOULA, NEAR ELEELE, KAUAI.

LOCATION.—At the first flume below siphon at Koula, 4 miles below intake, and 4 miles north of Eleele.
RECORDS AVAILABLE.—January 1, 1910, to June 30, 1916.
GAGE.—Vertical staff.
DISCHARGE MEASUREMENTS.—Made in flume.
CHANNEL AND CONTROL.—Wooden flume; straight for 20 feet above and below gage; some vegetable growth on bottom and sides of flume. Control fairly permanent.
EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 3.1[illegible] feet at 7 a. m. September 23 (discharge, 34 million gallons per day, or 53 second-feet); ditch occasionally dry.

Maximum stage recorded during period of record, 4.97 feet November 30, 1913 (discharge, 67 million gallons per day, or 104 second-feet).

DIVERSIONS.—Diverts part of flow of Hanapepe River.
REGULATION.—By head gates.
UTILIZATION.—For domestic supply and irrigation of sugar cane.
ACCURACY.—Discharge ascertained from fairly well defined rating curve; fair for low and medium stages; determinations for high stages probably somewhat in error owing to fluctuation of stage not shown by the one daily gage reading.

Discharge measurements of Hanapepe ditch at Koula, near Eleele, Kauai, during the year ending June 30, 1916.

Date.	Made by—	Gage height (feet).	Discharge.	
			Second-feet.	Million gallons per day.
Aug. 19	D. E. Horner	2.94	48	31
20	do	3.12	53	34
Sept. 21	W. V. Hardy	2.94	46	30
May 16	do	3.14	53	34

Daily discharge, in million gallons, of Hanapepe ditch at Koula, near Eleele, Kauai, for the year ending June 30, 1916.

Date.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	33	32	32	34	34	34	0.5	4.6	18	29	33	33
2	33	33	28	34	34	34	.5	4.6	18	31	33	33
3	33	33	31	34	34	34	.5	5.0	18	30	33	33
4	31	33	28	34	32	34	.5	5.0	4.6	29	33	32
5	32	33	30	34	34	34	.5	5.0	4.6	27	33	32
6	33	33	33	34	27	34	.....	.....	4.6	27	33	34
7	33	33	29	34	34	34	.....	5.5	4.6	26	33	34
8	33	33	32	34	34	34	.....	5.5	4.6	26	33	33
9	33	33	33	34	33	34	4.2	5.5	4.6	26	33	34
10	34	33	30	34	21	34	11	5.5	4.6	28	33	34
11	33	33	33	34	.....	34	12	5.5	4.6	28	33	33
12	33	32	33	34	.....	34	12	6.0	12	27	33	33
13	33	33	32	34	.....	34	12	.....	22	26	33	34
14	33	33	32	32	28	34	.....	6.0	22	32	33	34
15	33	33	29	31	32	34	.....	6.0	22	28	33	33
16	33	33	28	32	33	34	.....	6.0	22	28	33	34
17	33	33	28	30	33	.....	.....	6.0	22	31	33	34
18	31	33	31	34	33	.....	.....	12	22	32	33	34
19	33	31	33	34	34	.....	.....	18	22	31	33	33
20	33	33	33	34	34	28	.....	18	22	32	33	33
21	33	33	31	34	34	18	.....	18	22	28	33	34
22	32	33	30	34	34	15	2.3	18	22	27	33	33
23	29	33	34	34	34	12	2.3	18	32	26	33	33
24	33	33	34	34	34	4.2	3.0	18	32	27	33	33
25	29	33	33	33	34	.....	6.0	18	30	30	33	33
26	33	32	31	34	34	.....	.....	18	30	33	33	34
27	33	30	34	34	34	.....	.....	18	29	33	33	34
28	33	28	34	34	34	.....	9.1	18	30	33	33	34
29	33	28	34	34	34	.....	9.1	18	29	33	33	34
30	32	32	33	34	34	.....	9.1	.....	29	31	33	34
31	32	33	.....	34	.....	.7	4.6	.....	29	.....	33	.....

NOTE.—Discharge determined from rating curve fairly well defined above 23 million gallons per day. 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, 1916.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July	34	29	32.5	50.3	1,010	3,090
August	33	28	32.4	50.1	1,000	3,080
September	34	28	31.5	48.7	946	2,900
October	34	30	33.6	52.0	1,040	3,200
November 1–10, 14–30	34	21	32.7	50.6	884	2,710
December 1–16, 20–24, 31	34	.7	26.7	41.3	588	1,800
January 1–5, 9–13, 22–25, 28–31	12	.5	5.51	8.52	99	304
February 1–5, 7–12, 14–29	18	4.6	10.8	16.7	292	895
March	32	4.6	19.1	29.6	593	1,820
April	33	26	29.2	45.2	875	2,690
May	33	33	33.0	51.1	1,020	3,140
June	34	32	33.4	51.7	1,000	3,080
The period	34	.5	27.7	42.9	9,350	28,700

HANAPEPE DITCH AT WEIR NEAR HANAPEPE, KAUAI.

LOCATION.—About 2½ miles northeast of Hanapepe, below the last siphon across Hanapepe River.

RECORDS AVAILABLE.—January, 1910, to June 30, 1916.

GAGE.—Vertical staff.

DISCHARGE MEASUREMENTS.—Made by 12-foot sharp-crested weir with end contractions.

CHANNEL AND CONTROL.—Weir conditions good.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 15 inches January 3–5 and 10 (discharge, 36 million gallons per day, or 56 second-feet), ditch frequently dry.

DIVERSIONS.—Ditch diverts from Hanapepe River.

UTILIZATION.—Irrigation of sugar cane and for domestic use.

ACCURACY.—Records fair.

COOPERATION.—Gage height records copied from records kept by Hawaiian Sugar Co. (Ltd.).

Daily discharge, in million gallons, of Hanapepe ditch at weir near Hanapepe, Kauai, for the year ending June 30, 1916.

Date.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	25	27	28	28	28	29	.....	.....	20	26	29	27
2	27	27	26	27	28	29	27	.....	20	26	26	27
3	27	27	26	27	29	.....	36	.....	17	26	29	27
4	26	27	26	28	29	.....	36	.....	.....	26	30	27
5	26	27	26	28	29	.....	36	.....	.....	26	30	27
6	26	27	26	27	28	.....	.....	.....	.....	23	30	27
7	28	28	27	27	27	29	.....	.....	.....	27	30	27
8	27	27	26	27	30	.....	.....	.....	.....	27	30	27
9	27	27	27	27	30	29	.....	.....	.....	24	29	27
10	28	27	27	27	.....	29	36	.....	.....	23	30	27
11	27	27	27	27	.....	29	.....	.....	.....	23	27	27
12	28	27	27	28	.....	29	.....	.....	5	25	27	27
13	28	27	27	28	.....	29	.....	.....	21	25	27	27
14	28	26	27	27	.....	29	.....	.....	21	24	27	27
15	28	26	27	27	13	.....	.....	.....	21	27	27	27
16	28	26	26	27	27	.....	.....	.....	20	23	27	27
17	28	26	27	27	27	.....	.....	.....	22	25	27	27
18	27	27	26	27	.....	.....	.....	.....	23	26	27	27
19	27	27	27	27	.....	.....	.....	.....	23	27	27	27
20	28	27	27	27	.....	.....	.....	.....	23	26	27	27
21	27	27	27	27	27	.....	.....	20	12	23	27	27
22	26	27	27	29	27	.....	.....	20	24	26	27	27
23	26	27	27	29	.....	.....	.....	20	.....	23	27	27
24	25	27	27	27	.....	.....	.....	20	26	23	27	27
25	25	27	27	27	28	.....	.....	18	26	23	27	27
26	25	27	27	27	29	.....	.....	19	27	27	27	27
27	28	27	27	27	.....	.....	.....	20	27	27	27	27
28	28	24	27	29	27	.....	.....	20	27	27	27	26
29	27	24	28	27	27	.....	.....	19	23	29	27	27
30	27	25	28	28	29	.....	.....	.....	26	27	27	27
31	27	25	.....	28	.....	.....	.....	.....	27	.....	27	.....

NOTE.—Ditch dry on days for which discharge is not given.

Monthly discharge of Hanapepe ditch at weir near Hanapepe, Kauai, for the year ending June 30, 1916.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July	28	25	26.9	41.6	835	2,560
August	28	24	26.6	41.2	824	2,530
September	28	26	26.8	41.5	805	2,470
October	29	27	27.4	42.4	850	2,610
November 1–8, 15–17, 21–22, 25–26, 28–30	30	13	27.3	42.2	519	1,590
December 1–2, 7, 9–14	29	29	29.0	44.9	261	801
January 2–5, 10	36	27	34.2	52.9	171	525
February 21–29	20	18	19.6	30.3	176	541
March 1–3, 12–22, 24–31	27	5	21.9	33.9	481	1,480
April	29	23	25.3	39.1	760	2,330
May	30	26	27.7	42.9	860	2,640
June	27	26	27.0	41.8	809	2,490
The period	36	5	26.4	40.8	7,350	22,600

HULEIA RIVER NEAR LIHUE, KAUAI.

LOCATION.—About 300 feet above stone bridge where wagon road from Lihue to the rice plantation crosses stream, about 4 miles southeast of Lihue.

RECORDS AVAILABLE.—May 8, 1912, to December 31, 1915, when station was discontinued.

GAGE.—Vertical staff for low water; inclined staff for high water.

DISCHARGE MEASUREMENTS.—Made by wading.

CHANNEL AND CONTROL.—One channel at all stages; straight for 200 feet above and below gage; current sluggish at low stages; right bank low with gentle slope; left bank high and steep. Control composed of large boulders and rock ledge; fairly permanent between extreme floods.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 8.5 feet November 4 (discharge, 88 million gallons per day, or 136 second-feet); minimum stage recorded, 6.2 feet July 2–16 (discharge, 4.0 million gallons per day, or 6.2 second-feet).

Maximum stage during period of record, 10.2 feet March 23, 1913 (discharge, approximately 176 million gallons per day, or 272 second-feet); minimum stage recorded, 6.1 feet April 2–4, 1915 (discharge, 2.8 million gallons per day, or 4.3 second-feet).

DIVERSIONS.—Several above station.

REGULATION.—None except by diversions.

UTILIZATION.—Irrigation of sugar cane, rice. and taro.

ACCURACY.—Gage read once daily. Records poor because of lack of sufficient discharge measurements to define changes in stage-discharge relation.

Discharge measurements of Huleia River near Lihue, Kauai, during the year ending June 30, 1916.

Date.	Made by—	Gage height (feet).	Discharge.	
			Second-feet.	Million gallons per day.
July 20	W. V. Hardy	6.33	8.5	5.5
26	do	6.46	14	8.9
Nov. 20	do	7.73	82	53
Jan. 24	D. E. Horner	8.07	99	64

Monthly discharge of Huleia River near Lihue, Kauai, for year ending June 30, 1916.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July	5.4	4.0	4.70	7.27	146	447
August	20	5.4	6.75	10.4	209	642
September	73	5.4	27.6	42.7	827	2,540
October	73	14	45.2	69.9	1,400	4,300
November	88	43	59.0	91.3	1,770	5,430
December	83	7.0	43.5	67.3	1,350	4,140
The period						17,500

NOTE.—Discharge determined from poorly defined rating curve.

SOUTH FORK OF WAILUA RIVER NEAR LIHUE, KAUAI.

LOCATION.—One mile above Waiehu Falls and about 7 miles northeast of Lihue.

RECORDS AVAILABLE.—December 10, 1911, to June 30, 1916.

GAGE.—Friez water-stage recorder.

DISCHARGE MEASUREMENTS.—Made from cable.

CHANNEL AND CONTROL.—One channel at all stages; straight for 600 feet above and below station; right bank steep and high; left bank slopes gently. Control composed of gravel and small boulders; shifting.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 13.25 feet at 3.30 a. m. January 26 (discharge, approximately 9,800 million gallons per day, or 15,200 second-feet); minimum stage recorded, 2.65 feet April 7, 8, and 14 (discharge, 14 million gallons per day, or 22 second-feet).

Maximum stage recorded during period of record, 14.75 feet at 7 p. m. September 26, 1914 (discharge, computed from extension of rating curve, approximately 10,000 million gallons per day, or 15,500 second-feet); minimum stage recorded, 3.09 feet February 14 and 15, 1912 (discharge, 2.9 million gallons per day, or 4.5 second-feet).

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

REGULATION.—By diversions above station.

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

ACCURACY.—Discharge ascertained from well-defined rating curve and a continuous gage-height record; determinations good for all stages except extreme floods, for which they are fair.

Discharge measurements of South Fork of Wailua River near Lihue, Kauai, during the year ending June 30, 1916.

Date.	Made by—	Gage height (feet).	Discharge.	
			Second-feet.	Million gallons per day.
Sept. 23	W. V. Hardy	4.54	371	240
Nov. 26	D. E. Horner	3.78	173	112
27	do	3.68	149	96
28	do	4.14	237	153
28	do	3.92	191	123
Jan. 22	do	3.74	172	111
24	do	3.90	227	147
Apr. 4	W. V. Hardy	2.70	25	16

Daily discharge, in million gallons, of South Fork of Wailua River near Lihue, Kauai, for the year ending June 30, 1916.

Date.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	90	70	56	205	123	138	146	162	116	29	146	66
2	80	146	52	241	270	109	292	205	740	26	130	61
3	80	80	52	303	840	123	154	123	990	29	138	70
4	80	196	48	162	965	116	146	146	1,320	17	96	61
5	70	96	48	116	518	102	162	102	336	17	250	61
6	80	223	61	116	398	102	123	96	292	17	130	85
7	102	70	52	102	250	80	130	187	196	14	102	66
8	96	270	56	90	570	75	314	138	138	14	75	146
9	90	109	80	146	570	70	385	292	116	17	130	138
10	196	61	52	102	890	116	270	138	102	17	154	70
11	109	56	96	80	440	90	187	116	90	17	123	75
12	116	52	178	75	380	80	138	102	85	17	75	70
13	85	70	90	80	320	75	138	96	80	14	61	61
14	70	102	70	75	260	75	232	90	75	29	56	61
15	80	80	61	70	187	518	162	85	70	20	61	56
16	116	66	196	80	162	187	138	80	61	17	48	205
17	75	56	154	75	154	130	385	75	61	23	44	130
18	75	52	303	123	138	170	385	70	56	32	44	80
19	187	48	146	146	196	116	348	66	52	32	85	75
20	96	75	96	385	146	102	170	56	44	29	123	80
21	196	90	130	146	116	146	130	75	36	23	70	138
22	138	52	130	154	146	281	109	66	36	20	75	102
23	102	61	292	281	214	130	96	52	40	23	85	85
24	96	61	116	162	162	205	138	44	56	20	146	70
25	85	52	116	146	146	336	740	36	52	96	75	96
26	178	48	162	162	146	196	940	40	40	109	116	90
27	109	44	130	232	102	1,260	214	52	32	348	138	75
28	123	44	102	130	130	535	162	44	29	66	90	75
29	80	40	138	130	360	292	138	48	29	40	80	80
30	66	48	130	123	138	232	154	.....	29	36	75	96
31	80	70	.....	130	.....	178	116	.....	29	.....	66	.....

NOTE.—Discharge determined from well-defined rating curve; Nov. 12-13 interpolated.

Monthly discharge of South Fork of Wailua River near Lihue, Kauai, for year ending June 30, 1916.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July	196	66	104	161	3,230	9,890
August	270	40	83.5	129	2,590	7,940
September	303	48	113	175	3,390	10,400
October	385	70	147	227	4,570	14,000
November	965	116	315	487	9,440	29,000
December	1,260	70	205	317	6,360	19,500
January	940	96	237	367	7,340	22,500
February	292	36	99.4	154	2,880	8,850
March	1,320	29	175	271	5,430	16,600
April	348	14	40.3	62.4	1,210	3,710
May	250	44	99.6	154	3,090	9,480
June	205	56	87.5	135	2,620	8,060
The year	1,320	14	142	220	52,200	160,000

HANAMAULU DITCH NEAR LIHUE, KAUAI.

LOCATION.—In flume 180 feet below point where Kauai Electric Co.'s power line crosses the South Fork of Wailua River, about 6 miles northwest of Lihue.

RECORDS AVAILABLE.—July 1, 1910, to June 30, 1916.

GAGE.—Vertical staff. New datum September 30, 1911.

DISCHARGE MEASUREMENTS.—Made in flume.

CHANNEL AND CONTROL.—Wooden flume; straight for 20 feet above and below gage; aquatic plants grow on bottom and sides of flume. Control is rock section at end of flume; probably permanent; stage-discharge relation changed by repairs to flume and ditch, August 1 to December 31, 1915.

EXTREMES OF DISCHARGE.—Maximum stage recorded during period of record, 2.80 feet August 6, 1913 (discharge, 36 million gallons per day, or 56 second-feet); ditch occasionally dry.

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

REGULATION.—By head gates.

UTILIZATION.—Irrigation of sugar cane and for domestic supply.

ACCURACY.—Gage read once daily; determinations fair for all stages; rating curves well defined.

Discharge measurements of Hanamaulu ditch near Lihue, Kauai, during the year ending June 30, 1916.

Date.	Made by—	Gage height (feet).	Discharge.	
			Second-feet.	Million gallons per day.
Aug. 16	D. E. Horner	2.24	26	17
Sept. 23	W. V. Hardy	2.34	28	18
Jan. 23	D. E. Horner	1.04	9.0	5.8
April 4	W. V. Hardy	2.10	31	20

Monthly discharge of Hanamaulu ditch near Lihue, Kauai, for year ending June 30, 1916

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July	19	15	17.5	27.1	543	1,660
January 24–31	9.0	3.0	5.16	7.98	41	127
February	22	2.3	7.96	12.3	231	708
March	23	4.2	16.8	26.0	521	1,600
April	24	20	22.1	34.2	662	2,030
May	25	20	23.5	36.4	729	2,240
June	25	22	23.4	36.2	702	2,150

NOTE.—Discharge determined from rating curves applicable as follows: July 1–31, 1915, well defined. Jan. 24 to June 30, 1916, well defined. Gage heights not recorded Aug. 1 to Dec. 31, 1915; ditch undergoing repairs. Ditch dry Jan. 1–23, 1916.

LIHUE DITCH NEAR LIHUE, KAUAI.

LOCATION.—At point where Kauai Electric Co.'s power line crosses ditch, 1½ miles below intake, and about 5 miles northwest of Lihue.

RECORDS AVAILABLE.—July 1, 1910, to June 30, 1916.

GAGE.—Vertical staff.

DISCHARGE MEASUREMENTS.—Made by wading.

CHANNEL AND CONTROL.—Channel cut in clay and gravel; ditch clean with low grade. Stage-discharge relation sometimes affected by backwater caused by inflow of Kanaha ditch 260 feet below gage.

EXTREMES OF DISCHARGE.—Maximum stage recorded during period of record, 1.6 feet April, May, and June, 1916 (discharge, 14 million gallons per day, or 22 second-feet); ditch occasionally dry.

DIVERSIONS.—Part of flow diverted above station into a ditch at lower level.

REGULATIONS.—By head gates.

UTILIZATION.—For irrigation of sugar cane and for domestic supply.

ACCURACY.—Gage read once daily. Determinations poor owing to variable effect of backwater on stage-discharge relation.

Discharge measurements of Lihue ditch near Lihue, Kauai, during the year ending June 30, 1916.

Date.	Made by—	Gage height (feet).	Discharge.	
			Second-feet.	Million gallons per day.
Jan. 20	W. V. Hardy	0.49	0.7	0.45
Apr. 4	.....do	1.50	19	12

Monthly discharge of Lihue ditch near Lihue, Kauai, for year ending June 30, 1916.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July	4.2	3.6	4.10	6.34	127	390
February 25–29	7.8	6.4	7.38	11.4	37	113
March	12	3.0	7.98	12.3	248	759
April	14	11	11.7	18.1	352	1,080
May	14	11	12.6	19.5	391	1,200
June	14	11	12.3	19.0	369	1,130

NOTE.—Discharge determined from poorly defined rating curve. No gage record Aug. 1, 1915, to Feb. 24, 1916.

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

LOCATION.—One mile above intake of Kanaha ditch and 10 miles northwest of Lihue.

RECORDS AVAILABLE.—September 21, 1914, to June 30, 1916.

GAGE.—Stevens 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 recorded during year, 7.9 feet at 4 a. m. January 26 (discharge, approximately 1,700 million gallons per day, or 2,630 second-feet).

1914–1916: 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, 1.3 feet April, 1916 (discharge, 13 million gallons per day, or 20 second-feet).

DIVERSIONS.—None above station.

REGULATION.—None.

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

ACCURACY.—Discharge July 1 to October 29 ascertained from well-defined rating curve and a continuous record of gage height; determinations good for all stages; rating curve November 28 to June 30 not so well defined; results fair for all stages during this period.

Discharge measurements of North Fork of Wailua River, at elevation 650 feet, near Lihue, Kauai, during the year ending June 30, 1916.

Date.	Made by—	Gage height (feet).	Discharge.	
			Second-feet.	Million gallons per day.
July 29	D. E. Horner	1.87	53	34
Sept. 24	W. V. Hardy	2.16	114	74
Nov. 29	.....do	2.02	74	48
Jan. 23	.....do	1.93	67	43
May 10	.....do	1.91	63	41
June 10	.....do	1.67	51	33

Daily discharge, in million gallons, of North Fork of Wailua River, at elevation 650 feet, near Lihue, Kauai, for the year ending June 30, 1916.

Date.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	38	48	35	76	.....	55	52	55	68	14	41	32
2	35	59	30	86	.....	48	81	48	246	18	52	32
3	32	41	30	114	.....	52	52	38	323	14	72	32
4	30	59	30	59	.....	52	52	41	300	13	44	30
5	28	41	41	48	.....	48	55	41	114	13	76	32
6	28	86	35	41	.....	76	59	41	114	13	48	32
7	44	41	35	41	.....	44	134	63	63	13	52	30
8	38	108	41	35	.....	41	246	44	41	13	44	63
9	48	52	38	48	.....	38	335	59	32	13	38	52
10	63	38	32	35	.....	63	323	41	30	14	68	35
11	44	35	55	30	.....	41	142	38	25	14	52	41
12	44	38	68	30	.....	35	81	35	25	14	38	35
13	38	55	48	32	.....	35	68	32	22	14	35	30
14	32	48	38	28	.....	32	72	32	38	20	32	32
15	35	38	32	25	.....	134	55	32	30	14	35	32
16	41	38	.....	28	.....	76	52	30	22	13	28	102
17	30	41	.....	25	.....	52	205	30	20	18	28	59
18	38	35	.....	52	.....	68	127	30	20	25	32	41
19	55	30	.....	48	.....	44	120	28	18	16	44	44
20	41	44	.....	114	.....	38	68	28	18	18	48	41
21	59	52	.....	44	.....	52	52	48	18	14	32	59
22	48	72	.....	55	.....	96	48	35	18	14	38	52
23	38	38	.....	68	.....	48	44	30	20	13	48	44
24	35	38	48	55	.....	63	59	28	30	13	48	35
25	32	32	59	48	.....	91	186	28	20	52	35	48
26	76	30	72	52	.....	68	246	25	16	44	59	38
27	44	30	68	72	.....	267	68	32	14	278	68	32
28	48	28	55	48	52	142	52	30	14	32	48	32
29	35	28	59	55	108	102	44	32	16	22	38	35
30	35	32	52	.....	52	72	63	.....	16	20	35	52
31	32	41	.....	.....	.....	63	41	.....	22	.....	30	.....

NOTE.—Discharge determined from rating curves applicable as follows: July 1 to Oct. 29, 1915, well defined; Nov. 28, 1915, to June 30, 1916, fairly well defined. Gage height not recorded on days for which discharge is not given.

Monthly discharge of North Fork of Wailua River, at elevation 650 feet, near Lihue, Kauai, for the year ending June 30, 1916.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July	76	28	40.8	63.1	1,260	3,880
August	108	28	45.0	69.6	1,400	4,280
October 1–29	114	25	51.4	79.5	1,490	4,570
December	267	32	68.9	107	2,140	6,550
January	335	41	106	164	3,280	10,100
February	63	25	37.0	57.2	1,070	3,290
March	323	14	57.2	88.5	1,770	5,440
April	278	13	26.9	41.6	806	2,480
May	76	28	44.7	69.2	1,390	4,250
June	102	30	41.8	64.7	1,250	3,850

KANAHA DITCH NEAR LIHUE, KAUAI.

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

RECORDS AVAILABLE.—August 6, 1910, to June 30, 1916.

GAGE.—Vertical staff. New datum May 28, 1913.

DISCHARGE MEASUREMENTS.—Made in flume 100 feet above gage.

CHANNEL AND CONTROL.—Cut in soft lava rock; straight for 30 feet above and 10 feet below gage. Control composed of soft lava rock, fairly permanent between dates of cleaning ditch.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 2.7 feet at 5 p. m., September 12 (discharge, 20 million gallons per day, or 31 second-feet); no flow November 7–17.

Maximum stage recorded during period of record, 2.6 feet July 24–26, 1913 (discharge, 22 million gallons per day, or 34 second-feet); ditch occasionally dry.

DIVERSIONS.—Diverts part of flow of North Fork of Wailua River.

REGULATION.—By head gates.

UTILIZATION.—Irrigation of sugar cane and for domestic supply.

ACCURACY.—Discharge ascertained from well-defined rating curves; good for low and medium stages; determinations for high and fluctuating stages poor, as gage read only once daily.

Discharge measurements of Kanaha ditch near Lihue, Kauai, during the year ending June 30, 1916.

Date.	Made by—	Gage height (feet).	Discharge.	
			Second-feet.	Million gallons per day.
Sept. 24	W. V. Hardy	2.43	25	16
Jan. 21	do	.97	9.9	6.4
22	do	.62	6.3	4.1

Daily discharge, in million gallons, of Kanaha ditch near Lihue, Kauai, for the year ending June 30, 1916.

Date.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	16	16	17	18	11	7.4	6.0	6.0	14	14	14	13
2	16	16	16	16	11	7.8	7.8	4.6	15	13	16	12
3	16	17	15	16	11	8.1	5.6	4.6	16	12	15	14
4	19	17	16	16	11	7.8	7.8	4.2	8.8	13	14	14
5	16	18	18	14	11	8.1	7.4	3.9	7.4	13	15	14
6	16	16	16	14	11	8.4	7.0	3.9	8.1	13	14	14
7	17	17	16	14	.....	7.8	7.4	5.3	5.6	12	13	14
8	16	16	18	13	.....	7.4	8.1	4.2	6.4	12	13	15
9	16	16	18	14	.....	6.7	7.4	6.0	6.4	13	13	15
10	16	16	17	14	.....	7.0	7.4	4.6	6.4	13	14	15
11	16	16	19	13	.....	7.0	6.4	4.2	6.4	14	15	15
12	16	17	20	13	.....	6.7	6.4	5.6	6.4	13	15	14
13	16	17	18	14	.....	6.7	5.3	5.6	6.0	12	14	14
14	16	17	16	12	.....	6.7	3.9	5.6	11	14	13	15
15	16	17	15	12	.....	8.1	6.0	5.6	11	12	15	15
16	17	17	18	12	.....	7.4	5.6	6.4	11	12	14	16
17	16	17	18	12	.....	7.0	6.0	6.4	10	14	15	15
18	17	16	18	14	7.8	6.7	7.0	6.4	9.5	15	14	15
19	16	15	16	14	9.5	6.7	6.7	6.4	12	14	15	14
20	16	16	18	16	9.5	6.7	5.3	6.4	12	13	15	15
21	16	8.4	18	15	9.2	7.0	3.9	11	12	13	15	15
22	16	16	18	14	9.5	8.1	3.6	8.8	13	13	15	15
23	17	16	18	14	11	6.7	3.9	6.7	14	13	15	15
24	17	16	17	14	9.5	7.0	6.4	6.4	14	13	15	14
25	17	16	18	14	8.4	6.7	8.8	10	14	17	15	14
26	16	15	17	.....	7.4	8.1	6.7	11	14	16	15	14
27	17	15	17	.....	7.4	8.4	6.0	13	13	16	16	14
28	17	16	17	.....	7.4	8.8	5.6	11	13	16	14	14
29	17	16	16	.....	9.5	7.4	5.6	12	14	10	14	14
30	16	17	16	.....	7.4	6.7	6.4	.....	14	14	14	15
31	16	16	.....	.....	.....	6.4	4.6	.....	15	.....	13	.....

NOTE.—Discharge determined from well-defined rating curve. No record Oct. 26–31. No flow Nov. 7–17.

Monthly discharge of Kanaha ditch near Lihue, Kauai, for year ending June 30, 1916.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July	19	16	16.4	25.4	508	1,560
August	18	8.4	16.0	24.8	497	1,520
September	20	15	17.2	26.6	515	1,580
October 1–25	18	12	14.1	21.8	352	1,080
November 1–6, 18–30	11	7.4	9.45	14.6	180	551
December	8.8	6.4	7.34	11.4	228	698
January	8.8	3.6	6.19	9.58	192	589
February	13	3.9	6.75	10.4	196	601
March	16	5.6	10.9	16.9	339	1,040
April	17	12	13.4	20.7	402	1,230
May	16	13	14.4	22.3	447	1,370
June	16	12	14.4	22.3	432	1,330

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

LOCATION.—400 feet above confluence with North Fork, 600 feet above gaging station on North Fork, and about 8 miles north of Lihue.

RECORDS AVAILABLE.—July 27, 1912, to June 30, 1916.

GAGE.—Stevens water-stage recorder, December 31, 1914, to June 30, 1916; staff 250 feet below present site July 27, 1912, to September 30, 1914.

DISCHARGE MEASUREMENTS.—Made by wading or from cable.

CHANNEL AND CONTROL.—One channel at all stages; straight for 30 feet above and 120 feet below gage; banks low and wooded. Control composed of boulders; shifting.

EXTREMES OF DISCHARGE.—Maximum stage recorded during period of record, 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 (new datum) March, 1915 (discharge, 7 million gallons per day, or 11 second-feet).

Minimum stage recorded during year, 1.8 feet July, August, and September (discharge, 16 million gallons per day, or 25 second-feet).

DIVERSIONS.—None.

REGULATION.—None.

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.—Determinations good for low and medium stages, except those for March 4 to June 30, which are doubtful on account of lack of current-meter measurements.

Discharge measurements of East Branch of North Fork of Wailua River near Lihue, Kauai, during the year ending June 30, 1916.

Date.	Made by—	Gage height (feet).	Discharge.	
			Second-feet.	Million gallons per day.
Aug. 17	D. E. Horner	1.95	42	27
Sept. 24	W. V. Hardy	2.20	9[illegible]	61
Nov. 27	do	2.17	6[illegible]	44
28	do	2.29	9[illegible]	62
Jan. 23	do	2.12	63	41
June 10	do	1.70	3[illegible]	20

Daily discharge, in million gallons, of East Branch of North Fork of Wailua River near Lihue, Kauai, for the year ending June 30, 1916.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	27	20	23	67	74	50	.....	.....	23	42	60	16
2	31	27	16	90	273	39	.....	.....	352	42	143	16
3	31	20	16	121	318	.....	.....	.....	.....	42	166	16
4	27	35	20	67	178	.....	.....	.....	.....	37	190	16
5	23	23	16	54	154	.....	.....	.....	.....	42	132	16
6	23	64	16	48	100	.....	.....	.....	.....	37	202	24
7	27	31	16	42	132	.....	.....	129	.....	37	132	20
8	31	80	16	32	230	.....	.....	44	.....	37	100	16
9	27	44	16	42	258	.....	.....	39	.....	37	110	42
10	39	35	16	32	210	.....	.....	35	.....	37	166	20
11	27	31	35	28	140	.....	.....	31	.....	37	67	24
12	23	27	50	28	98	.....	.....	31	.....	37	42	20
13	23	31	31	28	80	.....	.....	31	.....	37	32	16
14	16	39	23	24	64	.....	.....	27	90	42	28	20
15	20	27	23	20	50	.....	.....	27	90	42	28	20
16	27	27	140	24	39	.....	.....	23	67	37	24	67
17	20	27	67	32	39	.....	.....	23	60	37	20	37
18	23	23	67	48	.....	.....	.....	23	60	42	20	28
19	27	20	48	67	.....	.....	.....	23	60	54	32	28
20	44	31	54	82	.....	.....	.....	20	54	42	32	28
21	44	31	110	42	.....	.....	.....	27	54	37	24	42
22	31	39	74	67	.....	.....	.....	23	54	37	24	37
23	27	23	90	60	.....	.....	39	20	54	37	28	37
24	23	23	60	60	.....	.....	44	20	60	37	32	24
25	31	23	82	54	.....	.....	285	16	54	42	24	32
26	27	20	100	74	.....	.....	.....	16	48	100	24	28
27	27	16	82	60	44	.....	.....	23	48	90	32	24
28	23	16	67	54	50	.....	.....	20	48	110	28	16
29	23	16	67	74	98	.....	.....	20	48	60	24	42
30	23	20	60	48	44	.....	.....	.....	48	54	20	74
31	23	31	.....	54	.....	.....	.....	.....	48	.....	20	.....

NOTE.—Discharge determined from rating curves applicable as follows: July 1 to Sept. 16, 1915, and Nov. 10, 1915, to Mar. 3, 1916, well defined below 100 million gallons per day. Sept. 17 to Nov. 9, 1915, well defined below 60 million gallons per day. Mar. 4 to June 30, 1916, poorly defined. Gage heights not recorded on days for which discharge is not given.

Monthly discharge of East Branch of North Fork of Wailua River near Lihue, Kauai, for year ending June 30, 1916.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July	44	16	27.0	41.8	838	2,570
August	80	16	29.7	46.0	920	2,830
September	140	16	50.0	77.4	1,500	4,600
October	121	20	52.4	81.1	1,620	4,980
February 7–29	129	16	30.0	46.4	691	2,120
April	110	37	46.7	72.3	1,400	4,300
May	202	20	64.7	100	2,010	6,160
June	74	16	28.2	43.6	846	2,600

KAPAA RIVER NEAR KEALIA, KAUAI.

LOCATION.—A quarter of a mile below confluence of two main branches, about 1½ miles above intake of Kapahi ditch and 6 miles northwest of Kealia.

RECORDS AVAILABLE.—June 23, 1915, to June 30, 1916. July 23, 1910, to May 16, 1915, at old station about a mile downstream.

GAGE.—Friez water-stage recorder; July 23, 1910, to May 16, 1915, vertical staff about a mile below present site.

DISCHARGE MEASUREMENTS.—Made by wading or from cable.

CHANNEL AND CONTROL.—One channel at all stages; straight for 100 feet above and and below gage; right bank vertical; left bank high with gentle slope. Control fairly permanent between extreme floods.

EXTREMES OF DISCHARGE.—Maximum stage recorded at present site, 9.2 feet at 1 a. m. March 4, 1916 (discharge, approximately 850 million gallons per day, or 1,320 second-feet); minimum stage recorded, 1.65 feet August 28 and 29, 1915 (discharge, 11 million gallons per day, or 17 second-feet).

Maximum stage recorded during period of record at staff gage site, 13 feet, ascertained from flood marks, December 3, 1914 (discharge, roughly estimated by extension of previous rating curve, 1,200 million gallons per day, or 1,860 second-feet); minimum stage recorded, 1.35 feet February, March, and April, 1914 (discharge, 6.2 million gallons per day, or 9.6 second-feet).

DIVERSIONS.—Very small irrigation ditch diverts water above station.

REGULATION.—Practically none.

UTILIZATION.—Irrigation of sugar cane and for domestic supply.

ACCURACY.—Records fair for entire year.

Discharge measurements of Kapaa River near Kealia, Kauai, during the year ending June 30, 1916.

Date.	Made by—	Gage height (feet).	Discharge.	
			Second-feet.	Million gallons per day.
Sept. 25	W. V. Hardy	2.15	39	25
Nov. 20	.....do	1.90	28	18
Jan. 26	D. E. Horner	2.84	118	76
26	.....do	2.71	105	68

Daily discharge, in million gallons, of Kapaa River near Kealia, Kauai, for the year ending June 30, 1916.

Date.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	17	16	14	24	18	34	24	31	26	17	44	17
2	17	17	13	37	40	20	60	24	152	16	60	17
3	18	14	14	37	97	26	26	26	112	16	56	18
4	14	24	18	20	60	18	37	24	212	16	26	20
5	12	18	16	17	44	20	34	28	78	17	48	24
6	13	31	14	17	34	52	34	28	56	16	26	24
7	17	20	13	16	22	18	74	26	44	16	22	24
8	18	52	14	14	37	17	88	34	24	14	22	48
9	17	22	14	22	70	17	83	107	18	14	20	26
10	28	16	12	18	88	24	117	40	17	16	52	20
11	18	16	24	14	40	17	60	26	17	18	28	22
12	18	16	22	16	52	16	37	24	17	16	18	20
13	17	17	16	16	37	16	34	22	17	16	16	18
14	14	16	13	14	26	16	70	20	40	18	17	20
15	17	14	13	13	18	107	31	20	26	17	20	20
16	20	13	70	14	17	28	34	20	20	16	16	60
17	14	13	20	14	17	26	83	18	18	17	14	37
18	20	12	22	52	16	34	56	18	18	26	18	24
19	22	12	17	31	28	20	31	18	18	17	34	24
20	17	22	20	70	18	18	24	18	18	17	37	31
21	70	17	40	22	18	31	22	18	18	17	22	37
22	28	18	31	22	31	60	20	20	18	17	34	28
23	20	14	22	37	37	22	20	20	20	16	34	26
24	16	16	20	34	48	56	26	18	24	17	31	22
25	13	15	44	22	56	48	127	18	17	26	24	34
26	17	13	28	31	34	34	122	18	17	18	28	26
27	14	12	34	31	20	142	28	26	16	34	34	22
28	17	11	22	24	31	92	24	24	16	14	22	20
29	14	11	22	24	48	52	22	20	16	13	18	24
30	16	14	20	22	20	34	26	.....	16	16	18	37
31	16	22	.....	20	.....	28	22	.....	17	.....	17	.....

NOTE.—Discharge determined from fairly well defined rating curve. Aug. 14 and 15 interpolated.

Monthly discharge of Kapaa River near Kealia, Kauai, for the year ending June 30, 1916.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July	70	12	19.0	29.4	589	1,810
August	52	11	17.6	27.2	545	1,670
September	70	12	22.1	34.2	662	2,030
October	70	13	24.7	38.2	765	2,350
November	97	16	37.4	57.9	1,120	3,440
December	142	16	36.9	57.1	1,140	3,510
January	127	20	48.3	74.7	1,500	4,600
February	107	18	26.0	40.2	754	2,310
March	212	16	36.5	56.5	1,130	3,470
April	34	13	17.5	27.1	524	1,610
May	60	14	28.3	43.8	876	2,690
June	60	17	26.3	40.7	790	2,420
The year	212	11	28.4	43.9	10,400	31,900

KAPAHI DITCH NEAR KEALIA, KAUAI.

LOCATION.—500 feet below intake and about 4 miles west of Kealia.

RECORDS AVAILABLE.—April 15, 1909, to May 2, 1914, and May 10, 1915, to June 30, 1916.

GAGE.—Stevens 8-day water-stage recorder, installed May 10, 1915, to replace original Watson recorder.

DISCHARGE MEASUREMENTS.—Made by 20-foot sharp-crested weir immediately below gage.

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

EXTREMES OF DISCHARGE.—Maximum stage recorded during period of record, 1.98 [1] feet at 2 a. m. September 16, 1915; discharge, 120 million gallons per day, or 186 second-feet, minimum discharge recorded, 1.5 million gallons per day, or 2.3 second-feet October 1, 1911.

Minimum stage recorded during year, 0.15 foot November 1f and February 28 (discharge, 2.6 million gallons per day, or 4.0 second-feet).

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

REGULATION.—Flow regulated by head gates.

UTILIZATION.—Irrigation of sugar cane and for domestic supply.

ACCURACY.—Conditions at weir fairly good; results fair for all stages

Discharge measurements of Kapahi ditch near Kealia, Kauai, during the year ending June 30, 1916.

[Made by W. V. Hardy.]

Date.	Gage height.	Discharge.		Date.	Gage height.	Discharge.	
	Feet.	Second-feet.	Million gallons per day.		Feet.	Second-feet.	Million gallons per day.
Oct. 2	0.60	29	19	Nov. 20	0.56	28	18
Oct. 2	.61	29	19	Apr. 26	.56	26	17

Daily discharge, in million gallons, of Kapahi ditch near Kealia, Kauai, for the year ending June 30, 1916.

Date.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	17	16	14	.....	18	15	18	5.5	15	13	40	.....
2	.....	17	13	20	20	15	11	5.5	15	13	40	.....
3	.....	14	14	20	20	13	11	5.5	7.1	13	25	.....
4	.....	24	18	20	13	13	11	7.1	3.9	13	22	13
5	.....	18	13	17	11	13	11	9.0	7.1	13	20	18
6	.....	28	13	17	11	15	11	9.0	9.0	13	18	18
7	.....	20	13	15	11	13	11	9.0	9.0	11	18	18
8	.....	28	13	14	11	13	9.0	9.0	9.0	11	20	22
9	.....	22	13	20	11	13	7.1	.....	13	11	18	22
10	.....	15	12	18	11	15	7.1	.....	17	11	18	15
11	18	15	20	14	9.0	15	7.1	.....	17	15	18	18
12	.....	15	22	15	9.0	15	7.1	.....	17	13	18	15
13	.....	17	16	15	7.1	13	7.1	5.5	15	13	15	13
14	.....	16	13	13	7.1	13	7.1	5.5	18	15	15	15
15	15	14	13	13	.....	7.1	7.1	7.1	18	13	18	15
16	.....	13	70	13	2.6	13	7.1	7.1	18	11	13	37
17	.....	13	20	13	17	20	7.1	9.0	15	11	13	22
18	.....	12	22	46	16	18	7.1	13	15	20	15	18
19	.....	12	17	28	28	18	7.1	13	15	13	22	18
20	.....	22	20	28	18	18	7.1	13	13	13	.....	20
21	.....	17	40	22	18	22	7.1	13	13	11	.....	22
22	13	18	25	20	15	22	7.1	13	13	11	.....	20
23	18	13	22	25	11	20	7.1	13	15	13	.....	18
24	15	11	20	25	11	22	7.1	13	18	13	.....	15
25	13	11	22	22	7.1	18	5.5	13	15	20	.....	20
26	17	11	.....	22	9.0	22	22	.....	13	15	.....	20
27	14	11	.....	22	15	34	22	.....	13	34	.....	18
28	17	11	.....	22	9.0	34	22	2.6	11	13	.....	15
29	14	11	.....	20	9.0	34	9.0	9.0	13	11	.....	18
30	16	11	.....	18	13	34	3.9	.....	13	16	.....	25
31	16	22	.....	18	.....	28	3.9	.....	13	.....	.....	.....

NOTE.—Discharge determined by weir formula, $Q=3.33\ LH^{3/2}$. Gage height not recorded on days for which discharge is not given.

[1] Determinations of maximum discharge supersede those published in Water Supply Paper 430, which were based on extension of current-meter rating curve.

Monthly discharge of Kapahi ditch near Kealia, Kauai, for the year ending June 30, 1916.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
August	28	11	16.1	24.9	49[illegible]	1,530
September 1–25	70	13	19.9	30.8	49[illegible]	1,530
October 2–31	46	13	19.8	30.6	59[illegible]	1,820
December	34	7.1	18.7	28.9	578	1,780
January	22	3.9	9.51	14.7	2[illegible]5	905
March	18	3.9	13.4	20.7	416	1,270
April	34	11	13.9	21.5	416	1,280
May 1–19	40	13	20.3	31.4	38[illegible]	1,180
June 4–30	37	13	18.8	29.1	5[illegible]	1,560

ANAHOLA RIVER NEAR KEALIA, KAUAI.

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

RECORDS AVAILABLE.—August 22 to November 2, 1910; December 28, 1912, to June 30, 1916. Fragmentary record December 15, 1910, to December 28, 1912, at dam a quarter of a mile below present site.

GAGE.—Friez water-stage recorder August 22 to November 2, 1910, and December 28, 1912, to June 30, 1916. From December 15, 1910, to December 28 1912, an inclined staff.

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; shifting.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 9.7 feet at 1 a. m. March 4 (discharge, approximately 1,000 million gallons per day, or 1,550 second-feet); minimum stage recorded, 1.65 feet, July, August, September, and April (discharge, 4.2 million gallons per day, or 6.5 second-feet).

Maximum stage recorded during period of record, 12.9 feet at 7:30 p. m. September 26, 1914 (discharge, estimated from extension of rating curve, approximately 1,450 million gallons per day, or 2,240 second-feet); minimum stage recorded, 1.3 feet February 27 and 28, 1915 (discharge, 2 million gallons per day, or 3.1 second-feet).

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

REGULATION.—None, except by diversions.

UTILIZATION.—Irrigation of sugar cane.

ACCURACY.—Discharge ascertained from fairly well defined rating curve and continuous gage-height record; determinations fair below 120 million gallons per day.

Discharge measurements of Anahola River near Kealia, Kauai, during the year ending June 30, 1916.

[Made by W. V. Hardy.]

Date.	Gage height (feet).	Discharge.		Date.	Gage height (feet).	Discharge.	
		Second-feet.	Million gallons per day.			Second-feet.	Million gallons per day.
Sept. 25	1.90	15	9.4	Jan. 26	2.79	99	64
Dec. 23	2.10	17	11	Apr. 25	1.69	7.1	4.6
Jan. 26	2.96	127	82	June 26	1.73	8.0	5.2

Daily discharge, in million gallons, of Anahola River near Kealia, Kauai, for the year ending June 30, 1916.

Date.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	6.0	4.8	4.8	9.5	9.5	29	23	20	9.5	4.8	.....	5.4
2	6.0	4.8	4.8	20	18	20	50	18	92	4.8	.....	5.4
3	6.0	4.2	4.8	20	55	26	26	16	50	4.8	.....	4.8
4	5.4	6.0	4.8	9.5	37	18	42	16	178	4.8	.....	6.0
5	4.8	6.0	4.8	8.0	29	20	29	29	65	4.8	.....	7.0
6	4.8	7.0	4.8	7.0	29	33	23	20	37	4.8	.....	14
7	4.8	5.4	4.2	7.0	18	16	29	18	23	4.8	.....	8.0
8	4.8	14	4.8	6.0	26	14	42	55	14	4.8	.....	6.0
9	4.8	6.0	4.8	9.5	55	14	37	178	9.5	4.8	.....	6.0
10	6.0	5.4	4.8	7.0	70	16	50	60	8.0	4.8	.....	6.0
11	5.4	5.4	6.0	6.0	42	12	42	29	8.0	6.0	.....	6.0
12	6.0	5.4	6.0	6.0	46	12	37	18	8.0	5.4	.....	5.4
13	4.8	7.0	4.8	6.0	33	11	37	18	8.0	4.8	.....	5.4
14	4.8	7.0	4.8	6.0	20	11	37	18	23	5.4	.....	.....
15	6.0	5.4	4.8	6.0	16	119	20	18	11	4.8	.....	.....
16	4.8	4.8	46	6.0	14	33	20	18	8.0	4.8	.....	.....
17	4.2	4.8	8.0	6.0	12	20	70	18	7.0	5.4	.....	8.0
18	6.0	4.8	6.0	18	11	42	46	18	6.0	8.0	.....	6.0
19	9.5	4.8	6.0	11	16	18	23	18	6.0	6.0	.....	5.4
20	6.0	5.4	5.4	26	11	18	20	18	6.0	5.4	11	6.0
21	12	6.0	11	9.5	9.5	20	18	16	6.0	4.8	7.0	6.0
22	7.0	6.0	11	8.0	11	42	16	14	6.0	4.2	7.0	6.0
23	6.0	4.8	14	11	11	14	16	12	7.0	4.2	8.0	5.4
24	5.4	7.0	8.0	23	65	65	20	11	9.5	4.8	8.0	4.8
25	4.8	6.0	8.0	12	37	42	154	11	6.0	4.8	7.0	5.4
26	4.8	5.4	11	16	37	29	154	8.0	6.0	4.8	7.0	5.4
27	4.8	5.4	12	20	18	130	33	8.0	5.4	9.5	12	4.8
28	5.4	4.8	8.0	11	29	102	23	8.0	5.4	4.8	8.0	4.8
29	4.8	4.8	9.5	14	65	55	20	8.0	5.4	4.2	6.0	5.4
30	4.8	4.8	11	11	23	33	29	.....	5.4	6.0	6.0	7.0
31	4.8	4.8	.....	11	.....	29	20	.....	6.0	.....	5.4	.....

NOTE.—Discharge determined from rating curve fairly well defined below 120 million gallons per day. Discharge, Mar. 4 to Apr. 22, ascertained by comparison with Kapaa River. Gage height not recorded on days for which discharge is not given.

Monthly discharge of Anahola River near Kealia, Kauai, for the year ending June 30, 1916.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July	12	4.2	5.66	8.76	176	538
August	14	4.2	5.75	8.90	178	547
September	46	4.2	8.29	12.8	249	763
October	26	6.0	11.2	17.3	347	1,070
November	70	9.5	29.1	45.0	873	2,680
December	130	11	34.3	53.1	1,060	3,260
January	154	16	38.9	60.2	1,210	3,700
February	178	8.0	24.7	38.2	717	2,200
March	178	5.4	20.8	32.2	645	1,980
April	9.5	4.2	5.20	8.05	156	479
May 20–31	12	5.4	7.70	11.9	92	284
June 1–13, 17–30	14	4.8	6.14	9.50	166	509

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 30, 1915, to June 30, 1916.

GAGE.—Stevens 8-day water-stage recorder.

DISCHARGE MEASUREMENTS.—Made from wooden footbridge at gage.

CHANNEL AND CONTROL.—Channel at gage is short straight stretch of open ditch cut in firm earth between two tunnels. Control, rock section of ditch, is probably permanent.

EXTREMES OF DISCHARGE, 1915–16.—Maximum stage recorded, 3.72 feet at 4.30 a. m. January 26, 1916 (discharge, 53 million gallons per day, or 82 second-feet); minimum stage recorded, 1.0 foot January 1, 1916 (discharge, 0.9 million gallons per day, or 1.4 second-feet).

DIVERSIONS.—Diverts from Anahola River.

REGULATION.—By head gates.

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

ACCURACY.—Discharge ascertained from well defined rating curve and a continuous gage-height record; results good below 20 million gallons per day.

Discharge measurements of Anahola ditch above Kaneha reservoir, near Kealia, Kauai, during the year ending June 30, 1916.

[Made by W. V. Hardy.]

Date.	Gage height (feet).	Discharge.		Date.	Gage height (feet).	Discharge.	
		Second-feet.	Million gallons per day.			Second-feet.	Million gallons per day.
July 20	1.44	6.5	4.2	Dec. 23	1.55	8.4	5.4
Sept. 25	2.10	19	12	Apr. 25	1.24	3.6	2.3

Daily discharge, in million gallons, of Anahola ditch above Kaneha Reservoir, near Kealia, Kauai, for the year ending June 30, 1916.

Date.	July.	Aug.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	5.9	4.4	.....	2.2	4.9	0.9	.....	5.9	3.4	27	3.9
2	7.6	4.4	.....	3.0	3.9	1.2	.....	15	2.6	40	3.4
3	7.0	4.4	.....	3.4	4.4	1.2	.....	.....	2.6	20	3.4
4	6.4	14	.....	5.9	3.9	1.2	.....	.....	2.2	20	4.4
5	4.4	8.9	.....	3.9	3.4	1.2	.....	5.9	2.6	26	4.9
6	4.4	11	.....	3.9	3.9	1.2	.....	6.4	2.2	18	7.0
7	6.4	8.2	.....	3.9	3.4	1.5	.....	5.4	2.2	11	8.2
8	5.4	13	.....	3.9	5.4	1.5	.....	5.4	1.8	8.2	16
9	4.4	7.0	.....	3.9	5.9	1.2	.....	5.4	1.8	5.9	8.9
10	.....	.....	.....	4.9	7.0	1.5	.....	4.9	1.8	14	4.9
11	5.9	.....	.....	3.9	4.9	1.2	.....	4.4	4.9	14	4.9
12	7.0	7.6	.....	3.9	4.4	1.2	.....	3.9	2.2	7.0	3.9
13	4.4	.....	.....	3.9	3.9	3.4	.....	3.9	2.2	5.4	3.4
14	3.9	.....	.....	3.9	3.4	7.0	.....	7.0	6.4	5.4	5.4
15	5.9	.....	.....	3.9	7.0	5.4	.....	6.4	.....	5.4	4.4
16	4.9	.....	.....	3.9	4.4	5.4	.....	3.9	.....	3.9	17
17	3.4	.....	.....	5.4	6.4	10	5.4	3.4	.....	3.4	.....
18	8.2	.....	.....	5.9	7.0	8.2	4.4	3.4	.....	7.0	5.4
19	12	.....	.....	10	5.9	6.4	3.9	3.4	.....	11	4.9
20	8.2	.....	.....	5.9	5.4	4.9	3.4	3.0	.....	12	8.2
21	16	.....	.....	4.9	5.9	3.9	3.0	3.0	.....	7.6	8.2
22	6.4	.....	.....	7.6	7.0	3.4	3.0	3.0	.....	8.2	5.4
23	3.9	.....	.....	4.9	5.4	3.0	3.0	3.0	2.6	.....	4.9
24	4.4	.....	.....	3.9	.....	4.4	3.0	5.9	3.9	.....	4.4
25	4.4	.....	.....	3.9	3.4	12	3.0	3.4	4.4	10	7.0
26	5.4	.....	.....	4.9	5.9	12	2.6	3.0	3.4	8.2	4.9
27	5.4	.....	.....	3.9	4.4	10	3.9	2.6	11	11	4.4
28	6.4	.....	.....	4.4	3.0	8.9	3.0	2.6	3.0	5.9	3.9
29	4.4	.....	.....	4.9	1.8	.....	3.0	3.9	2.6	4.9	4.9
30	3.9	.....	3.0	4.4	1.5	.....	.....	4.9	10	4.4	8.2
31	3.9	.....	2.2	.....	1.5	.....	.....	5.4	.....	3.9	.....

NOTE.—Discharge determined from rating curve well defined below 20 million gallons per day. Record sheets Aug. 13 to Oct. 29 and Apr. 15 to 22 were lost by observer. Water spilling through side gates Jan. 29 to Feb. 16. Gage height not recorded on other days for which discharge is not given.

KALIHIWAI RIVER NEAR HANALEI, KAUAI.

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

RECORDS AVAILABLE.—March 13, 1914, to June 30, 1916.

GAGE.—Stevens 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; probably permanent.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 8.8 feet at 11.30 p. m. March 3 (discharge, approximately 2,100 million gallons per day, or 3,250 second-feet); minimum stage recorded, 0.8 foot April, 1916 (discharge, 9 million gallons per day, or 14 second-feet).

1914–1916: 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-feet); minimum stage recorded: 0.95 foot March 13, 1914 (discharge, 6.5 million gallons per day, or 10 second-feet).

DIVERSIONS.—None above station.

REGULATION.—None.

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

ACCURACY.—Discharge ascertained from well-defined rating curves and a continuous gage-height record; determinations good below 600 million gallons per day.

Discharge measurements of Kalihiwai River near Hanalei, Kauai, during the year ending June 30, 1916.

Date.	Made by—	Gage height (feet).	Discharge.	
			Second-feet.	Million gallons per day.
Oct. 1	W. V. Hardy	2.16	133	86
Dec. 14	.....do	1.33	22	14
Mar. 17	D. E. Horner	1.05	23	15
May 10	.....do	2.28	192	124
10	.....do	3.26	488	315
11	.....do	1.69	101	65
12	.....do	1.32	43	28
13	.....do	1.22	36	23
16	.....do	1.14	28	18
19	.....do	1.67	91	59
19	.....do	1.54	73	47
20	.....do	1.73	113	73

Daily discharge, in million gallons, of Kalihiwai River near Hanalei, Kauai, for the year ending June 30, 1916.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	30	21	14	71	26	26	24	21	38	11	68	17
2	26	30	14	65	83	24	42	16	.....	10	95	17
3	24	26	16	77	180	26	24	14	.....	10	101	16
4	21	42	21	33	145	24	59	14	192	9	83	17
5	18	30	16	26	89	.....	42	21	63	10	119	20
6	19	48	16	24	71	.....	33	18	43	9	73	22
7	26	38	14	21	48	.....	77	16	27	9	53	20
8	26	83	13	18	115	.....	77	19	22	9	43	43
9	24	33	13	26	115	.....	77	71	20	9	38	27
10	33	24	13	21	130	.....	108	21	17	9	95	20
11	26	21	30	18	65	.....	59	18	17	10	58	20
12	24	24	24	18	53	.....	53	16	16	9	34	17
13	19	33	16	16	59	.....	42	14	14	10	27	16
14	19	30	14	14	38	16	65	14	53	14	24	17
15	21	24	14	14	26	83	33	13	24	10	27	16
16	21	21	42	16	24	26	65	12	17	9	20	53
17	18	18	18	19	24	21	77	12	16	11	17	34
18	21	18	16	59	21	38	42	12	16	17	24	22
19	30	18	13	38	42	21	33	12	14	11	43	24
20	48	30	26	108	24	19	24	11	14	11	48	34
21	.....	30	53	30	21	30	21	14	14	9	27	43
22	.....	24	53	33	38	65	19	13	14	10	34	30
23	.....	18	38	42	42	24	18	12	16	9	38	27
24	.....	19	59	53	38	53	24	11	24	10	34	22
25	.....	19	77	38	33	48	.....	11	14	27	30	27
26	.....	16	77	48	24	33	.....	11	12	16	58	22
27	.....	14	77	38	26	122	.....	16	11	27	53	20
28	21	14	48	26	59	77	.....	13	11	12	30	17
29	18	13	59	38	48	59	18	12	12	11	24	22
30	19	14	71	24	33	33	19	.....	12	22	20	27
31	18	18	.....	21	.....	30	16	.....	17	.....	20	.....

NOTE.—Discharge determined from rating curves applicable as follows: July 1, 1915, to Mar. 3, 1916, well defined below 600 million gallons per day. Mar. 4 to June 30, 1916, well defined. Gage height not recorded on days for which discharge is not given.

Monthly discharge of Kalihiwai River near Hanalei, Kauai, for year ending June 30, 1916.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons	Acre-feet.
	Maximum.	Minimum.	Mean.			
August	83	13	26.2	40.5	811	2,490
September	77	13	32.5	50.3	975	2,990
October	108	14	35.3	54.6	1,090	3,360
November	180	21	58.0	89.7	1,740	5,340
February	71	11	16.5	25.5	478	1,470
April	27	9	12.0	18.6	360	1,100
May	119	17	47.0	72.7	1,460	4,470
June	53	16	24.3	37.6	729	2,240

HANALEI RIVER AT ELEVATION 625 FEET[1], NEAR HANALEI, KAUAI.

LOCATION.—Two miles west of Kauai Electric Co.'s power line and 10 miles south of Hanalei. Trail to station leaves power line at pole No. 485.

RECORDS AVAILABLE.—January 26, 1914, to June 30, 1916.

GAGE.—Stevens water-stage recorder; datum raised 6.0 feet January 15, 1915.

DISCHARGE MEASUREMENTS.—Made by wading or from footbridge.

CHANNEL AND CONTROL.—One channel at all stages; straight for 100 feet above and below gage. Stream bed rough; right bank steep and high; left bank slopes gently. Control composed of boulders; shifting.

[1] Corrected elevation; formerly published as 750 feet.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 7.2 feet at 2 a. m. January 26 (discharge, approximately 2,500 million gallons per day, or 3,860 second-feet); minimum stage recorded, 0.5 foot April 21–24 (discharge, 25 million gallons per day, or 39 second-feet).

Maximum stage recorded during period of record, 9.7 feet (new datum) September 26, 1914 (discharge, computed from extension of rating curve, approximately 3,800 million gallons per day, or 5,880 second-feet); minimum stage recorded, 0.4 foot (new datum) March, 1914 (discharge, 24 million gallons per day, or 37 second-feet).

DIVERSIONS.—None above station.

REGULATION.—None.

UTILIZATION.—Irrigation, power, and domestic supply.

ACCURACY.—Discharge ascertained from well-defined rating curves and a continuous gage-height record; results good for all stages.

Discharge measurements of Hanalei River, at elevation 625 feet, near Hanalei, Kauai, during the year ending June 30, 1916.

Date.	Made by—	Gage height (feet).	Discharge.	
			Second-feet.	Million gallons per day.
July 30	D. E. Horner	0.88	59	38
Sept. 30	W. V. Hardy	1.34	138	89
Dec. 13	.....do	.91	70	45
Jan. 29	.....do	1.09	99	64
Mar. 16	D. E. Horner	.95	76	49
May 14	.....do	.92	79	51
20	.....do	1.03	91	59

Daily discharge, in million gallons, of Hanalei River at elevation 625 feet, near Hanalei, Kauai, for the year ending June 30, 1916.

Date.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	53	48	58	118	96	88	76	76	352	29	126	43
2	48	64	44	126	126	88	64	64	352	29	118	40
3	48	48	40	204	360	76	95	59	678	32	183	43
4	44	70	37	103	580	76	64	50	335	29	152	43
5	40	48	44	70	360	70	126	64	118	27	335	46
6	44	110	48	64	245	64	88	70	255	27	172	70
7	58	53	40	58	182	152	95	64	95	27	126	59
8	53	135	37	53	118	132	285	64	64	27	88	76
9	70	70	37	53	440	112	410	59	50	27	82	76
10	89	53	37	53	370	92	470	126	43	27	118	54
11	58	48	37	44	450	72	490	95	40	29	64	50
12	58	53	89	44	194	52	216	70	37	27	59	43
13	58	82	96	48	172	46	118	59	34	27	54	40
14	44	126	58	48	162	46	110	50	82	32	50	37
15	44	82	48	40	126	162	110	46	88	29	46	95
16	58	70	96	40	95	118	143	43	50	27	43	54
17	48	70	58	44	82	76	390	40	43	29	40	43
18	82	70	82	76	76	95	216	40	37	34	43	46
19	76	70	64	89	76	64	183	37	34	29	64	88
20	48	89	64	162	172	59	95	34	34	29	64	76
21	70	76	204	118	95	64	82	34	32	25	54	88
22	48	64	103	70	102	118	70	43	32	25	59	70
23	34	53	89	126	162	70	59	50	32	25	82	59
24	34	48	110	96	216	76	82	37	37	25	59	46
25	40	48	103	118	143	172	430	34	32	54	46	54
26	76	44	103	110	95	88	570	43	29	50	64	54
27	48	40	103	135	110	300	102	37	29	118	102	54
28	53	37	70	96	76	228	76	34	27	46	82	64
29	44	37	76	82	82	183	64	64	27	37	59	54
30	40	34	82	126	194	126	88	.....	27	37	50	54
31	40	58	.....	76	.....	88	64	.....	29	.....	43	.....

NOTE.—Discharge determined as follows: July 1 to Nov. 9, 1915, and Nov. 10, 1915, to June 30, 1916, from well-defined rating curves; Sept. 26–29 and May 9–14 estimated by comparison with flow of Kalihiwai Stream; Dec. 8–12, interpolated.

Monthly discharge of Hanalei River at elevation 625 feet, near Hanalei, Kauai, for the year ending June 30, 1916.

Month.	Discharge.				Run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July	89	34	53.2	82.3	1,650	5,060
August	135	34	64.5	99.8	2,000	6,140
September	204	37	71.9	111	2,160	6,620
October	204	40	86.8	134	2,690	8,260
November	580	76	192	297	5,760	17,700
December	300	46	105	162	3,250	9,990
January	570	59	178	275	5,530	16,900
February	126	34	54.7	84.6	1,590	4,870
March	678	27	102	158	3,150	9,700
April	118	25	33.8	52.3	1,020	3,110
May	335	40	88.0	136	2,730	8,370
June	95	37	57.3	88.7	1,720	5,280
The year	678	25	90.8	140	33,200	102,000

HANALEI RIVER NEAR HANALEI, KAUAI.

LOCATION.—About 5 miles up the river from Hanalei.

RECORDS AVAILABLE.—December 28, 1911, to June 30, 1916.

GAGE.—Inclined and vertical staff on left bank.

DISCHARGE MEASUREMENTS.—Made by wading or from cable.

CHANNEL AND CONTROL.—One channel at all stages; straight for 500 feet above and below gage; banks low, wooded, and not subject to overflow. Control composed of boulders; fairly permanent.

EXTREMES OF DISCHARGE.—Maximum stage recorded during yaer, 11.75 feet at 3 p. m. November 8 (discharge, approximately 4,150 million gallons per day, or 6,420 second-feet); minimum stage recorded, 6.55 feet April 16 and May 4 (discharge, 32 million gallons per day, or 50 second-feet).

Maximum stage recorded during period of record, 17.52 feet at 4 p. m. September 26, 1914 (discharge, computed from extension of rating curve, approximately 14,000 million gallons per day, or 21,700 second-feet); minimum stage recorded, 6.21 feet March 25, 1914 (discharge, 26 million gallons per day, or 40 second-feet).

DIVERSIONS.—China ditch diverts water above station.

REGULATION.—By diversions only.

UTILIZATION.—Most of the water passing the station is wasted, but a small amount is diverted for irrigation of rice and taro.

ACCURACY.—Gage read twice daily. Determinations based on rating curves well defined below 1,000 million gallons per day; fair for all stages.

Discharge measurements of Hanalei River near Hanalei, Kauai, during the year ending June 30, 1916.

Date.	Made by—	Gage height (feet).	Discharge.	
			Second-feet.	Million gallons per day.
Dec. 18	W. V. Hardy	7.10	285	184
Jan. 30	.....do.....	7.22	332	215
May 5	.....do.....	7.95	1,000	648

Daily discharge, in million gallons, of Hanalei River near Hanalei, Kauai, for the year ending June 30, 1916.

Date.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	130	76	76	225	315	200	144	144	320	60	610	84
2	130	130	66	560	472	144	295	144	645	60	550	72
3	130	76	76	445	530	144	144	144	550	50	144	84
4	115	205	76	245	985	128	162	112	960	50	32	98
5	115	115	130	165	680	128	320	270	345	50	855	128
6	115	390	76	130	500	370	200	128	580	50	460	144
7	100	130	76	130	290	144	430	112	270	40	270	98
8	165	650	76	115	2,120	112	490	144	162	50	270	220
9	100	650	76	130	1,100	112	715	128	128	40	460	144
10	185	148	88	115	460	220	610	200	112	50	430	98
11	115	130	185	100	430	112	430	144	98	50	820	128
12	100	130	165	100	370	98	320	128	98	40	245	84
13	130	148	100	100	430	84	320	112	84	32	128	98
14	115	76	88	88	270	144	520	98	295	84	98	84
15	88	165	76	76	295	680	220	112	162	50	112	72
16	130	148	115	100	144	270	180	98	98	32	112	270
17	76	130	76	76	128	162	750	84	72	60	84	162
18	100	100	115	268	128	200	180	72	84	112	84	98
19	245	88	88	205	295	144	270	72	60	50	200	128
20	88	205	245	620	144	128	200	72	128	60	320	162
21	205	165	445	205	162	162	162	128	60	40	128	270
22	145	148	225	165	430	430	144	128	98	40	200	144
23	100	115	165	340	925	144	128	220	84	40	200	128
24	88	115	205	740	270	295	128	180	50	40	180	84
25	76	100	340	315	162	520	680	72	50	180	180	112
26	245	88	390	205	162	270	1,320	60	60	84	270	98
27	115	66	390	315	144	960	245	112	60	220	345	84
28	148	76	205	245	162	550	180	245	50	112	144	98
29	100	66	245	245	400	370	144	112	72	60	98	84
30	76	76	290	225	162	200	295	.....	72	430	98	128
31	76	76	.....	205	.....	162	144	.....	60	.....	112	.....

NOTE.—Discharge determined from rating curves fairly well defined below 1,000 million gallons per day and applicable as follows: July 1 to Nov. 8, 1915; Nov. 9, 1915, to June 30, 1916.

Monthly discharge of Hanalei River near Hanalei, Kauai, for year ending June 30, 1916.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July	245	76	124	192	3,850	11,800
August	650	66	161	249	4,980	15,300
September	445	66	166	257	4,970	15,300
October	740	76	232	359	7,200	22,100
November	2,120	128	436	675	13,100	40,100
December	960	84	251	388	7,790	23,900
January	1,320	128	338	523	10,500	32,200
February	270	60	130	201	3,780	11,600
March	960	50	192	297	5,970	18,300
April	430	32	77.2	119	2,320	7,110
May	855	32	266	412	8,240	25,300
June	270	72	123	190	3,690	11,300
The year	2,120	32	208	322	76,400	234,000

CHINA DITCH NEAR HANALEI, KAUAI.

LOCATION.—Just below intake, about 5 miles south of Hanalei.

RECORDS AVAILABLE.—March 17, 1914, to June 30, 1916. December 28, 1911, to September 30, 1913, at old station a quarter of a mile below present station.

GAGE.—Vertical staff on left bank. Vertical staff at old station.

DISCHARGE MEASUREMENTS.—Made from plank.

CHANNEL AND CONTROL.—Cut in clay and gravel; subject to growth of grass and weeds which affects stage-discharge relation.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 2.4 feet at 7 a. m. April 28 (discharge, 46 million gallons per day, or 71 second-feet); minimum stage recorded, 0.8 foot February 14 and 15 (discharge, 4.8 million gallons per day, or 7.4 second-feet).

Maximum stage recorded during period of record, 2.36 feet at noon June 22, 1914 (discharge, 50 million gallons per day, or 77 second-feet), ditch occasionally dry.

DIVERSIONS.—Diverts part of flow of Hanalei River.

REGULATION.—By head gates.

UTILIZATION.—Irrigation of rice and taro.

ACCURACY.—Gage read twice daily. Stage-discharge relation rather unstable owing to growth of aquatic plants in channel; determinations poor.

Discharge measurements of China ditch near Hanalei, Kauai, during the year ending June 30, 1916.

[Made by W. V. Hardy.]

Date.	Gage height (feet).	Discharge.		Date.	Gage height (feet).	Discharge.	
		Second-feet.	Million gallons per day.			Second-feet.	Million gallons per day.
Dec. 18	1.44	20	13	May 5	1.97	42	28
Jan. 30	1.10	15	9.6	5	1.90	40	26
30	.99	13	8.3				

Monthly discharge of China ditch near Hanalei, Kauai, for year ending June 30, 1916.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July	31	22	25.5	39.5	792	2,430
August	31	19	24.2	37.4	749	2,300
September	25	16	23.0	35.6	692	2,120
October	28	18	21.9	33.9	680	2,080
November	32	12	18.7	28.9	561	1,720
December	23	8.2	13.1	20.3	405	1,250
January	24	5.5	12.8	19.8	397	1,220
February	20	4.8	9.58	14.8	278	853
March	34	7.1	17.9	27.7	550	1,700
April	32	19	23.2	35.9	696	2,140
May	32	14	20.7	32.0	642	1,970
June	29	16	21.6	33.4	649	1,990
The year	34	4.8	19.4	30.0	7,100	21,800

NOTE.—Discharge determined from poorly defined rating curves applicable as follows: July 1 to Nov. 8, 1915, Nov. 9, 1915, to Jan. 26, 1916, Jan. 27 to Apr. 30, May 1 to June 30, 1916.

LUMAHAI RIVER NEAR HANALEI, KAUAI.

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

RECORDS AVAILABLE.—May 23, 1914, to June 30, 1916.

GAGE.—Stevens water-stage recorder.

DISCHARGE MEASUREMENTS.—Made from cable or by wading.

CHANNEL AND CONTROL.—One channel at all stages; straight for 50 feet above and 100 feet below gage; stream bed very rough, right bank vertical; left bank slopes gently. Control composed of boulders; shifting.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 3.6 feet at 6 a. m. January 26 (discharge, approximately 950 million gallons per day, or 1,470 second-feet). Minimum stage recorded, 0.65 feet September 2, 3, 6–10 (discharge, 24 million gallons per day, or 37 second-feet).

1914–1916: Maximum stage recorded, 8.0 feet at 3 a. m. September 25, 1914 (discharge, computed from extension of rating curve, approximately 2,600 million gallons per day, or 4,020 second-feet); minimum stage recorded, 0.6 foot April, 1915 (discharge, 20 million gallons per day, or 31 second-feet).

DIVERSIONS.—None above station.

REGULATION.—None.

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

ACCURACY.—Determinations based on a continuous record of gage heights and rating curves fairly well defined for low and medium stages; fair below 300 million gallons per day.

Discharge measurements of Lumahai River near Hanalei, Kauai, during the year ending June 30, 1916.

Date.	Made by—	Gage height (feet).	Discharge.	
			Second-feet.	Million gallons per day.
Sept. 28	W. V. Hardy	1.26	158	102
Dec. 16	do	1.52	278	180
Jan. 29	D. E. Horner	.78	90	58
Mar. 18	do	.70	65	42
Apr. 24	do	.62	56	36

Daily discharge, in million gallons, of Lumahai River near Hanalei, Kauai, for the year ending June 30, 1916.

Date.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	54	27	27	90	150	.....	78	56	86	34	238	56
2	54	32	24	90	470	.....	86	50	86	34	200	50
3	54	27	24	108	610	.....	94	44	138	34	380	50
4	67	47	36	67	450	.....	138	44	380	34	380	70
5	42	42	27	54	178	.....	265	70	86	34	530	86
6	54	67	24	47	168	.....	138	50	111	34	250	44
7	47	47	24	47	168	.....	200	44	86	34	168	39
8	42	60	24	36	345	.....	650	50	56	34	102	39
9	47	60	24	60	250	.....	750	78	44	34	111	34
10	67	42	24	47	158	.....	710	56	44	39	94	39
11	42	42	60	36	148	.....	650	50	39	39	94	50
12	36	47	74	42	138	.....	189	50	39	39	50	86
13	36	47	42	42	86	.....	158	50	34	34	39	94
14	32	82	36	36	63	.....	129	50	200	86	34	56
15	36	47	27	32	111	.....	178	50	120	50	39	50
16	47	47	27	47	225	138	94	44	63	39	30	70
17	36	42	27	36	178	94	189	44	50	63	34	129
18	54	36	27	227	225	120	200	44	44	70	78	86
19	82	36	27	118	238	120	178	44	44	50	94	70
20	42	54	32	214	158	102	111	44	44	44	56	44
21	60	54	99	82	86	94	78	56	39	39	63	86
22	47	42	67	67	78	168	70	50	39	44	86	86
23	36	36	60	108	70	94	63	44	56	39	56	50
24	32	36	60	150	.....	129	78	39	44	34	78	44
25	32	36	74	139	.....	310	310	39	39	39	70	39
26	54	32	82	128	.....	120	328	39	39	39	94	70
27	42	32	82	162	.....	310	78	44	34	78	56	86
28	54	27	108	82	.....	200	63	39	34	39	50	56
29	36	27	90	139	.....	168	56	39	34	34	50	50
30	32	32	128	108	.....	111	78	.....	34	111	50	78
31	27	36	.....	108	.....	86	56	.....	34	.....	56	.....

NOTE.—Discharge determined from rating curves applicable as follows: July 1 to Nov. 4, 1915, fairly well defined below 200 million gallons per day. Nov. 5, 1915, to June 30, 1916, fairly well defined below 300 million gallons per day. Gage height not recorded Nov. 24 to Dec. 15, 1915.

Monthly discharge of Lumahai River near Hanalei, Kauai, for year ending June 30, 1916.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July	82	27	45.9	71.0	1,42[illegible]	4,370
August	82	27	42.6	65.9	1,32[illegible]	4,050
September	128	24	49.6	76.7	1,49[illegible]	4,570
October	227	32	88.7	137	2,75[illegible]	8,440
November 1–23	610	63	207	320	4,75[illegible]	14,600
December 16–31	310	86	148	229	2,36[illegible]	7,270
January	750	56	208	322	6,440	19,800
February	78	39	48.3	74.7	1,40[illegible]	4,300
March	380	34	71.6	111	2,22[illegible]	6,810
April	111	34	45.2	69.9	1,36[illegible]	4,160
May	530	30	120	186	3,71[illegible]	11,400
June	129	34	62.9	97.3	1,86[illegible]	5,790

WAIOLI STREAM NEAR HANALEI, KAUAI.

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

RECORDS AVAILABLE.—June 30, 1914, to June 30, 1916.

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 50 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, 4.2 feet at 2 p. m. March 3 (discharge, approximately 750 million gallons per day, or 1,160 second-feet); minimum stage recorded, 1.2 feet January 1 (discharge, 6.0 million gallons per day, or 9.3 second-feet).

1914–1916: Maximum stage recorded, 5.8 feet at 6 a. m. December 5, 1914 (discharge, computed from extension of rating curve, approximately 1,100 million gallons per day, or 1,700 second-feet); minimum stage recorded, 0.6 foot July 22, 1914 (discharge, 2.0 million gallons per day, or 3.1 second-feet).

DIVERSION.—None above station.

REGULATION.—None.

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

ACCURACY.—Several changes in stage-discharge relation occurred during the year, but enough current meter measurements were made to insure fairly well defined rating curves; determinations fair, except those for March 5 to April 30 and May 8 to June 30, which are doubtful.

Discharge measurements of Waioli Stream near Hanalei, Kauai, during the year ending June 30, 1916.

Date.	Made by—	Gage height (feet).	Discharge.	
			Second-feet.	Million gallons per day.
Aug. 1	D. E. Horner	1.26	23	15
Sept. 29	W. V. Hardy	1.54	53	34
Dec. 15	....do	2.47	192	124
Jan. 28	D. E. Horner	1.56	25	16
Apr. 21	....do	1.31	17	11
May 5	....do	2.32	180	116
5	....do	2.40	227	147
6	....do	2.56	2[illegible]	183
6	....do	2.60	302	195
7	....do	1.92	104	67
7	....do	1.80	82	53
7	....do	1.60	68	44
8	....do	1.50	50	32

Daily discharge, in million gallons, of Waioli Stream near Hanalei, Kauai, for the year ending June 30, 1916.

Date.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	24	15	.....	27	13	.....	6.0	15	30	13	143	79
2	24	15	.....	27	53	.....	13	15	20	13	79	79
3	24	15	.....	31	143	.....	8.0	15	44	13	79	79
4	35	21	.....	19	134	.....	23	18	80	13	134	101
5	21	21	.....	17	21	.....	34	55	23	13	194	109
6	24	27	.....	15	17	.....	13	18	30	13	134	117
7	21	27	.....	17	9.5	.....	18	15	20	13	86	109
8	21	59	.....	13	53	.....	61	26	18	13	65	143
9	21	11	.....	17	93	.....	55	39	15	13	79	109
10	31	17	.....	7.5	44	.....	.....	20	15	13	109	86
11	19	17	.....	6.8	23	.....	.....	15	15	13	79	86
12	17	24	.....	9.5	18	.....	.....	15	15	11	53	72
13	17	35	.....	9.5	15	.....	.....	15	13	18	48	59
14	15	53	.....	9.5	11	.....	.....	15	55	24	48	59
15	19	21	.....	9.5	8.0	.....	.....	13	30	18	59	53
16	21	19	.....	13	8.0	18	.....	11	18	13	48	86
17	15	19	.....	9.5	8.0	9.5	.....	13	15	20	48	65
18	19	17	.....	27	8.0	13	.....	11	13	28	72	65
19	27	17	.....	17	23	13	.....	11	13	18	93	163
20	13	.....	.....	27	9.5	9.5	.....	11	11	15	93	117
21	31	.....	.....	9.5	9.5	15	.....	20	11	13	79	93
22	24	.....	.....	8.5	13	34	.....	13	11	18	79	93
23	17	.....	.....	15	18	7.0	.....	13	18	13	86	72
24	15	.....	.....	21	11	15	.....	11	15	13	93	53
25	15	.....	.....	19	.....	26	.....	11	13	15	72	59
26	21	.....	.....	24	.....	11	.....	11	11	13	59	59
27	21	.....	.....	39	.....	44	.....	15	11	23	48	48
28	24	.....	.....	13	.....	23	18	13	11	13	59	31
29	17	.....	27	15	.....	15	15	13	15	9.5	59	27
30	15	.....	35	11	.....	8.0	23	.....	15	61	59	31
31	17	.....	.....	11	.....	7.0	18	.....	13	.....	65	.....

NOTE.—Discharge determined from rating curves applicable as follows: July 1 to Nov. 9, 1915 and May 1–7, 1916, fairly well defined below 200 million gallons per day. Nov. 10, 1915, to Mar. 4, 1916, fairly well defined. Mar. 5 to Apr. 30, and May 8 to June 30, 1916, poorly defined. Gage heights not recorded on days for which discharge is not given.

Monthly discharge of Waioli Stream near Hanalei, Kauai, for the year ending June 30, 1916.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July	35	13	20.8	32.2	645	1,980
August 1–19	59	11	23.7	36.7	450	1,380
October	39	6.8	16.6	25.7	515	1,580
November 1–24	143	8.0	31.8	49.2	764	2,340
December 16–31	44	7.0	16.8	26.0	268	825
February	55	11	16.8	26.0	486	1,500
March	80	11	20.5	31.7	637	1,950
April	61	9.5	17.2	26.6	518	1,580
May	194	48	80.7	125	2,500	7,680
June	163	27	80.1	124	2,400	7,370

WAINIHA RIVER NEAR WAINIHA, KAUAI.

LOCATION.—One mile above intake of Kauai Electric Co.'s power ditch, 6 miles above power house, and 14 miles from Hanalei.

RECORDS AVAILABLE.—July 28, 1914, to June 30, 1916.

GAGE.—Stevens water-stage recorder.

DISCHARGE MEASUREMENTS.—Made from cable.

CHANNEL AND CONTROL.—One channel at all stages; straight for 75 feet above and 200 feet below gage; right bank steep and high; left bank slopes gently. Control composed of large boulders; fairly permanent.

EXTREMES OF DISCHARGE.—1914–1916: Maximum stage recorded, 9.25 feet at 5 a. m. January 25, 1916 (discharge, computed from extension of rating curve, approximately 7,000 million gallons per day, or 10,800 second-feet); minimum stage recorded, 1.55 feet October 8 and 11–13, 1915 (discharge, 59 millions gallons per day, or 91 second-feet).

DIVERSIONS.—None above station.

REGULATION.—None.

UTILIZATION.—Power development and irrigation of rice and taro.

ACCURACY.—Determinations based on fairly well defined rating curves and a continuous gage-height record; fair for all stages except extreme floods.

Discharge measurements of Wainiha River near Wainiha, Kauai, during the year ending June 30, 1916.

Date.	Made by—	Gage height (feet).	Discharge.	
			Second-feet.	Million gallons per day.
July 1	D. E. Horner	1.76	166	107
31	W. V. Hardy	1.50	105	68
Sept. 27	do	2.55	390	252
Dec. 17	do	1.97	175	113
Jan. 30	D. E. Horner	2.28	322	208
Mar. 21	do	1.46	110	71
22	do	1.54	121	78
June 21	W. V. Hardy	1.77	132	85

Daily discharge, in million gallons, of Wainiha River near Wainiha, Kauai, for the year ending June 30, 1916.

Date.	July.	Aug.	Sept.	Oct.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	108	100		186		106	190	270	79	390	114
2	108	141		162		140	141	160	79	270	114
3	108	100		226		114	124	420	79	340	114
4	108	150		90		212	116	640	72	490	122
5	100	100		64		300	132	160	72	800	140
6	116	180		70		240	124	360	72	378	122
7	132	93		70		915	170	160	72	272	98
8	93	340		59		1,800	132	100	72	186	212
9	124	116		90		1,720	141	86	72	151	122
10	132	79		70		1,600	124	79	86	162	83
11	79	93		59		460	124	79	100	140	114
12	93	124		59		202	116	79	79	114	98
13	93	132		59		170	116	72	93	106	76
14	72					180	116	215	141	90	106
15	93					141	116	190	93	106	122
16	132					170	116	100	79	90	226
17	79				122	700	116	86	124	83	131
18	93				186	285	116	79	141	122	174
19	170				140	420	116	72	93	131	98
20	86				114	170	116	72	100	174	131
21	93				162	132	180	66	79	162	98
22	86				255	124	124	72	79	131	90
23	66				122	116	116	100	79	140	106
24	66				270	160	108	93	72	106	98
25	66				535	610	108	86	108	114	76
26	190				226	765	108	79	132	162	98
27	108				1,090	170	132	79	300	131	90
28	132		162		395	132	124	79	124	98	131
29	79		162		226	124	124	79	93	98	226
30	72		174		140	190		79	132	90	114
31	79				122	141		79		83	

NOTE.—Discharge determined from rating curves applicable as follows: July 1 to Aug. 13, 1915, and Jan. 9 to May 5, 1916, fairly well defined below 500 million gallons a day. Sept. 28, 1915, to Jan. 8, 1916, and May 6 to June 30, 1916, fairly well defined below 400 million gallons a day. Gage heights not recorded on days for which discharge is not given.

Monthly discharge of Wainiha River near Wainiha, Kauai, for the year ending June 30, 1916.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July	190	66	102	158	3,160	9,700
August 1–13	340	79	134	207	1,750	5,350
October 1–13	226	59	97.2	150	1,260	3,880
December 17–31	1,090	114	274	424	4,100	12,600
January	1,800	106	410	634	12,700	39,000
February	190	108	127	197	3,690	11,300
March	640	66	141	218	4,370	13,400
April	300	72	99.9	155	3,000	9,200
May	800	83	181	280	5,600	17,200
June	226	76	121	187	3,640	11,100

WAINIHA RIVER (EAST AND WEST CHANNELS) NEAR WAINIHA, KAUAI.

LOCATION.—Just northeast of Kauai Electric Co.'s power house, 2 miles south of Wainiha.

RECORDS AVAILABLE.—East Channel, February 25, 1912, to June 30, 1916; West Channel, December 30, 1911, to June 30, 1916.

GAGE.—Inclined staff in each channel.

DISCHARGE MEASUREMENTS.—Made by wading or from footbridge over each channel.

CHANNEL AND CONTROL.—The river divides a short distance above power house, and a station is maintained on each channel to obtain total flow. Fish dams built by the natives at the point where the river divides shift the water from one channel to the other. Control for East Channel composed of boulders; fairly permanent; control for West Channel composed of boulders; shifting.

EXTREMES OF DISCHARGE.—East Channel: Maximum stage recorded during year, 11.5 feet at 7 a. m. December 27 (discharge, approximately 1,000 million gallons per day, or 1,550 second-feet); minimum stage recorded, 7.5 feet August and October (discharge, 21 million gallons per day, or 32 second-feet).

Maximum stage recorded during period of record, 13.5 feet at 5 p. m. September 26, 1914 (discharge, computed from extension of rating curve, approximately 2,000 million gallons per day, or 3,090 second-feet); minimum stage recorded, 6.5 feet August 3 to 6, 1913 (discharge, 3 million gallons per day, or 4.6 second-feet).

West Channel: Maximum stage recorded during year, 8.6 feet at 7 a. m. November 8 (discharge, approximately 1,300 million gallons per day, or 2,000 second-feet); minimum stage recorded, 5.40 feet July and August (discharge, 53 million gallons per day, or 82 second-feet).

Maximum stage recorded during period of record, 9.0 feet at 5 p. m. September 26, 1914 (discharge, 1,500 million gallons per day, or 2,320 second-feet); minimum stage recorded, 5.4 feet, on many days (discharge, 53 million gallons per day, or 82 second-feet).

DIVERSIONS.—Water diverted for power development above stations is returned to river again just above station on West Channel.

REGULATION.—None except by diversions.

UTILIZATION.—Part of water passing stations is used for irrigation of rice and taro.

ACCURACY.—East Channel: Determinations July 1, 1915, to January 9, 1916, and May 1 to June 30 fair between 20 and 50 million gallons a day; those for January 10–30 poor.

West Channel: Determinations fair below 400 million gallons a day.

Gages read twice daily.

Discharge measurements of East Channel of Wainiha River near Wainiha, Kauai, during the year ending June 30, 1916.

Date.	Made by—	Gage height (feet).	Discharge.	
			Second-feet.	Million gallons per day.
July 1	D. E. Horner	7.90	74	48
Dec. 19	W. V. Hardy	8.21	122	79
Jan. 29	D. E. Horner	7.98	70	45
Mar. 20	....do	7.68	56	36
Apr. 19	....do	7.88	74	48
June 24	W. V. Hardy	7.83	79	51

Daily discharge, in million gallons, of East Channel of Wainiha River near Wainiha, Kauai, for the year ending June 30, 1916.

Date.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	May.	June.
1915–15.									
1	68	33	33	90	68	40	33	420	79
2	68	63	33	48	466	40	40	224	52
3	68	40	33	40	752	36	63	308	59
4	58	84	33	33	688	40	105	395	99
5	40	48	33	33	112	33	292	705	63
6	40	150	48	33	140	68	78	395	79
7	40	63	33	26	120	48	368	247	63
8	33	224	33	26	424	40	560	146	128
9	33	84	40	26	140	40	864	146	63
10	68	48	40	26	140	48	424	155	63
11	48	58	112	48	.....	48	280	128	99
12	40	48	68	26	.....	33	90	63	48
13	40	68	48	26	.....	33	53	48	48
14	33	150	33	21	40	33	160	48	48
15	33	68	33	33	68	90	48	48	48
16	48	48	26	26	48	112	90	42	113
17	33	48	33	21	48	36	180	42	73
18	40	58	33	202	48	40	180	48	73
19	84	40	33	130	996	105	257	63	85
20	33	130	63	213	73	36	90	194	128
21	48	84	58	84	68	40	33	99	247
22	48	68	68	40	576	68	26	73	99
23	33	33	73	98	304	40	26	113	68
24	33	40	130	140	68	33	26	99	48
25	33	48	202	170	48	63	410	63	48
26	90	33	90	150	48	33	90	137	48
27	68	33	90	98	48	688	26	55	48
28	58	21	78	78	40	396	26	63	73
29	40	21	90	160	78	105	26	48	59
30	33	48	90	63	40	40	24	48	85
31	33	73	.....	63	.....	33	.....	48	.....

NOTE.—Discharge determined from rating curves applicable as follows: July 1, 1915, to Jan. 9, 1916, fairly well defined between 20 and 500 million gallons per day; Jan. 10–30, 1916, poorly defined; May 1 to June 30, 1916, fairly well defined. Gage heights not recorded on days for which discharge is not given.

Monthly discharge of East Channel of Wainiha River near Wainiha, Kauai, for the year ending June 30, 1916.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July	90	33	47.3	73.2	1,460	4,500
August	224	21	66.3	103	2,060	6,310
September	202	26	60.3	93.3	1,810	5,550
October	213	21	73.3	113	2,270	6,970
December	688	33	81.9	127	2,540	7,790
January 1–30	864	24	166	257	4,970	15,300
May	705	42	152	235	4,710	14,500
June	247	48	77.8	120	2,330	7,160

Discharge measurements of West Channel of Wainiha River near Wainiha, Kauai, during the year ending June 30, 1916.

Date.	Made by—	Gage height (feet).	Discharge.	
			Second-feet.	Million gallons per day.
July 1	D. E. Horner	5.59	133	86
Dec. 19	W. V. Hardy	5.85	201	130
Mar. 23	D. E. Horner	5.75	181	117
Apr. 17	do	5.66	150	97
18	do	5.88	223	144
19	do	5.56	122	79
27	do	6.10	330	213
June 24	W. V. Hardy	5.56	114	74

Daily discharge, in million gallons, of West Channel of Wainiha River near Wainiha, Kauai, for the year ending June 30, 1916.

Date.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	105	67	67	152	180	128	105	116	180	67	350	116
2	105	95	67	152	424	128	128	105	105	67	212	85
3	105	76	67	128	502	116	140	95	196	67	279	95
4	95	116	67	105	502	128	180	85	314	67	350	128
5	85	85	67	105	228	116	279	128	116	67	502	105
6	85	212	85	105	196	180	152	105	140	67	332	116
7	85	95	67	85	672	105	314	128	128	67	228	105
8	76	296	67	85	898	85	544	105	105	67	152	152
9	76	116	76	85	716	85	586	128	85	67	152	105
10	105	85	76	85	180	85	544	95	67	67	166	105
11	85	95	166	105	167	85	314	95	67	67	140	105
12	76	85	105	85	154	67	180	85	67	67	105	85
13	76	105	85	85	141	67	140	85	67	60	85	76
14	67	166	67	67	128	67	212	85	279	105	85	67
15	67	105	67	85	105	152	140	85	166	85	85	67
16	85	67	60	67	85	196	180	85	85	85	67	140
17	67	85	67	67	85	116	279	85	76	105	67	105
18	76	95	67	296	85	128	228	85	67	105	85	105
19	116	76	67	245	502	180	279	76	67	85	105	116
20	67	128	95	296	140	116	180	67	67	85	196	140
21	85	116	95	196	128	128	128	105	67	67	116	180
22	85	105	105	128	443	180	105	85	67	67	105	128
23	76	67	105	212	350	128	105	67	95	67	128	105
24	67	76	152	245	140	105	105	67	85	67	128	85
25	67	85	296	262	105	140	350	67	67	76	105	85
26	128	67	212	262	105	105	405	67	67	67	140	85
27	105	67	212	212	105	462	116	85	67	180	95	85
28	95	53	196	180	85	212	105	67	67	140	105	105
29	76	53	212	262	196	180	105	76	67	85	85	95
30	53	85	212	166	128	128	85	.....	67	245	85	116
31	67	105	.....	166	.....	105	100	.....	67	.....	85	.....

NOTE.—Discharge determined from rating curve well defined below 400 million gallons per day; Nov. 11–13 and Jan. 31, interpolated.

Monthly discharge of West Channel of Wainiha River near Wainiha, Kauai, for year ending June 30, 1916.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July	128	53	84.1	130	2,610	8,000
August	296	53	101	156	3 130	9,610
September	296	60	112	173	3 350	10,300
October	296	67	154	238	4.780	14,700
November	898	85	262	405	7,880	24,100
December	462	67	136	210	4 200	12,900
January	586	85	220	340	6 810	20,900
February	128	67	90.0	139	2,610	8,010
March	314	67	104	161	3 230	9,890
April	245	60	86.0	133	2,580	7,920
May	502	67	159	246	4.920	15,100
June	180	67	106	164	3 190	9,760
The year	898	53	135	209	49 300	151,000

WAINIHA CANAL AT INTAKE, NEAR WAINIHA, KAUAI.

LOCATION.—At 700 feet elevation, 620 feet below intake about 4 miles south of Kauai Electric Co.'s power house.

RECORDS AVAILABLE.—August 1, 1910, to June 30, 1916.

GAGE.—Vertical staff.

DISCHARGE MEASUREMENTS.—Made from foot plank.

CHANNEL AND CONTROL.—Straight for 25 feet above and below gage. Cut in lava rock. Control probably permanent.

EXTREMES OF DISCHARGE.—Maximum stage recorded during period of record, 4.95 feet August, September, and October, 1911 (discharge, 64 million gallons per day, or 99 second-feet). Water shut off occasionally.

DIVERSIONS.—Canal diverts from Wainiha River.

REGULATION.—By head gates.

UTILIZATION.—Power development.

ACCURACY.—Stage-discharge relation varies somewhat with the amount of head-gate opening and the stage of Wainiha River, but allowance has been made for this variation in drawing the rating curve; estimates fair for all stages.

COOPERATION.—Gage-height record furnished by Kauai Electric Co.

Discharge measurements of Wainiha Canal at intake, near Wainiha, Kauai, during the year ending June 30, 1916.

Date.	Made by—	Gage height (feet).	Discharge.	
			Second-feet.	Million gallons per day.
Jan. 30	D. E. Horner	2.07	23	15
Apr. 14	do	4.51	82	53
14	do	4.18	76	49
22	do	4.30	79	51
June 21	W. V. Hardy	4.71	88	57

Daily discharge, in million gallons, of Wainiha Canal at intake near Wainiha, Kauai, for the years ending June 30, 1911–1916.

Date.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1910–11.												
1	.....	56	47	64	48	23	8.5	17	17	17	43	57
2	.....	54	46	64	4.0	23	10	.....	17	17	43	57
3	.....	57	46	64	4.0	23	26	.....	17	17	43	57
4	.....	59	63	63	4.0	23	19	.....	17	17	43	57
5	.....	61	47	59	4.0	23	19	17	17	17	43	57
6	.....	63	62	52	4.0	23	19	17	17	17	43	57
7	.....	63	57	57	4.0	23	19	17	17	42	43	57
8	.....	63	46	64	4.0	23	19	17	17	43	57	57
9	.....	64	54	64	4.0	23	19	17	17	43	57	57
10	.....	63	48	64	4.0	23	19	17	17	43	57	57
11	.....	60	44	64	4.0	23	19	17	17	43	57	57
12	.....	57	54	64	4.0	23	19	17	17	43	57	57
13	.....	54	57	64	4.0	23	19	17	17	43	57	57
14	.....	61	47	63	4.0	23	19	17	17	43	57	57
15	.....	61	54	56	36	23	19	17	17	43	57	57
16	.....	59	64	54	36	23	16	17	17	43	57	57
17	.....	52	49	48	33	23	16	17	17	43	57	57
18	.....	50	44	44	31	23	16	17	17	43	57	56
19	.....	49	48	39	31	33	16	17	17	43	57	55
20	.....	56	61	45	31	34	16	17	17	48	57	57
21	.....	64	64	54	36	34	16	17	17	54	57	58
22	.....	64	61	64	40	33	16	17	17	54	57	59
23	.....	61	64	64	56	56	16	17	17	39	57	59
24	.....	53	57	59	56	56	16	17	17	36	57	59
25	.....	63	63	48	56	56	16	17	17	36	55	59
26	.....	64	64	43	23	18	16	17	17	36	56	59
27	.....	64	64	64	23	14	16	17	17	36	57	59
28	.....	64	64	58	4.0	14	16	17	17	36	57	59
29	.....	63	64	58	12	14	16	.....	17	36	57	59
30	.....	56	64	56	23	14	16	.....	17	36	57	59
31	.....	48	.....	55	.....	14	16	.....	17	.....	57	.....
1911–12.												
1	59	52	58	14	39	50	8.5	38	47	59	38	48
2	59	51	49	58	40	48	48	38	47	57	38	48
3	59	59	47	57	39	46	53	38	59	57	59	41
4	59	51	44	59	38	55	48	47	59	53	59	45
5	59	46	56	59	57	55	.....	47	59	57	58	41
6	59	45	56	59	55	59	.....	22	59	57	49	39
7	59	45	56	59	56	59	.....	36	59	57	48	37
8	59	49	59	59	59	59	.....	36	59	57	59	36
9	59	54	59	55	59	59	.....	36	59	59	48	55
10	59	59	59	51	59	30	.....	38	59	59	44	48
11	59	55	59	48	59	30	.....	45	59	59	39	39
12	59	55	59	48	56	30	.....	38	59	59	38	45
13	59	58	59	47	59	30	.....	36	59	59	42	53
14	59	59	57	47	59	30	.....	36	59	59	59	59
15	56	59	59	44	59	30	.....	34	59	59	59	56
16	54	57	59	43	59	30	.....	34	59	59	59	57
17	59	59	59	48	59	30	.....	34	22	59	56	47
18	54	59	59	48	59	30	.....	34	26	59	48	61
19	56	58	59	44	59	30	.....	36	47	59	46	59
20	59	59	59	43	59	30	.....	34	47	57	53	53
21	59	53	11	44	59	30	.....	47	47	55	54	59
22	59	46	11	43	59	30	.....	47	51	55	59	54
23	59	44	11	45	59	30	.....	47	47	54	59	56
24	59	47	11	59	59	30	.....	47	56	50	59	59
25	55	45	11	55	59	30	.....	47	57	54	58	51
26	55	56	11	48	57	30	.....	47	59	59	56	47
27	57	59	11	44	59	30	.....	47	59	54	59	49
28	59	48	11	43	59	30	.....	47	59	56	57	41
29	59	44	11	43	59	30	.....	47	59	45	38	37
30	53	59	11	42	57	30	.....	.....	59	40	59	36
31	51	59	.....	43	.....	30	.....	.....	59	.....	52	.....

Daily discharge, in million gallons, of Wainiha Canal at intake near Wainiha, Kauai, for the years ending June 30, 1911–1916—Continued.

Date.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1912–13.												
1	42	40	59	50	57	59	.....	34	35	59	52	36
2	42	37	59	41	48	59	8.5	34	34	56	59	36
3	38	35	59	56	54	.....	38	34	34	55	57	31
4	42	34	59	40	49	.....	38	34	34	53	51	8.5
5	50	50	22	49	57	.....	36	36	34	46	42	8.5
6	53	54	59	40	54	8.5	34	38	34	38	59	8.5
7	59	50	59	50	53	8.5	36	41	45	37	57	8.5
8	45	59	59	57	52	23	36	37	37	36	59	8.5
9	40	59	59	54	43	56	41	36	48	50	47	57
10	59	54	46	54	59	56	56	36	35	59	42	59
11	59	57	43	47	53	48	59	38	34	59	48	59
12	59	56	45	39	47	41	57	36	33	59	8.5	55
13	56	57	40	36	42	39	38	36	33	59	8.5	56
14	59	59	38	40	38	39	34	34	32	59	8.5	59
15	59	59	37	38	48	45	38	34	32	59	8.5	57
16	59	57	48	47	54	48	33	35	34	57	8.5	57
17	59	48	49	48	45	38	34	37	55	59	8.5	41
18	56	43	38	56	54	36	34	34	40	59	9.0	38
19	47	39	38	59	59	36	36	31	53	59	38	44
20	45	38	37	59	58	59	38	35	59	59	40	37
21	50	59	42	59	59	56	38	36	59	57	38	48
22	56	56	48	59	59	59	36	36	56	51	36	45
23	56	54	38	59	59	59	36	36	54	53	34	40
24	59	56	33	53	59	59	36	47	54	51	43	38
25	54	50	33	54	59	14	36	45	56	59	41	48
26	52	50	33	59	43	59	34	39	59	56	39	59
27	45	59	33	59	40	.....	38	38	59	49	41	54
28	43	59	43	59	38	.....	34	36	59	53	39	59
29	47	59	49	57	59	9.5	34	.....	58	59	38	52
30	54	59	48	57	59	47	34	.....	51	59	53	59
31	43	59	.....	59	.....	47	34	.....	56	.....	.....	.....
1913–14.												
1	59	34	59	39	.....	14	28	38	54	34	53	56
2	59	36	59	38	4.0	14	27	34	38	34	59	59
3	59	33	57	28	59	14	31	34	33	34	59	48
4	59	32	47	31	57	14	42	34	30	33	59	40
5	59	30	42	29	52	14	47	31	40	59	54	59
6	59	16	50	58	54	14	14	31	59	59	52	57
7	59	54	48	59	51	14	14	38	47	54	59	52
8	56	54	41	59	58	14	14	30	38	45	59	59
9	50	56	47	59	59	14	38	30	44	38	31	59
10	42	48	36	51	59	33	47	30	41	33	8.5	59
11	38	38	34	45	59	33	47	29	34	33	55	59
12	41	46	48	50	59	33	47	28	32	32	47	56
13	59	59	36	59	59	33	47	28	33	30	39	52
14	59	59	34	58	27	33	54	28	56	30	38	52
15	59	58	36	50	27	32	54	41	38	30	48	40
16	56	59	34	52	41	31	59	40	43	31	59	47
17	54	54	33	36	56	30	59	30	57	31	59	39
18	42	43	34	34	54	30	50	30	47	59	59	48
19	48	38	36	39	41	30	52	29	38	59	58	59
20	51	38	33	33	22	30	54	28	37	59	59	59
21	40	42	39	41	.....	30	41	28	35	59	59	59
22	43	42	38	39	22	30	39	28	34	59	59	59
23	36	35	33	36	23	30	34	28	32	59	54	50
24	52	47	32	23	24	30	33	28	32	59	52	59
25	59	56	30	14	23	30	31	28	35	59	59	52
26	58	49	30	14	22	28	31	28	34	59	56	52
27	56	39	30	.....	22	28	36	37	31	59	59	52
28	45	57	43	.....	16	28	47	59	50	59	59	54
29	57	59	36	.....	20	28	47	.....	59	53	59	50
30	39	59	32	.....	20	26	43	.....	44	43	59	52
31	37	59	.....	.....	.....	30	50	.....	35	.....	14	.....

Daily discharge, in million gallons, of Wainiha Canal at intake near Wainiha, Kauai, for the years ending June 30, 1911–1916—Continued.

Date.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1914–15.												
1	57	59	59	4.0	59	59	4.0	40	39	33	59	32
2	56	59	59	.....	59	59	4.0	39	15	33	59	34
3	55	59	59	.....	59	52	4.0	40	41	33	58	34
4	30	59	59	.....	59	.....	47	40	56	33	57	47
5	30	59	59	.....	59	.....	45	47	52	44	55	57
6	59	59	59	.....	59	.....	44	46	29	38	49	54
7	57	59	59	.....	59	.....	47	47	39	51	45	56
8	59	59	59	.....	.....	.....	46	47	48	41	41	59
9	47	57	59	.....	50	.....	45	45	47	52	41	57
10	30	57	59	.....	47	30	45	47	23	41	53	48
11	30	59	59	.....	57	47	51	47	37	36	50	43
12	30	56	59	14	47	47	52	47	45	34	50	39
13	43	51	59	33	47	47	47	59	56	35	42	39
14	47	48	59	41	59	47	45	59	39	34	39	48
15	48	45	59	47	59	47	45	59	36	59	38	59
16	56	44	59	54	57	47	44	59	34	59	38	59
17	54	44	59	57	51	45	44	59	34	59	38	59
18	51	42	59	56	47	46	42	59	34	59	45	59
19	48	57	59	59	56	45	42	57	34	59	39	59
20	45	56	59	59	48	14	41	59	33	59	47	59
21	43	57	59	59	45	47	30	59	33	59	45	59
22	40	52	56	50	43	47	45	59	34	59	40	57
23	48	59	59	48	44	47	43	59	33	59	41	56
24	57	59	59	46	59	47	41	53	36	59	36	59
25	59	59	14	45	59	25	40	52	35	59	35	54
26	59	58	.....	44	59	8.5	39	47	33	59	34	57
27	59	59	.....	47	59	8.5	39	43	33	59	34	50
28	59	59	8.5	52	59	59	40	41	33	.....	34	46
29	59	59	.....	50	59	59	38	.....	33	59	34	51
30	59	59	4.0	59	59	59	38	.....	33	59	34	52
31	59	59	.....	59	.....	23	40	.....	33	.....	34	.....
1915–16.												
1	59	38	54	.....	50	47	4.0	14	47	54	54	59
2	59	59	47	.....	50	47	4.0	14	47	50	56	59
3	59	50	43	.....	14	47	14	14	47	52	59	59
4	59	59	50	.....	14	47	14	14	14	49	59	59
5	14	56	43	.....	14	47	14	14	14	48	59	59
6	59	59	52	.....	4.0	47	14	14	14	47	59	59
7	57	52	39	.....	4.0	48	14	14	14	47	59	59
8	52	59	48	.....	.....	48	14	14	14	46	59	59
9	54	57	52	.....	4.0	50	14	14	14	51	59	59
10	57	52	47	17	4.0	48	14	14	30	53	59	59
11	50	54	59	43	4.0	45	14	14	30	54	59	56
12	56	59	59	45	4.0	45	14	14	30	52	59	58
13	56	59	56	45	4.0	45	14	14	41	52	59	56
14	48	59	43	43	4.0	45	14	14	41	54	56	59
15	54	57	38	39	4.0	28	14	14	41	54	59	59
16	59	56	38	41	4.0	14	14	30	41	54	56	59
17	50	52	52	41	4.0	14	14	30	41	54	52	59
18	41	52	48	47	4.0	14	4.0	30	41	54	56	59
19	59	56	41	47	4.0	14	4.0	30	41	54	59	59
20	54	50	47	47	4.0	47	4.0	30	41	54	59	59
21	56	59	57	47	4.0	47	4.0	47	41	54	59	59
22	56	59	.....	47	47	47	30	47	41	52	59	59
23	45	47	.....	47	47	47	30	47	50	52	59	59
24	41	50	.....	47	47	14	30	47	54	50	59	56
25	39	56	.....	47	47	4.0	14	47	54	52	59	59
26	59	43	.....	47	47	4.0	4.0	46	54	57	59	59
27	59	38	.....	47	47	.....	4.0	47	50	59	59	59
28	57	36	.....	47	47	4.0	4.0	47	50	57	59	59
29	50	33	.....	47	47	4.0	14	47	50	56	59	59
30	41	48	.....	47	47	4.0	14	.....	50	38	58	59
31	50	56	.....	50	.....	4.0	14	.....	52	.....	58	.....

NOTE.—Discharge determined from fairly well defined rating curve. Gage height not recorded Jan. 5–31, 1912, and May 31, 1913; water shut off on other days for which discharge is not given.

Monthly discharge of Wainiha Canal at intake, near Wainiha, Kauai, for years ending June 30, 1911–1916.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
1910–11.						
August	64	48	58.9	91.1	1,830	5,600
September	64	44	55.6	86.0	1,670	5,120
October	64	39	57.4	88.8	1,780	5,460
November	56	4.0	20.9	32.3	627	1,920
December	56	14	25.9	40.1	804	2,460
January	26	8.5	17.0	26.3	528	1,620
February 1, 5–28	17	17	17.0	26.3	425	1,300
March	17	17	17.0	26.3	527	1,620
April	54	17	36.9	57.1	1,110	3,400
May	57	43	53.7	83.1	1,670	5,110
June	59	55	57.5	89.0	1,730	5,290
1911–12.						
July	59	51	57.7	89.3	1,790	5,490
August	59	44	53.2	82.3	1,650	5,060
September	59	11	41.4	64.1	1,240	3,810
October	59	14	48.4	74.9	1,500	4,600
November	59	38	55.8	86.3	1,670	5,140
December	59	30	37.1	57.4	1,150	3,530
February	47	22	40.0	61.9	1,160	3,560
March	59	22	54.0	83.6	1,670	5,140
April	59	40	56.5	87.4	1,700	5,200
May	59	38	51.9	80.3	1,610	4,940
June	61	36	48.5	75.0	1,460	4,470
1912–13.						
July	59	38	51.2	79.2	1,590	4,870
August	59	34	51.8	80.1	1,600	4,930
September	59	22	45.1	69.8	1,350	4,150
October	59	36	51.4	79.5	1,590	4,890
November	59	38	51.9	80.3	1,560	4,780
December 1–2, 6–26, 29–31	59	8.5	42.6	65.9	1,110	3,400
January 2–31	59	8.5	37.6	57.6	1,110	3,420
February	47	31	36.5	56.5	1,020	3,250
March	59	32	45.0	69.6	1,400	4,280
April	59	36	54.1	83.7	1,620	4,980
May 1–30	59	8.5	37.1	57.4	1,110	3,420
June	59	8.5	42.2	65.3	1,270	3,890
1913–14.						
July	59	36	51.3	79.4	1,590	4,880
August	59	16	46.1	71.3	1,430	4,390
September	59	30	39.6	61.3	1,190	3,650
October 1–26, 31	50	4.0	39.9	61.7	1,080	3,310
November 2–20, 22–30	59	4.0	38.9	60.2	1,090	3,340
December	33	14	25.5	39.5	792	2,430
January	59	14	40.5	62.7	1,260	3,850
February	59	28	32.3	50.0	905	2,870
March	59	30	40.6	62.8	1,260	3,860
April	59	30	46.2	71.5	1,380	4,250
May	59	8.5	51.7	80.0	1,600	4,920
June	59	39	53.3	82.5	1,600	4,910
The period	59	4.0	42.3	65.4	15,200	46,700
1914–15.						
July	59	30	49.5	76.6	1,530	4,710
August	59	42	55.7	86.2	1,730	5,300
September 1–25, 28, 30	59	4.0	53.3	82.5	1,440	4,420
October 1, 12–31	59	4.0	46.8	72.4	980	3,020
November 1–7, 9–30	59	43	54.6	84.5	1,580	4,860
December 1–3, 10–31	59	8.5	42.5	65.8	1,060	3,260
January	52	4.0	39.3	60.8	1,220	3,440
February	59	39	50.5	78.1	1,420	4,490
March	56	15	36.8	56.9	1,140	3,500
April 1–27, 29–30	59	33	49.1	76.0	1,420	4,370
May	59	34	43.4	67.1	1,340	4,130
June	59	32	51.4	79.5	1,540	4,730
The period	59	4.0	47.7	73.8	16,400	50,200

Monthly discharge of Wainiha Canal at intake, near Wainiha, Kauai, for years ending June 30, 1911–1916—Continued.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
1915–16.						
July	59	14	51.9	80.3	1,610	4,940
August	59	33	52.3	80.9	1,620	4,980
September 1–21	59	38	48.2	74.6	1,010	3,100
October 10–31	50	17	44.3	68.5	975	2,990
November 1–7, 9–30	50	4.0	21.6	33.4	625	1,920
December 1–26, 28–31	50	4.0	32.2	49.8	966	2,960
January	30	4.0	12.6	19.5	392	1,200
February	47	14	27.0	41.8	782	2,400
March	54	14	38.4	59.4	1,190	3,650
April	59	38	52.0	80.5	1,560	4,790
May	59	52	58.2	90.0	1,800	5,540
June	59	56	58.7	90.8	1,760	5,400
The period	59	4.0	41.3	63.9	14,300	43,900

MISCELLANEOUS MEASUREMENTS.

Measurements 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, 1916.

Date.	Stream.	Locality.	Gage height.	Discharge.	
			Feet.	*Second-feet.*	*Million gallons per day.*
July 2	Kilauea River.	Elevation 275 feet, at confluence of two main branches, 1 mile above Kilauea plantation.	8.18	19	12
Dec. 20	....do....	....do....	8.30	26	17
July 9	Kauaikinana..	Elevation 3,250 feet, 2 miles by train northeast of Knudsen's mountain house, about 15 miles north of Waimea.	.58	2.0	1.3
Aug. 6	....do....	....do....	.38	1.0	.65
Oct. 10	....do....	....do....	.26	.7	.45
Jan. 5	....do....	....do....	1.50	14	8.8
Feb. 5	....do....	....do....	1.55	19	12
Mar. 9	....do....	....do....	1.38	11	7.1
Apr. 5	....do....	....do....	.70	3.2	2.1
May 31	....do....	....do....	.64	2.5	1.6
July 10	Waiakoali....	About 10 miles northeast of Knudsen's mountain house and 22 miles north of Waimea.	1.54	2.9	1.9
Oct. 10	....do....	....do....	1.49	1.1	.7
10	....do....	....do....	1.49	1.7	1.1
Jan. 4	....do....	....do....	2.10	23	15
Feb. 4	....do....	....do....	1.88	15.5	10
Apr. 4	....do....	....do....	1.48	5.0	3.2
July 29	Kaholalele ditch.	One-third mile below intake from North Wailua River, about 8 miles from Lihue.	1.25	5.7	3.7
Aug. 17	....do....	....do....	1.12	4.6	3.0
Aug. 6	Mohihi.....	Elevation about 3,400 feet, about 12 miles northeast of Knudsen's mountain house, 24 miles north of Waimea.	3.74	2.2	1.4
Oct. 9	....do....	....do....	3.76	2.5	1.6
Jan. 4	....do....	....do....	4.60	34	22
Feb. 4	....do....	....do....	4.32	19	12
Apr. 4	....do....	....do....	3.88	4.2	2.7
June 1	....do....	....do....	3.87	3.9	2.5
Sept. 21	Koale.....	About one-third mile above confluence with Waiahulu stream, above all diversions, 12 miles north of Waimea.	2.29	36	23
24	....do....	....do....	2.46	37	24
25	....do....	....do....	2.56	48	31
26	....do....	....do....	3.79	226	146
26	....do....	....do....	3.44	167	108
30	....do....	....do....	3.16	113	73
Feb. 24	....do....	....do....	2.24	31	21
26	....do....	....do....	2.19	29	19
Mar. 16	....do....	....do....	2.39	46	30
May 18	....do....	....do....	2.11	29	19
19	....do....	....do....	2.60	65	42
Feb. 26	Kehaha ditch.	Below Tunnel No. 12, 7.5 miles below intake, 2 miles from Waimea.	3.50	77	50
Apr. 28	....do....	....do....	3.00	62	40
May 30	....do....	....do....	3.37	74	48
June 5	....do....	....do....	3.30	73	47

ISLAND OF OAHU.

KALIHI STREAM NEAR HONOLULU, OAHU.

LOCATION.—At Kioi Pool, about 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 8, 1913, to June 30, 1916.

GAGE.—Gurley weight-driven water-stage recorder installed December 4, 1913. Friez recorder in use September 8 to November 22, 1913.

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 in solid rock, with steep, high banks; two channels for gage heights of 6.0 feet and over. The high-water control is solid rock, but gravel sometimes collects in the low-water control and affects the stage-discharge relation.

EXTREMES OF DISCHARGE.—Maximum stage recorded during period of record, 10 feet at 6.15 a. m. September 22, 1914 (discharge, approximately 300 million gallons per day or 460 second-feet); minimum stage recorded, 2.50 feet November 1, 1913 (discharge, 0.5 million gallons per day, or 0.8 second-foot.

Minimum stage recorded during year, 2.2 feet April 15–16 and 21–23 (discharge, 1.0 million gallons per day, or 1.55 second-feet).

DIVERSIONS.—None above station.

REGULATION.—None.

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.—Records good for all stages, as sufficient current-meter measurements were made to give well defined curves covering the periods between changes in control.

Discharge measurements of Kalihi Stream near Honolulu, Oahu, during the year ending June 30, 1916.

Date.	Made by—	Gage height (feet).	Discharge.	
			Second-feet.	Million gallons per day.
Aug. 18	R. C. Rice	2.28	2.8	1.8
31	H. A. R. Austin	2.18	2.5	1.6
Nov. 11	R. C. Rice	7.02	206	133
Dec. 8	R. D. Khso	2.77	5.3	3.4
Jan. 15	H. A. R. Austin	3.06	11	7.3
Feb. 9	....do	2.62	5.9	3.8
Mar. 7	....do	3.70	37	24
7	....do	3.57	29	19
7	....do	3.46	26	17
30	....do	2.36	2.8	1.8
May 2	....do	6.01	167	108
2	....do	5.06	104	67
June 8	....do	2.52	5.1	3.3

Daily discharge, in million gallons, of Kalihi Stream near Honolulu, Oahu, for the year ending June 30, 1916.

Date.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	.....	3.0	1.7	6.6	3.4	4.4	6.9	5.6	2.6	1.9	39	5.2
2	.....	3.9	1.7	9.2	9.2	7.2	5.6	5.0	17	1.9	74	3.5
3	28	2.6	1.7	12	31	4.8	12	4.5	4.6	1.6	12	4.6
4	9.2	2.6	1.7	6.6	20	8.5	15	4.0	42	1.6	17	19
5	6.0	2.6	1.7	5.4	11	5.4	19	7.6	9.7	2.2	16	18
6	4.4	4.4	1.4	3.9	12	5.4	6.2	5.0	8.3	1.6	11	3.0
7	3.9	2.6	1.4	3.9	7.2	3.9	15	4.5	30	1.6	8.3	2.6
8	3.9	2.6	1.4	4.4	20	5.4	56	4.0	7.0	1.3	7.0	3.5
9	12	2.3	1.4	4.4	14	3.5	28	4.0	5.2	1.3	22	2.6
10	6.6	2.3	1.4	3.4	44	3.5	22	7.6	4.6	1.3	9.7	2.6
11	4.8	2.3	2.6	3.0	51	3.0	13	4.0	4.0	1.3	7.0	2.6
12	4.4	2.6	2.6	2.6	18	3.0	9.0	3.5	3.5	1.3	5.8	2.2
13	3.9	2.5	3.4	2.6	20	2.5	9.0	3.4	3.5	1.3	5.2	2.2
14	3.4	2.5	2.0	2.6	10	2.5	9.8	3.3	4.0	1.3	5.2	2.2
15	3.4	2.4	2.3	2.3	8.5	4.0	.....	3.2	5.2	1.0	4.0	2.2
16	3.4	2.3	1.7	2.3	7.8	4.0	.....	3.1	3.0	1.0	4.0	2.6
17	3.4	2.3	1.7	2.3	7.2	2.5	.....	3.0	3.0	1.9	3.5	2.2
18	3.0	2.3	4.4	7.2	6.0	17	.....	2.8	3.0	3.0	4.0	1.9
19	3.9	2.0	6.6	3.9	6.0	9.8	.....	2.6	2.6	1.3	4.0	1.9
20	3.9	3.0	4.8	5.4	5.4	6.2	.....	2.6	2.6	1.3	9.0	2.2
21	3.0	2.6	2.6	4.8	4.8	6.9	.....	2.6	2.6	1.0	7.0	2.2
22	3.0	2.0	2.3	3.4	7.2	10	.....	2.6	2.6	1.0	14	3.5
23	2.6	2.0	2.0	3.0	7.2	6.2	.....	2.2	2.6	1.0	12	2.2
24	3.0	2.0	2.0	3.0	4.8	6.2	8.3	2.2	2.6	1.3	7.0	2.2
25	4.4	2.3	2.0	7.2	4.8	6.2	36	2.2	2.6	3.0	6.4	2.6
26	3.0	2.0	2.3	16	4.4	44	9.8	2.2	2.2	1.6	7.6	4.6
27	2.6	1.7	2.0	8.5	5.4	24	5.6	2.2	2.2	9.0	6.4	4.0
28	2.6	1.7	6.0	5.4	14	63	5.6	2.2	2.2	2.6	5.2	3.5
29	2.6	1.7	7.2	7.8	6.6	13	5.6	2.2	1.9	1.6	5.2	2.2
30	2.6	1.7	6.6	4.8	4.8	8.3	5.6	.....	2.2	1.6	4.0	2.2
31	2.3	1.7	.....	3.9	.....	10	5.6	.....	1.9	.....	4.0	.....

NOTE.—Discharge determined from well-defined rating curves applicable as follows: July 1 to Dec. 8, Dec. 9 to Feb. 8, and Feb. 9 to June 30. Discharge estimated Aug. 13–17 and Jan. 28 to Feb. 8. Gage-height not recorded on days for which discharge is not given.

Monthly discharge of Kalihi Stream near Honolulu, Oahu, for year ending June 30, 1916.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July 3-31	28	2.3	4.94	7.64	143	440
August	4.4	1.7	2.41	3.73	75	229
September	7.2	1.4	2.75	4.25	83	253
October	16	2.3	5.22	8.08	162	497
November	51	3.4	12.5	19.3	376	1,150
December	63	2.5	9.82	15.2	304	934
February	7.6	2.2	3.58	5.54	104	319
March	42	1.9	6.16	9.53	191	586
April	9.0	1.0	1.82	2.82	55	168
May	74	3.5	11.2	17.3	346	1,070
June	19	1.9	3.87	5.99	116	356

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 June 30, 1916.

GAGE.—Inclined staff on right bank.

DISCHARGE MEASUREMENTS.—Low-water discharge measured by 2.0-foot sharp-crested weir with end contractions, flood discharge measured by 12.0-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 in solid rock; straight for about 75 feet above and below weir; banks high and covered with vegetation.

EXTREMES OF DISCHARGE.—Maximum stage recorded during period of record, 6.0 feet at 4 p. m. April 5, 1914 (no estimate of discharge possible, as entire weir was overflowed); minimum stage recorded, 0.10 foot in November, 1913, and September, 1915 (discharge, 0.15 million gallons per day or 0.25 second-foot).

DIVERSIONS.—Most of the flow at low and medium stages is diverted above station for domestic supply and for power development. An irrigation ditch diverts low-water discharge at point 300 feet below station.

REGULATION.—Amount diverted above station varies.

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.—Determinations good below 4 million gallons per day, or 6 second-feet, but only fair for larger flow owing to varying velocity of approach and uncertainties resulting from use of compound weir.

Daily discharge, in million gallons, of Nuuanu Stream below Reservoir No. 2 wasteway, near Honolulu, Oahu, for the year ending June 30, 1916.

Date.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	5.6	2.3	0.4	4.3	2.5	7.6	8.9	16	7.6	4.3	48	3.7
2	1.3	2.3	.35	10	3.4	11	7.6	13	13	4.0	45	4.8
3	1.1	4.3	.3	6.5	10	6.5	11	13	10	5.6	7.6	4.8
4	.55	4.0	.25	2.5	16	5.6	15	13	111	5.6	13	4.3
5	.55	2.8	.2	2.5	10	4.8	28	26	24	5.6	13	3.4
6	15	2.5	.15	1.5	20	4.8	10	13	11	4.3	11	3.7
7	2.3	2.5	.15	1.3	7.6	4.8	30	13	41	3.4	11	3.4
8	2.3	2.5	.25	1.3	8.9	4.3	30	11	16	3.4	7.6	3.4
9	2.3	1.5	.15	1.3	53	4.8	15	22	11	3.4	24	2.5
10	2.0	1.8	.15	1.3	6.5	4.3	30	15	10	3.1	7.6	2.0
11	7.6	1.5	.15	1.1	34	4.3	16	13	8.9	3.1	7.6	1.5
12	3.7	1.8	1.3	.9	15	4.3	15	10	8.9	2.8	5.6	1.5
13	2.0	1.5	1.3	.9	11	4.3	15	10	8.9	2.8	5.6	1.5
14	2.0	1.5	.55	.9	7.6	4.3	15	10	8.9	2.5	5.6	1.5
15	2.0	1.5	.4	.9	11	2.8	10	10	8.9	1.8	5.6	1.5
16	4.8	1.3	.4	.9	7.6	3.1	10	8.9	8.9	1.8	5.6	1.5
17	2.3	1.3	.4	1.1	4.8	3.1	59	8.9	7.6	2.8	3.7	1.5
18	41	1.3	.75	1.1	5.6	7.6	95	7.6	6.5	2.5	3.1	1.5
19	4.8	1.5	1.3	1.1	5.6	4.3	39	7.6	6.5	1.8	4.0	1.5
20	4.0	2.8	1.1	1.1	6.5	4.0	20	7.6	5.6	1.3	4.8	2.3
21	11	.4	.9	2.0	5.6	4.0	16	6.5	5.6	1.3	4.8	1.5
22	4.8	.4	.9	1.1	5.6	4.0	16	6.5	5.6	1.3	4.8	3.1
23	3.4	.4	.9	1.5	5.6	5.6	15	6.5	5.6	1.3	4.8	1.5
24	2.8	.4	.9	.9	6.5	4.3	13	7.6	4.8	1.3	4.3	1.5
25	4.3	.55	.75	1.8	4.8	26	13	7.6	4.8	1.3	4.3	1.3
26	3.1	.75	.75	3.7	6.5	13	26	7.6	4.8	1.3	7.6	1.8
27	3.4	.4	.55	4.8	5.6	15	16	7.6	4.8	18	7.6	1.5
28	3.1	.4	.4	2.3	20	43	15	7.6	4.3	3.1	4.3	1.3
29	3.1	.4	1.8	4.0	6.5	11	15	7.6	4.3	2.8	3.4	1.1
30	3.1	.4	1.5	2.8	6.5	10	16	.....	4.3	2.0	3.4	1.1
31	2.3	.4	.....	1.8	.....	15	15	.....	4.8	.....	3.7	.....

Monthly discharge of Nuuanu Stream below Reservoir No. 2 wasteway, near Honolulu, Oahu, for the year ending June 30, 1916.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July	41	0.55	4.89	7.57	152	465
August	4.3	.4	1.53	2.37	47	146
September	1.8	.15	.64	.99	19	59
October	10	.9	2.23	3.45	69	212
November	53	2.5	10.7	16.6	320	985
December	43	2.8	8.11	12.5	252	772
January	95	7.6	21.1	32.6	656	2,010
February	26	6.5	10.8	16.7	314	962
March	111	4.3	12.5	19.3	388	1,190
April	18	1.3	3.32	5.14	100	306
May	48	3.1	9.42	14.6	292	896
June	4.8	1.1	2.25	3.48	68	207
The year	111	.15	7.31	11.3	2,680	8,210

MANOA STREAM AT COLLEGE OF HAWAII, NEAR HONOLULU, OAHU.

LOCATION.—In gorge about half a mile southeast of College of Hawaii and 3 miles east of Honolulu post office.

RECORDS AVAILABLE.—March 23, 1909, to November 24, 1910; November 1, 1912, to April 26, 1913; September 10, 1913, to June 30, 1916.

GAGE.—Vertical staff on left bank. The weir used during 1909 and 1910 was destroyed by flood of November 24, 1910. Several changes in gage datum previous to 1912.

DISCHARGE MEASUREMENTS.—Made by wading.

CHANNEL AND CONTROL.—Channel straight and confined in vicinity of station; stream bed, composed of rock; clean and fairly permanent; left bank composed of rock nearly vertical; right bank has a gentle slope, covered with vegetation.

EXTREMES OF DISCHARGE.—Maximum stage recorded, 5.8 feet at 4.45 p. m. January 18, 1916 (discharge, from extension of rating curve, 190 million gallons per day, or 294 second-feet); minimum daily discharge, March, 1914, 0.2 million gallons per day or 0.3 second-foot.

Minimum stage recorded during year, 0.75 foot September 1 (discharge, 0.3 million gallons per day, or 0.46 second-foot).

DIVERSIONS.—Nearly all the low-water flow is diverted above and below the station for irrigation.

REGULATION.—None.

UTILIZATION.—Records show water available for storage at this reservoir site. The low-water flow of the stream is extensively used for irrigation of rice and taro in upper and lower Manoa Valley.

ACCURACY.—Determinations good for low and medium stages. Discharge measurements well distributed on rating curve for low and medium stages and indicate that control is permanent. Determinations of daily discharges from mean gage heights, based on morning and afternoon readings of staff gage may be considerably in error during periods of rapidly fluctuating stage.

COOPERATION.—Gage-height record furnished by College of Hawaii.

Discharge measurements of Manoa Stream at College of Hawaii, near Honolulu, Oahu, during the year ending June 30, 1916.

[Made by H. A. R. Austin.]

Date.	Gage height (feet).	Discharge.		Date.	Gage height (feet).	Discharge.	
		Second feet.	Million gallons per day.			Second feet.	Million gallons. per day.
Dec. 4	2.21	26	17	Mar. 31	1.10	2.6	1.7
Feb. 3	1.58	9.1	5.9	June 28	2.01	20	13

Daily discharge, in million gallons, of Manoa Stream at College of Hawaii, near Honolulu, Oahu, for the year ending June 30, 1916.

Date.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	25	1.9	0.3	26	10	2.6	12	1.9	1.6	2.6	56	10
2	7.8	1.6	.5	50	22	24	7.8	24	1.6	1.6	74	7.8
3	3.0	8.6	.6	30	18	7.8	11	13	34	1.9	34	9.4
4	3.0	7.8	.8	7.1	34	16	16	4.6	80	1.0	52	5.2
5	2.2	3.0	.8	4.6	36	7.8	24	3.0	25	1.0	50	5.2
6	5.8	4.6	.8	2.6	42	9.4	18	4.6	10	1.0	38	4.6
7	4.0	2.6	.6	1.0	20	5.8	26	3.0	36	1.0	19	4.0
8	3.5	2.6	.5	2.2	52	4.6	114	2.2	13	1.6	46	5.2
9	4.6	2.2	.5	8.6	24	2.6	62	3.0	9.4	1.0	62	4.6
10	4.0	1.6	.6	7.8	42	2.2	52	12	8.6	1.0	30	4.0
11	13	1.9	8.6	5.8	52	1.0	40	3.5	7.8	1.0	19	4.6
12	5.2	4.6	4.6	5.2	25	1.0	24	1.3	8.6	1.0	13	4.0
13	4.0	3.5	1.9	2.6	16	1.0	22	1.0	7.8	1.6	12	4.0
14	3.5	2.6	1.0	1.0	15	1.0	28	1.0	5.8	1.0	15	4.0
15	2.6	2.2	.8	1.6	14	.6	24	.6	7.8	1.0	8.6	4.0
16	7.1	1.6	.6	1.0	10	1.0	13	.6	5.8	.8	5.8	4.6
17	3.5	1.9	.5	.8	7.8	.6	74	.6	4.6	5.8	5.8	3.5
18	80	1.6	1.0	9.4	9.4	5.2	141	.6	3.0	13	5.2	3.0
19	8.6	1.3	2.2	7.8	13	24	64	4.6	2.2	5.2	12	3.5
20	5.8	7.1	1.3	9.4	13	24	24	5.2	1.6	2.2	11	4.0
21	18	3.5	1.0	7.1	10	44	15	3.0	1.6	1.6	14	5.8
22	10	1.9	1.0	7.1	10	40	8.6	2.2	1.3	2.6	12	11
23	7.1	1.3	1.0	7.1	12	24	8.6	1.6	1.0	2.2	13	8.6
24	4.6	1.9	3.0	4.6	7.8	26	8.6	1.0	1.0	1.3	8.6	9.4
25	4.0	2.2	2.6	7.8	7.8	19	7.1	1.3	1.6	9.4	11	15
26	4.6	.8	3.5	18	7.1	17	15	2.6	1.0	2.6	12	22
27	7.8	1.3	24	24	7.1	32	11	1.6	.8	28	9.4	25
28	5.8	1.0	12	8.6	14	74	7.1	1.6	.6	7.8	7.8	22
29	3.5	.6	16	16	8.6	19	5.2	1.0	.6	15	6.4	18
30	3.5	.6	12	10	2.6	13	15	.....	1.0	46	5.8	7.8
31	2.6	.6	.....	7.1	.....	16	7.1	.....	3.5	.....	6.4	.....

NOTE.—Discharge determined from rating curve well defined below 30 million gallons per day.

Monthly discharge of Manoa Stream at College of Hawaii, near Honolulu, Oahu, for year ending June 30, 1916.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July	80	2.2	8.64	13.4	268	822
August	8.6	.6	2.60	4.02	80	247
September	24	.3	3.49	5.40	105	321
October	50	.8	9.74	15.1	302	927
November	52	2.6	18.7	28.9	562	1,720
December	74	.6	15.0	23.2	466	1,430
January	141	5.2	29.2	45.2	905	2,780
February	24	.6	3.66	5.66	106	326
March	80	.6	9.30	14.4	288	885
April	46	.8	5.43	8.40	163	500
May	74	5.2	21.8	33.7	675	2,070
June	25	3.0	8.13	12.6	244	748
The year	141	.3	11.4	17.6	4,160	12,800

WEST BRANCH OF MANOA STREAM NEAR HONOLULU, OAHU.

LOCATION.—At diversion dam at R. W. Shingle's bungalow, 300 feet above highway bridge, about one-eighth mile above confluence with East Branch of Manoa Stream, 4 miles northeast of Honolulu post office. From May 20, 1913, to June 16, 1914, station was 150 feet upstream from bridge.

RECORDS AVAILABLE.—May 29, 1913, to June 30, 1916.

GAGE.—Watson water-stage recorder in use June 17 to October 20, 1914; replaced October 20, 1914, by a Friez water-stage recorder, which was replaced May 9, 1915, by a Stevens 8-day water-stage recorder; all at same site and datum. Vertical staff gage (at different datum) 150 feet upstream from highway bridge, about 25 feet above a 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 wide rounded crest acts as control and forms a large, quiet pool in the vicinity of the gage for low and medium stages. Leaves and small débris lodge on control and growth of grass on sides at times affect 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 filled with boulders.

EXTREMES OF DISCHARGE.—Maximum stage recorded, 2.3 feet, morning of April 16, 1915 (discharge, 57 million gallons per day, or 88 second-feet); minimum stage recorded, December, 1913 (0.05 million gallons per day, or 0.08 second-foot); minimum stage recorded during year, 1.0 foot April 2–4 and 6–16 (discharge, 0.4 million gallons per day, or 0.6 second-foot).

DIVERSIONS.—None above station.

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 for filling a swimming pool, the intake for the ram being at the diverting dam.

UTILIZATION.—Records on west and east branches of Manoa Stream together show amount of surface water available in upper Manoa Valley, above nearly all diversions. Practically the entire low-water flow of Manoa Stream is utilized at lower elevations in Manoa Valley for rice and taro irrigation.

ACCURACY.—Determinations good except for extreme low-water periods when regulation at control and lack of sensitiveness of control section prevented refined accuracy of low-water estimates.

Discharge measurements of West Branch of Manoa Stream near Honolulu, Oahu, during the year ending June 30, 1916.

Date.	Made by—	Gage height (feet).	Discharge.	
			Second-feet.	Million gallons per day.
Feb. 2	H. A. R. Austin	1.13	3.7	2.4
3	do	1.10	2.8	1.8
Mar. 31	do	1.07	1.7	1.1

Daily discharge, in million gallons, of West Branch of Manoa Stream near Honolulu, Oahu, for the year ending June 30, 1916.

Date.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	11	1.5	1.5	11	4.2	2.8	9.0	4.5	1.8	0.9	24	1.8
2	8.7	2.8	1.5	18	8.7	7.2	4.2	3.0	11	.4	32	1.8
3	2.8	5.7	2.8	14	18	4.2	7.2	1.8	1.8	.4	11	1.8
4	2.8	5.7	1.5	7.2	18	8.7	12	1.8	13	.4	19	1.8
5	2.8	5.7	1.5	5.7	11	4.2	19	3.0	4.5	.9	17	1.8
6	7.2	5.7	1.5	4.2	14	4.2	5.7	1.8	4.5	.4	13	1.8
7	5.7	4.2	1.5	4.2	8.7	2.8	16	.9	15	.4	7.6	.9
8	5.7	4.2	1.5	4.2	14	2.8	50	.9	3.0	.4	9.3	1.8
9	7.2	2.8	1.5	8.7	11	2.8	30	.9	1.8	.4	22	.9
10	7.2	2.8	1.5	4.2	16	2.8	16	3.0	1.8	.4	11	.9
11	11	2.8	5.7	4.2	18	2.8	8.7	1.8	1.8	.4	7.6	1.8
12	5.7	4.2	2.8	2.8	11	1.5	7.2	.9	.9	.4	6.0	.9
13	5.7	4.2	1.5	2.8	12	1.5	7.2	.9	1.8	.4	6.0	.9
14	4.2	4.2	.5	2.8	7.2	1.5	7.2	.9	1.8	.4	4.5	.9
15	4.2	1.5	.5	2.8	7.2	1.5	5.7	1.8	1.8	.4	4.5	.9
16	7.2	1.5	.5	2.8	5.7	2.8	5.7	.9	1.8	.4	4.5	1.8
17	7.2	1.5	1.5	2.8	5.7	1.5	16	.9	1.8	3.0	3.0	.9
18	25	1.5	1.5	5.7	5.7	7.2	46	.9	1.8	3.0	4.5	1.8
19	9.0	1.5	2.8	5.7	5.7	4.2	22	.9	.9	1.8	4.5	.9
20	8.0	4.2	2.8	5.7	4.2	4.2	9.3	.9	.9	.9	6.0	3.0
21	13	2.8	1.5	5.7	2.8	5.7	6.0	.9	.9	.9	6.0	6.0
22	5.7	1.5	1.5	2.8	4.2	8.7	6.0	.9	.9	.9	11	6.0
23	7.2	1.5	1.5	5.7	4.2	4.2	4.5	.9	.9	.9	11	3.0
24	4.2	2.8	1.5	4.2	2.8	4.2	4.5	.9	.9	.9	6.0	1.8
25	2.8	2.8	2.8	7.2	2.8	18	3.0	.9	.9	1.8	6.0	6.0
26	2.8	1.5	4.2	11	2.8	7.2	13	.9	.9	.9	4.5	13
27	5.7	1.5	2.8	8.7	4.2	11	4.5	.9	.9	9.3	4.5	7.6
28	2.8	.5	7.2	5.7	7.2	30	4.5	.9	.9	6.0	3.0	6.0
29	2.8	.5	5.7	5.7	4.2	8.7	4.5	.9	.9	3.0	4.5	3.0
30	2.8	.5	8.7	4.2	2.8	5.7	4.5	.....	.9	3.0	3.0	3.0
31	2.8	.5	.....	4.2	.....	11	4.5	.....	.9	.....	1.8	.....

NOTE.—Discharge determined from well-defined rating curves applicable July 1, 1915, to Jan. 18, 1916, and Jan. 19 to June 30, 1916. Discharge July 18–21, Jan. 1, 4–5 and 7–8 estimated by comparison with flow of East Branch.

Monthly discharge of West Branch of Manoa Stream near Honolulu, Oahu, for the year ending June 30, 1916.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July	25	2.8	6.48	10.0	201	616
August	5.7	.5	2.73	4.22	85	260
September	8.7	.5	2.46	3.81	74	226
October	18	2.8	5.95	9.21	185	566
November	18	2.8	8.13	12.6	244	748
December	30	1.5	5.99	9.27	186	570
January	50	3.0	11.7	18.1	364	1,110
February	4.5	.9	1.40	2.17	40	125
March	15	.9	2.69	4.16	83	256
April	9.3	.4	1.46	2.26	44	134
May	32	1.8	8.98	13.9	278	854
June	13	.9	2.82	4.36	84	260
The year	50	.4	5.10	7.89	1,870	5,720

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, and 4 miles northeast of Honolulu post office. From May 29, 1913, to May 19, 1914, station was 200 feet upstream from bridge.

RECORDS AVAILABLE.—May 29, 1913, to June 30, 1916.

GAGE.—Stevens 8-day water-stage recorder. Watson water-stage recorder from May 29, 1913, to September 28, 1914. 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; control shifts considerably. At low and medium stages stream past gage is fairly wide and deep and velocity is well distributed. Both banks are fairly steep and covered with vegetation.

EXTREMES OF DISCHARGE.—Maximum stage recorded during period of record, 4.2 feet at 5 a. m. January 8, 1916 (discharge, from extension of rating curve, 180 million gallons per day, or 278 second-feet); minimum daily discharge March, 1914, 0.9 million gallons per day, or 1.4 second-feet.

Minimum stage recorded during year, 1.35 feet May 28 and 29 (discharge, 1.4 million gallons per day, or 2.2 second-feet).

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

REGULATION.—None.

UTILIZATION.—Records on east and west branches of Manoa Stream together show amount of surface water available in upper Manoa Valley above nearly all diversions. Practically the entire low-water flow of Manoa Stream is utilized at lower elevations in Manoa Valley for irrigation of rice and taro.

ACCURACY.—Determinations based on fairly well defined rating curves and a continuous record of gage height; fair for all stages.

Discharge measurements of East Branch of Manoa Stream near Honolulu, Oahu, during the year ending June 30, 1916.

Date.	Made by—	Gage height (feet).	Discharge.	
			Second-feet.	Million gallons per day.
July 24	R. C. Rice	1.47	4.3	2.8
24	....do	1.47	4.3	2.8
Aug. 31	R. D. Klise	1.33	2.3	1.5
Oct. 4	R. C. Rice	1.50	4.0	2.6
20	....do	1.53	5.0	3.2
Nov. 11	....do	1.90	15	10
Dec. 4	H. A. R. Austin	1.77	12	7.7
25	G. K. Larrison	2.37	45	29
Jan. 22	R. C. Rice	1.67	8.5	5.5
Feb. 2	....do	1.57	6.3	4.1
Mar. 31	H. A. R. Austin	1.48	4.0	2.6
May 31	....do	1.48	5.0	3.2

Daily discharge, in million gallons, of East Branch of Manoa Stream near Honolulu, Oahu, for the year ending June 30, 1916.

Date.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	6.0	2.7	1.7	5.7	2.5	2.5	4.5	4.5	3.0	2.4	19	3.8
2	3.1	2.7	1.7	9.4	5.0	7.0	3.8	5.4	10	1.8	34	3.0
3	2.5	3.8	2.2	7.0	8.0	4.5	4.5	3.8	3.0	1.8	8.2	3.0
4	2.5	3.8	2.2	2.5	7.0	7.2	6.2	3.8	10	1.8	15	3.0
5	2.0	3.2	1.7	2.0	4.4	3.8	9.4	5.4	3.8	2.4	10	3.0
6	3.1	3.2	1.7	2.0	5.0	3.2	3.8	3.8	3.0	2.4	12	3.0
7	3.1	2.7	1.7	1.5	4.4	3.2	8.2	3.8	7.2	1.8	7.2	3.0
8	3.1	2.7	1.7	2.0	6.0	2.6	37	3.8	3.0	1.8	7.2	3.8
9	4.4	2.7.	1.7	4.4	4.4	3.2	15	3.8	3.0	1.8	19	3.0
10	3.7	2.7	1.7	2.0	8.0	2.6	12	4.5	3.0	1.8	8.2	3.0
11	6.0	2.2	3.8	1.5	8.0	3.2	10	3.8	3.0	1.8	5.4	3.0
12	3.1	2.2	2.7	1.5	4.4	2.6	6.2	3.0	3.0	1.8	4.5	3.0
13	3.1	3.2	2.2	1.5	6.0	2.6	4.5	3.0	3.0	1.8	3.8	2.4
14	2.5	2.2	1.7	1.5	3.7	2.6	7.2	3.0	3.0	1.8	3.8	3.0
15	2.5	2.7	1.7	1.5	3.1	2.6	4.5	3.0	3.8	1.8	3.0	3.0
16	3.7	2.2	1.7	1.5	2.5	2.6	3.8	3.0	3.0	1.8	2.4	3.0
17	3.7	2.2	1.7	1.5	2.5	2.1	12	3.0	3.0	3.0	2.4	3.0
18	19	1.7	2.2	5.0	2.5	6.2	43	3.0	2.4	3.0	2.4	3.0
19	4.4	2.2	2.7	3.1	3.1	3.8	15	3.0	2.4	1.8	3.0	2.4
20	3.8	2.2	2.2	3.1	2.5	3.2	7.2	3.0	2.4	1.8	3.0	3.0
21	6.6	2.7	1.7	3.1	2.5	4.5	6.2	3.0	2.4	1.8	2.4	4.5
22	3.8	2.2	2.2	2.0	2.5	5.4	5.4	3.0	2.4	1.8	4.5	4.5
23	3.2	1.7	2.2	2.5	3.1	3.2	5.4	3.0	2.4	1.8	2.8	3.0
24	3.2	1.7	2.7	2.5	2.5	3.2	3.5	2.4	2.4	1.8	1.8	2.4
25	3.2	1.7	2.7	3.1	2.5	10	4.5	2.4	2.4	3.8	1.8	4.5
26	3.2	2.2	2.7	4.4	2.5	5.4	8.2	2.4	2.4	2.4	1.8	8.2
27	3.8	1.7	2.2	3.7	3.1	8.2	4.5	2.4	2.4	8.2	1.8	5.4
28	2.7	1.7	5.7	2.5	6.0	12	3.8	2.4	2.4	3.0	1.4	3.8
29	2.7	1.7	3.2	3.1	3.1	4.5	3.8	2.4	2.4	2.4	1.4	3.0
30	3.2	1.7	5.0	2.0	2.5	3.8	4.5	.....	2.4	2.4	2.4	2.4
31	2.7	1.7	.....	2.5	.....	7.2	3.8	.....	3.0	.....	3.0	.....

NOTE.—Discharge determined from fairly well defined rating curves applicable as follows: July 1–18, July 19 to Dec. 2, 1915, Dec. 3, 1915, to June 30, 1916.

Monthly discharge of East Branch of Manoa Stream near Honolulu, Oahu, for year ending June 30, 1916.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July	19	2.0	3.99	6.17	124	380
August	3.8	1.7	2.38	3.68	74	226
September	5.7	1.7	2.36	3.65	71	217
October	9.4	1.5	2.95	4.56	92	281
November	8.0	2.5	4.11	6.36	123	378
December	12	2.1	4.47	6.92	139	425
January	43	3.8	8.88	13.7	275	845
February	5.4	2.4	3.34	5.17	97	297
March	10	2.4	3.39	5.24	105	323
April	8.2	1.8	2.32	3.59	70	214
May	34	1.4	6.44	9.95	200	613
June	8.2	2.4	3.40	5.26	102	313
The year	43	1.4	4.02	6.22	1,470	4,510

EAST MANOA DITCH NEAR HONOLULU, OAHU.

LOCATION.—100 feet below intake. Ditch diverts from East Branch of Manoa Stream about 1,000 feet above gaging station on that stream, 4 miles northeast of Honolulu post office.

RECORDS AVAILABLE.—May 24, 1915, to June 30, 1916.

GAGE.—Vertical staff on left bank.

DISCHARGE MEASUREMENTS.—Made by wading.

CHANNEL AND CONTROL.—Channel is an earth cut on a side hill; straight for 50 feet above and below gage; banks high and covered with vegetation. Control not well defined; shifting.

EXTREMES OF DISCHARGE.—Maximum stage recorded, 1.3 feet July 18, 1915 (discharge, 3.2 million gallons per day, or 5.0 second-feet); minimum stage recorded, 0.75 foot January 22–24, 1916 (discharge, 0.7 million gallons per day, or 1.1 second-feet).

DIVERSIONS.—None above station.

REGULATION.—Flow regulated by head gates.

UTILIZATION.—Irrigation of rice and garo.

ACCURACY.—Gage read once daily. Records poor.

Discharge measurements of East Manoa ditch near Honolulu, Oahu, during the year ending June 30, 1916.

Date.	Made by—	Gage height (feet).	Discharge.	
			Second-feet.	Million gallons per day.
Aug. 31	H. A. R. Austin	0.88	2.6	1.7
Oct. 23	R. C. Rice	.94	2.2	1.4
Nov. 11	do	1.07	3.1	2.0
Jan. 22	do	.75	.9	.6
Feb. 2	do	.88	1.5	.95
Mar. 31	H. A. R. Austin	.93	2.0	1.3

Monthly discharge of East Manoa ditch near Honolulu, Oahu, for year ending June 30, 1916.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July	3.2	1.3	1.60	2.48	50	152
August	1.8	1.4	1.70	2.63	53	162
September	2.5	1.6	1.85	2.86	56	170
October	3.0	1.3	1.58	2.44	49	150
November	2.4	1.3	1.50	2.32	45	138
December	1.9	1.3	1.39	2.15	43	132
January	2.1	.7	1.35	2.09	42	128
February	1.3	.95	1.06	1.64	31	94
March	1.9	1.1	1.39	2.15	43	132
April	1.7	1.1	1.31	2.03	39	121
May	1.9	.95	1.23	1.90	38	117
June	1.7	1.3	1.34	2.07	40	123
The year	3.2	.7	1.44	2.23	529	1,620

NOTE.—Discharge determined from poorly defined rating curves applicable as follows: July 1–18, July 19 to Oct. 2, Oct. 3 to Jan. 18, Jan. 19 to Mar. 4, and Mar. 5 to June 30.

MAKAWAO DITCH NEAR KAILUA,[1] OAHU.

LOCATION.—At west end of flume crossing Makawao Gulch in Kailua Valley, about 2½ miles south of Kailua.

RECORDS AVAILABLE.—November 1, 1912, to June 30, 1916.

GAGE.—Watson water-stage recorder installed March 2, 1914. Vertical staff November 1, 1912, to March 1, 1914; change in datum November 24, 1913.

DISCHARGE MEASUREMENTS.—Prior to November 24, 1913, made by current meter in open flume; November 24, 1913, to February 11, 1914, by a 2.5-foot sharp-crested weir with end contractions; February 12, 1914, to June 30, 1916, by a 4-foot sharp-crested weir with end contractions.

CHANNEL AND CONTROL.—Earth ditch subject to growth of weeds and grass. Flow from Makawao Spring empties into main ditch at pool back of weir.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 0.5 foot July 18–19, 21–23, (discharge, 3.0 million gallons per day or 4.6 second-feet.

Maximum stage recorded during period of records available, 1.00 foot May 12, 1913 (discharge, 5.1 million gallons per day, or 7.9 second-feet; ditch frequently dry.

DIVERSIONS.—Ditch diverts all low water from headwaters of Kaimi and Makawao streams and discharges into Waimanalo reservoir.

REGULATION.—Flow regulated by head gates.

UTILIZATION.—Irrigation of sugar cane by Waimanalo Sugar Co.

ACCURACY.—Determinations fair. The weir discharge corrected for velocity of approach has been checked by current meter measurements. On account of faulty operation of the water-stage recorder only a fragmentary record was obtained after November 9, 1915. Ditch dry much of the time.

Discharge measurements of Makawao ditch near Kailua, Oahu, during the year ending June 30, 1916.

Date.	Made by—	Gage height (feet).	Discharge.	
			Second-feet.	Million gallons per day.
Sept. 2	H. A. R. Austin	0.38	3.2	2.1
2	.....do	.38	3.1	2.0

Monthly discharge of Makawao ditch near Kailua, Oahu, for year ending June 30, 1916.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July	3.0	2.2	2.39	3.70	74	227
August	2.2	2.2	2.20	3.40	68	209
September	2.2	1.8	2.16	3.34	65	199
October	2.6	2.2	2.25	3.48	70	214
November 1–9	2.6	2.2	2.24	3.47	20	62
The period	3.0	1.8	2.25	3.48	297	911

NOTE.—Discharge determined by weir formula.

[1] Described in Water Supply Paper 373 as "at Makawao flume, near Waimanalo."

KAILUA STREAM NEAR KAILUA, OAHU.

LOCATION.—About 200 feet below intake of Wong Leong's ditch, three-quarters of a mile east of point where road to Kailua rice mill leaves Waimanalo-Honolulu road, 1 mile southeast of Kailua and about 11 miles by road from Honolulu.

RECORDS AVAILABLE.—Fragmentary record November 12, 1913, to June 30, 1916.

GAGE.—Inclined staff on left bank installed April 29, 1914, at same site and datum as vertical staff installed January 21, 1913, the datum of the latter being different from that of original gage. A vertical staff for high-water reading is spiked to a mango tree on right bank about 35 feet above inclined staff.

DISCHARGE MEASUREMENTS.—Made by wading.

CHANNEL AND CONTROL.—Channel straight for 50 feet above and below gage; composed of small boulders and gravel; the gently sloping banks are overflowed in extreme floods. Control is a boulder riffle which shifts during floods.

EXTREME OF DISCHARGE.—Collection of débris on banks indicates a stage of approximately 11.0 feet on March 27, 1914 (data insufficient for an estimate of discharge); minimum stage recorded, 0.49 foot May, 1913 (discharge 0.1 million gallons per day, or 0.15 second-foot).

DIVERSIONS.—Wong Leong's ditch usually diverts all low-water flow at a point 200 feet above station.

REGULATION.—Amount diverted above varies.

UTILIZATION.—Low-water flow is diverted for irrigation of rice fields.

ACCURACY.—Gage read twice daily. Records poor owing to unstable stage-discharge relation and insufficient number of current-meter measurements.

Discharge measurements of Kailua Stream near Kailua, Oahu, during the year ending June 30, 1916.

Date.	Made by—	Gage height (feet).	Discharge.	
			Second-feet.	Million gallons per day.
Nov. 17	H. A. R. Austin	0.80	11	6.8
Feb. 1	do	1.63	28	18
June 29	do	.42	1.0	.65

Monthly discharge of Kailua Stream near Kailua, Oahu, for year ending June 30, 1916.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
November 6–30	202	1.0	22.0	34.0	550	1,690
December	172	4.0	18.3	28.3	567	1,740
January	335	4.6	37.3	57.7	1,160	3,550
February	34	11	14.0	21.7	405	1,250
March	58	2.8	10.2	15.8	317	970
April	4.2	1.0	1.60	2.48	48	147
May	14	1.6	4.15	6.42	128	395
June	1.6	.8	1.20	1.86	36	110

NOTE.—Discharge determined from poorly defined rating curves applicable as follows: July 1, 1915, to Jan. 18, 1916. Jan. 19 to June 30, 1916. No record for missing periods.

WONG LEONG'S DITCH NEAR KAILUA, OAHU.

LOCATION.—100 feet below ditch intake from Kailua Stream; three-fourths of a mile east of point where road to rice mill leaves Waimanalo-Honolulu road, about 1 mile south of Kailua and 11 miles from Honolulu.

RECORDS AVAILABLE.—November 12, 1912, to June 30, 1916.

GAGE.—Vertical staff.

DISCHARGE MEASUREMENTS.—Made by wading.

CHANNEL AND CONTROL.—Channel straight for 50 feet above and below gage; bank clean and high. Stage-discharge relation changed by growth of weeds and cleaning of ditch.

EXTREMES OF DISCHARGE.—Maximum stage recorded during period of record, 1.80 feet at 8 a. m., May 3, 1914 (discharge, 7.7 million gallons per day, or 12 second-feet), minimum stage recorded, 0.15 foot, February 2, 1916 (discharge, 0.6 million gallons per day, or 0.9 second-foot).

DIVERSION.—None above station.

REGULATION.—Flow controlled by head gates.

UTILIZATION.—Irrigation of rice fields.

ACCURACY.—Records poor owing to instability of stage-discharge relation.

Discharge measurements of Wong Leong ditch near Kailua, Oahu, during the year ending June 30, 1916.

Date.	Made by—	Gage height (feet).	Discharge.	
			Second-feet.	Million gallons per day.
Nov. 17	H. A. R. Austin	1.30	6.5	4.2
Feb. 1	do	.18	1.1	.7
June 29	do	.93	4.5	2.9

Monthly discharge of Wong Leong's ditch near Kailua, Oahu, for the year ending June 30, 1916.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July	3.8	2.0	3.09	4.78	96	294
August	3.4	2.5	2.83	4.38	88	269
September	4.1	2.5	3.28	5.07	98	302
October	3.8	2.6	3.37	5.21	105	321
November	5.1	2.8	3.56	5.51	107	328
December	7.2	2.6	5.68	8.79	176	540
January	7.6	.7	3.41	5.28	106	324
February	2.5	.6	2.08	3.22	60	185
March	4.3	.7	2.48	3.84	77	236
April	3.5	3.2	3.29	5.09	99	303
May	3.5	2.5	2.98	4.61	92	284
June	3.0	2.2	2.50	3.87	75	230
The year	7.6	.6	3.22	4.98	1,180	3,620

NOTE.—Discharge determined from a poorly defined rating curve.

MAKAWAO STREAM NEAR KAILUA, OAHU.

LOCATION.—One-fourth mile above confluence of Makawao and Kaimi streams and 100 feet above intake of irrigation ditch near Waimanalo-Honolulu road, 1 mile south of Kailua and about 12½ miles east by road from Honolulu.

RECORDS AVAILABLE.—November 12, 1912, to June 30, 1916.

GAGE.—Vertical staff on right bank, installed April 29, 1914, to replace gage washed out March 28, 1914; datum new but site same as old gage.

DISCHARGE MEASUREMENTS.—Made by wading or from footbridge 10 feet below gage.

CHANNEL AND CONTROL.—One channel at all stages except extreme flood; straight for 50 feet above and below gage; right bank nearly vertical; left bank overflows in floods. Control probably permanent between extreme floods.

EXTREMES OF DISCHARGE.—Maximum stage recorded during period of records available, 5.9 feet at 11.25 a. m., January 18, 1916 (discharge approximately 400 million gallons per day, or 619 second-feet); minimum stage recorded, 0.55 foot, October and November, 1915 (discharge 0.8 million gallons per day, or 1.2 second-feet).

DIVERSIONS.—Low-water discharge of two main branches is diverted into Makawao ditch about three-fourths of a mile above station. An irrigation ditch diverts most of low flow at a point 100 feet below gage.

REGULATION.—Amount diverted above station varies.

UTILIZATION.—Entire low flow is diverted for irrigation of rice fields.

ACCURACY.—Gage read twice daily. Determinations July 1 to January 18 good for low water; those January 19 to June 30 fair for all stages.

Discharge measurements of Makawao Stream near Kailua, Oahu, during the year ending June 30, 1916.

Date.	Made by—	Gage height (feet).	Discharge.	
			Second-feet.	Million gallons per day.
Nov. 17	H. A. R. Austin	0.90	4.8	3.1
Jan. 19	R. C. Rice	1.99	50	32
19	H. A. R. Austin	2.34	87	56
Feb. 1	.....do	1.00	10	6.7
June 29	.....do	.55	2.2	1.4

Monthly discharge of Makawao Stream near Kailua, Oahu, for year ending June 30, 1916.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July	5.0	1.3	1.78	2.75	55	169
August	1.6	1.0	1.36	2.10	42	129
September	2.0	1.0	1.27	1.96	38	117
October	1.0	.8	.88	1.36	27	84
November	12	.8	3.14	4.86	94	289
December	140	2.3	10.7	16.6	331	1,020
January	328	5.0	25.4	39.3	788	2,420
February	15	3.3	5.23	8.09	152	465
March	20	2.8	5.79	8.96	180	551
April	2.8	1.9	1.99	3.08	60	183
May	5.0	2.4	2.89	4.47	90	275
June	2.4	1.4	1.77	2.74	53	163
The year	328	.8	5.22	8.08	1,910	5,860

NOTE.—Discharge determined from rating curves applicable as follows: July 1, 1915, to Jan. 18, 1916, well defined below 4 million gallons per day. Jan. 19 to June 30, 1916, fairly well defined below 60 million gallons per day.

MAKAWAO SPRING NEAR KAILUA, OAHU.

LOCATION.—15 feet above flume joining Makawao ditch, three-fourths of a mile south of Maunawili Ranch, and about 3 miles south of Kailua.

RECORDS AVAILABLE.—February 12, 1914, to June 30, 1916.

GAGE.—Vertical staff.

DISCHARGE MEASUREMENTS.—Made by a 1-foot sharp-crested weir with end contractions.

CHANNEL AND CONTROL.—Water emerges from ground directly into pool back of weir.

EXTREMES OF DISCHARGE.—Maximum stage recorded during period of record: January 1–31, 1916 (discharge 0.5 million gallons per day, or 0.77 second-foot); minimum stage recorded, 0.29 foot frequently (discharge, 0.32 million gallons per day, or 0.50 second-foot).

DIVERSIONS.—None.

REGULATION.—None.

UTILIZATION.—Irrigation of sugar cane by Waimanalo Sugar Co.

ACCURACY.—Gage read once daily. Results good, flow steady, and conditions at weir good.

The following discharge measurement was made by H. A. R. Austin: March 29, 1916, gage height, 1.34 feet; discharge, 0.45 million gallons.

Monthly discharge of Makawao Spring near Kailua, Oahu, for year ending June 30, 1916.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July	0.34	0.32	0.33	0.51	10	31
August	.34	.32	.33	.51	10	31
September	.32	.32	.32	.50	9.6	29
October	.32	.32	.32	.50	9.9	30
November	.36	.32	.34	.53	10	31
December	.36	.34	.35	.54	11	33
January	.50	.50	.50	.77	16	48
February	.40	.40	.40	.62	12	36
March	.36	.36	.36	.56	11	34
April	.36	.36	.36	.56	11	33
May	.36	.36	.36	.56	11	34
June	.36	.35	.36	.56	11	33
The year	.50	.32	.36	.56	132	403

KAIMI STREAM NEAR KAILUA, OAHU.

LOCATION.—At highway bridge on Waimanalo-Honolulu government road, 1 mile south of Kailua, about 12½ miles east of Honolulu.

RECORDS AVAILABLE.—November 12, 1912, to June 30, 1916.

GAGE.—Vertical staff on right bank. Datum raised 1.00 foot April 10, 1913.

DISCHARGE MEASUREMENTS.—Made by wading or from highway bridge at gage.

CHANNEL AND CONTROL.—One channel at all stages, confined between abutments of bridge at gage. Control composed of small boulders; fairly permanent.

EXTREMES OF DISCHARGE.—Maximum stage recorded during period of record, 4.25 feet at 8 a. m. April 27, 1915 (discharge, approximately 220 million gallons per day, or 340 second-feet). Minimum stage recorded, 0.8 foot September 1, 1915 (discharge, 0.7 million gallons per day, or 1.1 second-feet).

DIVERSIONS.—Headwaters diverted by Makawao ditch.

REGULATION.—None.

UTILIZATION.—Water diverted by Makawao ditch used for irrigation of sugar cane; that flowing past station is later diverted for irrigation of rice fields.

ACCURACY.—Gage read twice daily. Determinations July 1 to November 2 fair below 20 million gallons per day; those for remainder of year poor owing to unstable condition of control.

Discharge measurements of Kaimi Stream near Kailua, Oahu, during the year ending June 30, 1916.

[Made by H. A. R. Austin.]

Date.	Gage height (feet).	Discharge.		Date.	Gage height (feet).	Discharge.	
		Second-feet.	Million gallons per day.			Second-feet.	Millions gallons per day.
Nov. 17	1.27	6.7	4.3	Feb. 1	1.47	11	6.8
Jan. 19	1.94	32	21	June 29	1.10	1.9	1.2

Monthly discharge of Kaimi Stream near Kailua, Oahu, for the year ending June 30, 1916.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July	3.5	1.2	1.34	2.07	42	127
August	1.8	1.0	1.31	2.03	41	125
September	1.8	.7	1.26	1.95	38	116
October	1.8	1.2	1.28	1.98	40	122
November	16	1.2	4.08	6.31	122	376
December	87	3.0	7.88	12.2	244	750
January	138	4.5	13.7	21.2	424	1,300
February	14	5.2	6.27	9.70	182	558
March	30	2.2	4.09	6.33	127	389
April	2.2	1.0	1.47	2.27	44	135
May	6.8	1.8	2.83	4.38	88	269
June	1.8	1.2	1.31	2.03	39	121
The year	138	.7	3.91	6.05	1,430	4,390

NOTE.—Discharge determined from rating curves applicable as follows: July 1, 1915 to Mar. 2, 1916, well defined below 20 million gallons per day; Mar. 3 to June 30, 1916, poorly defined.

MAIN SPRING NEAR KAILUA, OAHU.

LOCATION.—At the head of Makawao ditch, 1 mile south of Maunawili ranch, and about 3 miles south of Kailua.

RECORDS AVAILABLE.—February 12, 1914, to June 30, 1916.

GAGE.—Vertical staff.

DISCHARGE MEASUREMENTS.—Made by a 1-foot sharp-crested weir with end contractions.

CHANNEL AND CONTROL.—Water emerges from ground directly into pool back of weir.

EXTREMES OF DISCHARGE.—Maximum stage recorded during period of record, 0.60 foot January 1–31, 1916 (discharge, 0.88 million gallons per day, or 1.36 second-feet); minimum stage recorded, 0.39 foot March 17–28, 1914 (discharge, 0.48 million gallons per day, or 0.74 second-foot).

DIVERSIONS.—None.

REGULATION.—None.

UTILIZATION.—Irrigation of sugar cane by Waimanalo Sugar Co.

ACCURACY.—Gage read once daily. Determinations fair. There is a small amount of seepage around weir and a velocity of approach of about 0.4 foot per second.

Monthly discharge of Main Spring near Kailua, Oahu, for year ending June 30, 1916.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July	0.67	0.67	0.67	1.04	21	64
August	.67	.63	.65	1.01	20	62
September	.63	.59	.61	.94	18	56
October	.59	.59	.59	.91	18	56
November	.65	.59	.63	.97	19	58
December	.69	.65	.66	1.02	20	63
January	.88	.88	.88	1.36	27	84
February	.84	.84	.84	1.30	24	75
March	.84	.78	.81	1.25	25	77
April	.78	.72	.77	1.19	23	71
May	.78	.78	.78	1.21	24	74
June	.78	.78	.78	1.21	23	72
The year	.88	.59	.72	1.11	262	812

KAMAKALEPO STREAM NEAR KAILUA, OAHU.

LOCATION.—At highway bridge on Waimanalo-Honolulu government road, 1 mile south of Kailua, and about 3½ miles from Waimanalo.

RECORDS AVAILABLE.—November 12 to December 3, 1912; April 9, 1913, to June 30, 1916.

GAGE.—Vertical staff bolted to left abutment of bridge; installed April 10, 1913, to replace original gage washed out December 3, 1912; new datum.

DISCHARGE MEASUREMENTS.—Made by wading or from footbridge 30 feet below gage.

CHANNEL AND CONTROL.—One at all stages; confined between bridge abutments at gage. Control composed of small boulders and gravel; fairly permanent.

EXTREMES OF DISCHARGE.—Maximum stage recorded during period of record, 4.52 feet at 8.20 a. m., December 28, 1915 (discharge, approximately 300 million gallons per day, or 464 second-feet); minimum stage recorded, 1.15 feet November 5 and 6, 1913 (discharge, 0.3 million gallons per day, or 0.45 second-foot).

DIVERSIONS.—None above station.

REGULATION.—None.

UTILIZATION.—Kamakalepo Stream joins Kailua Stream; low flow is diverted for irrigation of rice fields.

ACCURACY.—Gage read twice daily. Rating curve well defined throughout the year; determinations good except for high and fluctuating stages.

Discharge measurements of Kamakalepo Stream near Kailua, Oahu, during the year ending June 30, 1916.

Date.	Made by—	Gage height (feet).	Discharge.	
			Second-feet.	Million gallons per day.
Nov. 17	H. A. R. Austin	1.46	4.5	2.9
Jan. 19	R. C. Rice	1.90	22	14
19	H. A. R. Austin	2.18	43	28
Feb. 1	.....do	1.44	5.0	3.2
June 29	.....do	1.18	1.4	.9

Monthly discharge of Kamakalepo Stream near Kailua, Oahu, for the year ending June 30, 1916.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July	4.9	0.9	1.57	2.43	49	149
August	1.6	.9	1.33	2.06	41	127
September	1.6	.9	1.20	1.86	36	110
October	1.6	1.2	1.35	2.09	42	128
November	18	1.2	3.60	5.57	108	331
December	120	1.2	6.58	10.2	204	626
January	120	2.6	12.5	19.3	387	1,190
February	12	1.6	2.57	3.98	75	229
March	32	1.2	3.96	6.13	123	377
April	2.1	.7	.96	1.49	29	88
May	6.9	1.6	2.72	4.21	84	259
June	1.6	.9	1.20	1.86	36	110
The year	120	.7	3.31	5.12	1,210	3,720

NOTE.—Discharge determined from rating curve well defined below 40 million gallons per day.

KAHANAIKI STREAM NEAR KAILUA, OAHU.

LOCATION.—75 feet below confluence of north and south branches, 100 feet above highway bridge on main road 1 mile south of Kailua, 4 miles from Waimanalo, and 12 miles from Honolulu.

RECORDS AVAILABLE.—October 13, 1914, to June 30, 1916.

GAGE.—Vertical staff on left bank.

DISCHARGE MEASUREMENTS.—Made by wading or from highway bridge 100 feet below gage.

CHANNEL AND CONTROL.—One channel at all stages. Straight for 50 feet above and below gage. Banks high and covered with vegetation. Control composed of small boulders; fairly permanent between extreme floods.

EXTREMES OF DISCHARGE.—1914–1916: Maximum stage recorded, 8.03 feet at 4 p. m. March 6, 1916 (discharge, approximately 650 million gallons per day, or 1,000 second-feet). Minimum stage recorded, 0.65 foot August 6 and September 6, 1915 (discharge, 0.3 million gallons per day, or 0.46 second-foot).

DIVERSIONS.—Two small ditches divert water above station, one from the north branch and one from the south branch. The combined flow of these ditches never exceeds 0.4 million gallons per day.

REGULATION.—Amounts diverted above station vary.

UTILIZATION.—Low flow is all diverted for irrigation of rice and taro.

ACCURACY.—Gage read twice daily. Records fairly good for low and medium stages, although the quantity of water involved is too small for best results; high-water curve not well defined.

Discharge measurements of Kahanaiki Stream near Kailua, Oahu, during the year ending June 30, 1916.

Date.	Made by—	Gage height (feet).	Discharge.	
			Second-feet.	Million gallons per day.
Nov. 17	H. A. R. Austin	0.94	2.2	1.4
Jan. 18	.....do	2.96	135	87
June 29	.....do	.76	.75	.5

Monthly discharge of Kahanaiki Stream near Kailua, Oahu, for year ending June 30, 1916.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July	1.5	0.5	0.60	0.93	19	57
August	.6	.3	.46	.71	14	44
September	.6	.3	.43	.67	13	40
October	.8	.4	.53	.82	16	50
November	20	.4	2.05	3.17	61	189
December	62	.6	3.86	5.97	120	367
January	98	3.0	11.1	17.2	346	1,060
February	8.0	.6	1.74	2.69	50	155
March	246	.6	10.3	15.9	319	980
April	1.1	.5	.58	.90	18	53
May	3.0	.5	.96	1.49	30	91
June	.5	.5	.50	.77	15	46
The year	246	.3	2.79	4.32	1,020	3,130

NOTE.—Discharge determined from fairly well defined rating curve.

KANEOHE STREAM NEAR KANEOHE, OAHU.

LOCATION.—100 feet below confluence of two main branches of stream near Heeia Agricultural Co.'s mill, about 3½ miles south of Kaneohe.

RECORDS AVAILABLE.—January 15, 1914, to June 30, 1916.

GAGE.—Vertical staff on right bank. Datum raised 1.0 foot March 11, 1915.

DISCHARGE MEASUREMENTS.—Made by wading.

CHANNEL AND CONTROL.—Channel straight for 25 feet above and below gage; stream bed composed of firm earth and gravel; banks are low and overflow at a gage height of about 3.0 feet. Control is a riffle of gravel and small boulders; shifts during floods.

EXTREMES OF DISCHARGE.—Maximum stage recorded during period of record, 3.80 feet at 7.30 a. m., May 30, 1914 (discharge, approximately 145 million gallons per day, or 224 second-feet), minimum stage recorded, 0.5 foot January 16, 1916 (discharge, 1.4 million gallons per day, or 2.2 second-feet).

DIVERSIONS.—None above station; several diversions below station, the first one being about 150 feet below gage.

REGULATION.—None.

UTILIZATION.—Low-water flow diverted for irrigation of rice fields.

ACCURACY.—As gage was read only once a day, determinations for high or fluctuating stages only approximate; determinations of low-water flow, which is very steady, fair.

Discharge measurements of Kaneohe Stream near Kaneohe, Oahu, during the year ending June 30, 1916.

[Made by H. A. R. Austin.]

Date.	Gage height (feet).	Discharge.		Date.	Gage height (feet).	Discharge.	
		Second-feet.	Million gallons per day.			Second-feet.	Million gallons per day.
Nov. 22	0.76	4.2	2.7	Feb. 10	1.13	12	7.5
Dec. 10	.69	3.9	2.5	June 26	.89	5.3	3.4
Jan. 17	2.71	105	68				

Monthly discharge of Kaneohe Stream near Kaneohe, Oahu, for year ending June 30, 1916.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July	5.5	3.9	4.19	6.48	130	399
August	3.8	3.3	3.51	5.43	109	334
September	4.3	3.3	3.38	5.23	102	311
October	3.8	2.5	3.26	5.04	101	310
November	57	2.5	5.63	8.71	169	518
December	14	2.5	3.63	5.62	113	345
January	86	1.4	5.74	8.88	178	546
February	9.9	6.2	7.29	11.3	212	649
March	86	5.5	10.6	16.4	327	1,010
April	9.4	2.7	5.29	8.18	159	487
May	7.4	4.5	4.98	7.71	154	474
June	5.2	3.5	4.26	6.59	128	392
The year	86	1.4	5.14	7.95	1,880	5,780

NOTE.—Discharge determined from fairly well defined rating curves applicable as follows: July 1, 1915, to Mar. 31, 1916, and Apr. 1 to June 30, 1916.

YOUNG MAU DITCH NEAR KANEOHE, OAHU.

LOCATION.—100 yards below intake. Ditch diverts from Kaneohe Stream half a mile from main road, 1 mile southeast of Kaneohe, and 10 miles from Honolulu.

RECORDS AVAILABLE.—January 15, 1914, to June 30, 1916.

GAGE.—Vertical staff on left bank. Datum lowered 2.0 feet March 10, 1915.

DISCHARGE MEASUREMENTS.—Made by wading.

CHANNEL AND CONTROL.—Earth channel with steep banks; straight for 50 feet above and below gage. Control is a 2 by 12 inch plank set on edge across the channel; fairly permanent.

EXTREMES OF DISCHARGE.—Maximum stage recorded, 4.8 feet at 10.30 a. m. November 11, 1915 (discharge, 31 million gallons per day, or 48 second-feet); ditch occasionally dry.

DIVERSIONS.—None above station.

REGULATION.—None. No head gates.

UTILIZATION.—Irrigation of rice fields.

ACCURACY.—Gage read once daily. Rating curve fairly good; determinations fair below 5 million gallons per day.

Discharge measurements of Young Mau ditch near Kaneohe, Oahu, during the year ending June 30, 1916.

Date.	Made by—	Gage height (feet).	Discharge.	
			Second-feet.	Million gallons per day.
Dec. 10	H. A. R. Austin	3.52	2.6	1.7
Mar. 10	.....do	3.45	2.3	1.5
June 26	.....do	3.64	5.7	3.7

Monthly discharge of Young Mau ditch near Kaneohe, Oahu, for the year ending June 30, 1916.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July	5.8	3.3	3.84	5.94	119	365
August	4.8	2.7	3.56	5.51	110	339
September	5.8	.7	3.93	6.08	118	362
October	11	.7	3.20	4.95	99	304
November	31	.4	4.33	6.70	130	399
December	15	.4	3.26	5.04	101	310
January	11	.4	3.15	4.87	98	300
February	2.1	.4	1.77	2.74	51	158
March	15	.7	2.53	3.91	78	241
April	3.3	.4	1.53	2.37	46	141
May	3.3	.4	1.37	2.12	43	130
June	5.8	.4	2.74	4.24	82	252
The year	31	.4	2.94	4.55	1,080	3,300

NOTE.—Discharge determined from rating curve fairly well defined below 5 million gallons per day.

AHLO DITCH NEAR KANEOHE, OAHU.

LOCATION.—50 feet below Honolulu-Kaneohe road, 400 feet below intake and 600 feet south of Kaneohe.

RECORDS AVAILABLE.—January 15, 1914, to June 30, 1916.

GAGE.—Vertical staff on right bank. Datum raised 1.0 foot March 10, 1915; published records based on new datum.

DISCHARGE MEASUREMENTS.—Made from plank 12 feet below gage.

CHANNEL AND CONTROL.—Earth channel cut on hillside; right bank high and steep straight for 50 feet above and below gage. No well-defined control. Stage-discharge relation affected by growth of grass and weeds in channel and on banks.

EXTREMES OF DISCHARGE.—Gage readings of highest water during year considered unreliable; ditch occasionally dry.

DIVERSIONS.—None above station. Ditch diverts from Kaneohe Stream.

REGULATION.—Flow regulated by head gates.

UTILIZATION.—Irrigation of rice fields.

ACCURACY.—Gage read once daily. Determinations poor on account of unstable conditions caused by growth of grass and weeds which made frequent cleaning of ditch necessary. Rating curves not well defined.

Discharge measurements of Ahlo ditch near Kaneohe, Oahu, during the year ending June 30, 1916.

[Made by H. A. R. Austin.]

Date.	Gage height (feet).	Discharge.		Date.	Gage height (feet).	Discharge.	
		Second-feet.	Million gallons per day.			Second-feet.	Million gallons per day.
Aug. 10	0.57	7.4	4.8	May 3	0.69	10	6.7
Dec. 9	.65	10	6.6	June 5	.66	9.1	5.9
Feb. 10	.83	11	7.3				

Monthly discharge of Ahlo ditch near Kaneohe, Oahu, for year ending June 30, 1916.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July	7.5	5.1	5.86	9.07	182	557
August	6.0	3.4	4.80	7.43	149	457
September	4.6	2.6	3.34	5.17	97	297
October 2–31	9.0	6.0	8.23	12.7	247	758
November 2–10, 12–30	14	4.2	7.38	11.4	207	634
December	14	4.2	6.27	9.70	194	596
January 1–16, 20–31	10	4.2	6.74	10.4	189	579
February	8.0	2.2	6.61	10.2	192	588
March 1–6, 9–31	14	7.0	8.98	13.9	260	799
April	12	7.0	8.38	13.0	252	772
May	12	5.6	7.09	11.0	220	675
June	7.5	5.1	6.07	9.39	182	559

NOTE.—Discharge determined from two poorly defined rating curves applicable (*a*) July 1 to Nov. 11, 1915, Jan. 19 to Mar. 7, 1916, and May 21 to June 30, 1916; (*b*) Nov. 12, 1915, to Jan. 18 1916, and Mar. 8 to May 20, 1916. Gage readings Nov. 11, Jan. 17–19, and Mar. 7 and 8 discarded on account of doubt as to their accuracy. No flow Oct. 1 and Nov. 1.

HOOLEINAIWA STREAM NEAR KANEOHE, OAHU.

LOCATION.—400 yards above junction with Kaneohe Stream; three-quarters of a mile by road from Pali camp, and 3½ miles southwest of Kaneohe.

RECORDS AVAILABLE.—January 15, 1914, to June 30, 1916.

GAGE.—Vertical staff on left bank. Datum raised 0.85 foot on March 11, 1915; records published to new datum.

DISCHARGE MEASUREMENTS.—Made by wading.

CHANNEL AND CONTROL.—Channel makes a bend at control 10 feet below gage; banks steep and high; one channel at all stages. Bed of stream hardpan and gravel. Control is a boulder riffle: shifts during extreme floods, though fairly permanent for ordinary stages.

EXTREMES OF DISCHARGE.—Highest water occurred September 22–25 1914, and April 27, 1915 (gage heights not recorded). Minimum stage recorded, 0.5 foot September 13, 1915 (discharge, 0.1 million gallons per day).

DIVERSIONS.—None above station.

REGULATION.—None.

UTILIZATION.—Low-water flow diverted for irrigation of rice fields.

ACCURACY.—Gage read once daily. Rating curves fairly well defined for low and medium stages; percentage of error in determinations may be large on account of small amount of water involved.

Discharge measurements of Hooleinaiwa Stream near Kaneohe, Oahu, during the year ending June 30, 1916.

[Made by H. A. R. Austin.]

Date.	Gage height (feet).	Discharge.		Date.	Gage height (feet).	Discharge.	
		Second-feet.	Million gallons per day.			Second-feet.	Million gallons per day.
Nov. 22	0.89	0.75	0.5	Feb. 10	1.18	1.7	1.1
Dec. 10	.86	.75	.5	June 26	1.04	.6	.4

Monthly discharge of Hooleinaiwa Stream near Kaneohe, Oahu, for year ending June 30, 1916.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July	2.9	0.15	0.29	0.45	9.1	28
August	.2	.15	.16	.25	5.0	15
September	.3	.1	.22	.34	6.5	20
October	.4	.25	.25	.39	7.9	24
November	6.0	.25	.81	1.25	24	75
December	1.4	.4	.52	.80	16	49
February	1.4	.9	1.03	1.59	30	92
April	.9	.5	.60	.93	18	55
May	.7	.5	.54	.84	17	51
June	.6	.5	.51	.79	15	47

NOTE.—Discharge determined from rating curves applicable as follows: July 1, 1915, to Mar. 7, 1916, fairly well defined below 2.0 million gallons per day; Mar. 8 to June 30, 1916, poorly defined. Gage readings Jan. 18–19, Jan. 29, and Mar. 7 discarded on account of doubt as to their accuracy.

PIHO STREAM NEAR KANEOHE, OAHU.

LOCATION.—100 feet above junction with Kaneohe Stream, 3½ miles southwest of Kaneohe, and 8½ miles from Honolulu.

RECORDS AVAILABLE.—January 15, 1914, to June 30, 1916.

GAGE.—Vertical staff on left bank. Datum raised 0.7 foot March 11, 1915.

DISCHARGE MEASUREMENTS.—Made by wading.

CHANNEL AND CONTROL.—One channel at all stages; straight 10 feet above and 25 feet below gage. Banks steep and high; stream bed composed of firm earth and gravel. Control is a riffle of small boulders; shifts frequently. Stage-discharge relation also affected by growth of grass and weeds on sides of channel.

EXTREMES OF DISCHARGE.—Gage readings on days of highest water considered unreliable; minimum discharge, 0.1 million gallons per day, or 0.15 second-foot, April, 1914, October, 1915, and March, 1916.

DIVERSIONS.—None above station.

REGULATIONS.—None.

UTILIZATION.—After joining Kaneohe Stream water of Piho Stream is diverted for irrigation of rice fields.

ACCURACY.—Gage read once daily. Records only approximate owing to frequent shifts in control; measurements insufficient to define good rating curves.

Discharge measurements of Piho Stream near Kaneohe, Oahu, during the year ending June 30, 1916.

[Made by H. A. R. Austin.]

Date.	Gage height (feet).	Discharge.		Date.	Gage height (feet).	Discharge.	
		Second-feet.	Million gallons per day.			Second-feet.	Million gallons per day.
Dec. 7	0.25	0.85	0.55	May 3	0.60	1.7	1.1
Feb. 10	.58	1.0	.65	June 26	.52	.4	.25

Monthly discharge of Piho Stream near Kaneohe, Oahu, for year ending June 30, 1916.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July	1.0	0.3	0.40	0.62	12	38
August	1.0	.4	.66	1.02	20	63
September	2.2	.2	1.23	1.90	37	113
October	3.0	.1	2.03	3.14	63	193
November	22	.8	3.80	5.88	114	350
December	12	.6	1.94	3.00	60	185
February	.6	.2	.37	.57	11	33
April	4.0	1.4	1.88	2.91	56	173
May	2.3	.8	1.34	2.07	42	127
June	1.6	.3	.49	.76	15	45

NOTE.—Discharge determined from poorly defined rating curves applicable as follows: July 1 to Nov. 11, 1915, Nov. 12, 1915, to Jan. 18, 1916, Jan. 19 to Mar. 7, Mar. 8 to May 31, June 1 to 30, 1916. Gage readings of floods Jan. 17–19 and Mar. 7 discarded because of doubt as to their accuracy.

KUOU STREAM NEAR KANEOHE, OAHU.

LOCATION.—Just below trail crossing, 300 feet above junction with Kaneohe Stream, 3½ miles southwest of Kaneohe and 8½ miles from Honolulu.

RECORDS AVAILABLE.—January 15, 1914, to June 30, 1916.

GAGE.—Vertical staff on right bank; datum raised 0.5 foot March 10, 1915.

DISCHARGE MEASUREMENTS.—Made by wading.

CHANNEL AND CONTROL.—One channel at all stages, straight for 15 feet above gage and for 50 feet below gage; bed of stream composed of boulders and gravel; right bank steep and high; left bank slopes gently. Control is a boulder riffle; shifts during floods.

EXTREMES OF DISCHARGE.—Gage readings for days of highest water considered unreliable; minimum stage recorded, 0.8 foot frequently 1915–16 (discharge, 1.0 million gallons per day, or 1.5 second-feet).

DIVERSIONS.—None above station.

REGULATION. None.

UTILIZATION.—Low-water flow is diverted below junction with Kaneohe Stream for irrigation of rice fields.

ACCURACY.—Daily records fair for low stages when flow is steady. Records poor, for high and medium stages; gage read only once daily; extensions of the rating curves approximate above 4,000,000 gallons per day, or 6 second-feet.

Discharge measurements of Kuou Stream near Kaneohe, Oahu, during the year ending June 30, 1916.

[Made by H. A. R. Austin.]

Date.	Gage height (feet).	Discharge.		Date.	Gage height (feet).	Discharge.	
		Second-feet.	Million gallons per day.			Second-feet.	Million gallons per day.
Dec. 10	0.95	3.2	2.1	May 3	0.80	4.2	2.7
Feb. 10	.87	4.8	3.1	June 26	.78	2.9	1.9

Monthly discharge of Kuou Stream near Kaneohe, Oahu, for year ending June 30, 1916.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July	1.8	1.0	1.28	1.98	40	122
August	1.8	1.0	1.40	2.17	43	133
September	1.8	1.0	1.25	1.93	38	115
October	1.8	1.4	1.63	2.52	51	155
December	13	2.4	3.40	5.26	105	323
February	4.0	2.2	2.91	4.50	84	259
April	6.3	1.0	2.36	3.65	71	217
May	4.7	1.0	2.66	4.12	82	253
June	2.2	1.7	1.97	3.05	59	181

NOTE.—Discharge determined from rating curves applicable as follows: July 1, 1915, to Jan. 18, 1916, fairly well defined below 4,000,000 gallons per day. Jan. 19 to June 30, 1916, poorly defined. Gage readings Nov. 11, Jan. 17 and 18, Mar. 7 and 31 discarded on account of doubt as to their accuracy.

KUOU DITCH NEAR KANEOHE, OAHU.

LOCATION.—Four feet above highway bridge, 200 yards below intake. Ditch diverts from Kaneohe Stream between inflow of Piho and Kuou streams, 3½ miles southwest of Kaneohe.

RECORDS AVAILABLE.—January 13, 1914, to June 30, 1916.

GAGE.—Vertical staff on left bank. New datum May 6, 1914.

DISCHARGE MEASUREMENTS.—Two-foot sharp-crested weir with end contractions. Weir was destroyed April 3, 1914, and was replaced May 6, 1914.

CHANNEL AND CONTROL.—Large pool back of weir.

EXTREMES OF DISCHARGE.—Weir sometimes entirely submerged; ditch occasionally dry.

DIVERSIONS.—None above station.

REGULATION.—Flow regulated by head gates.

UTILIZATION.—Irrigation of rice fields.

ACCURACY.—Records fair. Gage read once daily. Occasionally backwater at the weir.

Monthly discharge of Kuou ditch near Kaneohe, Oahu, for year ending June 30, 1916.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July	2.3	1.4	1.78	2.75	55	169
August	2.3	1.9	2.29	3.54	71	218
September	2.3	1.9	2.15	3.33	64	198
February	.7	.15	.40	.62	12	36
June	1.4	1.0	1.12	1.73	34	103

NOTE.—Discharge determined from formula for sharp-crested rectangular weir with end contractions. Weir flooded on days for which discharge is not given.

LULUKU STREAM NEAR KANEOHE, OAHU.

LOCATION.—A short distance above junction with Kaneohe Stream, 3 miles southwest of Kaneohe.

RECORDS AVAILABLE.—March 1, 1914, to June 30, 1916.

GAGE.—Vertical staff on right bank. Datum raised 1.0 foot March 19, 1915.

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

CHANNEL AND CONTROL.—One channel at all stages; straight for 30 feet above and 10 feet below control; left bank steep; right bank slopes gently. Bed of stream composed of boulders and gravel. Control is a riffle of large boulders; shifts during heavy floods. Stage-discharge relation affected by growth of grass and weeds on control.

EXTREMES OF DISCHARGE.—Maximum stage recorded, 3.0 feet at 10 a. m., March 7, 1916 (discharge approximately 118 million gallons per day, or 182 second-feet; minimum stage recorded, 0.09 foot (new datum) at 7.40 a. m. March 9, 1914 (discharge, 0.3 million gallons per day, or 0.45 second-foot.)

DIVERSIONS.—North Luluku ditch diverts about 1,500 feet above station.

REGULATION.—Amount diverted above station varies.

UTILIZATION.—Water diverted above station is used for irrigation of taro. Water flowing past the station joins Kaneohe Stream, from which it is diverted for irrigation of rice fields.

ACCURACY.—Gage read once daily. Owing to shifting control and lack of sufficient current meter-measurements, records are poor for all except low stages, for which they are fair.

Discharge measurements of Luluku Stream near Kaneohe, Oahu, during the year ending June 30, 1916.

Date.	Made by—	Gage height (feet).	Discharge.	
			Second-feet.	Million gallons per day.
Dec. 10	H. A. R. Austin	0.24	1.5	0.95
Feb. 4	do	.24	2.8	1.8
June 26	do	.17	1.7	1.1

Monthly discharge of Luluku Stream near Kaneohe, Oahu, for year ending June 30, 1916.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July	1.4	0.8	1.18	1.83	36	112
August	3.4	1.4	1.86	2.88	58	177
September	6.0	2.2	3.59	5.55	108	331
October	7.0	5.0	5.77	8.93	179	549
November	96	1.1	10.5	16.2	314	967
December	34	.8	4.08	6.31	126	388
January	114	1.1	10.7	16.6	332	1,020
February	2.2	1.4	1.58	2.44	46	141
March	118	1.4	10.0	15.5	310	951
April	11	1.4	2.63	4.07	79	242
May	6.4	.8	1.57	2.43	49	149
June	1.4	.8	1.19	1.84	36	110
The year	118	.8	4.57	7.07	1,670	5,140

NOTE.—Discharge determined from poorly defined rating curves applicable as follows: July 1, 1915, to Jan. 18, 1916; Jan. 19 to June 30, 1916.

NORTH LULUKU DITCH NEAR KANEOHE, OAHU.

LOCATION.—200 feet below intake. Ditch diverts from Luluku Stream about three-quarters of a mile above confluence with Kaneohe Stream, and about 3 miles southwest of Kaneohe.

RECORDS AVAILABLE.—January 15, 1914, to June 30, 1916.

GAGE.—Vertical staff on right bank. Datum raised 0.56 foot February 7, 1914 and 0.5 foot March 10, 1914.

DISCHARGE MEASUREMENTS.—Made by wading.

CHANNEL AND CONTROL.—Channel straight for 20 feet above and below gage; subject to growth of grass and weeds. Control is a 2-foot sharp-crested weir with end contractions. Weir has not been used for measurement of discharge on account of high velocity of approach and tendency of weir to become choked with sediment.

EXTREMES OF DISCHARGE.—Maximum stages uncertain; ditch dry occasionally.

DIVERSIONS.—Small amount of water diverted above station for irrigation of taro.

REGULATION.—No regulation by head gates.

UTILIZATION.—Irrigation of taro and rice fields.

ACCURACY.—Gage read once daily. Records fair. Weir made a good control; rating curve fairly well defined.

Discharge measurements of North Luluku ditch near Kaneohe, during the year ending June 30, 1916.

Date.	Made by—	Gage height (feet).	Discharge.	
			Second-feet.	Million gallons per day.
Dec. 10	H. A. R. Austin	0.60	0.55	0.35
Feb. 4	do	.57	.3	.2
June 26	do	.74	1.3	.85

Monthly discharge of North Luluku ditch near Kaneohe, Oahu, for year ending June 30, 1916.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July	1.1	0.65	0.72	1.11	22	68
August	.65	.3	.54	.84	17	51
September	1.3	.15	.47	.73	14	43
October	.45	.3	.44	.68	14	42
November 1–10, 12–30	4.2	.05	.70	1.08	20	62
December	4.2	.05	.65	1.01	20	62
January 1–17, 19–31	2.2	.05	.66	1.02	20	61
February	.3	.05	.16	.25	4.7	14
March 1–6, 8–31	4.2	.05	.49	.76	15	45
April	1.6	.15	.33	.51	10	30
May	1.6	.15	.95	1.47	30	90
June	1.1	.85	.88	1.36	26	81

NOTE.—Discharge determined from rating curve fairly well defined below 1.5 million gallons per day. Gage readings Nov. 11, Jan. 18, and Mar. 7 were discarded because of doubt as to their accuracy.

KAWA STREAM NEAR KANEOHE, OAHU.

LOCATION.—At highway bridge half a mile south of Kaneohe ranch buildings and 1 mile southeast of Kaneohe.

RECORDS AVAILABLE.—March 1, 1914, to June 30, 1916.

GAGE.—Vertical staff bolted to right abutment of bridge, installed October 19, 1914, to replace original gage washed out September 22, 1914. Datum raised 1.02 feet October 19, 1914; records published to new datum.

DISCHARGE MEASUREMENTS.—Made by wading.

CHANNEL AND CONTROL.—One channel at all stages; confined between bridge abutments at gage; straight for 20 feet above and below gage. Control shifting.

EXTREMES OF DISCHARGE.—Maximum stage recorded during period of record, 2.5 feet at 8.10 a. m. April 27, 1915 (discharge, approximately 46 gallons per day, or 71 second-feet); minimum stage recorded, 0.38 foot (new datum) at 8.50 a. m. July 24, 1914, and September, 1915 (discharge, 0.3 million gallons per day, or 0.45 second-foot).

DIVERSION.—None above station.

REGULATION.—None.

UTILIZATION.—Low-water flow diverted below station for irrigation of rice fields.

ACCURACY.—Gage read once daily. Records for low stages fair; for high and fluctuating stages approximate.

Discharge measurements of Kawa Stream near Kaneohe, Oahu, during the year ending June 30, 1916.

[Made by H. A. R. Austin.]

Date.	Gage height (feet).	Discharge.		Date.	Gage height (feet).	Discharge.	
		Second feet.	Million gallons per day.			Second-feet.	Million gallons per day.
Aug. 10	0.43	0.55	0.35	Feb. 10	1.22	15	9.5
Dec. 9	.64	1.9	1.2	June 5	.78	1.0	.65
Feb. 10	1.29	17	11				

Monthly discharge of Kawa Stream near Kaneohe, Oahu, for year ending June 30, 1916.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July	1.5	0.5	0.79	1.22	24	75
August	1.1	.5	.55	.85	17	52
September	1.1	.3	.56	.87	17	52
October	1.1	.5	.75	1.16	23	71
November	32	.7	5.07	7.84	152	467
December	13	.4	2.21	3.42	68	210
February	7.6	4.4	5.88	9.10	170	523
April	4.0	1.7	2.45	3.79	74	226
May	11	1.7	2.84	4.39	88	270
June	2.8	.8	1.48	2.29	44	136

NOTE.—Discharge determined from rating curves applicable as follows: July 1 to Nov. 12, 1915, fairly well defined below 10 million gallons per day. Nov. 13, 1915, to Mar. 7, 1916, fairly well defined below 15 million gallons per day. Mar. 8 to June 30, 1916, poorly defined. Gage readings Jan. 18–19 and Mar. 7 discarded because of doubt as to their accuracy.

WING WO TAI DITCH NEAR HEEIA, OAHU.

LOCATION.—100 feet below intake. Ditch diverts from Heeia Stream half a mile west of Heeia.

RECORDS AVAILABLE.—January 19, 1914, to June 30, 1916.

GAGE.—Vertical staff on left bank. Datum raised 1.31 feet March 10, 1915.

DISCHARGE MEASUREMENTS.—Made by wading. A 2.5-foot sharp-crested weir with end contractions was installed but a rating by current meter has been used, as the conditions for measurement by weir are not good.

CHANNEL AND CONTROL.—Channel is cut in earth and gravel; section about 2 feet wide and 3 feet deep; subject to growth of grass and weeds. Control is a 2.5-foot weir.

EXTREMES OF DISCHARGE.—Maximum stages uncertain; ditch occasionally dry.

DIVERSIONS.—None above station.

REGULATION.—Flow regulated by head gates.

UTILIZATION.—For irrigation of rice fields.

ACCURACY.—Gage read once daily. Channel frequently choked by grass and weeds; records approximate only.

Discharge measurements of Wing Wo Tai ditch near Heeia, Oahu, during the year ending June 30, 1916.

Date.	Made by—	Gage height (feet).	Discharge.	
			Second-feet.	Million gallons per day.
Aug. 10	H. A. R. Austin	0.63	0.85	0.55
Dec. 9	....do	.56	.75	.5

Monthly discharge of Wing Wo Tai ditch near Heeia, Oahu, for year ending June 30, 1916.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July	0.5	0.1	0.29	0.45	9	28
August	1.7	.35	1.18	1.83	37	112
September	2.7	1.4	2.04	3.16	61	188
October 1–11, 13–19, 23–27, 30–31	2.7	.5	1.01	1.56	25	77
November	3.1	.7	1.04	1.61	31	96
December	2.4	.1	.60	.93	19	57
January 1–16, 19–31	3.1	.3	.75	1.16	22	67
February	1.1	.3	.88	1.36	26	78
March 1–6, 8–29	1.1	.3	.73	1.13	20	63
April	3.1	.1	1.04	1.61	31	96
May	3.1	.1	.96	1.49	30	91
June	1.4	.5	1.24	1.92	39	114

NOTE.—Discharge determined from rating curves fairly well defined below 2 million gallons per day, applicable as follows: July 1 to Oct. 29, Oct. 30, 1915, to June 30, 1916, water shut off Oct. 12, 20–22, 28, and 29. Gage readings Jan. 17 and 18, Mar. 7, 30, and 31 discarded on account of doubt as to their accuracy.

HOP TUCK DITCH NEAR HEEIA, OAHU.

LOCATION.—200 yards below intake, 300 yards above rice mill, and 1½ miles northeast of Heeia.

RECORDS AVAILABLE.—March 1, 1914, to June 30, 1916.

GAGE.—Vertical staff on right bank. Datum raised 1.14 feet March 10, 1915; records published to new datum.

DISCHARGE MEASUREMENTS.—Made by wading. A 2.5-foot sharp-crested weir with end contractions was installed when station was established, but a rating by current meter has been used, as conditions for measurement by weir are not good.

CHANNEL AND CONTROL.—Channel is cut in firm earth; section about 5 feet wide and 4 feet deep; straight for 50 feet above and below gage; channel and banks subject to growth of weeds and grass. Control is 2.5-foot weir; weir sometimes drowned out by closing of gates below.

EXTREMES OF DISCHARGE.—Maximum stages uncertain; ditch occasionally dry.

DIVERSIONS.—None above station. Ditch diverts from Heeia Stream.

REGULATION.—Flow regulated by head gates.

UTILIZATION.—Irrigation of rice fields.

ACCURACY.—Gage read once daily. Determinations between 1 and 3 million gallons per day fair July 1, 1915, to April 16, 1916; those for other periods poor owing to lack of current-meter measurements.

Discharge measurements of Hop Tuck ditch near Heeia, Oahu, during the year ending June 30, 1916.

[Made by H. A. R. Austin.]

Date.	Gage height (feet).	Discharge.		Date.	Gage height (feet).	Discharge.	
		Second-feet.	Million gallons per day.			Second-feet.	Million gallons per day.
Aug. 10	0.80	2.2	1.4	Mar. 10	0.96	4.3	2.8
Dec. 9	.76	1.7	1.1	June 5	.92	2.3	1.5

Monthly discharge of Hop Tuck ditch near Heeia, Oahu, for year ending June 30, 1916.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July	1.8	0.2	0.97	1.50	30	92
August	1.8	.8	1.33	2.06	41	127
September 1–13, 15–30	2.2	1.4	1.84	2.85	53	164
October	2.2	.1	1.40	2.17	43	133
November	3.2	.4	.88	1.36	26	81
December	2.2	.2	.73	1.13	23	69
January 1–16, 19–31	3.2	.1	.47	.73	14	42
February	4.2	1.4	2.89	4.47	84	257
March 1–6, 8–29	3.2	.2	2.54	3.93	71	218
April 1–25, 27–28	5.5	.2	2.11	3.26	57	175
May 1–9, 11, 13–14, 16–17, 19–21, 25, 29–31	4.3	.2	.98	1.52	20	63
June 1, 3–30	2.7	1.4	2.28	3.53	66	203

NOTE.—Discharge determined from rating curves applicable as follows: July 1, 1915, to Apr. 15, 1916, fairly well defined between 1 and 3 million gallons per day. Apr. 16 to June 30, 1916, poorly defined. Gage readings Jan. 17, 18, and Mar. 7, 30, and 31 discarded because of doubt as to their accuracy.

LEE DITCH NEAR HEEIA, OAHU.

LOCATION.—100 feet below intake. Ditch diverts from Heeia Stream 1½ miles northwest of Heeia.

RECORDS AVAILABLE.—March 1, 1914, to June 30, 1916.

GAGE.—Vertical staff on right bank. Datum raised 1.0 foot March 10, 1915.

DISCHARGE MEASUREMENTS.—Made by wading. A 2.5-foot sharp-crested weir with end contractions was installed when station was established, but a rating by current meter has been used, as conditions for measurement by weir are not good.

CHANNEL AND CONTROL.—Channel is cut in earth and gravel; section about 3 feet wide and 3 feet deep; straight for 50 feet above and below gage. Control is 2.5-foot weir.

EXTREMES OF DISCHARGE.—Maximum stage recorded, 1.05 feet at 2:40 p. m. June 30, 1916; discharge, 9.4 million gallons per day, or 14.5 second-feet); ditch occasionally dry.

DIVERSIONS.—None above station.

REGULATION.—Flow regulated by head gates.

UTILIZATION.—Irrigation of rice fields.

ACCURACY.—Gage read once daily. Records poor owing to unstable stage-discharge relation caused by growth of aquatic plants in the ditch.

Discharge measurements of Lee ditch near Heeia, Oahu, during the year ending June 30, 1916.

Date.	Made by—	Gage height (feet).	Discharge.	
			Second-feet.	Million gallons per day.
Aug. 10	H. A. R. Austin	0.54	1.5	1.0
Dec. 9	do	.50	1.0	.65
Feb. 4	R. C. Rice	.39	1.1	.7
June 5	H. A. R. Austin	.35	.6	.4

Monthly discharge of Lee ditch near Heeia, Oahu, for the year ending June 30, 1916.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre feet.
	Maximum.	Minimum.	Mean.			
July	0.7	0.3	0.40	0.62	12	38
August	1.0	.3	.65	1.01	20	62
September	.7	.3	.64	.99	19	59
October 1–22, 25–26, 30–31	4.4	.5	.98	1.52	25	78
November	5.2	.7	1.16	1.79	35	107
December	3.7	.5	1.11	1.72	34	106
January 1–16, 21–31	6.6	.7	2.08	3.22	56	172
February	2.4	.7	1.11	1.72	32	99
March	8.4	.2	1.26	1.95	39	120
April	8.4	.2	1.26	1.95	38	116
May 1–25, 27, 31	8.4	.1	.72	1.11	20	60
June 1–2, 6–30	9.4	.4	1.24	1.92	34	103

NOTE.—Discharge determined from poorly defined rating curves applicable as follows: July 1, 1915, to Jan. 18, 1916, Jan. 19 to June 30, 1916, staff gage out Jan. 17–20 and June 3–5.

HAIKU STREAM NEAR HEEIA, OAHU.

LOCATION.—60 feet above intake of Reservoir ditch, 1½ miles west of Heeia.

RECORDS AVAILABLE.—January 29, 1914, to June 30, 1916.

GAGE.—Stevens water-stage recorder installed April 28, 1914, at same location and datum as staff gage, original staff gage datum was raised 0.88 foot March 29, 1914.

DISCHARGE MEASUREMENTS.—Made by wading or from footbridge.

CHANNEL AND CONTROL.—One channel at all stages; straight for 20 feet above and 40 feet below station, banks steep and high, stream bed of solid rock. Control is smooth, solid-rock ledge, permanent.

EXTREMES OF DISCHARGE.—Maximum stage recorded during period of record, 6.45 feet at 8.30 p. m. May 1, 1914 (estimated discharge, 250 million gallons per day, or 390 second-feet), minimum stage recorded, 0.65 foot frequently 1914–1916 (discharge, 1.9 million gallons per day or 2.9 second-feet).

Maximum stage recorded during year, 5.05 feet at 8 p. m. November 10 (discharge, approximately 170 million gallons per day, or 260 second-feet).

DIVERSIONS.—None above station.

REGULATION.—None.

UTILIZATION.—Low flow diverted below station for domestic supply and for irrigation of taro and rice.

ACCURACY.—Rating curve well defined for low and medium stages; records good. High-water extension of rating curve not based on measurements; determinations above 16 million gallons per day may be considerably in error.

Discharge measurements of Haiku stream near Heeia, Oahu, during the year ending June 30, 1916.

Date.	Made by—	Gage height (feet).	Discharge.	
			Second-feet.	Million gallons per day.
Nov. 22	H. A. R. Austin	0.68	3.7	2.4
Feb. 4	R. C. Rice	.73	3.9	2.5

Daily discharge, in million gallons, of Haiku Stream near Heeia, Oahu, for the year ending June 30, 1916.

Date.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	2.4	1.9	1.9	2.4	1.9	2.4	3.0	3.6	3.0	3.0	3.6	3.0
2	2.4	1.9	1.9	2.4	3.0	1.9	3.0	4.3	6.4	3.0	7.8	3.0
3	2.4	1.9	1.9	3.6	3.0	1.9	7.8	2.4	3.6	3.0	3.6	3.0
4	2.4	1.9	1.9	2.4	3.0	1.9	4.3	3.0	12	3.0	3.6	3.0
5	2.4	1.9	1.9	1.9	2.4	2.4	3.6	7.1	4.3	3.0	3.6	3.0
6	2.4	1.9	1.9	1.9	2.4	2.4	3.0	3.6	4.3	3.0	3.6	3.0
7	2.4	2.4	1.9	1.9	2.4	1.9	4.3	3.0	12	3.0	3.0	3.0
8	2.4	2.4	1.9	1.9	3.0	1.9	12	3.0	3.6	3.0	3.0	3.0
9	2.4	2.4	1.9	1.9	3.0	1.9	5.7	3.0	3.0	3.0	3.0	3.0
10	2.4	1.9	1.9	1.9	18	1.9	5.7	5.0	3.0	3.0	3.0	3.0
11	2.4	1.9	1.9	1.9	15	1.9	3.6	3.0	3.0	3.0	3.0	3.0
12	2.4	2.4	2.4	1.9	4.3	1.9	3.0	3.0	3.0	3.0	3.0	3.0
13	2.4	2.4	2.4	1.9	3.6	1.9	3.6	3.0	3.0	3.0	3.0	3.0
14	2.4	2.4	1.9	1.9	2.4	1.9	6.4	2.4	3.0	3.0	3.0	3.0
15	2.4	2.4	1.9	1.9	2.4	1.9	3.6	3.0	3.0	3.0	3.0	3.0
16	2.4	2.4	1.9	1.9	2.4	2.4	3.0	3.0	3.0	2.4	3.0	3.0
17	2.4	2.4	2.4	1.9	1.9	1.9	21	3.0	3.0	2.4	3.0	3.0
18	4.3	2.4	5.7	2.4	1.9	5.0	33	2.4	3.0	2.4	3.0	3.0
19	2.4	2.4	6.4	1.9	1.9	2.4	8.6	2.4	3.0	2.4	3.0	3.0
20	2.4	2.4	3.0	1.9	1.9	2.4	3.0	3.0	3.0	2.4	3.0	3.0
21	5.0	2.4	2.4	1.9	1.9	2.4	2.4	3.0	3.0	2.4	3.0	3.0
22	4.3	2.4	2.4	1.9	2.4	2.4	2.4	2.4	3.0	2.4	3.0	3.0
23	2.4	2.4	1.9	1.9	2.4	2.4	2.4	2.4	3.0	2.4	3.6	3.0
24	2.4	1.9	1.9	1.9	2.4	3.0	2.4	2.4	3.0	2.4	3.6	3.0
25	2.4	2.4	1.9	1.9	2.4	18	3.0	2.4	3.0	3.0	3.0	3.0
26	1.9	1.9	1.9	3.6	1.9	7.1	3.3	3.0	3.0	3.0	3.0	3.0
27	2.4	1.9	1.9	4.3	1.9	11	2.4	3.0	3.0	4.3	3.0	3.0
28	2.4	1.9	2.4	2.4	3.0	15	2.4	3.0	3.0	3.6	3.0	3.0
29	1.9	1.9	2.4	2.4	2.4	4.3	2.4	3.0	3.0	3.0	3.0	3.0
30	2.4	1.9	2.4	1.9	2.4	3.6	3.0	.....	3.0	3.0	3.0	3.0
31	1.9	1.9	.....	1.9	.....	3.6	3.6	.....	3.0	.....	3.0	.....

NOTE.—Discharge determined from rating curve well defined below 16 million gallons per day.

Monthly discharge of Haiku Stream near Heeia, Oahu, for year ending June 30, 1916.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July	5.0	1.9	2.56	3.96	79	244
August	2.4	1.9	2.16	3.34	67	205
September	6.4	1.9	2.35	3.64	70	216
October	4.3	1.9	2.18	3.37	68	207
November	18	1.9	3.43	5.31	103	316
December	18	1.9	3.77	5.83	117	359
January	33	2.4	6.47	10.0	201	616
February	7.1	2.4	3.13	4.84	91	279
March	12	3.0	3.81	5.89	118	362
April	4.3	2.4	2.88	4.46	86	265
May	7.8	3.0	3.29	5.09	102	313
June	3.0	3.0	3.00	4.64	90	276
The year	33	1.9	3.26	5.04	1,190	3,660

RESERVOIR DITCH NEAR HEEIA, OAHU.

LOCATION.—200 yards below intake. Ditch diverts from Haiku Stream 1½ miles by road west of Heeia and 12 miles by road from Honolulu.

RECORDS AVAILABLE.—January 19, 1914, to June 30, 1916.

GAGE.—Vertical staff on left bank. Datum raised 1.0 foot March 9, 1915.

DISCHARGE MEASUREMENTS.—Made by wading. When station was established a 2.5-foot sharp-crested weir with end contractions was installed, but a current-meter rating has been used, as the conditions for measurement by weir are not good.

CHANNEL AND CONTROL.—Channel is cut in firm earth and is approximately rectangular in section; subject to growth of weeds and grass, which affect flow. Control is 2.5-foot weir. Crest of weir was bent over somewhat June 3, 1915, changing stage-discharge relation.

EXTREMES OF DISCHARGE.—Maximum stage recorded during period of record, 1.32 feet (new datum) at 10 a. m., September 14, 1914 (discharge, approximately 11 million gallons per day, or 17 second-feet); ditch occasionally dry.

DIVERSIONS.—None above station.

REGULATION.—Flow regulated by head gates.

UTILIZATION.—Part of ditch flow is impounded in reservoir for domestic supply of Heeia and part is diverted for irrigation of taro.

ACCURACY.—Gage read once daily. Records good for low and medium stages; above 4 million gallons per day approximate only.

Discharge measurements of Reservoir ditch near Heeia, Oahu, during the year ending June 30, 1916.

[Made by H. A. R. Austin.]

Date.	Gage height (feet).	Discharge.		Date.	Gage height (feet).	Discharge.	
		Second-feet.	Million gallons per day.			Second-feet.	Million gallons per day.
Aug. 10	0.47	3.6	2.3	May 3	0.46	3.2	2.1
Dec. 9	.33	2.0	1.3	June 5	.39	2.6	1.7
Feb. 4	.32	1.9	1.2				

Monthly discharge of Reservoir ditch near Heeia, Oahu, for year ending June 30, 1916.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July	5.8	2.8	3.71	5.74	115	353
August	4.2	1.7	2.23	3.45	69	212
September	5.8	1.4	2.14	3.31	64	197
October	6.4	1.1	1.77	2.74	55	168
November	7.6	.9	1.58	2.44	47	145
December	6.4	.9	1.96	3.03	61	186
January	7.6	.9	2.41	3.73	75	229
February	3.2	1.4	1.70	2.63	49	151
March	7.6	.7	1.65	2.55	51	157
April	7.6	1.1	2.09	3.23	63	192
May	7.6	1.1	2.55	3.95	79	243
June	2.0	1.7	1.71	2.65	51	157
The year	7.6	.7	2.13	3.30	779	2,390

NOTE.—Discharge determined from rating curve well defined below 3 million gallons per day. Discharge for Sept. 16 interpolated.

IOLEKAA STREAM NEAR HEEIA, OAHU.

LOCATION.—About 50 feet above uppermost diversion, 2 miles west of Heeia.

RECORDS AVAILABLE.—January 19, 1914, to June 30, 1916.

GAGE.—Vertical staff fastened to boulder on right bank, 12 feet above footbridge.

DISCHARGE MEASUREMENTS.—Made by wading or from footbridge.

CHANNEL AND CONTROL.—One channel at all stages; straight for 10 feet above and 40 feet below gage; composed of boulders and gravel; banks steep and high. Control composed of large boulders; fairly permanent.

EXTREMES OF DISCHARGE.—Maximum stage recorded, 5.0 feet, January 17, 18, and March 7, 1916 (discharge, approximately 98 million gallons per day, or 152 second-feet); minimum stage recorded, 1.71 feet at 10.20 a. m., March 18, 1914 (discharge, 0.3 million gallons per day, or 0.45 second-foot).

DIVERSIONS.—None above station.

REGULATION.—None.

UTILIZATION.—Low-water flow diverted below station for irrigation of taro and rice.

ACCURACY.—Records for low and medium stages fair. Rating curves fairly well defined for ordinary stages; flow steady. Records for high and fluctuating stages only approximate, as gage was read only once daily.

Discharge measurements of Iolekaa Stream near Heeia, Oahu, during the year ending June 30, 1916.

[Made by H. A. R. Austin.]

Date.	Gage height (feet).	Discharge.		Date.	Gage height (feet).	Discharge.	
		Second-feet.	Million gallons per day.			Second-feet.	Million gallons per day.
Aug. 10	1.90	2.0	1.3	May 3	1.99	3.1	2.0
Dec. 9	1.92	1.5	1.0	June 5	1.98	2.0	1.3
Jan. 31	2.01	3.6	2.3				

Monthly discharge of Iolekaa Stream near Heeia, Oahu, for year ending June 30, 1916.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July	8.0	1.3	1.79	2.77	56	170
August	2.2	1.3	1.34	2.07	41	127
September	2.8	1.0	1.35	2.09	40	124
October	4.8	.7	1.60	2.48	50	152
November	22	1.3	2.56	3.96	77	236
December	8.0	1.8	2.29	3.54	71	218
January	98	1.8	8.25	12.8	256	785
February	8.0	2.2	3.06	4.73	89	272
March	98	1.3	5.89	9.11	182	560
April	6.4	1.3	2.12	3.28	64	195
May	3.4	.7	1.84	2.85	57	175
June	1.5	.7	1.11	1.72	33	102
The year	98	.7	2.78	4.30	1,020	3,120

NOTE.—Discharge determined from rating curves fairly well defined below 20 million gallons per day, applicable as follows: July 1, 1915, to May 20, 1916; May 21 to June 30, 1916.

WAIPIO DITCH NEAR HEEIA, OAHU.

LOCATION.—50 yards below intake. Ditch diverts from Haiku Stream, 1 mile west of Heeia.

RECORDS AVAILABLE.—January 19, 1914, to June 30, 1916.

GAGE.—Vertical staff.

DISCHARGE MEASUREMENTS.—Made by wading. A 2.5-foot sharp-crested weir with end contractions was installed when station was established, but conditions for measurements by weir were not good and a rating by current meter has been used.

CHANNEL AND CONTROL.—Channel cut in earth and gravel; section about 4 feet wide and 2 feet deep; straight for 20 feet above and below gage. Control is 2.5-foot weir. Stage-discharge relation sometimes affected by silt filling in back of weir.

EXTREMES OF DISCHARGE.—Maximum stages uncertain; minimum daily discharge, 0.6 million gallons per day or 0.9 second-foot, December, 1914 and January and February, 1916.

DIVERSIONS.—None above station.

REGULATION.—None.

UTILIZATION.—Irrigation of rice fields.

ACCURACY.—Gage read once daily. Determinations below 3 million gallons per day fair, as rating curve is fairly well defined for ordinary stages and flow steady; records for high stages approximate only.

Discharge measurements of Waipio ditch near Heeia, Oahu, during the year ending June 30, 1916.

[Made by H. A. R. Austin.]

Date.	Gage height (feet).	Discharge.		Date.	Gage height (feet).	Discharge.	
		Second-feet.	Million gallons per day.			Second-feet.	Million gallons per day.
Aug. 10	0.58	2.3	1.5	Jan. 31	0.46	1.1	0.7
Dec. 9	.54	1.5	.95	June 5	.74	3.6	2.3

Monthly discharge of Waipio ditch near Heeia, Oahu, for the year ending June 30, 1916.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July	4.3	1.6	1.96	3.03	61	186
August	2.0	1.0	1.34	2.07	42	127
September	3.6	1.3	1.87	2.89	56	172
October	4.3	.8	2.07	3.20	64	197
November	20	1.3	3.09	4.78	93	284
December	9.6	.8	3.03	4.69	94	288
January 1–16, 19–31	7.6	.6	2.49	3.85	72	222
February	2.0	.6	.91	1.41	26	81
March 1–6, 8–31	9.6	1.0	2.77	4.29	83	255
April	5.8	.8	2.00	3.09	60	184
May	5.8	1.6	2.79	4.32	86	265
June	3.6	1.0	2.58	3.99	77	238

NOTE.—Discharge determined from a rating curve fairly well defined below 3 million gallons per day. Gage readings Jan. 17, 18, and Mar. 7 were discarded on account of doubt as to their accuracy.

WAIAHOLE STREAM BELOW POWER HOUSE, NEAR WAIAHOLE, OAHU.

LOCATION.—About 600 feet below hydroelectric power station, half a mile above gaging station, at lower boundary of Government land, and 2½ miles south of junction of Waiahole Valley and main country road.

RECORDS AVAILABLE.—April 15 to October 8, 1915.

GAGE.—Gurley water-stage recorder on left bank.

DISCHARGE MEASUREMENTS.—Made by wading.

CHANNEL AND CONTROL.—One channel at all stages, except possibly extreme floods; straight for several hundred feet above station and with very high gradient, resulting in a series of rapids and pools; bed composed of large boulders, and, prior to beginning of work on tunnels in the valley above was clean, containing little gravel or silt. Waste from the tunnels has partly filled the pool at the station; right bank perpendicular; left bank has a fairly flat slope, both above and below station; banks covered with heavy vegetation above ordinary flood stages. Control probably permanent before tunnelling was begun but is now affected by tunnel waste.

EXTREMES OF DISCHARGE.—Maximum stage recorded during period of record, 1.94 feet at 2.30 a. m., April 26, 1915, (discharge, approximately 75 million gallons per day, or 116 second-feet); minimum stage recorded, 1.15 feet October 8, 1915 (discharge, 17 million gallons per day, or 26 second-feet).

DIVERSIONS.—None above station.

UTILIZATION.—Station was established to measure the water obtained by the main Waiahole tunnel and a water development tunnel in the upper valley. Tunnel structures prevent direct measurements being made in the tunnels or at the portals. Water is used first to operate a hydroelectric power plant and is then wasted back into the stream at a point about 600 feet above station. Discharge at station includes flow from several springs in addition to tunnel water. Miscellaneous measurements of the discharge of these other sources are made at frequent intervals and coefficients obtained which may be applied to the total discharge at the station to determine the flow from the tunnels.

ACCURACY.—Records based on fairly well defined rating curve and continuous gage-height record; fair for ordinary stages.

Discharge measurements of Waiahole Stream below power house, near Waiahole, Oahu, during the year ending June 30, 1916.

Date.	Made by—	Gage height (feet).	Discharge.	
			Second-feet.	Million gallons per day.
Sept. 6	H. A. R. Austin	1.27	31	20
Oct. 8	G. K. Larrison	1.24	29	19
Nov. 20	H. A. R. Austin	1.25	23	15
Dec. 13	....do	1.18	25	16
21	G. K. Larrison	1.18	25	16
Mar. 8	H. A. R. Austin	1.22	22	14
Apr. 13	R. C. Rice	1.21	19	12

Monthly discharge of Waiahole Stream below power house, near Waiahole, Oahu, for year ending June 30, 1916.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre feet.
	Maximum.	Minimum.	Mean.			
July	30	23	26.5	40.0	820	2,520
August	23	21	22.0	34.0	681	2,090
September	21	18	19.2	29.7	577	1,770
October 1–8	21	17	18.5	28.6	148	454

WAIAHOLE STREAM NEAR WAIAHOLE, OAHU.[1]

LOCATION.—About 100 feet south of house of Peleioholani, at lower boundary of Government land, a mile above junction of Waianu and Waiahole streams, and 2 miles south of junction of Waiahole Valley and main country roads.

RECORDS AVAILABLE.—September 25, 1911, to June 30, 1916.

GAGE.—Vertical staff on right bank, about 100 feet south of house of Peleioholani.

DISCHARGE MEASUREMENTS.—Made by wading.

CHANNEL AND CONTROL.—One channel at all stages, except possibly extreme floods; straight for several hundred feet above and below gage; composed of loose boulders and gravel. Right bank nearly vertical and covered with vegetation; left bank very flat slope and covered with vegetation; cross section the same for several hundred feet above and below station. Control made up of large loose boulders; shifting.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 3.6 feet at 1.35 p. m. December 28 (discharge, approximately 120 million gallons per day, or 186 second-feet).

1911–1916: Maximum stage recorded, 5.00 feet at 6 a. m. August 5, 1914 (discharge, 210 million gallons per day, or 325 second-feet); minimum stage recorded, 1.4 feet May to June 30, 1916 (discharge, 9 million gallons per day, or 14 second-feet).

DIVERSIONS.—None above station.

UTILIZATION.—A small part of the original flow of the stream is used to irrigate taro and rice lands in the lower valley. The Waiahole tunnel, which is the principal feature of a large irrigation project to deliver the discharge of windward Oahu streams to the sugar-cane lands near Pearl Harbor, on the opposite side of the Koolau Mountain range, diverts the greater part of the low-water discharge of the stream.

[1] Described in water-supply papers previous to No. 430 as Waiahole Stream at Maniania'ili, near Waikane, Oahu.

ACCURACY.—Gage read twice daily. Determinations fair below 30 million gallons per day.

Prior to August 1, 1913, the discharge was very steady, the greater part being supplied by a number of large springs about a mile above station. In August, 1913, additional water was developed in the bore of the Waiahole tunnel in the upper valley and was spilled into stream above station. As the bore progressed the quantity of tunnel water added to the stream fluctuated considerably and increased the previous low-water discharge proportionately at the station below. After May 27, 1916, no tunnel water was spilled into the stream.

Discharge measurements of Waiahole Stream near Waiahole, Oahu, during the year ending June 30, 1916.

Date.	Made by—	Gage height (feet).	Discharge.	
			Second-feet.	Million gallons per day.
July 12	G. K. Larrison	1.89	43	28
Sept. 13	H. A. R. Austin	1.80	36	23
Nov. 20	.....do	1.74	26	17
Dec. 13	.....do	1.72	26	17
Feb. 18	.....do	1.60	22	14
May 4	.....do	1.72	28	18
June 27	.....do	1.41	14	9.2

Daily discharge, in million gallons, of Waiahole Stream near Waiahole, Oahu, for the year ending June 30, 1916.

Date.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	29	26	26	22	22	18	18	20	17	17	17	9
2	29	26	26	22	22	18	18	20	17	14	20	9
3	29	26	26	34	22	17	18	20	17	12	18	9
4	29	26	24	22	15	17	20	20	18	12	17	9
5	29	24	24	22	15	17	20	20	17	12	17	9
6	29	24	24	22	15	17	20	18	17	11	17	9
7	30	24	22	22	15	17	20	18	18	11	17	9
8	28	24	22	22	15	17	22	18	17	11	17	9
9	28	24	22	22	15	17	50	18	17	11	17	9
10	28	24	22	22	72	17	20	18	17	11	18	9
11	28	24	22	22	48	17	20	18	17	11	18	9
12	28	24	22	22	20	17	17	18	14	14	18	9
13	28	24	24	22	20	17	18	18	14	17	18	9
14	28	24	24	22	18	17	20	18	16	17	18	9
15	28	24	24	22	18	17	18	16	17	17	18	9
16	28	24	24	22	18	17	18	17	17	16	18	9
17	28	24	24	22	18	17	33	17	17	16	18	9
18	28	24	47	24	18	17	30	17	17	16	18	9
19	28	24	24	22	18	17	28	17	17	16	18	9
20	28	24	24	22	18	17	20	17	16	16	18	9
21	32	24	24	22	18	17	20	17	16	16	18	9
22	30	24	24	22	18	17	20	17	12	16	18	9
23	26	24	24	22	18	17	18	17	12	16	18	9
24	26	24	24	22	18	17	18	17	12	16	18	9
25	26	24	24	22	18	17	20	17	12	16	18	9
26	26	24	24	22	18	18	22	17	12	18	18	9
27	26	24	24	24	18	46	20	17	12	18	14	9
28	26	24	24	22	18	68	18	17	12	17	9	9
29	26	24	22	22	18	18	18	17	12	16	9	9
30	26	24	22	22	18	18	18	.....	12	16	9	9
31	26	24	.....	22	.....	18	18	.....	14	.....	9	.....

NOTE.—Discharge determined as follows: July 1–12, 1915, by indirect method for shifting control. July 13 to Nov. 10, 1915, by rating curve fairly well defined between 20 and 30 million gallons per day. Nov. 11, 1915, to June 30, 1916, by rating curve fairly well defined below 30 million gallons per day.

Monthly discharge of Waiahole Stream near Waiahole, Oahu, for the year ending June 30, 1916.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July	32	26	27.9	43.2	864	2,650
August	26	24	24.3	37.6	752	2,310
September	47	22	24.6	38.1	738	2,260
October	34	22	22.5	34.8	698	2,140
November	72	15	20.7	32.0	622	1,910
December	68	17	19.8	30.6	613	1,880
January	50	17	21.2	32.8	658	2,020
February	20	16	17.8	27.5	516	1,580
March	18	12	15.2	23.5	472	1,450
April	18	11	14.8	22.9	443	1,360
May	20	9	16.7	25.8	518	1,590
June	9	9	9.0	13.9	270	829
The year	72	9	19.6	30.3	7,160	22,000

KAHANA STREAM NEAR KAHANA, OAHU.

LOCATION.—Half a mile above confluence with East Branch of Kahana Stream, 1½ miles above mouth of stream, and south of Kahana.

RECORDS AVAILABLE.—June 19, 1914, to 30, 1916.

GAGE.—Stevens water-stage recorder on right bank.

DISCHARGE MEASUREMENTS.—Made by wading or from cable.

CHANNEL AND CONTROL.—One channel at all stages; straight for 50 feet above and 150 feet below gage; stream bed of gravel and boulders; right bank steep and high; left bank slopes gently. Control composed of large and small boulders, shifts during floods.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 5.5 feet at 9 p. m., February 1 (discharge, approximately 800 million gallons per day, or 1,24[illegible] second-feet).

Maximum stage recorded during period of record, 6.79 feet at 6 a. m., September 23, 1914 (discharge, approximately 1,150 million gallons per day, or 1,780 second-feet); minimum stage recorded, 0.8 foot June, 1916 (discharge, 13 million gallons per day, or 20 second-feet).

DIVERSIONS.—None above station.

REGULATION.—None.

UTILIZATION.—Irrigation of sugar cane, taro, and rice.

ACCURACY.—Determinations July 1 to November 10, poor; November 11 to June 30, based on well-defined rating curve, good, except for short periods when recorder did not work and discharge was interpolated.

Discharge measurements of Kahana Stream near Kahana, Oahu, during the year ending June 30, 1916.

Date.	Made by—	Gage height (feet).	Discharge.	
			Second-feet.	Million gallons per day.
Sept. 8	H. A. R. Austin	1.03	26	17
Nov. 18	do	1.16	37	25
26	R. D. Klise	1.10	36	23
Jan. 13	H. A. R. Austin	1.28	45	29
Mar. 10	do	1.01	29	19
May 4	do	2.16	162	105
June 30	do	.82	20	13

Daily discharge, in million gallons, of Kahana Stream near Kahana, Oahu, for the year ending June 30, 1916.

Date.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June.
1	38	18	16	28	22	22	47	47	20	20	83	14
2	32	20	16	81	39	28	37	34	26	18	116	14
3	32	22	18	100	81	24	37	26	26	16	47	13
4	32	24	22	33	93	34	47	24	37	16	74	13
5	32	26	22	26	49	26	69	37	24	15	74	13
6	32	24	18	24	39	28	43	26	20	15	40	13
7	60	20	18	22	30	24	43	24	24	15	34	13
8	30	22	18	26	49	22	74	24	18	15	28	24
9	35	20	16	36	49	22	51	20	18	15	43	14
10	38	18	16	24	135	22	51	24	18	15	31	14
11	52	18	24	22	83	20	51	40	18	15	31	14
12	30	18	28	20	51	20	51	28	18	15	26	13
13	30	28	28	20	47	20	60	26	18	15	37	13
14	28	26	20	18	37	20	28	22	22	15	28	13
15	28	20	18	18	34	20	26	22	22	15	26	14
16	32	18	18	18	24	24	26	22	18	15	22	20
17	38	18	18	18	24	20	93	22	18	16	22	16
18	65	18	18	26	24	24	241	20	18	22	22	14
19	26	16	18	26	24	26	88	20	18	16	26	13
20	22	20	16	30	22	22	47	20	18	15	37	14
21	30	24	16	28	22	28	37	20	18	14	34	15
22	28	20	24	22	24	31	31	20	18	14	28	26
23	22	18	20	22	37	22	28	18	18	14	56	16
24	20	18	18	20	22	20	26	18	18	14	26	15
25	20	20	20	24	22	83	28	18	16	60	24	22
26	18	20	22	42	24	110	51	18	16	43	20	16
27	28	18	20	39	26	88	26	18	16	43	18	15
28	20	18	22	26	28	78	26	18	16	24	16	14
29	18	16	24	26	24	34	24	18	16	20	16	14
30	22	16	22	22	22	34	28	.....	16	20	15	13
31	18	16	.....	22	.....	47	26	.....	24	.....	14	.....

NOTE.—Discharge determined from rating curves applicable as follows: July 1–18, 1915, poorly defined. July 19 to Nov. 10, 1915, poorly defined. Nov. 11, 1915 to June 30, 1916, well defined below 200 million gallons per day. Daily discharge July 1–11, Oct. 26–31, Nov. 1–4, 10, 11, 13–17, 21–23, Dec. 26–31, 1915, Jan. 1–13, Feb. 9–13, and May 15–23 determined by comparison with record of flow of Kaluanui Stream.

Monthly discharge of Kahana Stream near Kahana Oahu, for year ending June 30, 1916.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July	65	18	30.8	47.7	956	2,930
August	28	16	19.9	30.8	618	1,890
September	28	16	19.8	30.6	594	1,820
October	100	18	29.3	45.3	909	2,790
November	135	22	40.2	62.2	1,210	3,700
December	110	20	33.6	52.0	1,040	3,200
January	241	24	49.7	76.9	1,540	4,730
February	47	18	23.9	37.0	694	2,130
March	37	16	19.7	30.5	611	1,870
April	60	14	19.5	30.2	585	1,800
May	116	14	35.9	55.5	1,110	3,420
June	26	13	15.2	23.5	455	1,400
The year	241	13	28.2	43.6	10,300	31,700

EAST BRANCH OF KAHANA STREAM NEAR KAHANA, OAHU.

LOCATION.—Just above headquarters of Kahana Agricultural Co.; 500 feet above confluence with main Kahana Stream, and 1 mile south of Kahana.

RECORDS AVAILABLE.—April 30, 1914, to June 30, 1916.

GAGE.—Vertical staff on left bank.

DISCHARGE MEASUREMENTS.—Made by wading or from cable.

CHANNEL AND CONTROL.—Two channels at high stages; straight for 50 feet above and below gage; left bank steep and high; right bank low and is overflowed at high stages. Control is a riffle of small boulders; shifting.

EXTREMES OF DISCHARGE.—Maximum stage recorded during period of record, 4.62 feet at 6 p. m., November 10, 1915 (discharge, approximately 200 million gallons per day, or 309 second-feet); minimum stage recorded, 1.14 feet June, 1915 (discharge, 0.8 million gallons per day, or 1.2 second-feet).

Minimum stage recorded during year, 1.0 foot April 7–17 (discharge, 1.2 million gallons per day, or 1.9 second-feet).

DIVERSIONS—None above station.

REGULATION.—None.

UTILIZATION.—Irrigation of taro.

ACCURACY.—Gage read twice daily. Determinations July 1 to January 17 based on well-defined rating curve; good for low and medium stages; above 16 million gallons per day records approximate. Records January 19 to June 30 poor except for low stages.

Discharge measurements of East Branch of Kahana Stream near Kahana, Oahu, during the year ending June 30, 1916.

Date.	Made by—	Gage height (feet).	Discharge.	
			Second-feet.	Million gallons per day.
July 12	G. K. Larrison	1.28	5.0	3.2
Nov. 18	H. A. R. Austin	1.28	5.4	3.5
26	R. D. Klise	1.23	3.7	2.4
Feb. 18	H. A. R. Austin	1.13	4.5	2.9
Mar. 8	do	1.14	3.7	2.4
June 30	do	1.04	2.6	1.7

Daily discharge, in million gallons, of East Branch of Kahana Stream near Kahana, Oahu, for the year ending June 30, 1916.

Date.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	2.8	4.0	1.6	5.4	8.4	4.0	10	9.0	5.9	1.7	4.4	2.2
2	2.8	2.8	1.6	6.8	10	4.0	29	9.0	5.9	1.7	18	2.2
3	1.6	2.8	1.6	21	15	4.0	10	7.4	7.4	1.7	11	2.2
4	1.6	4.0	1.6	17	12	4.0	12	7.4	5.9	1.7	9.0	2.2
5	1.6	4.0	1.6	17	8.4	4.0	8.4	7.4	5.9	1.7	11	1.7
6	1.6	4.0	1.6	10	6.8	4.0	10	7.4	4.4	1.7	7.4	1.7
7	8.4	4.0	1.6	6.8	6.8	4.0	8.4	5.9	5.9	1.2	5.9	2.2
8	5.4	4.0	1.6	6.8	6.8	4.0	6.8	5.9	3.3	1.2	5.9	2.2
9	4.0	2.8	1.6	4.0	8.4	2.8	62	5.9	2.2	1.2	4.4	2.2
10	4.0	2.8	1.6	4.0	108	2.8	53	5.9	2.2	1.2	12	1.7
11	4.0	1.6	1.6	4.0	25	2.8	23	5.9	2.2	1.2	12	1.7
12	4.0	1.6	1.6	4.0	23	1.6	12	4.4	2.2	1.2	9.0	1.7
13	2.8	4.0	2.8	2.8	15	1.6	12	4.4	2.2	1.2	9.0	1.7
14	2.8	4.0	2.8	4.0	8.4	1.6	12	4.4	2.2	1.2	7.4	1.7
15	8.4	4.0	4.0	4.0	5.4	1.6	10	3.3	2.2	1.2	5.9	1.7
16	6.8	2.8	2.8	4.0	4.0	1.6	8.4	3.3	2.2	1.2	4.4	1.7
17	5.4	2.8	2.8	4.0	4.0	1.6	33	3.3	2.2	1.2	4.4	2.2
18	6.8	2.8	2.8	4.0	4.0	2.8	.....	2.2	2.2	1.7	3.3	1.7
19	6.8	1.6	2.8	4.0	4.0	2.8	24	2.2	2.2	1.7	3.3	1.7
20	6.8	1.6	2.8	2.8	4.0	2.8	16	2.2	2.2	1.7	5.9	1.7
21	6.8	1.6	2.8	2.8	5.4	2.8	14	2.2	2.2	1.7	3.3	1.7
22	5.4	1.6	4.0	2.8	4.0	2.8	14	2.2	2.2	1.7	3.3	4.4
23	5.4	1.6	2.8	2.8	4.0	2.8	12	2.2	2.2	1.7	11	2.2
24	5.4	1.6	2.8	2.8	2.8	4.0	12	2.2	1.7	2.2	5.9	1.7
25	5.4	1.6	4.0	2.8	2.8	53	12	2.2	1.7	2.2	4.4	4.4
26	5.4	1.6	4.0	4.0	2.8	21	40	2.2	1.7	2.2	4.4	3.3
27	6.8	1.6	2.8	6.8	2.8	14	12	2.2	1.7	3.3	3.3	1.7
28	6.8	1.6	2.8	6.8	4.0	46	11	3.3	1.7	3.3	3.3	1.7
29	5.4	1.6	2.8	8.4	4.0	14	11	3.3	1.7	3.3	3.3	1.7
30	5.4	1.6	4.0	8.4	4.0	10	11	.....	2.2	2.2	3.3	1.7
31	5.4	1.6	.....	8.4	.....	8.4	9.0	.....	1.7	.....	2.2	.....

NOTE.—Discharge determined from rating curves applicable as follows: July 1 to Jan. 17, well defined below 16 million gallons per day; Jan. 19 to June 30, poorly defined. No record Jan. 18.

Monthly discharge of East Branch of Kahana Stream near Kahana, Oahu, for the year ending June 30, 1916.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July	8.4	1.6	4.90	7.58	152	466
August	4.0	1.6	2.57	3.98	80	244
September	4.0	1.6	2.52	3.90	76	232
October	21	2.8	6.23	9.64	193	593
November	108	2.8	10.8	16.7	324	994
December	53	1.6	7.65	11.8	237	728
February	9.0	2.2	4.44	6.87	129	395
March	7.4	1.7	2.96	4.58	92	282
April	3.3	1.2	1.74	2.69	52	160
May	18	2.2	6.49	10.0	201	617
June	4.4	1.7	2.08	3.22	62	192

PUNALUU STREAM AT ELEVATION 539[1] FEET NEAR PUNALUU, OAHU.

LOCATION.—About a quarter of a mile below confluence of Kalena and Pio branches of the stream and 5 miles by road and foot trail south of Punaluu railroad station.

RECORDS AVAILABLE.—April 27, 1915, to June 30, 1916.

GAGE.—Friez water-stage recorder substituted for 8-day Stevens recorder February 16, 1916.

DISCHARGE MEASUREMENTS.—Made by wading or from cable 150 feet above gage.

CHANNEL AND CONTROL.—One channel at all stages; straight for several hundred feet above and below station; composed of boulders and gravel; right bank slopes sharply; left bank is vertical; both banks fairly clean up to extreme flood stages. Cross section is the same for several hundred feet above and below gage. Control composed of large boulders; fairly permanent.

EXTREMES OF DISCHARGE.—Maximum stage recorded during period, 5.04 feet at 8 p. m. November 10, 1915 (discharge, approximately 300 million gallons per day, or 464 second-feet).

Minimum stage recorded 0.75 foot June, 1915 (discharge, 2.4 million gallons per day, or 3.7 second-feet).

DIVERSIONS.—None above station.

REGULATION.—None.

UTILIZATION.—Part of low-water flow is diverted at low elevations for irrigation of sugar cane, rice, and taro. Station was established to determine the feasibility of a project to divert the waters of the upper Punaluu Valley to augment the water diverted from the Kahana Valley by the Waiahole Water Co.

ACCURACY.—Determinations based on rating curves fairly well defined below 30 million gallons per day; good for low and medium stages.

Discharge measurements of Punaluu Stream at 539 feet elevation, near Punaluu, Oahu, during the year ending June 30, 1916.

Date.	Made by—	Gage height (feet).	Discharge.	
			Second-feet.	Million gallons per day.
July 13	G. K. Larrison	0.93	6.8	4.4
Sept. 7	H. A. R. Austin	.82	4.0	2.6
Jan. 14	.....do	.94	11	6.9
Feb. 16	.....do	.85	6.5	4.2
Mar. 9	.....do	.84	6.0	8.9
May 5	.....do	1.24	22	14

[1] Elevation given in Water Supply Paper 430 as 600 feet.

Daily discharge, in million gallons, of Punaluu Stream at 539 feet elevation, near Punaluu, Oahu, for the year ending June 30, 1916.

Date	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	4.0	4.6	2.8	4.0	4.0	4.0	6.5	12	4.8	3.2	22	4.8
2	4.0	4.6	2.8	6.2	4.6	4.0	6.5	6.5	6.5	3.2	25	4.0
3	4.0	5.3	2.8	9.0	14	4.0	7.5	5.5	7.5	3.2	10	4.0
4	4.0	4.6	2.8	5.3	18	4.0	7.5	5.5	8.8	3.2	13	4.0
5	4.0	4.6	4.0	4.6	9.0	4.0	8.8	8.8	5.5	3.2	16	4.0
6	3.4	4.6	3.4	4.6	7.0	4.0	7.5	6.5	5.5	3.2	10	4.0
7	12	4.6	2.8	4.6	6.2	4.0	13	6.5	6.5	3.2	7.5	4.0
8	5.3	4.0	2.8	4.6	9.0	4.0	20	5.5	4.8	3.2	6.5	5.5
9	4.6	4.0	2.8	4.6	10	4.0	16	5.5	4.8	3.2	7.5	4.0
10	4.6	3.4	2.8	4.0	35	3.2	14	6.5	4.8	3.2	6.5	4.0
11	5.3	3.4	2.8	4.0	20	3.2	12	6.5	4.8	2.5	6.5	4.0
12	4.6	3.4	2.8	3.4	12	3.2	10	6.5	4.8	2.5	5.5	3.2
13	4.6	5.3	3.4	4.0	10	3.2	8.8	5.5	4.8	2.5	7.5	3.2
14	4.6	5.3	2.8	4.0	8.8	2.5	6.5	5.5	4.8	2.5	6.5	3.2
15	4.6	4.0	2.8	4.0	7.5	3.2	6.5	4.8	4.8	2.5	5.5	3.2
16	4.6	4.0	3.4	4.0	6.5	3.2	7.5	4.8	4.8	2.5	5.5	4.8
17	5.3	3.4	3.4	4.0	5.5	3.2	20	4.8	4.8	2.5	5.5	4.0
18	9.0	3.4	3.4	4.6	5.5	4.0	70	4.8	4.0	2.5	5.5	3.2
19	5.3	3.4	2.8	4.6	5.5	4.0	22	4.8	4.0	2.5	4.8	3.2
20	4.6	3.4	2.8	4.0	5.5	4.0	14	4.0	4.0	2.5	6.5	3.2
21	6.2	3.4	2.8	4.0	5.5	4.0	13	4.0	4.0	2.5	5.5	4.8
22	5.3	3.4	3.4	4.0	4.8	4.0	13	4.0	4.0	2.5	5.5	4.8
23	4.6	3.4	4.0	4.0	8.8	4.0	12	4.8	4.0	2.5	8.8	4.0
24	4.6	3.4	3.4	4.0	5.5	4.0	12	4.8	4.0	2.5	5.5	4.0
25	4.6	3.4	3.4	4.6	4.8	18	12	4.8	4.0	6.5	5.5	4.0
26	4.0	3.4	3.4	7.0	4.8	7.5	12	4.0	4.0	4.8	5.5	4.0
27	4.6	3.4	3.4	7.0	4.8	25	7.5	4.8	3.2	7.5	7.5	4.0
28	4.6	3.4	3.5	4.6	5.5	20	7.5	4.0	3.2	4.0	5.5	4.0
29	4.6	2.8	4.0	4.0	4.8	14	7.5	4.0	3.2	3.2	4.8	4.0
30	4.6	2.8	4.0	4.0	4.0	12	7.5	.....	3.2	4.0	4.8	4.0
31	4.0	2.8	.....	4.0	.....	10	7.5	.....	4.0	.....	4.8	.....

NOTE.—Discharge determined from rating curves applicable as follows: July 1 to Nov. 10, 1915, fairly well defined below 30 million gallons per day. Nov. 11, 1915, to June 30, 1916, fairly well defined below 20 million gallons per day. Daily discharge July 7–12 and 21–26, Dec. 15–20 and 31, Jan. 1–4, 18, and 19, determined by comparison with record obtained at Punaluu at elevation 250 feet.

Monthly discharge of Punaluu Stream at 539 feet elevation, near Punaluu, Oahu, for year ending June 30, 1916.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July	12	3.4	4.97	7.69	154	473
August	53	2.8	3.84	5.94	119	365
September	4.0	2.8	3.18	4.92	96	293
October	9.0	3.4	4.62	7.15	143	440
November	35	4.0	8.56	13.2	257	788
December	25	2.5	6.30	9.75	195	569
January	70	6.5	12.8	19.8	396	1,220
February	12	4.0	5.52	8.54	160	491
March	8.8	3.2	4.71	7.29	146	448
April	7.5	2.5	3.23	5.00	97	297
May	25	4.8	7.97	12.3	247	758
June	5.5	3.2	3.97	6.14	119	366
The year	70	2.5	5.82	9.00	2,130	6,510

PUNALUU STREAM AT ELEVATION 250 FEET NEAR PUNALUU, OAHU.

LOCATION.—About 1½ miles, by road and horse trail, south of Punaluu railroad station.

RECORDS AVAILABLE.—May 14, 1914, to June 30, 1916.

GAGE.—Stevens water-stage recorder on left bank.

DISCHARGE MEASUREMENTS.—Made by wading or from cable about 150 feet below gage.

CHANNEL AND CONTROL.—One channel at all stages, straight for about 200 feet above and below gage; composed of large boulders; right bank slopes gradually and is covered with small trees and vegetation; left bank slopes sharply and is covered with vegetation; cross section the same for several hundred feet above gage; at a point about 100 feet below gage left bank becomes vertical and right bank is about the same as at the gage. Control composed of large boulders; apparently permanent.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 4.1 feet at 7:30 p. m. November 10 (discharge, approximately 400 million gallons per day, or 619 second-feet).

Maximum stage recorded during period of record, 5.85 feet at 5 a. m. September 23, 1914 (discharge, approximately 700 million gallons per day, or 1.080 second-feet); minimum stage recorded, 1.00 foot March, August, and September, 1915 (discharge, 10 million gallons per day, or 15 second-feet).

DIVERSIONS.—None above station.

REGULATION.—None.

UTILIZATION.—Part of low-water flow is diverted for irrigation of sugar cane, rice, and taro.

ACCURACY.—Records good for all stages except for several short periods when discharge was estimated because there was no gage-height record. Stage-discharge relation constant; rating curve good.

Discharge measurements of Punaluu Stream at elevation 250 feet, near Punaluu, Oahu, during the year ending June 30, 1916.

Date.	Made by—	Gage height (feet).	Discharge.	
			Second-feet.	Million gallons per day.
Nov. 19	H. A. R. Austin	1.18	28	18
23	R. D. Klise	1.22	32	21
Jan. 14	H. A. R. Austin	1.26	34	22
Feb. 16	....do	1.15	26	17

Daily discharge, in million gallons, of Punaluu Stream at elevation 250 feet, near Punaluu, Oahu, for the year ending June 30, 1916.

Date.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	19	12	10	14	14	14	22	34	16	14	60	16
2	16	14	10	19	16	14	22	22	22	14	64	16
3	16	14	12	25	42	14	25	19	25	14	38	16
4	16	14	12	16	50	14	25	19	28	14	46	14
5	16	14	14	14	28	14	25	28	22	14	42	14
6	14	12	12	14	22	14	19	22	19	12	28	14
7	38	12	12	12	19	14	38	22	22	12	25	14
8	19	12	10	14	28	14	55	22	19	12	22	19
9	16	12	10	14	31	12	46	22	16	12	22	14
10	16	12	10	14	84	12	34	19	16	12	28	14
11	19	12	12	12	55	12	34	19	16	12	38	14
12	16	12	12	12	34	12	31	19	16	12	28	14
13	14	16	12	12	31	12	28	19	16	12	28	14
14	14	16	10	12	25	12	22	19	16	12	25	14
15	14	14	10	12	22	14	19	16	16	12	22	14
16	14	14	12	12	22	16	19	16	16	12	19	16
17	16	12	10	12	19	16	55	16	16	12	19	14
18	31	12	10	14	19	14	140	16	16	12	19	14
19	19	12	10	14	19	14	60	16	16	12	16	14
20	16	12	10	14	16	14	34	16	16	12	19	14
21	22	14	10	14	14	14	28	16	14	12	19	14
22	19	12	12	12	14	14	25	16	14	12	16	16
23	16	12	12	12	25	14	22	16	14	12	25	14
24	16	12	12	12	14	14	34	14	14	12	19	14
25	16	14	12	14	14	50	34	16	14	22	19	14
26	14	12	12	19	14	25	28	16	14	28	19	14
27	16	12	12	28	14	64	25	16	14	28	22	14
28	14	10	12	16	16	55	25	14	14	14	16	14
29	14	10	12	14	14	42	22	14	14	12	16	14
30	14	12	12	14	14	34	25	.....	14	14	16	14
31	14	10	.....	14	.....	28	22	.....	14	.....	16	.....

NOTE.—Daily discharge determined from rating curve well defined below 100 million gallons per day. Discharge Dec. 1–7, 12, 13, 16–20, and 23–31, Jan. 7–9, 12, 13, and 24–31, Feb. 1–5, and 27–29, Mar. 1–8, Apr. 14–20, Apr. 28 to May 4, and June 6–8 was determined by comparison with records of flow of Kaluanui Stream and Punaluu Stream at elevation 539 feet.

Monthly discharge of Punaluu Stream at elevation 250 feet, near Punaluu, Oahu, for the year ending June 30, 1916.

Month.	Discharge.				Run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July	38	14	17.2	26.6	534	1,640
August	16	10	12.6	19.5	390	1,200
September	14	10	11.3	17.5	338	1,040
October	28	12	14.5	22.4	451	1,380
November	84	14	25.0	38.7	749	2,300
December	64	12	20.2	31.3	626	1,920
January	140	19	33.6	52.0	1,040	3,200
February	34	14	18.6	28.8	539	1,660
March	28	14	16.7	25.8	519	1,590
April	28	12	13.9	21.5	416	1,280
May	64	16	26.2	40.5	811	2,490
June	19	14	14.5	22.4	435	1,340
The year	140	10	18.7	28.9	6,850	21,000

WAIHOI STREAM NEAR PUNALUU, OAHU.

LOCATION.—Half a mile above confluence with Punaluu Stream, 3 miles by road and trail from Government highway, and 6 miles by road and trail south of Hauula.

RECORDS AVAILABLE.—April 27, 1915, to June 30, 1916.

GAGE.—Vertical staff. New datum January 19, 1916. Stevens eight-day water-stage recorder in use April 27 to November 9, 1915.

DISCHARGE MEASUREMENTS.—Made by wading.

CHANNEL AND CONTROL.—One channel at all stages; very steep and rough. Both banks high and wooded. Control composed of large boulders; shifts somewhat owing to growth of grass and roots at the banks.

EXTREMES OF DISCHARGE.—Maximum stage recorded, 1.46 feet at 2 p. m. November 3, 1915 (discharge approximately 9.0 million gallons per day, or 14 second-feet); minimum daily discharge, September, October, November, December, and January, 3.3 million gallons per day, or 5.1 second-feet.

DIVERSIONS.—None above station.

REGULATION.—None.

UTILIZATION.—Station established in connection with contemplated plan for development of Punaluu waters.

ACCURACY.—Records fair. Flow so steady that water-stage recorder was removed November 9, 1915, and only weekly readings of staff gage were made after that; for this reason some of the higher stages were doubtless not recorded.

Discharge measurements of Waihoi Stream near Punaluu, Oahu, during the year ending June 30, 1916.

Date.	Made by—	Gage height (feet).	Discharge.	
			Second-feet.	Million gallons per day.
July 13	G. K. Larrison	1.21	6.5	4.2
Nov. 19	H. A. R. Austin	1.15	5.1	3.3
Jan. 14	do	.87	5.7	3.7
Feb. 16	do	.90	6.7	4.3
Mar. 9	do	.90	7.0	4.5
Apr. 7	R. D. Klise	.89	7.4	4.8

Monthly discharge of Waihoi Stream near Punaluu, Oahu, for years ending June 30, 1915 and 1916.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
1915.						
May	4.8	4.0	4.48	6.93	139	426
June	5.6	4.0	4.11	6.36	123	378
1915–16.						
July	4.8	4.0	4.15	6.42	129	395
August	4.0	4.0	4.00	6.19	124	381
September	4.0	3.3	3.74	5.79	112	.44
October	4.0	3.3	3.48	5.38	108	331
November	4.8	3.3	3.47	5.37	104	319
December	4.0	3.3	3.44	5.32	107	327
January	4.4	3.3	3.97	6.14	123	378
February	4.4	4.4	4.40	6.81	128	392
March	4.4	4.4	4.40	6.81	136	419
April	4.4	4.4	4.40	6.81	132	405
May	4.4	4.4	4.40	6.81	136	419
June	4.0	4.0	4.00	6.19	120	368
The year	4.8	3.3	4.00	6.19	1,450	4,480

NOTE.—Discharge determined from fairly well defined rating curves applicable Apr. 27, 1915, to Jan. 13, 1916, and Jan. 14 to June 30, 1916. Discharge interpolated between weekly observations of gage height after Nov. 9, 1915.

KALUANUI STREAM NEAR HAUULA, OAHU.

LOCATION.—At Castle's rest house, 5 miles from government road and 7¼ miles by road and trail south of Hauula.

RECORDS AVAILABLE.—April 28, 1915, to June 30, 1916.

GAGE.—Stevens continuous water-stage recorder installed February 17, 1916, in place of 8-day Stevens recorder.

DISCHARGE MEASUREMENTS.—Made by wading.

CHANNEL AND CONTROL.—One channel at all stages; straight for 25 feet above and below gage; composed of boulders and gravel; right bank slopes gently; left bank steep and high. Control composed of large boulders; probably permanent.

EXTREMES OF DISCHARGE.—Maximum stage recorded, 4.08 feet at 2:30 a. m. January 8, 1916 (discharge, approximately 150 million gallons per day, or 232 second-feet); minimum stage recorded, 0.75 foot March and April, 1916 (discharge, 0.3 million gallons per day, or 0.46 second-foot).

DIVERSIONS.—None above station.

REGULATION.—None.

UTILIZATION.—Irrigation of sugar cane and rice.

ACCURACY.—Determinations based on well-defined rating curve and a continuous record of gage height; good for all stages, with the possible exception of those occuring during several short periods when the discharge was determined by comparison with record of flow of Punaluu Stream.

Discharge measurements of Kaluanui Stream near Hauula, Oahu, during the year ending June 30, 1916.

[Made by H. A. R. Austin.]

Date.	Gage height (feet).	Discharge.		Date.	Gage height (feet).	Discharge.	
		Second-feet.	Million gallons per day.			Second-feet.	Million gallons per day.
Sept. 6	1.01	0.75	0.5	May 5	1.45	5.9	3.8
Nov. 19	1.30	3.6	2.3	June 23	1.28	3.4	2.2
Feb. 17	1.01	.7	.45				

Daily discharge, in million gallons, of Kaluanui Stream near Hauula, Oahu, for the year ending June 30, 1916.

Date.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	3.2	1.0	0.5	4.0	1.3	1.3	6.7	15	0.4	0.6	14	0.6
2	2.1	.8	.5	8.0	5.7	4.0	4.0	2.1	.4	.4	18	.6
3	2.1	1.3	2.6	8.0	16	3.2	4.0	1.7	.4	.4	4.7	.6
4	2.1	2.1	2.1	2.1	18	4.7	6.7	1.7	.5	.4	9.2	.5
5	2.1	2.1	2.1	1.3	5.7	1.7	12	12	.6	.4	8.0	.5
6	2.1	3.2	.6	1.0	4.7	2.1	5.7	4.0	2.6	.4	2.6	.5
7	9.2	1.3	.5	.8	2.6	1.0	5.7	2.1	.8	.3	1.7	.5
8	1.7	2.6	.5	1.3	5.7	1.0	14	1.3	.6	.3	1.7	1.7
9	2.6	2.1	.5	4.0	11	1.0	8.0	.8	.5	.3	4.0	.6
10	3.2	.8	.5	1.3	32	.8	8.0	1.3	.5	.3	6.7	.5
11	6.7	.8	2.6	.8	18	.8	8.0	4.7	.5	.3	8.0	.6
12	2.1	1.0	2.1	.6	12	.6	8.0	2.1	.5	.3	2.1	.6
13	1.7	2.6	.8	.6	9.2	.6	11	1.7	.5	.3	4.7	.5
14	1.3	3.2	.5	.8	6.7	.5	6.7	1.0	1.3	.4	2.6	.6
15	1.7	1.0	.8	.6	4.0	.8	2.6	1.0	2.1	.4	1.7	.5
16	5.7	.8	1.7	.5	1.3	1.0	1.7	1.0	.6	.3	1.0	1.7
17	2.1	.6	.8	.8	1.3	1.0	16	.5	.5	.6	1.0	1.3
18	8.0	.6	.5	4.7	1.3	1.0	46	.5	.5	3.2	1.0	.6
19	1.7	.8	.5	3.2	2.1	1.0	8.0	.5	.4	.4	1.7	.6
20	1.3	3.2	.6	4.0	1.0	1.0	8.0	.5	.4	.4	4.0	1.7
21	3.2	3.0	.4	4.0	1.0	1.0	6.7	.5	.4	.4	3.2	4.7
22	4.7	2.8	1.0	1.3	1.0	5.7	6.7	.5	.4	.6	2.1	8.0
23	1.7	2.5	.8	1.3	3.2	2.1	6.7	.4	.4	.5	9.2	2.1
24	1.3	2.3	1.0	1.3	2.1	1.3	5.7	.4	.4	.4	2.1	1.0
25	1.3	2.0	1.3	1.7	2.1	27	5.7	.4	.4	6.7	1.7	4.0
26	1.3	1.7	1.3	6.7	2.0	46	20	.4	.4	1.7	2.1	2.6
27	2.6	1.4	.6	5.7	1.8	46	14	.4	.4	5.7	1.3	1.7
28	2.1	1.1	1.3	2.1	1.7	32	14	.4	.4	1.3	1.7	1.7
29	1.3	.8	1.7	2.1	1.6	3.2	14	.4	.3	.8	1.0	1.3
30	2.6	.6	2.1	1.3	1.4	3.2	14	.....	.3	.6	1.0	1.0
31	1.3	.4	.....	1.3	.....	6.7	16	.....	.6	.....	.8	.....

NOTE.—Daily discharge determined from well-defined rating curve. Discharge July 4 and 5, Aug. 21–30, Nov. 10–15, 22–23, and 25–30 and Dec. 16–21 computed by comparison with record of flow of Punaluu Stream.

Monthly discharge of Kaluanui Stream near Hauula, Oahu, for year ending June 30, 1916.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July	9.2	1.3	2.78	4.30	86	264
August	3.2	.4	1.63	2.52	50	155
September	2.6	.4	1.09	1.69	33	100
October	8.0	.5	2.49	3.85	77	237
November	32	1.0	5.92	9.16	178	545
December	46	.5	6.56	10.2	203	624
January	46	1.7	10.1	15.6	314	961
February	15	.4	2.04	3.16	59	182
March	2.6	.3	.61	.94	19	58
April	6.7	.3	.97	1.50	29	89
May	18	.8	4.02	6.22	125	382
June	8.0	.5	1.45	2.24	43	134
The year	46	.3	3.33	5.15	1,220	3,730

KOLOA STREAM NEAR LAIE, OAHU.

LOCATION.—At elevation about 500 feet, 3 miles by horse trail southwest of Laie.

RECORDS AVAILABLE.—July 30, 1914, to June 30, 1916.

GAGE.—Stevens water-stage recorder on left bank.

DISCHARGE MEASUREMENTS.—Made by wading or from cable about 20 feet below gage.

CHANNEL AND CONTROL.—Channel straight for a hundred feet above station. Right bank clean and perpendicular; left bank clean with gradual slope to above high-water stage; cross section above station about the same; about 50 feet below the channel turns to the left and both banks have gentle slopes. Prior to October 16, 1915, the low-water control was formed by boulders just below the intake pipe. On October 23, 1915, a 33-foot reinforced concrete control having a low-water notch 16 feet long was completed.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 3.35 feet at 9.30 p. m. November 9 (discharge, computed by extension of rating curve, approximately 450 million gallons per day, or 696 second-feet); maximum stage recorded during period of record, 5.3 feet at about 9 a. m. September 25, 1914 (discharge, 755 million gallons per day, or 1,170 second-feet).

Channel nearly dry at times, less than 0.1 million gallons per day, or 0.15 second-foot passing the gage.

DIVERSIONS.—None above station.

REGULATION.—None.

UTILIZATION.—Stream is not perennial in its lower course. A small part of the flood discharge is diverted at low elevations for irrigation of sugar cane. Station was established to determine whether the total discharge of the streams would justify the construction of a large flood-water storage project in the vicinity.

ACCURACY.—Determinations of discharge July 1 to October 15 for extreme low stages may be considerably in error, owing to seepage through the gravels in the natural control and also to uncertainty as to point of zero flow; determinations for medium stages fairly reliable; those for high water are based on extension of rating curve and are fairly good. Discharge October 24 to June 30, after construction of control, determined from a rating curve well defined below 40 million gallons per day; determinations good below that limit. Discharge for days of decided fluctuation in stage computed hourly.

Discharge measurements of Koloa Stream near Laie, Oahu, during the year ending June 30, 1916.

Date.	Made by—	Gage height (feet).	Discharge.	
			Second-feet.	Million gallons per day.
Aug. 13	H. A. R. Austin	0.55	4.0	2.6
Nov. 13	R. E. Woolley	.53	11	6.8
24	do	.66	19	12
Dec. 2	do	.73	22	14
2	do	1.01	42	27

Monthly discharge of Koloa Stream near Laie, Oahu, for year ending June 30, 1916.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July	13	1.0	2.71	4.19	84	258
August	6.5	.8	1.57	2.43	49	149
September	8.9	.8	1.73	2.68	52	159
November	42	1.0	6.75	10.4	202	621
December	30	1.0	4.24	6.56	131	403
January	45	1.0	6.83	10.6	212	650
February	6.6	.6	1.38	2.14	40	123
March	9.3	.3	1.33	2.06	41	127
April	9.9	.15	.91	1.41	27	84
May	17	.6	3.03	4.69	94	288

NOTE.—Determinations based on rating curves applicable as follows: July 1 to Oct. 15, 1915, fairly well defined below 150 million gallons per day. Oct. 24, 1915, to June 30, 1916, well defined below 40 million gallons per day. Discharge estimated July 29 to Aug. 13.

EAST BRANCH OF KAHAWAINUI STREAM NEAR LAIE, OAHU.

LOCATION.—Half a mile above junction with West Branch of Kahawainui Stream, 3 miles by horse trail southwest of Laie, at elevation about 500 feet above sea level.

RECORDS AVAILABLE.—July 29, 1914, to June 30, 1916.

GAGE.—Stevens water-stage recorder on left bank. Datum raised 0.6 foot November 1, 1915.

DISCHARGE MEASUREMENTS.—Made by wading or from cable 10 feet below gage.

CHANNEL AND CONTROL.—One channel at all stages; straight for several feet above station, composed of large boulders and free from vegetation; right bank clean and nearly perpendicular; left bank sloping and fairly clean. Right bank flattens out about 60 feet below gage, otherwise the cross-section is the same for several hundred feet above and below station. Control prior to October 26, 1915, consisted of a natural dam of large boulders. On November 1, 1915, a reinforced concrete control, 32 feet long with a low-water notch 15 feet long, was completed.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 2.85 feet at 11 p. m. November 9 (discharge, approximately 200 million gallons per day, or 309 second-feet); maximum stage recorded during period of record, 5.1 feet at 7 a. m. September 25, 1914 (discharge, 340 million gallons per day, or 526 second-feet); channel dry during a considerable part of the time.

DIVERSIONS.—None above station.

REGULATION.—None.

UTILIZATION.—Part of the flood discharge is diverted at present at low elevations to irrigate sugar cane. Station was established to determine whether total flood discharge at this elevation is sufficient to justify a large flood water storage project near Kahuku.

ACCURACY.—Determinations July 1 to October 25 approximate; sufficient measurements were not made to define the high-water extension of rating curve; uncertainty as to permanence of control and point of zero flow subjects the low-water determination to considerable error. Determinations November 2 to June 30, after construction of concrete control, fair below 75 million gallons per day. Discharge for days of decided fluctuation in stage computed hourly.

Discharge measurements of East Branch of Kahawainui Stream near Laie, Oahu, during the year ending June 30, 1916.

Date.	Made by—	Gage height (feet).	Discharge.	
			Second-feet.	Million gallons per day.
Nov. 10	R. E. Woolley	1.67	85	55
13	do	.44	1.5	1.0

Monthly discharge of East Branch of Kahawainui Stream near Laie, Oahu, for year ending June 30, 1916.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July 14–31	6.6	0	0.78	1.21	14	43
August	.8	0	.04	.06	1	4
September	.2	0	.02	.03	1	2
October 1–25	9.0	0	.64	.99	16	49
November 2–30	19	.2	2.52	3.90	72	224
December	16	.1	1.37	2.12	42	130
January	17	.3	2.10	3.25	65	200
February 1–16	1.2	.1	.38	.59	6	19
April 3–24	0	0	0	0	0	0
May 16–25	1.2	.1	.47	.73	5	14

NOTE.—Discharge determined by rating curves applicable as follows: July 1 to Oct. 25, poorly defined Nov. 2 to June 30, fairly well defined below 75 million gallons per day. Gage heights not recorded Oct. 26 to Nov. 1, Feb. 17 to Apr. 2, Apr. 25 to May 15, and May 26 to June 30.

EAST BRANCH OF MALAEKAHANA STREAM NEAR KAHUKU, OAHU.

LOCATION.—About three-quarters of a mile above junction with Middle Branch of Malaekahana Stream and 3½ miles, by horse trail, south of Kahuku, about 375 feet above sea level.

RECORDS AVAILABLE.—July 31, 1914, to June 30, 1916.

GAGE.—Stevens water-stage recorder on right bank. Original staff gage, established on July 31, 1914, was washed out by flood September 24, 1914. From September 25, 1914, to May 28, 1915, a reference point consisting of a 20-penny nail in kukui tree on left bank 50 feet upstream, at same datum as staff gage, was used to check gage heights. On May 28, 1915, a new staff gage was established at the original datum.

DISCHARGE MEASUREMENTS.—Made by wading or from cable about 5 feet upstream from staff gage.

CHANNEL AND CONTROL.—One channel at all stages; straight for several hundred feet above gage; composed of loose boulders and gravel; right bank at gage is clean and nearly vertical; left bank has gradual slope and above ordinary flood stages is covered with small trees and vegetation; cross section same for several hundred feet upstream. Reinforced-concrete control completed November 9, 1915, is 33 feet long with a 14-foot notch for low water. Original control consisted of a concrete slab 2 feet wide, with a small notch for low flow, between large boulders, about 6 feet below gage; this control was destroyed by the flood September 24, 1914.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 3.0 feet at 11.30 p. m. November 9, 1915 (discharge, computed by extension of the rating curve, approximately 180 million gallons per day, or 278 second-feet); maximum stage recorded during period of record, 5.05 feet at 5 a. m. September 25, 1914 (discharge, 378 million gallons daily, or 585 second-feet); channel dry the greater part of the time.

DIVERSIONS.—None above station.

REGULATION.—None.

UTILIZATION.—Stream not perennial. A small part of the flood discharge is diverted at low elevations for irrigation of sugar cane. Station was established to determine whether the total flood discharge at an elevation of about 350 feet above sea level will justify the construction of a large flood-water storage project near Kahuku.

ACCURACY.—Determinations July 1 to November 1, before new control was constructed poor owing to uncertainty of point of zero flow and lack of current-meter measurements. Discharge November 9 to June 30 ascertained from a rating curve well defined below 15 million gallons per day; determinations good below that limit. Discharge for days of decided fluctuation in stage computed hourly.

Discharge measurements of East Branch of Malaekahana Stream near Kahuku, Oahu, during the year ending June 30, 1916.

Date.	Made by—	Gage height (feet).	Discharge.	
			Second-feet.	Million gallons per day.
Nov. 11	R. D. Klise	0.36	7.9	5.1
13	do	.30	5.6	3.6
16	do	.12	.75	.5
Mar. 4	R. C. Rice	.60	15	10
4	do	.50	11	7.1

Monthly discharge of East Branch of Malaekahana Stream near Kahuku, Oahu, for year ending June 30, 1916.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July	5.4	0	0.52	0.80	16	49
August	2.5	0	.12	.19	4	11
September	0	0	0	0	0	0
October	6.4	0	.70	1.08	22	67
December 7–31	23	.3	2.80	4.33	70	215
January	23	.3	4.00	6.19	124	381
February	2.6	.3	.67	1.04	19	60
March	3.5	0	.47	.73	15	45
May	3.5	0	.88	1.36	27	84
June	1.0	0	.12	.19	4	11

NOTE.—Discharge determined from rating curves applicable as follows: July 1 to Nov. 1, poorly defined. Nov. 9 to June 30, well defined below 15 million gallons per day.

MIDDLE BRANCH OF MALAEKAHANA STREAM NEAR KAHUKU, OAHU.

LOCATION.—About a mile above junction with East Branch of Malaekahana Stream; 3½ miles, by horse trail, south of Kahuku about 440 feet above sea level.

RECORDS AVAILABLE.—July 31, 1914, to June 30, 1916.

GAGE.—Stevens water-stage recorder on right bank. Gage datum lowered 1.00 foot September 25, 1914, to avoid minus readings.

DISCHARGE MEASUREMENTS.—Made by wading or from cable 15 feet downstream from staff gage.

CHANNEL AND CONTROL.—One channel at all stages; composed of loose boulders and gravel, free from vegetation, and straight for several hundred feet above gage; at the gage right bank clean and nearly vertical; left bank slopes gradually and above ordinary flood stages is covered with trees and vegetation; the cross section about the same for several feet above and below gage. Reinforced concrete control completed November 20, 1915, replacing concrete control washed out September 24, 1914.

EXTREMES OF DISCHARGE.—Maximum stage recorded during period of record, 3.40 feet at 9.30 p. m. January 7, 1916 (discharge, approximately 200 million gallons per day, or 309 second-feet); channel dry greater part of the time.

DIVERSIONS.—None above station.

REGULATION.—None.

UTILIZATION.—Stream not perennial. A small part of the flood discharge is diverted at low elevations for irrigation of sugar cane. Station was established to determine whether the total flood discharge at an elevation of about 400 feet above sea level will justify the construction of a large flood-water storage project near Kahuku.

ACCURACY.—Discharge measurements secured insufficient to properly define the rating curves and the determinations are poor for that reason, as well as on account of the small amount of water involved. Discharges for days of decided fluctuation in stage computed hourly.

Discharge measurements of Middle Branch of Malaekahana Stream near Kahuku, Oahu, during the year ending June 30, 1916.

Date.	Made by—	Gage height (feet).	Discharge.	
			Second-feet.	Million gallons per day.
Mar. 4	R. C. Rice	0.41	6.7	4.3
May 6	H. A. R. Austin	.21	0.08	a.05

a Estimated.

Monthly discharge of Middle Branch of Malaekahana Stream near Kahuku, Oahu,, for year ending June 30, 1916.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July	0.7	0	0.03	0.05	1	3
August	0	0	0	0	0	0
September	0	0	0	0	0	0
October	2.1	0	.12	.19	4	11
December	25	0	2.53	3.91	7?	241
January	13	0	3.49	5.40	108	332
February	6.6	0	.97	1.50	2?	86
March 1-13	.....	.....	1.45	2.24	1?	58
May 7-31	0	0	0	0	0	0
June	0	0	0	0	0	0

NOTE.—Discharge determined from poorly defined rating curves.

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

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

RECORDS AVAILABLE.—May 29, 1913, to June 30, 1916.

GAGE.—Stevens water-stage recorder on left bank.

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, 6.0 feet at 4 a. m. May 1 (discharge, approximately 440 million gallons per day, or 680 second-feet); minimum stage recorded, 1.35 feet April 24 (discharge, 0.6 million gallons per day, or 0.9 second-foot).

Maximum stage recorded during period of record, 6.9 feet, 10 p. m. November 8, 1914 (discharge, estimated by extension of rating curve, 560 million gallons per day, or 866 second-feet); minimum daily discharge, March, 1914, 0.2 million gallons per day or 0.3 second-foot).

DIVERSIONS.—None above station; entire low-water flow below station diverted.

REGULATION.—None.

UTILIZATION.—Wahaiwa Water Co.'s ditch diverts entire low-water flow of both right and left branches of North Fork at their confluence below gaging station on each branch, for domestic water supply and irrigation in vicinity of Wahiawa. Discharge from North Fork is impounded in Wahiawa reservoir for irrigation of sugar cane on Waialua plantation.

ACCURACY.—Records are good for all stages except possibly during the periods in which the flow was determined by comparison with record of the Left Branch.

Discharge measurements of Right Branch of North Fork of Kaukonahua Stream near Wahiawa, Oahu, during the year ending June 30, 1916.

Date.	Made by—	Gage height (feet).	Discharge.	
			Second-feet.	Million gallons per day.
July 1	R. C. Rice	2.25	23	15
Sept. 1	R. D. Klise	1.54	2.3	1.5
Nov. 15	H. A. R. Austin	2.07	14	9.0
Feb. 7	....do	1.70	4.6	3.0
Apr. 3	....do	1.47	1.2	.8
June 1	....do	1.89	9.6	6.2

Daily discharge, in million gallons, of Right Branch of North Fork of Kaukonahua Stream near Wahiawa, Oahu, for the year ending June 30, 1916.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	5.2	3.8	1.6	16	6.0	4.5	8.0	9.0	6.0	1.6	126	6.0
2	3.8	12	1.6	14	8.0	9.0	6.0	12	10	1.2	62	5.2
3	2.5	16	3.0	34	70	6.0	6.0	5.2	14	1.0	20	4.5
4	2.0	13	6.0	9.0	50	9.0	10	4.5	12	1.0	42	3.8
5	2.0	9.0	9.0	7.0	18	5.2	24	4.5	5.2	1.0	32	3.0
6	12	10	3.8	5.2	22	6.0	6.0	3.8	3.0	1.0	16	3.0
7	32	5.2	3.8	4.5	13	3.8	5.2	3.0	6.0	.7	12	2.5
8	8.0	6.0	3.8	4.5	32	3.8	42	3.0	2.5	.7	26	14
9	14	4.5	3.8	10	18	3.0	29	2.5	2.0	.7	53	4.5
10	9.0	3.8	2.0	4.5	36	3.8	18	3.8	2.0	.7	14	7.0
11	13	3.0	8.0	3.8	18	3.0	13	5.2	1.6	.7	10	5.2
12	7.0	3.8	6.0	3.0	13	3.0	9.0	3.8	1.6	.7	8.0	3.0
13	7.0	10	3.8	3.0	16	2.5	8.0	2.5	1.6	.7	8.0	3.0
14	7.0	7.0	2.5	3.0	10	2.5	7.0	2.5	2.0	.7	10	2.5
15	4.5	5.2	2.5	2.5	9.0	2.5	6.0	2.0	7.0	.7	7.0	3.0
16	13	4.5	5.2	2.5	8.0	16	6.0	2.0	2.0	.7	5.2	10
17	14	3.0	2.5	2.5	9.0	3.8	22	2.0	1.6	1.0	4.5	7.0
18	24	3.8	3.0	8.0	7.0	6.0	82	1.6	1.6	6.0	4.5	6.0
19	8.0	3.0	2.5	12	8.0	10	20	1.6	1.2	1.2	4.5	3.8
20	8.0	4.5	2.0	22	6.0	4.5	12	1.6	1.2	1.0	13	4.5
21	9.0	5.2	2.0	7.0	5.2	12	9.0	2.0	1.2	.7	7.0	13
22	7.0	3.0	9.0	7.0	7.0	16	8.0	2.0	1.2	.7	10	12
23	5.2	2.5	7.0	22	16	5.2	7.0	1.6	5.2	.7	22	6.0
24	4.5	2.5	3.8	7.0	6.0	4.5	6.0	1.2	2.0	.6	8.0	4.5
25	7.0	5.2	4.5	8.0	5.2	39	5.2	1.2	1.2	9.0	7.0	7.0
26	9.0	3.0	7.0	22	5.2	9.0	16	1.0	1.2	2.0	10	9.0
27	9.0	2.0	6.0	26	6.0	12	6.0	1.2	1.2	8.0	22	6.0
28	5.2	2.0	9.0	9.0	9.0	39	4.5	1.0	1.0	2.0	9.0	5.2
29	4.5	2.0	10	8.0	7.0	10	4.5	1.0	1.0	1.2	10	4.5
30	7.0	1.6	16	6.0	5.2	8.0	5.2	.....	1.2	5.2	7.0	3.8
31	3.8	1.6	.....	5.2	.....	18	4.5	.....	2.0	.....	6.0	.....

NOTE.—Discharge determined from well defined rating curve. Discharge Sept. 24 to Oct. 1, Nov. 3-14, and Jan. 8-11 ascertained by comparison with record of flow of Left Branch.

Monthly discharge of Right Branch of North Fork of Kaukonahua Stream near Wahiawa, Oahu, for year ending June 30, 1916.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July	32	2.0	8.62	13.3	267	820
August	16	1.6	5.22	8.08	162	497
September	16	1.6	5.02	7.77	151	462
October	34	2.5	9.62	14.9	298	915
November	70	5.2	15.0	23.2	449	1,380
December	39	2.5	9.05	14.0	281	861
January	82	4.5	13.4	20.7	415	1,270
February	12	1.0	3.04	4.70	88	271
March	14	1.0	3.31	5.12	102	315
April	9.0	.6	1.77	2.74	53	163
May	126	4.5	19.2	29.7	596	1,830
June	14	2.5	5.75	8.90	172	529
The year	126	.6	8.29	12.8	3,030	9,310

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

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

RECORDS AVAILABLE.—May 25, 1913, to June 30, 1916.

GAGE.—Stevens water-stage recorder on left bank.

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

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 during year, 6.55 feet morning of May 1 (discharge, approximately 680 million gallons per day, or 1,050 second-feet); minimum daily discharge, 0.5 million gallons per day, or 0.77 second-foot April 24.

Maximum stage recorded during period of record, 6.95 feet at 5 p. m. November 8, 1914 (discharge, approximately 750 million gallons per day, or 1,160 second-feet); minimum stage, 0.85 foot February 9 and 19, 1915 (discharge, 0.25 million gallons per day, or 0.37 second-foot).

DIVERSIONS.—None above station.

REGULATION.—None.

UTILIZATION.—The entire low-flow of the North Fork is diverted immediately below confluence of the right and left branches, and is impounded in Wahiawa reservoir for sugar-cane irrigation on Waialua Agricultural Co.'s plantation.

ACCURACY.—Records good for all stages except possibly those during the periods January 17 to February 6 and April 3 to May 1, when the recorder failed to operate and determinations were obtained by comparison with record of flow of the Right Branch.

Discharge measurements of Left Branch of North Fork of Kaukonahua Stream near Wahiawa, Oahu, during the year ending June 30, 1916.

[Made by H. A. R. Austin.]

Date.	Gage height (feet).	Discharge.		Date.	Gage height (feet).	Discharge.	
		Second-feet.	Million gallons. per day.			Second-feet.	Million gallons. per day.
July 1	2.77	128	83	Mar. 2	1.62	13	8.6
1	2.76	130	84	Apr. 3	1.10	1.5	.95
Oct. 2	2.98	161	104	May 1	3.70	316	204
Nov. 15	1.70	19	12	1	3.56	275	178
Jan. 12	1.69	19	12	June 1	1.69	17	11

Daily discharge, in million gallons, of Left Branch of North Fork of Kaukonahua Stream near Wahiawa, Oahu, for the year ending June 30, 1916.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	23	5.8	3.2	26	9.0	6.8	10	14	5.8	2.6	214	15
2	7.9	10	3.2	81	19	14	9.0	17	10	2.0	108	9.0
3	5.8	21	5.8	81	126	9.0	10	7.9	17	1.0	28	9.0
4	4.8	21	14	19	86	15	17	6.8	15	1.0	72	6.8
5	4.8	14	12	14	28	9.0	28	6.8	5.8	1.0	54	6.8
6	28	14	6.8	10	34	12	9.0	5.8	3.2	1.0	26	6.8
7	23	7.9	5.8	7.9	19	6.8	19	4.0	5.8	.8	19	5.8
8	12	12	6.8	9.0	50	5.8	67	4.0	2.6	.8	34	28
9	17	7.9	5.8	26	28	5.8	46	4.0	2.0	.8	91	9.0
10	10	5.8	4.0	9.0	58	5.8	28	5.8	2.0	.8	19	12
11	15	5.8	17	6.8	28	4.8	19	7.9	2.0	.8	14	10
12	7.9	5.8	28	5.8	19	4.8	12	4.0	2.0	.8	19	6.8
13	9.0	12	10	5.8	26	4.0	10	3.2	2.0	.8	14	5.8
14	9.0	9.0	6.8	5.8	15	4.0	9.0	3.2	3.2	.8	14	5.8
15	6.8	6.8	4.8	4.8	14	4.0	7.9	2.6	7.9	.8	9.0	14
16	23	4.8	6.8	4.8	12	10	7.9	2.6	2.0	.8	7.9	34
17	21	4.8	4.8	4.8	10	4.8	34	2.6	2.0	1.0	6.8	14
18	46	5.8	5.8	14	9.0	9.0	144	2.0	2.0	9.0	6.8	12
19	12	4.8	4.0	17	10	14	31	2.0	1.5	1.5	6.8	9.0
20	19	6.8	3.2	38	7.9	6.8	17	2.0	1.5	1.0	39	15
21	15	14	3.2	12	7.9	26	14	2.0	2.0	.8	15	23
22	10	6.8	10	15	9.0	31	12	2.0	2.0	.8	31	50
23	7.9	5.8	7.9	19	17	9.0	10	2.0	4.8	.8	43	14
24	6.8	4.8	4.8	9.0	9.0	6.8	9.0	1.5	2.0	.5	15	10
25	10	7.9	6.8	15	6.8	50	7.9	1.5	2.6	14	12	23
26	9.0	6.8	10	38	7.9	12	23	1.5	2.0	2.6	12	19
27	15	4.0	9.0	26	12	17	9.0	1.5	1.5	12	27	12
28	7.9	3.2	14	12	15	50	6.8	1.5	1.0	2.6	19	9.0
29	6.8	3.2	15	12	14	14	6.8	1.5	1.0	1.5	15	9.0
30	9.0	3.2	26	10	9.0	10	7.9	.....	1.0	7.9	9.0	7.9
31	5.8	3.2	.....	10	.....	23	6.8	.....	5.8	.....	7.9	.....

NOTE.—Discharge determined from well-defined rating curve; Jan. 17 to Feb. 6 and Apr. 3 to May 1 determined by comparison with record of flow of Right Branch.

Monthly discharge of Left Branch of North Fork of Kaukonahua Stream near Wahiawa, Oahu, for year ending June 30, 1916.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July	46	4.8	13.2	20.4	408	1,260
August	21	3.2	8.02	12.4	249	763
September	28	3.2	8.84	13.7	265	814
October	81	4.8	18.3	28.3	568	1,740
November	126	6.8	23.8	36.8	716	2,190
December	50	4.0	13.1	20.3	405	1,250
January	144	6.8	20.9	32.3	648	1,990
February	17	1.5	4.25	6.58	123	378
March	17	1.0	3.90	6.03	121	371
April	14	.5	2.42	3.74	73	223
May	214	6.8	31.8	49.2	986	3,030
June	50	5.8	13.7	21.2	412	1,260
The year	214	.5	13.6	21.0	4,970	15,300

SOUTH FORK OF KAUKONAHUA STREAM ABOVE UNITED STATES ARMY RESERVOIR, NEAR WAHIAWA, OAHU.[1]

LOCATION.—About one-eighth mile above United States Army ditch intake, 5 miles by trail above United States Army reservoir, and 10 miles east of Wahiawa by road to reservoir and trail along ditch.

RECORDS AVAILABLE.—June 18, 1913, to June 30, 1916.

GAGE.—Stevens water-stage recorder.

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

CHANNEL AND CONTROL.—Channel in vicinity of gage is straight and has been cleared of boulders. Banks steep; flow is confined past the gage. Natural control at head of long riffle has been improved for low-water stages by construction of a low rock-fill dam.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 5.1 feet at 1.30 a. m. January 8 (discharge, approximately 550 million gallons per day, or 850 second-feet). Minimum stage recorded, 1.2 feet April 3–8; discharge, 0.5 million gallons per day, or 0.77 second-foot.

Maximum stage recorded during period of record, 7.05 feet 11 p. m. November 20, 1913 (estimated discharge, 900 million gallons per day, or 1,390 second-feet, by extension of rating curve); minimum daily discharge March ,1915, 0.15 million gallons per day, or 0.25 second-foot.

DIVERSIONS.—None above gage. United States Army ditch diverts all the low-water flow one-eighth of a mile below station.

REGULATION.—None.

UTILIZATION.—Low-water flow past this station is diverted one-eighth mile downstream into United States Army ditch and impounded in United States Army storage reservoir of 21 million gallons capacity (64 acre-feet), 5 miles downstream, and carried thence by pipe line for water supply for cantonment at Castner. Records show amount of water available for additional water supply for Castner. Discharge from South Fork is impounded in Wahiawa reservoir for sugar-cane irrigation on Waialua Plantation.

ACCURACY.—Records good below 50 million gallons per day and fair above that limit. Rating curve well defined for low and medium stages; continuous record of gage height was obtained.

Discharge measurements of South Fork of Kaukonahua Stream above United States Army reservoir, near Wahiawa, Oahu, during the year ending June 30, 1916.

[Made by H. A. R. Austin.]

Date.	Gage height (feet).	Discharge.		Date.	Gage height (feet).	Discharge.	
		Second-feet.	Million gallons per day.			Second-feet.	Million gallons per day.
July 5	1.49	4.3	2.8	Feb. 14	1.40	3.2	2.1
Sept. 10	1.39	2.6	1.7	Mar. 6	1.36	2.6	1.7
Oct. 5	1.75	17	11	May 9	2.21	54	35
Nov. 16	1.70	13	8.7	June 6	1.55	6.3	4.1
Jan. 20	1.83	23	15				

[1] Called South Fork of Kaukonahua Stream near Wahiawa, Oahu, in Water-Supply Paper 373.

Daily discharge, in million gallons, of South Fork of Kaukonahua Stream above United States Army reservoir, near Wahiawa, Oahu, for the year ending June 30, 1916.

Date.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	20	2.8	1.5	17	7.5	6.0	9.0	17	1.5	1.5	89	22
2	6.0	2.8	2.0	74	28	15	7.5	11	2.0	.8	122	7.5
3	3.5	2.8	9.0	64	56	11	7.5	3.5	13	.8	34	9.0
4	4.8	6.0	9.0	17	102	9.0	17	3.5	15	.5	122	6.0
5	3.5	6.0	6.0	11	22	6.0	41	6.0	4.8	.5	69	4.8
6	31	3.5	2.8	9.0	31	13	7.5	6.0	1.5	.5	41	4.8
7	13	2.8	2.0	7.5	17	6.0	22	3.5	4.8	.5	31	4.8
8	7.5	3.5	2.0	7.5	28	4.8	102	3.5	1.5	.5	25	13
9	6.0	3.5	1.5	20	34	3.5	90	3.5	1.0	.8	60	4.8
10	7.5	2.8	2.0	9.0	64	3.5	31	6.0	1.0	.8	17	3.5
11	6.0	2.8	31	6.0	41	3.5	22	6.0	1.0	.8	11	3.5
12	4.8	3.5	31	6.0	22	2.8	13	3.5	1.0	.8	9.0	2.8
13	3.5	6.0	11	4.8	25	2.8	11	2.8	1.0	.8	15	2.8
14	3.5	9.0	4.8	4.8	15	2.8	9.0	2.0	2.0	1.0	9.0	4.8
15	4.8	3.5	3.5	3.5	15	3.5	9.0	2.0	13	.8	6.0	9.0
16	7.5	2.8	4.8	3.5	9.0	11	7.5	2.0	2.0	.8	4.8	38
17	7.5	2.0	3.5	3.5	9.0	3.5	60	2.0	1.0	2.8	4.8	13
18	64	2.0	4.8	20	9.0	7.5	115	2.0	1.0	20	4.8	6.0
19	11	2.8	3.5	11	9.0	17	28	1.5	1.0	3.5	4.8	4.8
20	7.5	9.0	2.8	17	7.5	6.0	13	1.5	.8	3.5	41	9.0
21	11	11	2.0	13	6.0	17	11	1.5	1.0	2.0	13	25
22	6.0	4.8	2.0	6.0	11	22	9.0	1.5	1.5	3.5	22	28
23	4.8	2.8	2.0	7.5	15	6.0	7.5	1.5	1.0	2.0	2[illegible]	11
24	3.5	3.5	2.8	6.0	7.5	6.0	7.5	1.5	1.0	1.0	11	9.0
25	4.8	7.5	6.0	20	4.8	56	6.0	1.5	.8	15	9.0	31
26	3.5	6.0	13	34	4.8	13	25	1.5	.8	4.8	9.0	38
27	11	2.8	6.0	25	9.0	20	6.0	1.5	.8	17	7.5	17
28	4.8	2.0	25	9.0	15	60	4.8	1.5	.8	2.8	6.0	15
29	3.5	2.0	20	11	15	13	3.5	1.5	.8	2.0	7.5	11
30	3.5	1.5	28	6.0	7.5	9.0	4.8	.....	.8	13	4.8	9.0
31	3.5	1.5	.....	6.0	.....	17	3.5	.....	1.5	.....	4.8	.....

NOTE.—Discharge determined from rating curve well defined below 50 million gallons per day.

Monthly discharge of South Fork of Kaukonahua Stream above United States Army reservoir, near Wahiawa, Oahu, for year ending June 30, 1916.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July	64	3.5	9.12	14.1	283	868
August	11	1.5	4.04	6.25	125	384
September	31	1.5	8.18	12.7	245	753
October	74	3.5	14.8	22.9	460	1,410
November	102	4.8	21.6	33.4	647	1,990
December	60	2.8	12.2	18.9	377	1,160
January	115	3.5	20.3	31.4	630	1,930
February	17	1.5	3.53	5.46	102	314
March	15	.8	2.60	4.02	81	247
April	20	.5	3.50	5.42	105	322
May	122	4.8	27.2	42.1	844	2,590
June	38	2.8	12.3	19.0	368	1,130
The year	122	.5	11.7	18.1	4,270	13,100

SOUTH FORK OF KAUKONAHUA STREAM BELOW UNITED STATES ARMY RESERVOIR NEAR WAHIAWA, OAHU.

LOCATION.—About 600 feet upstream from highway bridge on road from Castner to United States Army reservoir, about one-quarter mile above gulch entering from northeast, 2½ miles east of Castner and 2 miles southeast of Wahiawa.

RECORDS AVAILABLE.—July 23, 1914, to June 30, 1916.

GAGE.—Stevens water-stage recorder on right bank.

DISCHARGE MEASUREMENTS.—Made by wading or from cable directly over concrete control 50 feet downstream from gage.

CHANNEL AND CONTROL.—Reinforced concrete slab 26 feet long, extending from bank to bank, 4 feet wide, with rectangular low-water section 7.5 feet wide near left bank, to confine extreme low flow. Downstream side of concrete slab protected from undermining by apron of discarded fence posts. Banks high. Channel composed of gravel, is straight and fairly smooth in vicinity of gaging station.

EXTREMES OF DISCHARGE.—Maximum stage recorded during period of record, 10.35 feet at 7 a. m. August 5, 1914 (discharge, about 1,400 million gallons per day, or 2,170 second-feet, estimated by extension of rating curve), minimum daily discharge March and June, 1915, and March and June, 1916, 1.0 million gallons per day or 1.5 second-feet.

DIVERSIONS.—United States Army ditch diverts water from stream near headwaters.

REGULATION.—Practically none.

UTILIZATION.—Water diverted at about 1,130 feet above sea level by the United States Army ditch impounded in United States Army reservoir and carried by pipe line to the cantonment of Castner for water supply. An additional supply is pumped into this pipe line during periods of extreme low water from the stream just below the highway bridge below the gaging station. Wahiawa reservoir, into which the stream empties, supplies water for sugar-cane irrigation on Waialua Plantation.

ACCURACY.—Discharge ascertained from well-defined rating curve and a continuous record of gage height; good below 120 million gallons per day.

Discharge measurements of South Fork of Kaukonahua Stream below United States Army reservoir, near Wahiawa, Oahu, during the year ending June 30, 1916.

[Made by H. A. R. Austin.]

Date.	Gage height (feet).	Discharge.		Date.	Gage height (feet).	Discharge.	
		Second-feet.	Million gallons per day.			Second-feet.	Million gallons per day.
Dec. 14	0.82	8.8	5.7	Apr. 6	0.41	1.9	1.2
Dec. 16	1.12	22	14	May 9	a 3.98	364	235
Mar. 6	.70	7.3	4.7				

a Affected by backwater.

Daily discharge, in million gallons, of South Fork of Kaukonahua Stream below United States Army reservoir, near Wahiawa, Oahu, for the year ending June 30, 1916.

Date.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	21	2.6	1.3	31	12	12	17	60	3.3	2.6	161	42
2	14	2.1	1.6	80	50	21	12	65	3.3	1.3	196	19
3	6.8	2.1	19	108	114	19	11	16	12	1.3	60	26
4	6.3	4.9	19	23	226	14	21	12	19	1.0	200	17
5	5.8	7.8	14	16	42	12	55	14	12	1.0	210	12
6	34	3.3	3.3	12	60	19	14	12	4.9	1.0	85	11
7	14	2.6	1.6	11	28	12	17	11	11	1.0	90	10
8	8.9	3.3	1.6	10	55	10	274	10	4.9	1.3	65	17
9	8.9	2.6	1.3	21	75	10	182	10	3.3	1.3	126	10
10	10	2.1	2.1	12	154	8.9	90	14	2.1	1.3	26	8.9
11	7.8	2.1	34	8.9	114	8.9	50	16	2.1	1.3	21	10
12	6.8	4.0	38	7.8	42	7.8	28	11	2.1	1.3	16	7.8
13	4.9	3.3	16	6.8	42	7.8	21	8.9	1.6	1.3	19	6.8
14	4.9	12	6.8	6.8	26	6.8	19	6.8	1.6	1.3	14	10
15	6.8	3.3	4.0	4.9	23	6.8	17	6.8	14	1.3	11	8.9
16	10	2.1	7.8	4.9	19	17	16	6.8	2.1	1.3	10	34
17	8.9	2.1	5.8	5.8	17	6.8	70	5.8	1.6	2.1	10	23
18	90	1.6	4.0	16	16	7.8	372	4.9	1.6	21	12	8.9
19	14	1.6	5.8	19	17	19	120	4.9	1.6	6.8	11	8.9
20	8.9	11	2.1	28	14	12	34	4.0	1.3	2.6	70	23
21	12	12	2.1	16	12	17	23	4.9	2.1	2.1	28	28
22	8.9	6.8	1.6	10	17	31	19	4.0	4.9	4.0	34	34
23	6.8	2.6	1.6	12	28	11	17	4.0	2.6	5.8	65	21
24	4.9	2.6	1.6	7.8	16	8.9	16	4.0	2.1	2.6	21	19
25	4.0	6.8	8.9	17	12	108	16	3.3	1.3	8.9	16	70
26	5.8	4.9	19	46	11	21	60	3.3	1.3	10	19	80
27	10	3.3	14	65	14	23	17	3.3	1.0	42	14	28
28	5.8	1.6	21	14	21	196	14	3.3	1.0	12	12	26
29	3.3	1.6	42	17	26	26	12	3.3	1.0	6.8	12	21
30	2.6	1.3	50	11	14	17	14	.....	1.0	11	12	19
31	3.3	1.3	.....	10	.....	21	12	.....	1.3	.....	10	.....

NOTE.—Discharge determined from rating curve well defined below 120 million gallons per day. Discharge Aug. 29 to Sept. 9, Sept. 25, and June 23-30, determined by comparison with records obtained at station above United States Army Reservoir.

Monthly discharge of South Fork of Kaukonahua Stream below United States Army reservoir, near Wahiawa, Oahu, for year ending June 30, 1916.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July	90	2.6	11.6	17.9	360	1,100
August	12	1.3	3.91	6.05	121	372
September	50	1.3	11.7	18.1	351	1,080
October	108	4.9	21.2	32.8	659	2,020
November	226	11	43.9	67.9	1,320	4,040
December	196	6.8	23.2	35.9	718	2,210
January	372	11	53.5	82.8	1,660	5,090
February	65	3.3	11.5	17.8	333	1,020
March	19	1.0	4.03	6.24	125	383
April	42	1.0	5.29	8.18	159	487
May	210	10	53.5	82.8	1,660	5,090
June	80	6.8	22.0	34.0	660	2,030
The year	372	1.0	22.2	34.3	8,130	24,900

MISCELLANEOUS MEASUREMENTS.

Measurements of streams and ditches on the island of Oahu at points other than regular gaging stations are listed below:

Miscellaneous measurements on Oahu for the year ending June 30, 1916.

Date.	Stream.	Locality.	Discharge.	
			Second-feet.	Million gallons per day.
Jan. 8	Waikiki swamps	Fort De Russy culvert, Kalakaua Ave., Honolulu	14	9.0
8	do	Culvert at Cressaty station of Rapid Transit Line, Kalakaua Ave.	40	26
11	do	Culvert at junction of Rapid Transit Line and Kalakaua Ave., near Cressaty station.	26	17
11	Main leak reservoir No. 4.	Nuuanu Valley, near Honolulu	3.2	2.1
21	do	do	3.6	2.3
11	Total seepage reservoir No. 4.	do	4.8	3.1
21	do	do	5.1	3.3
11	Drainage from swamp.	do	2.3	1.5
21	do	do	3.6	2.3
26	Waihee	Side tunnel No. 3, Waiahole	1.3	.85
26	Waiahole tunnel	Flume at North Portal, Waiahole	15	9.6
Mar. 8	do	do	2.8	1.8
20	do	do	2.8	1.8
28	do	do	1.9	1.2
8	"R" tunnel	North Portal, near Waiahole	7.7	5.0
13	Waiahole tunnel	South Portal, near Waiawa	23	15
21	do	do	23	15
20	do	Government boundary, 1,700 feet in from North Portal.	8.2	5.3
Apr. 9	Waiahole side tunnel No. 26.	Includes all water from intakes 1, 2, and 3.	2.6	1.7
1	Maole	Elevation 760 feet, about 300 feet above Reservoir No. 2, Nuuanu Valley.	0.3	0.2
1	do	Elevation 1,030 feet, Hillebrand Glen, Nuuanu Valley.	.06	.04
May 4	do	Proposed gaging station site, ¼ mile below upper falls.	2.9	1.9
29	South Fork of Punaluu.	100 feet below proposed diversion point	1.55	1.0
29	Main Fork of Punaluu.	do	1.9	1.2
29	North Branch of Main Fork of Punaluu.	do	.4	.25
29	North Branch of South Fork of Punaluu.	do	.6	.4

ISLAND OF MAUI.

SOUTH WAIEHU STREAM NEAR WAILUKU, MAUI.

LOCATION.—Previous to January 18, 1916, 300 feet above intake of South Waiehu ditch, about 3 miles west of Wailuku. On January 18, 1916, the gage was washed out and station was reestablished 500 feet downstream.

RECORDS AVAILABLE.—March 19, 1913, to June 30, 1916.

GAGE.—Vertical staff.

DISCHARGE MEASUREMENTS.—Made by wading.

CHANNEL AND CONTROL.—(New site.) One channel at all stages; straight for 45 feet above gage; bed of stream very rough and steep; banks high and covered with vegetation. Control at both sites composed of boulders and gravel; shifting.

EXTREMES OF DISCHARGE.—Maximum stage recorded during period of record, 6.0 feet at 5 p. m., January 9, 1916 (discharge, determined from extension of rating curve, approximately 150 million gallons per day, or 232 second-feet); minimum

stage recorded, 0.5 foot, July, 1913 (discharge, 1.5 million gallons per day, or 2.3 second-feet).

Minimum stage recorded during year 0.5 feet, August and September (discharge, 4.0 million gallons per day, or 6.2 second-feet).

DIVERSIONS.—A small taro ditch diverts about 0.1 second-foot around station.

REGULATION.—None.

UTILIZATION.—Irrigation of sugar cane and taro.

ACCURACY.—Determinations of discharge July 1 to January 17 fair for low and medium stages, as control was fairly stable during this period; those for April 25 to June 30 poor, as a good rating curve has not been developed at the new site.

Discharge measurements of South Waiehu Stream near Wailuku, Maui, during the year ending June 30, 1916.

Date.	Made by—	Gage height (feet).	Discharge.	
			Second-feet.	Million gallons per day.
Aug. 17	H. A. R. Austin	0.44	5.3	3.4
Dec. 27	C. T. Bailey	.68	8.7	5.6
Apr. 25	H. A. R. Austin	.96	7.9	5.1
May 22	....do	1.02	9.4	6.1

Daily discharge, in million gallons, of South Waiehu Stream near Wailuku, Maui, for the year ending June 30, 1916.

Date.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Apr.	May.	June.
1	5.5	4.5	4.0	5.5	6.0	6.0	5.0	.....	21	5.0
2	5.0	4.2	4.0	9.5	18	5.5	5.0	.....	21	5.0
3	4.5	4.5	4.5	5.5	7.2	5.5	5.0	.....	9 1	5.0
4	5.0	5.0	5.5	4.5	6.0	8.8	5.0	.....	8 4	5.0
5	5.5	5.5	4.2	4.5	6.0	6.0	13	.....	5 6	5.0
6	7.2	5.0	4.5	4.5	5.5	6.0	22	.....	5 0	5.0
7	6.0	5.0	4.5	4.5	5.0	5.5	28	.....	5 0	5.0
8	6.5	4.2	4.2	25	5.0	5.5	52	.....	5 0	5.0
9	6.0	4.5	4.5	4.5	6.0	5.5	100	.....	5 0	5.0
10	5.5	5.0	4.5	4.5	6.0	5.5	13	.....	5.0	5.0
11	5.0	5.0	5.5	5.0	30	5.5	8.8	.....	5 0	5.0
12	5.5	5.5	4.5	4.5	17	4.5	5.5	.....	5.0	5.0
13	5.0	4.5	4.5	4.5	6.0	4.5	5.5	.....	5.0	5.0
14	5.0	4.5	4.5	4.5	5.5	4.5	5.5	.....	5 6	5.6
15	5.0	4.5	4.5	7.2	5.5	5.0	5.5	.....	5 0	5.0
16	6.5	4.5	4.5	5.5	5.5	5.5	5.5	.....	5.0	5.6
17	10	4.2	5.0	4.5	5.0	5.5	52	.....	5 0	5.0
18	6.0	4.5	4.5	9.5	8.8	8.8	.....	.....	5 0	5.0
19	5.0	4.5	4.5	5.0	20	6.5	.....	.....	5 6	5.0
20	5.0	4.5	4.5	4.5	7.2	5.5	.....	.....	5.0	5.0
21	5.0	4.5	4.5	9.5	6.0	5.5	.....	.....	5.0	5.0
22	5.0	4.5	5.0	5.5	5.5	5.0	.....	.....	5.0	5.6
23	4.5	4.5	4.5	5.5	5.5	5.5	.....	.....	5.6	5.6
24	4.5	4.0	5.5	5.0	5.5	5.5	.....	.....	5.0	5.0
25	6.0	4.2	5.5	5.0	6.0	5.5	.....	5.0	5.0	5.0
26	5.0	4.2	5.0	5.5	5.0	5.5	.....	5.0	5.0	5.6
27	4.5	4.5	4.5	5.0	5.0	5.5	.....	31	5.0	5.0
28	4.5	4.5	6.0	16	5.0	5.5	.....	9.1	5.0	5.6
29	4.5	4.5	5.5	25	5.0	5.5	.....	5.0	5.0	5.0
30	4.2	4.2	5.5	7.2	5.0	5.0	.....	5.0	5.6	5.6
31	4.2	4.0	.....	5.5	.....	5.5	.....	.....	5.6	.....

NOTE.—Discharge determined from rating curves applicable as follows: July 1, 1915 to Jan. 17, 1916, fairly well defined below 8 million gallons per day. Apr. 25 to June 30, 1916, poorly defined. Gage heights not recorded Jan. 18 to Apr. 24, 1916.

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Monthly discharge of South Waiehu Stream near Wailuku, Maui, for year ending June 30, 1916.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July	10	4.2	5.37	8.31	167	511
August	5.5	4.0	4.55	7.04	141	433
September	6.0	4.0	4.75	7.35	142	437
October	25	4.5	7.16	11.1	222	681
November	30	5.0	7.82	12.1	235	720
December	8.8	4.5	5.65	8.74	175	538
Jan. 1–17	100	5.0	19.8	30.6	336	1,030
Apr. 25–30	31	5.0	10.0	15.5	60	184
May	21	5.0	6.39	9.89	198	608
June	5.6	5.0	5.14	7.95	154	473

NORTH WAIEHU STREAM NEAR WAILUKU, MAUI.

LOCATION.—Fifty feet above uppermost diversion, 1 mile above Waihee canal crossing and about 2½ miles northwest of Wailuku.

RECORDS AVAILABLE.—July 9, 1912, to December 31, 1915. Gage washed out and station discontinued January 8, 1916.

GAGE.—Vertical staff on right bank.

DISCHARGE MEASUREMENTS.—Made by wading.

CHANNEL AND CONTROL.—One channel at all stages; stream bed very steep and rough; right bank nearly vertical rock wall; left bank high with gentle slope. Control composed of small boulders; shifting.

EXTREMES OF DISCHARGE.—Maximum stage recorded during period of record, 4.08 feet morning of September 6, 1914 (discharge, computed from extension of rating curve, approximately 300 million gallons per day, or 460 second-feet); minimum stage recorded, 1.20 feet March 25 to 31, 1915 (discharge, 1.6 million gallons per day, or 2.5 second-feet).

DIVERSIONS.—None above station.

REGULATION.—None.

UTILIZATION.—Irrigation of sugar cane.

ACCURACY.—Gage read twice daily. Owing to unstable control satisfactory rating curves not developed and estimates poor.

Discharge measurements of North Waiehu Stream near Wailuku, Maui, during the year ending June 30, 1916.

Date.	Made by—	Gage height (feet).	Discharge.	
			Second-feet.	Million gallons per day.
Aug. 17	H. A. R. Austin	1.50	6.5	4.2
Dec. 31	C. T. Bailey	1.53	6.3	4.1

Monthly discharge of North Waiehu Stream near Wailuku, Maui, for year ending June 30, 1916.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July	7.5	3.8	5.29	8.18	164	503
August	5.5	3.8	3.85	5.96	120	366
September	5.5	3.8	4.22	6.53	127	389
October	12	3.8	5.81	8.99	180	553
November	10	3.8	4.44	7.47	133	408
December	16	3.8	5.03	7.78	156	479

NOTE.—Discharge determined from poorly defined rating curve.

WAIHEE STREAM NEAR WAIHEE, MAUI.

LOCATION.—About 300 feet above intake of Waihee canal, 3 miles west of Waihee, and 7 miles northwest of Wailuku.

RECORDS AVAILABLE.—April 1, 1913, to June 30, 1916.

GAGE.—Stevens water-stage recorder installed January 15, 1916, replacing Barrett & Lawrence water-stage recorder. Datum raised 2.0 feet August 18, 1915.

DISCHARGE MEASUREMENTS.—Made by wading or from footbridge 250 feet below gage.

CHANNEL AND CONTROL.—Channel at gage is a pool at foot of low waterfall; banks, mostly of solid rock, steep and high. Control composed of boulders; fairly permanent.

EXTREMES OF DISCHARGE.—Maximum stage recorded during period of record, 9 feet (new datum) estimated from gage-height of flood of January 18, 1916; no estimate of discharge possible; minimum stage recorded, 2.59 feet August 5, 1913 (discharge, 21 million gallons per day, or 32 second-feet).

Minimum stage recorded during year, 0.6 feet September 9 (discharge, 27 million gallons per day, or 42 second-feet).

DIVERSIONS.—None above station.

REGULATION.—Normal flow of stream is increased by development tunnels near headwaters.

UTILIZATION.—Irrigation of sugar cane and taro.

ACCURACY.—Record is broken on account of faulty working of recorder, but as given is good for low and medium stages.

Discharge measurements of Waihee Stream near Waihee, Maui, during the year ending June 30, 1916.

Date.	Made by—	Gage height (feet).	Discharge.	
			Second-feet.	Million gallons per day.
July 13	H. A. R. Austin	2.80	57	37
Sept. 28	do	[a] 1.01	113	73
Mar. 4	R. D. Klise	2.24	65	42
Apr. 11	H. A. R. Austin	2.15	56	36

Daily discharge, in million gallons, of Waihee Stream near Waihee, Maui, for the year ending June 30, 1916.

Date.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	.....	37	29	68	163	41	41	48	.....	36	470	64
2	.....	34	37	124	153	41	41	48	.....	36	410	64
3	.....	90	56	68	215	41	45	44	.....	36	194	70
4	.....	56	34	37	115	.....	62	40	130	36	410	58
5	.....	56	29	.....	76	.....	237	112	76	36	150	64
6	.....	41	29	.....	68	.....	124	48	44	36	257	58
7	.....	37	34	.....	62	.....	56	44	82	36	161	70
8	.....	37	31	.....	83	.....	503	.....	44	36	270	76
9	.....	37	27	.....	90	.....	553	.....	40	36	150	70
10	.....	34	41	.....	115	.....	124	.....	58	44	82	64
11	.....	62	83	.....	115	.....	.....	.....	44	36	70	76
12	.....	56	37	.....	62	.....	.....	.....	48	36	82	58
13	.....	37	29	.....	45	.....	.....	.....	53	36	82	58
14	41	37	34	.....	45	.....	.....	.....	244	40	70	104
15	41	34	34	.....	45	.....	45	.....	96	48	64	112
16	133	36	31	37	45	.....	45	.....	44	36	64	64
17	143	38	.....	34	41	.....	283	.....	40	44	82	58
18	83	41	.....	90	62	.....	.....	.....	40	44	70	70
19	45	37	.....	56	143	.....	.....	.....	44	64	64	58
20	41	41	.....	106	56	.....	70	.....	40	44	82	64
21	41	34	.....	215	62	.....	64	.....	44	70	64	112
22	41	31	.....	41	62	.....	58	.....	48	40	96	82
23	41	41	.....	62	45	37	58	.....	48	70	121	64
24	37	45	.....	37	37	34	58	.....	44	130	70	58
25	90	37	.....	56	90	83	58	.....	48	44	82	70
26	41	34	.....	41	73	98	121	.....	40	36	64	130
27	50	29	.....	41	56	68	58	.....	40	183	64	96
28	34	29	90	153	56	45	53	.....	40	58	70	161
29	50	29	68	124	62	37	53	.....	36	40	70	82
30	41	29	68	76	41	41	53	.....	48	58	58	76
31	37	29	.....	90	.....	41	48	.....	40	.....	70	.....

NOTE.—Discharge determined from rating curves applicable as follows: July 1, 1915, to Jan. 18, 1916, fairly well defined. Jan. 19 to June 30, 1916, well defined below 100 million gallons per day. Gage heights not recorded on days for which discharge is not given. Discharge interpolated Aug. 16 and 17 and Nov. 26.

Monthly discharge of Waihee Stream near Waihee, Maui, for the year ending June 30, 1916.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July 14–31	143	34	57.2	88.5	1,030	3,160
August	90	29	40.2	62.2	1,240	3,820
November	215	37	79.4	123	2,380	7,310
February 1–7	112	40	54.9	84.9	384	1,180
March 4–31	244	36	58.7	90.8	1,640	5,040
April	183	36	50.8	78.6	1,520	4,680
May	470	58	133	206	4,110	12,700
June	161	58	77.0	119	2,310	7,090

HONOKAHAU STREAM NEAR HONOKAHAU, MAUI.

LOCATION.—1,000 feet above intake of Honokahau ditch, about 6 miles southeast of Honokahau.

RECORDS AVAILABLE.—March 6, 1913, to June 30, 1916.

GAGE.—Stevens 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 slopes gently; left bank is vertical wall of rock. Control composed of large boulders; seldom shifts.

EXTREMES OF DISCHARGE.—Maximum stage recorded during period of record, 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, 1.00 foot October 31 and October 6, 1915 (discharge, 10 million gallons per day, or 15.5 second-feet).

DIVERSIONS.—None above station.

REGULATION.—None.

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

ACCURACY.—Discharge July 1 to January 18 ascertained from a well-defined rating curve and continuous gage-height record; good for all stages; results January 19 to June 30 good for low and medium stages and fair for the higher stages.

Discharge measurements of Honokahau Stream near Honokahau, Maui, during the year ending June 30, 1916.

Date.	Made by—	Gage height (feet).	Discharge.	
			Second-feet.	Million gallons per day.
July 19	H. A. R. Austin	1.43	26	17
Aug. 24	.....do	1.42	25	16
Sept. 21	.....do	1.27	19	12
Feb. 13	R. D. Klise	1.93	32	21
Apr. 17	H. A. R. Austin	2.12	46	30
June 11	.....do	2.13	48	31

Daily discharge, in million gallons, of Honokahau Stream near Honokahau, Maui, for the year ending June 30, 1916.

Date.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	49	19	16	42	123	.....	46	19	46	19	405	42
2	18	18	20	49	76	.....	20	19	42	19	259	.....
3	16	49	49	31	176	.....	19	19	26	19	142	.....
4	18	39	26	12	28	26	26	18	56	19	238	.....
5	24	24	14	11	28	26	85	26	56	19	123	.....
6	49	22	14	10	24	117	72	39	22	19	228	.....
7	31	16	19	11	31	31	31	26	49	19	106	.....
8	42	16	13	14	56	22	405	26	24	19	192	46
9	52	14	13	28	22	20	270	24	22	19	100	34
10	20	14	20	19	60	20	85	22	26	28	36	31
11	16	22	39	14	20	20	42	22	22	19	31	49
12	19	31	13	13	20	19	26	22	24	18	36	31
13	20	20	13	13	24	19	22	24	39	18	39	28
14	19	16	.....	20	26	19	22	24	135	18	31	72
15	19	16	.....	24	19	19	22	22	85	31	28	64
16	64	13	.....	13	22	19	20	24	26	19	26	36
17	90	13	.....	31	19	20	95	24	22	26	39	31
18	39	19	.....	42	72	42	238	24	22	31	34	36
19	18	18	.....	68	49	52	142	24	26	49	34	24
20	16	19	.....	123	31	42	34	24	22	31	46	26
21	16	14	.....	20	49	36	26	24	26	56	31	72
22	16	13	22	39	34	72	24	24	39	22	52	56
23	16	14	14	22	.....	22	22	24	39	49	76	28
24	16	28	49	26	.....	20	22	24	24	72	34	24
25	52	24	31	19	.....	19	20	24	.....	31	52	39
26	22	18	36	24	.....	90	39	24	.....	24	31	90
27	34	16	31	90	.....	64	26	36	.....	106	28	56
28	18	16	64	60	.....	28	19	24	.....	36	34	123
29	18	16	60	46	.....	22	19	24	19	26	39	39
30	19	16	52	34	.....	20	19	.....	24	34	26	42
31	16	16	.....	56	.....	24	19	.....	20	.....	31	.....

NOTE.—Daily discharge determined from rating curves applicable as follows: July 1, 1915, to Jan. 18, 1916, well defined; Jan. 19 to June 30, 1916, fairly well defined. Gage heights not recorded on days for which discharge is not given.

Monthly discharge of Honokahau Stream near Honokahau, Maui, for year ending June 30, 1916.

Month.	Discharge.				Run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July	90	16	29.0	44.9	900	2,760
August	49	13	19.6	30.3	609	1,860
October	123	10	33.0	51.1	1,020	3,140
November 1–22	176	19	45.9	71.0	1,010	3,100
December 4–31	117	19	33.9	52.5	950	2,910
January	405	19	63.8	98.7	1,980	6,070
February	39	18	24.1	37.3	700	2,140
April	106	18	30.5	47.2	915	2,810
May	405	26	84.1	130	2,610	8,000

HONOLUA STREAM NEAR HONOKAHAU, MAUI.

LOCATION.—300 feet above Honokahau ditch crossing, about 2 miles south of Honokahau.

RECORDS AVAILABLE.—March 12, 1913, to June 30, 1916.

GAGE.—Vertical staff on right bank.

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. Stream bed very rough and on steep grade; right bank high and nearly vertical; left bank high with gentle slope. Control composed of large boulders; shifts during floods.

EXTREMES OF DISCHARGE.—Maximum stage recorded during period of record, 4.2 feet at 6 p. m. January 9, 1916 (discharge, computed from extension of rating curve, approximately 200 million gallons per day, or 309 second-feet); minimum stage recorded, 0.25 foot October 23 and 24, 1913 (discharge, 0.15 million gallons per day, or 0.25 second-foot).

Minimum stage recorded during year, 0.75 foot, February 25–26 (discharge, 0.3 million gallons per day, or 0.46 second-foot).

DIVERSIONS.—None above station.

REGULATION.—None.

UTILIZATION.—Normal flow is diverted by Honokahau ditch for irrigation of sugar cane.

ACCURACY.—Discharge July 1 to January 18 ascertained from fairly well defined rating curve and a reliable gage-height record of two readings daily; results fair for all stages. Several shifts in control; during remainder of year rating curves poorly defined; determinations only approximate for this period.

Discharge measurements of Honolua Stream near Honokahau, Maui, during the year ending June 30, 1916.

Date.	Made by—	Gage height (feet).	Discharge.	
			Second-feet.	Million gallons per day.
July 19	H. A. R. Austin	0.84	3.6	2.3
Aug. 24	R. D. Klise	.56	.95	.6
Feb. 13	....do	.99	2.0	1.3
Apr. 17	H. A. R. Austin	.79	2.2	1.4
June 11	....do	1.31	9.0	5.8

Daily discharge, in million gallons, of Honolua Stream near Honokahau, Maui, for the year ending June 30, 1916.

Date.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	4.7	1.0	0.5	18	24	11	9.2	2.3	0.4	1.4	60	3.0
2	2.3	1.8	.4	11	50	11	5.7	2.3	1.8	1.4	50	3.0
3	1.0	6.8	3.8	14	26	6.8	5.7	1.8	1.4	1.0	40	3.0
4	.7	9.2	8.0	3.8	42	22	6.8	1.8	1.4	1.0	53	3.0
5	1.8	3.0	1.8	2.3	15	9.2	40	3.0	16	1.0	2?	3.0
6	16	5.7	1.0	1.8	12	55	28	12	1.8	1.0	40	2.3
7	15	1.8	1.4	1.4	9.2	14	11	6.8	3.8	1.0	2'	1.4
8	2.3	1.4	1.0	1.0	12	8.0	139	4.7	2.3	.7	42	3.0
9	16	1.0	.7	11	20	6.8	160	3.8	.7	.7	33	3.0
10	5.7	1.0	.7	16	11	6.8	55	1.8	1.8	1.4	12	2.3
11	2.3	1.0	20	3.8	16	5.7	26	1.4	1.0	1.0	9.2	3.0
12	1.8	6.8	5.7	1.8	9.2	4.7	15	1.4	.4	.7	9.2	3.0
13	1.8	16	2.3	1.4	9.2	4.7	12	1.4	11	.7	12	3.0
14	1.4	1.4	1.0	1.4	9.2	4.7	11	1.4	75	.7	8.0	3.0
15	1.4	1.0	.7	11	9.2	4.7	11	1.0	47	3.8	5.7	3.0
16	9.2	1.0	.5	4.7	9.2	4.7	9.2	1.0	11	1.8	4.7	3.8
17	18	1.0	1.4	1.4	8.0	4.7	14	.7	6.8	1.8	4.7	3.8
18	16	2.3	.7	18	5.7	20	84	.7	4.7	8.0	4.7	3.0
19	3.8	1.0	.5	9.2	44	16	32	.7	4.7	12	4.7	2.3
20	2.3	5.7	3.0	22	12	9.2	14	.5	3.0	8.0	.7	1.4
21	1.8	2.3	.4	28	18	12	8.0	.5	3.0	20	3.0	4.7
22	1.4	1.0	.4	5.7	26	28	5.7	.4	8.0	3.0	8.0	4.7
23	1.4	.7	1.4	11	12	6.8	5.7	.4	9.2	4.7	3.8	3.8
24	1.0	2.3	9.2	6.8	8.0	4.7	4.7	.4	4.7	16	4.7	1.4
25	5.7	5.7	8.0	4.7	9.2	8.0	4.7	.3	8.0	8.0	4.7	3.0
26	3.0	1.8	9.2	3.8	6.8	37	5.7	.3	3.0	3.0	3.8	.11
27	5.7	1.0	9.2	4.7	8.0	20	5.7	1.8	3.0	20	3.0	5.7
28	2.3	.7	24	30	15	9.2	4.7	.7	2.3	14	3.0	12
29	1.8	.5	14	26	6.8	9.2	3.0	.4	1.8	6.8	3.8	5.7
30	3.0	.5	18	15	5.7	6.8	3.0	.....	1.4	6.8	3.0	5.7
31	1.4	.5	.....	15	.....	15	2.3	.....	1.4	.....	2.3	.....

NOTE.—Discharge determined from rating curves applicable as follows: July 1, 1915, to Jan. 18, 1916, fairly well defined. Jan. 19 to Mar. 14 and May 1 to June 30, 1916, poorly defined; Mar. 15 to Apr. 30, 1916, poorly defined.

Monthly discharge of Honolua Stream near Honokahau, Maui, for the year ending June 30, 1916.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July	18	0.7	4.90	7.58	152	466
August	16	.5	2.80	4.33	87	266
September	24	.4	4.96	7.67	149	457
October	30	1.0	9.86	15.3	306	938
November	50	5.7	15.6	24.1	468	1,440
December	55	4.7	12.5	19.3	386	1,190
January	160	2.3	23.9	37.00	742	2,270
February	12	.3	1.92	2.97	56	171
March	75	.4	7.80	12.1	242	742
April	20	.7	5.05	7.81	151	465
May	60	.7	15.9	24.6	493	1,510
June	12	1.4	3.80	5.88	114	350
The year	160	.3	9.14	14.1	3,350	10,300

HONOKAWAI STREAM NEAR LAHAINA, MAUI.

LOCATION.—500 feet below confluence with Amalu Stream, about 8 miles northeast of Lahaina.

RECORDS AVAILABLE.—May 13, 1913, to June 30, 1916.

GAGE.—Vertical staff on right bank.

DISCHARGE MEASUREMENTS.—Made by wading or from footbridge 150 feet below gage.

CHANNEL AND CONTROL.—One channel at all stages; filled with large boulders and very rough; very narrow at gage. Control a rock ledge; probably permanent.

EXTREMES OF DISCHARGE.—Maximum stage recorded during period of record, 5.9 feet at 3 p. m. January 8, 1916 (discharge, computed from extension of rating curve, approximately 150 million gallons per day, or 232 second-feet); stream occasionally dry.

Minimum stage recorded during year, 0.95 foot August 17 and December 14 and 15 (discharge, 0.1 million gallons per day, or 0.15 second-foot).

DIVERSIONS.—Most of the normal flow is diverted into Honokawai ditch half a mile above gage.

REGULATION.—Natural flow of stream is increased by a development tunnel a short distance above intake of Honokawai ditch.

UTILIZATION.—Irrigation of sugar cane and taro.

ACCURACY.—Discharge ascertained from rating curve well defined below 40 million gallons per day and a gage-height record of two readings daily; results fair except for flood stages.

The following discharge measurement was made by H. A. R. Austin.

August 25, 1915: Gage height, 1.12 feet; discharge, 0.15 second-foot.

Daily discharge, in million gallons, of Honokowai Stream near Lahaina, Maui, for the year ending June 30, 1916.

Date.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	16	0.7	0.2	5.3	19	0.4	0.2	0.4	0.2	0.2	15	3.4
2	.4	.2	.2	1.2	25	1.4	.2	.4	2.3	.2	48	1.7
3	.2	8.4	6.4	2.6	66	.3	.4	.2	.4	.2	29	23
4	.2	5.8	1.7	.3	17	3.9	26	.2	.3	.2	84	1.4
5	.6	.3	.2	.2	4.8	.2	14	.2	17	.2	30	.4
6	5.8	.7	.2	.2	2.3	30	.6	1.7	.6	.2	110	.2
7	1.0	.2	.2	.2	1.7	1.4	112	1.2	9.0	.2	34	.2
8	.3	.2	.2	.2	28	.2	104	.7	3.0	.2	32	3.9
9	17	.2	.2	.2	2.6	.2	13	.4	.4	.2	32	.6
10	.6	.2	.2	1.4	.6	.2	5.8	.4	.4	3.0	12	.7
11	.3	.2	28	1.0	8.4	.2	1.7	.4	.4	.4	3.0	2.3
12	.2	1.4	2.3	.2	.4	.2	.4	.3	.4	.2	1.0	1.7
13	.3	.4	.3	.2	.3	.2	.4	.3	5.8	.2	2.0	.7
14	.2	.2	.2	.2	8.4	.1	.2	.6	34	.2	1.0	25
15	.2	.2	.2	5.8	1.4	.1	.2	.7	40	8.4	.4	1.4
16	17	.2	.2	.3	.4	.3	1.7	.4	1.4	1.2	.3	1.2
17	10	.1	.2	.2	.3	.2	60	4.4	.6	.3	5.3	.3
18	4.4	.7	.2	4.8	.2	1.2	35	3.9	.3	5.8	5.3	3.9
19	.3	.2	.2	15	20	11	3.0	.2	.2	7.8	3.0	.7
20	.2	1.0	.2	41	2.3	1.0	3.0	.2	.2	7.8	7.1	1.0
21	.2	.2	.2	8.4	2.3	12	1.2	.3	.6	21	2.0	10
22	.2	.2	.7	.3	4.4	8.4	.4	.2	7.8	.6	3.9	24
23	.2	.2	.2	21	.4	.3	.4	.3	7.8	17	15	2.3
24	3.0	.4	8.4	.7	.2	.2	.4	1.0	.6	9.7	2.6	.2
25	.3	.7	4.4	3.9	1.0	.2	.3	1.2	8.4	3.0	6.4	5.3
26	16	.2	6.4	4.8	.2	41	2.0	.2	.4	.3	.7	29
27	.2	.2	7.1	.6	.2	23	.6	5.8	.2	22	.3	9.7
28	.2	.2	5.8	19	1.0	1.2	.6	.4	.2	12	5.3	24
29	.2	.2	3.4	9.7	.2	1.0	.7	.2	.2	3.0	12	5.3
30	.2	.2	4.8	3.4	.2	.2	.6	.....	.2	1.0	.6	10
31	.2	.2	.....	2.6	.....	.6	.5	.....	.3	.....	1.4	.....

NOTE.—Discharge determined from a rating curve well defined below 40 million gallons per day.

Monthly discharge of Honokawai Stream near Lahaina, Maui, for year ending June 30, 1916.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July	17	0.2	3.10	4.80	96	295
August	8.4	.1	.79	1.22	24	75
September	28	.2	2.77	4.29	83	255
October	41	.2	5.00	7.74	155	476
November	66	.2	7.31	11.3	219	673
December	41	.1	4.54	7.02	141	432
January	112	.2	13.0	20.1	390	1,200
February	5.8	.2	.92	1.42	27	82
March	40	.2	4.63	7.16	144	440
April	22	.2	4.22	6.53	127	389
May	110	.3	16.3	25.2	505	1,550
June	29	.2	6.45	9.98	194	594
The year	112	.1	5.74	8.88	2,100	6,460

HONOKAWAI DITCH NEAR LAHAINA, MAUI.

LOCATION.—250 feet below junction with Amalu wooden flume, 1,000 feet below intake, 2 miles above Pioneer Mill Co.'s power house, and about 7 miles northeast of Lahaina.

RECORDS AVAILABLE.—July 1, 1912, to June 30, 1916.

GAGE.—A graduated rod which the observer places in center of flume at each reading.

DISCHARGE MEASUREMENTS.—Made in flume near gage.

CHANNEL AND CONTROL.—Semicircular galvanized-iron flume 3 feet in diameter; straight for 100 feet above and below gage; flume is clean and uniform in section and grade. Stage-discharge relation stable.

EXTREMES OF DISCHARGE.—Maximum stage recorded during period of record, 1.67 feet August 12, 1913 (discharge, 15 million gallons per day, or 23 second-feet); minimum stage recorded, 0.80 foot May 15, 1913 (discharge, 2.4 million gallons per day, or 3.8 second-feet).

Maximum stage recorded during year, 1.45 feet April 27 and June 21 and 26; (discharge, 9.0 million gallons per day, or 14 second-feet); minimum stage recorded 0.95 foot August, September, October, and December (discharge, 3.6 million gallons per day, or 5.6 second-feet).

DIVERSIONS.—Ditch diverts all low-water flow from Honokawai and Amalu streams.

REGULATION.—Flow controlled by head gates.

UTILIZATION.—Power development and irrigation of sugar cane.

ACCURACY.—Gage read twice daily. Determinations fair for all stages. Great care has to be taken in making measurements on account of slope of flume, but a fairly good rating curve has been developed. Because of the uniform conditions the extension of the rating curve probably good.

Discharge measurements of Honokawai ditch near Lahaina, Maui, during the year ending June 30, 1916.

Date.	Made by—	Gage height (feet).	Discharge.	
			Second-feet.	Million gallons per day.
Aug. 25	H. A. R. Austin	1.13	8.5	5.5
Jan. 5	C. T. Bailey	1.15	8.2	5.3

Daily discharge, in million gallons, of Honokawai ditch near Lahaina, Maui, for the year ending June 30, 1916.

Date.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	7.2	5.0	3.6	7.2	7.2	5.0	4.0	4.0	5.0	6.0	7.2	8.4
2	5.0	4.0	3.6	6.0	6.0	6.0	4.0	4.0	7.2	6.0	7.2	7.8
3	4.5	5.5	7.2	7.2	6.0	4.0	5.5	4.0	6.0	6.0	6.6	8.4
4	4.0	6.6	6.0	4.0	5.0	6.0	6.6	4.0	6.0	6.0	7.2	7.2
5	5.5	5.0	4.0	4.0	5.0	4.0	5.0	4.0	7.2	6.0	6.6	6.0
6	6.0	6.0	3.6	4.0	5.0	7.2	5.0	5.0	6.0	6.0	6.0	6.0
7	6.0	4.0	3.6	4.0	5.0	6.0	6.6	5.0	6.0	6.0	4.0	6.0
8	4.5	4.0	3.6	3.6	6.0	4.0	6.0	5.0	6.0	6.0	4.0	8.4
9	6.6	4.0	3.6	3.6	5.5	4.0	6.6	4.5	5.5	6.0	5.0	6.0
10	5.0	4.0	3.6	6.0	5.0	4.0	5.0	4.5	5.5	7.8	6.0	7.2
11	4.0	4.0	7.2	6.6	6.0	4.0	5.0	4.5	6.0	6.6	5.0	7.2
12	4.0	5.5	6.0	4.0	5.0	4.0	5.0	4.0	5.5	6.0	6.6	7.8
13	4.5	5.0	4.0	4.0	4.0	4.0	5.0	4.0	6.0	6.0	7.2	7.2
14	4.0	4.0	4.0	4.0	6.0	3.6	4.5	4.5	7.2	6.0	6.6	7.2
15	4.5	4.0	4.0	5.5	6.0	3.6	4.0	4.5	7.2	7.2	6.0	8.4
16	7.2	3.6	3.6	4.0	5.5	3.6	4.5	4.5	6.6	7.2	6.6	7.2
17	6.6	3.6	3.6	4.0	5.0	4.0	6.0	4.5	6.0	6.6	6.6	6.0
18	6.0	5.5	3.6	6.0	4.0	7.2	5.5	4.0	6.0	7.2	7.2	7.2
19	5.0	4.0	3.6	7.2	7.2	7.2	4.0	4.0	6.0	7.2	7.8	6.0
20	4.5	5.5	3.6	7.2	7.2	7.2	4.0	4.0	5.5	7.2	8.4	7.2
21	4.0	5.5	3.6	7.2	6.6	7.2	4.5	5.0	7.2	8.4	7.2	9.0
22	4.0	4.0	5.0	4.5	6.6	7.2	4.5	5.0	7.2	7.2	8.4	8.4
23	4.0	4.0	4.6	7.2	5.0	4.0	4.5	5.0	7.2	8.4	8.4	7.8
24	4.0	4.5	7.2	5.0	4.0	4.0	4.5	4.0	6.0	7.8	8.4	6.0
25	6.0	5.0	6.0	6.6	5.0	4.0	4.5	4.0	7.2	7.2	7.8	8.4
26	5.0	5.0	7.2	6.0	4.0	4.5	5.0	5.0	6.0	6.6	7.2	9.0
27	6.6	4.0	7.2	4.5	4.0	4.0	4.5	6.6	6.0	9.0	7.2	8.4
28	5.0	4.0	6.0	7.2	5.0	4.0	4.0	5.5	5.5	7.2	6.6	8.4
29	4.0	3.6	7.2	7.2	4.0	4.0	.....	5.0	5.5	6.6	8.4	7.2
30	4.0	3.6	6.6	7.2	4.0	4.0	4.0	.....	6.0	6.0	6.6	8.4
31	4.0	3.6	.....	7.2	.....	4.5	.....	.....	6.0	.....	7.8	.....

NOTE.—Discharge determined from fairly well defined rating curve. Ditch broken Jan. 29. No record Jan. 31.

Monthly discharge of Honokawai ditch near Lahaina, Maui, for the year ending June 30, 1916.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July	7.2	4.0	5.01	7.75	155	477
August	6.6	3.6	4.50	6.96	140	428
September	7.2	3.6	4.87	7.53	146	448
October	7.2	3.6	5.55	8.59	172	528
November	7.2	4.0	5.33	8.25	160	491
December	7.2	3.6	4.84	7.49	150	460
February	6.6	4.0	4.54	7.02	132	404
March	7.2	5.0	6.20	9.59	192	590
April	9.0	6.0	6.78	10.5	203	624
May	8.4	4.0	6.83	10.6	212	650
June	9.0	6.0	7.46	11.5	224	687

KAHOMA STREAM NEAR LAHAINA, MAUI.

LOCATION.—About 125 feet above intake of Pioneer Mill Co.'s upper ditch, 3½ miles east of Lahaina.

RECORDS AVAILABLE.—August 3, 1911, to June 30, 1916.

GAGE.—Vertical staff on left bank.

DISCHARGE MEASUREMENTS.—Made by wading or from foot bridge at gage.

CHANNEL AND CONTROL.—Channel at gage is a pool at foot of rapids; right bank high and wooded; left bank a vertical wall of rock. Control composed of large and small boulders; fairly permanent.

EXTREMES OF DISCHARGE.—Maximum stage recorded during period of record, 8.5 feet at 7 a. m. January 18, 1916 (discharge, estimated from extension of rating curve, 700 million gallons per day, or 1,080 second-feet); stream frequently dry.

Minimum stage recorded during year, 0.95 foot August, September, and October (discharge, 2.0 million gallons per day, or 3.1 second-feet).

DIVERSIONS.—None above station at present. Before November 24, 1914, the minimum flow of the stream and water from Kahoma development tunnel was diverted above station; since that date all water passes the gage.

REGULATION.—Normal flow of the stream is largely increased by a development tunnel about 300 feet above station.

UTILIZATION.—Irrigation of sugar cane.

ACCURACY.—Gage read twice daily. Results fair for ordinary stages. Extension of rating curve not confirmed by measurements; estimates above 30 million gallons per day approximate only.

Discharge measurements of Kahoma Stream near Lahaina, Maui, during the year ending June 30, 1916.

Date.	Made by—	Gage height (feet).	Discharge.	
			Second-feet.	Million gallons per day.
July 22	H. A. R. Austin	0.98	3.6	2.3
Aug. 26	do	1.01	3.9	2.5
Jan. 4	C. T. Bailey	1.08	5.4	3.5
Feb. 2	G. K. Larrison	1.18	5.4	3.5
5	do	1.18	5.6	3.6
May 26	H. A. R. Austin	1.28	8.4	5.4

Daily discharge, in million gallons, of Kahoma Stream near Lahaina, Maui, for the year ending June 30, 1916.

Date.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	21	2.5	2.0	12	36	2.5	2.5	4.5	5.5	5.5	67	10
2	3.5	15	4.5	5.5	36	6.5	2.5	3.5	9.0	5.5	63	9.0
3	2.5	39	15	5.5	154	3.5	2.5	3.5	6.5	5.5	2[illegible]	48
4	2.5	10	4.5	3.5	23	7.8	2.5	3.5	36	5.5	117	9.0
5	2.6	3.5	2.5	2.5	6.5	2.5	28	3.5	19	5.5	140	9.0
6	9.0	3.5	2.5	2.5	6.5	36	26	3.5	5.5	5.5	135	5.5
7	2.6	2.5	2.5	2.5	3.5	5.5	5.5	7.8	19	5.5	7[illegible]	4.5
8	36	2.1	2.0	2.0	63	3.5	126	5.5	6.5	5.5	33	9.0
9	10	2.1	2.0	5.5	7.8	2.5	214	4.5	6.5	5.5	17	5.5
10	3.5	13	5.5	5.5	3.5	2.5	33	4.5	5.5	9.0	6.5	5.5
11	9.0	36	21	17	21	2.5	12	4.5	5.5	5.5	5.5	12
12	2.5	4.5	4.5	2.5	4.5	2.5	6.5	4.5	5.5	5.5	4.5	7.8
13	2.5	15	2.5	2.5	3.5	2.5	3.5	4.5	12	5.5	4.5	6.5
14	2.5	2.5	2.0	2.5	5.5	2.5	2.5	4.5	59	9.0	4.5	12
15	2.5	2.1	2.0	5.5	7.8	2.5	2.5	4.5	28	9.0	4.5	17
16	10	2.0	2.0	2.5	6.5	2.5	2.5	4.5	6.5	6.5	4.5	5.5
17	28	2.0	2.0	2.5	5.5	2.5	10	4.5	5.5	3.8	16	7.8
18	5.5	6.5	2.0	23	2.5	7.8	662	4.5	5.5	19	21	6.5
19	2.5	5.5	2.0	30	12	28	71	4.5	9.0	17	10	5.5
20	2.5	4.5	2.0	45	7.8	12	9.0	4.5	6.5	12	30	10
21	2.5	2.1	2.0	10	21	15	9.0	6.5	7.8	33	10	19
22	2.5	2.1	4.5	4.5	12	13	7.8	5.5	12	5.5	12	39
23	2.3	2.1	2.5	21	4.5	3.5	4.5	5.5	26	17	30	6.5
24	2.3	2.5	6.5	3.5	3.5	2.5	3.5	5.5	6.5	13	6.5	5.5
25	33	4.5	6.5	9.0	2.5	19	3.5	5.5	5.5	6.5	30	9.0
26	3.5	2.5	21	23	2.5	28	67	5.5	5.5	4.5	6.5	63
27	9.0	2.5	21	15	2.5	21	6.5	10	5.5	108	5.5	39
28	3.5	2.0	26	21	2.5	33	6.5	5.5	5.5	10	6.5	52
29	2.5	2.0	71	19	3.5	3.5	4.5	5.5	5.5	6.5	12	15
30	2.5	2.0	12	13	3.5	3.5	4.5	.....	5.5	5.5	5.5	19
31	2.2	2.0	.....	10	.....	3.5	3.5	.....	5.5	.....	23	.....

NOTE.—Discharge determined from rating curves applicable as follows: July 1, 1915, to Jan. 18, 1916, well defined below 20 million gallons per day. Jan. 19 to June 30, 1916, fairly well defined below 20 million gallons per day. Discharge July 3, 5, 7, 23, 24, and 31, Aug. 8, 9, 15, 21, 23, and Apr. 17 were taken from weir record at Kahoma development tunnel just above station. This weir measures total flow of station at very low stages.

Monthly discharge of Kahoma Stream near Lahaina, Maui, for year ending June 30, 1916.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July	36	2.2	7.31	11.3	226	695
August	39	2.0	6.45	9.98	200	614
September	71	2.0	8.60	13.3	258	792
October	45	2.0	10.6	16.4	329	1,010
November	154	2.5	15.8	24.4	474	1,450
December	36	2.5	9.15	14.2	284	870
January	662	2.5	43.4	67.1	1,340	4,130
February	10	3.5	4.98	7.71	144	443
March	59	5.5	11.4	17.6	353	1,080
April	108	3.8	12.0	18.6	361	1,100
May	140	4.5	30.2	46.7	936	2,870
June	63	4.5	15.8	24.4	473	1,450
The year	662	2.0	14.7	22.7	5,380	16,500

KAHOMA DEVELOPMENT TUNNEL NEAR LAHAINA, MAUI.

LOCATION.—At portal of the lower of two development tunnels of Pioneer Mill Co., 3½ miles east of Lahaina.

RECORDS AVAILABLE.—August 1, 1911, to June 30, 1916.

GAGE.—Vertical staff.

DISCHARGE MEASUREMENTS.—A 4-foot sharp-crested weir with end contractions measures discharge from development tunnel and amount diverted from stream by small pipe; measurements checked by current meter.

CHANNEL AND CONTROL.—Deep pool at weir confined by rock and concrete walls.

EXTREMES OF DISCHARGE.—Maximum discharge during periods of record, 6.5 million gallons per day, or 10 second-feet, August, 1911; minimum discharge, 1.7 million gallons per day, or 2.6 second-feet.

DIVERSIONS.—Small amount diverted from Kahoma Stream also passes over weir.

REGULATION.—None.

UTILIZATION.—Irrigation of sugar cane.

ACCURACY.—Results good. No velocity of approach; conditions good at weir. Gage read twice daily.

Daily discharge, in million gallons, of Kahoma development tunnel near Lahaina, Maui, for the year ending June 30, 1916.

Date.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	2.5	2.2	2.0	1.9	1.7	1.7	1.9	3.0	3.6	3.9	3.5	2.9
2	2.5	2.2	2.0	1.9	1.7	1.7	2.0	3.0	3.6	3.9	3.5	2.9
3	2.5	2.2	2.0	1.9	1.7	1.7	2.1	3.0	3.7	3.9	3.5	2.9
4	2.5	2.2	2.0	1.8	1.7	1.7	2.1	3.0	3.7	3.9	3.4	2.9
5	2.6	2.2	2.0	1.8	1.7	1.7	2.1	3.1	3.7	3.9	3.4	2.9
6	2.6	2.2	2.0	1.8	1.7	1.7	2.2	3.1	3.8	3.9	3.4	2.9
7	2.6	2.2	2.0	1.8	1.7	1.7	2.2	3.1	3.8	3.9	3.4	2.9
8	2.6	2.1	2.0	1.8	1.7	1.7	2.2	3.1	3.8	3.9	3.4	2.9
9	2.4	2.1	2.0	1.8	1.7	1.7	2.3	3.2	3.8	3.9	3.3	2.9
10	2.3	2.1	2.0	1.8	1.7	1.7	2.4	3.2	3.8	3.9	3.3	2.9
11	2.3	2.1	2.0	1.8	1.7	1.7	2.5	3.2	3.8	3.9	3.3	2.9
12	2.3	2.1	2.0	1.8	1.7	1.7	2.5	3.2	3.8	3.9	3.3	2.9
13	2.3	2.1	2.0	1.8	1.7	1.7	2.5	3.2	3.8	3.8	3.2	3.0
14	2.3	2.1	2.0	1.8	1.7	1.7	2.5	3.3	3.8	3.8	3.2	3.0
15	2.3	2.1	1.9	1.8	1.7	1.8	2.5	3.3	3.8	3.8	3.2	3.0
16	2.3	2.0	1.9	1.8	1.7	1.8	2.5	3.3	3.9	3.8	3.2	3.0
17	2.3	2.0	1.9	1.8	1.7	1.8	2.5	3.3	3.9	3.8	3.1	3.0
18	2.3	2.0	1.9	1.8	1.7	1.8	2.5	3.4	3.9	3.8	3.1	3.0
19	2.3	2.1	1.9	1.8	1.7	1.8	2.5	3.4	3.9	3.8	3.1	3.1
20	2.3	2.1	1.9	1.8	1.7	1.8	2.5	3.4	3.9	3.7	3.1	3.1
21	2.3	2.1	1.9	1.8	1.7	1.8	2.5	3.4	3.9	3.7	3.1	3.1
22	2.3	2.1	1.9	1.8	1.7	1.8	2.5	3.4	3.9	3.6	3.0	3.1
23	2.3	2.1	1.9	1.8	1.7	1.8	2.6	3.4	3.9	3.5	3.0	3.1
24	2.3	2.1	1.9	1.8	1.7	1.8	2.6	3.5	3.9	3.5	3.0	3.2
25	2.3	2.1	1.9	1.8	1.7	1.8	2.7	3.5	3.9	3.5	3.0	3.2
26	2.3	2.1	1.9	1.8	1.7	1.8	2.7	3.5	3.9	3.5	3.0	3.2
27	2.3	2.0	1.9	1.8	1.7	1.8	2.8	3.5	3.9	3.5	3.0	3.2
28	2.3	2.0	1.9	1.8	1.7	1.9	2.8	3.5	3.9	3.5	3.0	3.2
29	2.3	2.0	1.9	1.8	1.7	1.9	2.9	3.5	3.9	3.5	3.0	3.2
30	2.2	2.0	1.9	1.8	1.7	1.9	2.9	.....	3.9	3.5	3.0	3.2
31	2.2	2.0	.....	1.8	.....	1.9	2.9	.....	3.9	.....	3.0	.....

Monthly discharge of Kahoma development tunnel near Lahaina, Maui, for the year ending June 30, 1916.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July	2.6	2.2	2.36	3.65	73	225
August	2.2	2.0	2.10	3.25	65	200
September	2.0	1.9	1.95	3.02	58	180
October	1.9	1.8	1.81	2.80	56	172
November	1.7	1.7	1.70	2.63	51	157
December	1.9	1.7	1.77	2.74	55	168
January	2.9	1.9	2.46	3.81	76	234
February	3.5	3.0	3.28	5.08	95	292
March	3.9	3.6	3.83	5.93	119	364
April	3.9	3.5	3.75	5.80	112	345
May	3.5	3.0	3.19	4.94	99	303
June	3.2	2.9	3.02	4.67	91	278
The year	3.9	1.7	2.60	4.02	950	2,920

LAHAINALUNA STREAM NEAR LAHAINA, MAUI.

LOCATION.—200 feet above Pioneer Mill Co.'s upper ditch intake, a quarter of a mile above Lahianaluna School, and about 1½ miles northeast of Lahaina.

RECORDS AVAILABLE.—August 1, 1911, to January 8, 1916, when gage was washed out and station discontinued.

GAGE.—Vertical staff on right bank installed May 7, 1913. Prior to May 7, 1913, vertical staff 200 feet below present site.

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

CHANNEL AND CONTROL.—One channel at all stages; straight for 50 feet above and below gage; bed of stream very rough; banks high. Control composed of boulders and gravel; fairly permanent between extreme floods.

EXTREMES OF DISCHARGE.—Maximum stage recorded during period of record, 4.0 feet at 4 p. m. November 3, 1915 (discharge, approximately 180 million gallons per day, or 278 second-feet); minimum stage recorded, 0.5 foot September 6, 1915 (discharge, 0.2 million gallons per day, or 0.3 second-foot).

DIVERSIONS.—Most of the normal flow of the stream is diverted into Lahainaluna ditch about a mile above the station.

REGULATION.—Amount diverted above varies.

UTILIZATION.—Water diverted above station is used for domestic supply, power purposes, and irrigation; water passing gage is diverted for irrigation of sugar cane and taro.

ACCURACY.—Gage read twice daily. Rating curve well defined throughout; results good.

Discharge measurements of Lahainaluna Stream near Lahaina, Maui, during the year ending June 30, 1916.

Date.	Made by—	Gage height (feet).	Discharge.	
			Second-feet.	Million gallons per day.
July 1	H. A. R. Austin	0.58	0.4	0.25
Aug. 25	....do	.66	1.5	.95
Jan. 4	C. T. Bailey	1.07	3.1	2.0

Daily discharge, in million gallons, of Lahainaluna Stream near Lahaina, Maui, for the year ending June 30, 1916.

Date.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.
1	7.1	0.4	0.6	6.4	12	1.3	1.3
2	.9	.35	.4	.6	44	2.5	1.3
3	.6	2.5	8.8	1.6	88	1.3	1.3
4	1.3	1.6	1.3	.5	33	2.2	1.3
5	1.3	.4	.5	.4	2.2	1.8	30
6	2.5	.9	.2	4	2.2	8.8	3.8
7	.6	.4	.4	.4	1.1	2.5	1.6
8	.5	.3	.3	.5	33	.9	79
9	3.3	.3	.4	.5	4.4	.75	.....
10	.6	.4	2.5	1.8	1.1	.75	.....
11	.5	.9	1.8	11	18	.6	.....
12	.4	.6	1.3	.4	1.3	.4	.....
13	.4	.4	.4	.4	.9	.5	.....
14	.3	.4	.4	.6	4.4	.5	.....
15	.35	.4	.4	2.5	1.3	.5	.....
16	1.1	.4	.4	.5	2.2	.5	.....
17	1.3	.6	.3	.5	1.6	.5	.....
18	3.3	3.3	.25	3.8	1.1	2.9	.....
19	.35	.4	.5	3.3	5.7	33	.....
20	.3	.4	.4	38	2.2	12	.....
21	.3	.6	.4	4.4	3.3	22	.....
22	.3	.4	.4	.75	6.4	7.1	.....
23	.35	.5	.5	3.8	1.3	.9	.....
24	.4	.9	5.7	.6	.9	1.3	.....
25	.75	.9	3.3	.6	1.3	1.8	.....
26	.9	.4	9.9	8.8	.9	41	.....
27	1.6	.3	15	.75	.9	50	.....
28	.6	.25	8.8	17	.9	8.8	.....
29	.4	.4	5.7	28	1.6	1.6	.....
30	.35	.6	3.3	24	1.3	1.3	.....
31	.4	.6	.....	17	.....	1.3	.....

NOTE.—Discharge determined from well-defined rating curve.

Monthly discharge of Lahainaluna Stream near Lahaina, Maui, for year ending June 30, 1916.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July	7.1	0.3	1.08	1.67	33	103
August	3.3	.25	.68	1.05	21	65
September	15	.2	2.48	3.84	75	228
October	38	.4	5.80	8.97	180	552
November	88	.9	9.28	14.4	278	854
December	50	.4	6.82	10.6	211	649
January 1–8	79	1.3	15.0	23.2	120	368

KAUAULA STREAM NEAR LAHAINA, MAUI.

LOCATION.—350 feet above Kauaula ditch intake, about 3 miles east of Lahaina.

RECORDS AVAILABLE.—March 7, 1912, to June 30, 1916.

GAGE.—Vertical staff installed April 20, 1916, to replace vertical staff installed April 29, 1913, and washed out January 18. Old gage was 250 above present location.

DISCHARGE MEASUREMENTS.—Made by wading or from footbridge.

CHANNEL AND CONTROL.—One channel at all stages; straight for 100 feet above and below station; stream bed composed of boulders and coarse gravel; right bank slopes gently; left bank is of rock and nearly vertical. Controls at both sites are somewhat shifting.

EXTREMES OF DISCHARGE.—Maximum stage recorded during period of record, 5.0 feet at 6 a. m. January 9, 1916 (discharge, computed from extension of rating curve, approximately 600 millions gallons per day, or 928 second-feet); minimum stage recorded, 0.89 foot April, 1914 (discharge, 4.2 million gallons per day, or 6.5 second-feet).

Minimum stage recorded during year, 0.95 foot August and September (discharge, 5.2 million gallons per day, or 8.0 second-feet).

DIVERSIONS.—None above station.

REGULATION.—Natural flow of stream is increased by a development tunnel in mountains above station.

UTILIZATION.—Power development and irrigation of sugar cane.

ACCURACY.—Determinations July 1 to January 17 fair below 40 million gallons per day; those for April 20 to June 30 poor on account of unstability of control.

Discharge measurements of Kauaula Stream near Lahaina, Maui, during the year ending June 30, 1916.

Date.	Made by—	Gage height (feet).	Discharge.	
			Second-feet.	Million gallons per day.
Jan. 7	C. T. Bailey	1.10	15	9.6
Apr. 20	H. A. R. Austin	[a].96	12	7.8
May 24	....do	1.51	15	9.6
June 12	....do	1.51	14	9.0

[a] New location and datum.

Daily discharge, in million gallons, of Kauaula Stream near Lahaina, Maui, for the year ending June 30, 1916.

Date.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Apr.	May.	June.
1	18	6.2	5.2	18	62	6.2	10	.....	14	10
2	10	6.2	5.2	15	134	6.2	8.1	.....	20	9.2
3	8.1	8.1	15	15	41	8.1	8.1	.....	16	11
4	8.1	10	8.1	12	51	15	8.1	.....	23	9.2
5	6.2	8.1	6.2	12	28	8.1	36	.....	20	9.2
6	12	6.2	6.2	8.1	18	36	12	.....	17	8.8
7	8.1	6.2	5.2	6.2	12	15	12	.....	14	8.8
8	6.2	6.2	5.2	8.1	12	8.1	325	.....	14	9.2
9	15	6.2	5.2	10	15	8.1	738	.....	13	8.8
10	10	6.2	6.2	10	12	8.1	425	.....	11	8.8
11	6.2	6.2	21	18	15	8.1	174	.....	10	10
12	6.2	6.2	10	10	15	6.2	75	.....	10	9.2
13	6.2	6.2	6.2	8.1	12	6.2	56	.....	9.2	8.8
14	6.2	6.2	6.2	8.1	15	6.2	28	.....	9.2	10
15	6.2	6.2	5.2	12	12	6.2	24	.....	9.2	10
16	10	6.2	5.2	10	12	6.2	21	.....	9.2	10
17	15	6.2	5.2	6.2	12	6.2	21	.....	9.2	9.2
18	15	6.2	5.2	12	10	18	.....	.....	10	9.2
19	8.1	6.2	5.2	24	12	41	.....	.....	9.2	9.2
20	6.2	6.2	5.2	15	15	15	.....	7.8	10	9.2
21	6.2	5.2	5.2	15	28	12	.....	11	10	10
22	6.2	5.2	5.2	12	41	32	.....	9.2	10	11
23	6.2	5.2	5.2	12	28	8.1	.....	7.8	10	10
24	6.2	5.2	10	12	15	8.1	.....	7.4	10	9.2
25	6.2	6.2	15	12	12	8.1	.....	9.2	10	10
26	6.2	6.2	15	12	12	68	.....	7.4	10	13
27	10	6.2	15	24	10	28	.....	20	9.2	11
28	6.2	6.2	18	28	8.1	18	.....	13	9.2	13
29	6.2	6.2	21	36	8.1	15	.....	8.3	10	11
30	6.2	6.2	18	46	8.1	12	.....	11	8.8	10
31	6.2	5.2	.....	51	.....	10	.....	.....	9.2	.....

NOTE.—Discharge determined from rating curves applicable as follows: July 1, 1915, to Jan. 17, 1916, fairly well defined below 40 million gallons per day. Apr. 20–30, 1916, poorly defined. May 1 to June 30, 1916, poorly defined. Gage heights not recorded Jan. 18 to Apr. 19, 1916.

Monthly discharge of Kauaula Stream near Lahaina, Maui, for year ending June 30, 1916.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July	18	6.2	8.35	12.9	259	794
August	10	5.2	6.28	9.72	195	597
September	21	5.2	9.00	13.9	270	829
October	51	6.2	16.1	24.9	498	1,530
November	134	8.1	22.8	35.3	685	2,100
December	68	6.2	14.8	22.9	458	1,410
January 1–17	728	8.1	117	181	1,980	6,100
April 20–30	20	7.4	10.2	15.8	112	344
May	23	8.8	11.7	18.1	364	1,110
June	13	8.8	9.87	15.3	296	909

KAUAULA DITCH NEAR LAHAINA, MAUI.

LOCATION.—About 100 feet below intake which is uppermost on the stream, about 3 miles east of Lahaina.

RECORDS AVAILABLE.—October 16, 1911, to June 30, 1916.

GAGE.—Vertical staff.

DISCHARGE MEASUREMENTS.—Made in flume at gage.

CHANNEL AND CONTROL.—Straight wooden flume 3 feet wide and on even grade; stage-discharge relation changed by alterations in flume January 18 and 19, 1916.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 1.34 feet at 4 p. m. September 11 (discharge, 10 million gallons per day, or 15.5 second-feet).

Maximum stage recorded during period of record, 1.70 feet April 7, 1912 (discharge, 16 million gallons per day, or 24 second-feet); water occasionally turned off.

DIVERSIONS.—Diverts all low flow from Kauaula Stream.

REGULATION.—Flow regulated by head gates.

UTILIZATION.—Power development and irrigation of sugar cane.

ACCURACY.—Gage read twice daily. Determinations based on fairly well defined curves, fair for all stages.

Discharge measurements of Kauaula ditch near Lahaina, Maui, during the year ending June 30, 1916.

Date.	Made by—	Gage height (feet).	Discharge.	
			Second-feet.	Million gallons per day.
Jan. 7	C. T. Bailey	1.07	11	7.3
Apr. 20	H. A. R. Austin	1.26	12	7.8
May 24	do	1.12	10	6.7
June 12	do	1.35	13	8.5

Daily discharge, in million gallons, of Kauaula ditch near Lahaina, Maui, for the year ending June 30, 1916.

Date.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	9.5	4.4	4.0	9.5	9.0	6.2	7.1	4.4	8.2	5.8	7.8	9.0
2	8.0	4.4	4.0	9.0	9.0	6.2	6.6	4.8	8.2	5.8	6.6	8.2
3	6.2	6.2	9.5	9.0	9.0	6.6	7.1	5.1	8.2	5.8	6.6	9.0
4	5.8	7.1	6.6	7.6	9.0	8.5	7.1	5.1	7.8	5.8	6.6	8.2
5	5.8	6.2	4 8	6.2	9.0	8.0	7.6	5.1	7.4	5.8	6.6	8.2
6	9.0	5.8	4.4	5.8	9.0	8.5	7.6	5.8	5.8	5.8	6.6	7.8
7	6.2	5.3	4.4	5.3	8.5	8.5	7.1	5.8	5.8	5.8	6.6	7.0
8	5.8	4.8	4.4	6.6	8.5	7.1	6.6	5.8	6.6	5.8	7.0	7.4
9	9.0	4.4	4.4	5.8	8.5	6.6	.....	6.6	7.4	5.8	8.2	7.8
10	7.6	4.4	4.8	9.5	8.5	6.6	5.8	7.4	8.2	6.6.	7.0	7.4
11	5.8	5.3	9.5	7.6	5.3.	6.2	5.8	7.8	7.4	5.8	9.0	8.6
12	5.3	4.8	7.6	6.2	5.3	6.2	5.8	7.4	7.4	5.8	9.0	8.6
13	5.3	4.8	5.8	5.3	4.8	5.8	5.8	7.8	7.4	5.8	8.6	7.4
14	5.3	4.4	4.8	7.1	5.8	5.3	5.8	7.4	8.2	5.8	8.6	9.4
15	4.8	4.4	4.4	6.2	5.8	5.3	5.8	8.2	8.2	6.6	8.6	9.0
16	7.1	4.0	4.0	5.3	5.8	5.3	4.8	8.2	7.0	6.2	8.2	8.6
17	8.0	4.0	4.0	5.3	6.6	5.3	4.4	8.2	8.2	5.8	8.2	8.6
18	9.0	6.2	4.0	8.5	5.8	6.6	.....	8.2	7.8	7.4	8.2	8.2
19	5.8	4.8	4.0	8.5	7.6	8.5	3.0	8.2	7.4	7.8	8.6	8.2
20	5.3	4.4	4.0	9.0	7.6	7.6	3.7	8.2	7.0	7.8	9.0	8.6
21	4.8	4.4	4.0	9.0	7.6	7.6	4.4	8.2	6.6	8.2	9.0	9.0
22	4.8	4.0	4.0	9.0	7.6	8.5	4.4	8.2	8.2	6.6.	8.2	9.4
23	4.8	4.0	4.0	8.5	8.0	6.6	5.1	8.2	6.6	7.0	8.2	8.6
24	4.8	4.0	6.6	7.6	8.0	6.6	4.8	8.2	6.2	7.0	8.2	7.8
25	4.8	5.8	9.5	7.1	7.6	6.6	4.8	7.8	6.2	8.2	8.6	8.6
26	5.3	4.8	9.0	7.1	7.1	5.8	4.8	7.8	6.2	6.2	8.6	8.6
27	6.6	4.4	9.0	7.1	7.1	5.8	4.8	8.6	6.2	8.2	8.2	8.2
28	5.3	4.4	8.0	7.6.	7.1	6.2	4.4	8.2	6.2	6.6	7.8	9.0
29	4.8	4.4	9.5	8.0	6.6	7.6	4.4	8.2	6.2	7.0	8.2	8.6
30	4.4	4.0	9.5	9.0	5.8	7.6	4.4	.....	6.2	7.8	7.8	8.2
31	4.4	4.0	.....	9.0	.....	7.6	4.4	.....	6.2	.....	8.2	.....

NOTE.—Discharge determined from fairly well defined rating curves applicable as follows: July 1, 1915, to Jan. 18, 1916; Jan. 19 to June 30, 1916; no flow Jan. 9 and 18.

Monthly discharge of Kauaula ditch near Lahaina, Maui, for year ending June 30, 1916.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July	9.5	4.4	6.11	9.45	189	581
August	7.1	4.0	4.78	7.40	148	455
September	9.5	4.0	5.88	9.10	176	541
October	9.5	5.3	7.49	11.6	232	713
November	9.0	4.8	7.36	11.4	221	678
December	8.5	5.3	6.82	10.6	211	649
January 1–8, 10–17, 19–31	7.6	3.0	5.46	8.45	158	486
February	8.6	4.4	7.20	11.1	209	641
March	8.2	5.8	7.12	11.0	221	677
April	8.2	5.8	6.55	10.1	196	603
May	9.0	6.6	7.95	12.3	247	756
June	9.4	7.0	8.37	13.0	251	771
The period	9.5	3.0	6.76	10.5	2,460	7,550

LAUNIUPOKO STREAM NEAR LAHAINA, MAUI.

LOCATION.—About 175 feet above Pioneer Mill Co.'s ditch intake, 1 mile above storage reservoir, and about 5½ miles southeast of Lahaina.

RECORDS AVAILABLE.—July 25, 1911, to June 30, 1916.

GAGE.—Vertical staff on right bank. New datum April 21, 1916.

DISCHARGE MEASUREMENTS.—Made by wading.

CHANNEL AND CONTROL.—One channel at all stages; straight for 50 feet above and below gage; stream bed rough and steep. Control composed of small boulders; shifts during floods.

EXTREMES OF DISCHARGE.—Maximum stage recorded during period of record, 4.0 feet estimated gage height of flood of January 18, 1916 (determination of discharge not possible); minimum stage recorded, 0.4 foot frequently during 1913-14 (discharge, 0.5 million gallons per day, or 0.75 second-foot).

Minimum stage recorded during year, 0.15 foot August to September and October (discharge, 0.9 million gallons per day, or 1.4 second-feet).

DIVERSIONS.—None above station.

REGULATION.—Nearly all normal flow of stream is derived from a development tunnel above station.

UTILIZATION.—Irrigation of sugar cane.

ACCURACY.—Gage read once daily. Determinations approximate only owing to unstable control.

Discharge measurements of Launiupoko Stream near Lahaina, Maui, during the year ending June 30, 1916.

Date.	Made by—	Gage height (feet).	Discharge.	
			Second-feet.	Million gallons per day.
Aug. 26	H. A. R. Austin	0.16	1.0	0.65
Apr. 20	do	[a].88	1.9	1.2
May 27	do	.85	4.3	2.8

[a] New datum.

Monthly discharge of Launiupoko Stream near Lahaina, Maui, for the year ending June 30, 1916.

Month.	Discharge.				Run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July	1.4	1.1	1.14	1.76	35	108
August	1.8	.9	1.03	1.59	32	98
September	3.8	.9	1.10	1.70	33	101
October	4.5	.9	1.30	2.01	40	124
November	3.8	1.1	2.35	3.64	70	216
December	6.1	1.4	2.61	4.04	81	248
January 1-7	5.2	1.8	2.84	4.39	20	61
April 21-30	15	1.6	3.24	5.01	32	99
May	10	4.0	5.89	9.11	183	560
June	10	3.4	4.83	7.47	145	445

NOTE.—Discharge determined from poorly defined rating curves applicable as follows: July 1, 1915, to Jan. 7, 1916, and Apr. 21 to June 30, 1916. No record Jan. 8 to Apr. 20, 1916.

OLOWALU STREAM NEAR OLOWALU, MAUI.

LOCATION.—About 600 feet above Olowalu Sugar Co.'s power house, 1 mile north of Olowalu.

RECORDS AVAILABLE.—April 26, 1913, to January 8, 1916, when gage was washed out and station discontinued.

GAGE.—Vertical staff on right bank.

DISCHARGE MEASUREMENTS.—Made by wading or from footbridge.

CHANNEL AND CONTROL.—One channel at all stages; straight for 100 feet above and below gage; right bank nearly vertical to above high water; left bank low with gentle slope. Control composed of boulders and gravel; shifting.

EXTREMES OF DISCHARGE.—Maximum stage recorded during period of record, 2.8 feet at 5.30 p. m., November 2, 1915 (discharge, 200 million gallons per day, or 309 second-feet), stream frequently dry.

DIVERSIONS.—Water for power house and irrigation diverted 1½ miles above gage; partly measured in tailrace called Olowalu ditch.

REGULATION.—Diversion above station.

UTILIZATION.—Low and medium flow past gage is diverted for irrigation of sugar cane.

ACCURACY.—Gage read twice daily. Results poor. Control shifts greatly and insufficient measurements were made to develop good rating curves.

The following discharge measurement was made by H. A. R. Austin:
July 21, 1915: Gage height, 0.44 foot; discharge, 2.4 second-feet.

Monthly discharge of Olowalu Stream near Olowalu, Maui, for year ending June 30, 1916.

Month.	Discharge.				Run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July	15	0	1.79	2.77	56	170
August	2.0	0	.15	.23	4	14
September	24	0	2.41	3.72	72	.222
October	46	0	6.79	10.4	210	646
November	160	.5	23.2	35.9	696	2,140
December	138	.2	17.2	26.6	533	1,640
January 1–8	102	3.5	37.1	57.4	296	911

NOTE.—Discharge determined from a poorly defined rating curve. No flow on days for which discharge is not given.

OLOWALU DITCH NEAR OLOWALU, MAUI.

LOCATION.—In flume crossing Olowalu Stream near power house, 1 mile above Olowalu. Flume was washed out January 8, 1916, and new gage was installed April 22.

RECORDS AVAILABLE.—August 12, 1911, to June 30, 1916.

GAGE.—Vertical staff.

DISCHARGE MEASUREMENTS.—Made in flume.

CHANNEL AND CONTROL.—Straight wooden flume 3 feet wide. Control is earth section at end of flume and fairly permanent. Stage-discharge relation sometimes affected by cleaning of ditch.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year 0.8 foot January 8 (discharge, 10 million gallons per day, or 15.5 second-feet); minimum stage recorded, 0.35 foot May 10 and 11 (discharge 1.0 million gallons per day, or 1.55 second-feet).

DIVERSIONS.—Diverts from Olowalu Stream.

REGULATION.—Station is in tailrace from power house.

UTILIZATION.—After passing through power house water is used to irrigate sugar cane.

ACCURACY.—Discharge July 1 to January 8 ascertained from fairly well defined rating curves and a reliable gage-height record of two readings daily; fair for all stages. Determinations April 22 to June 30 poor on account of unstable control.

Discharge measurements of Olowalu ditch near Olowalu, Maui, during the year ending June 30, 1916.

[Made by H. A. R. Austin.]

Date.	Gage height (feet).	Discharge.		Date.	Gage height (feet).	Discharge.	
		Second-feet.	Million gallons per day.			Second-feet.	Million gallons per day.
July 21	0.40	4.2	2.7	May 23	0.96	10	6.5
Aug. 27	.37	3.9	2.5	June 10	.70	7.6	4.9
Apr. 22	a.88	8.5	5.5				

a New location and datum.

Daily discharge, in million gallons, of Olowalu ditch near Olowalu, Maui, for the year ending June 30, 1916.

Date.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Apr.	May.	June.
1	5.0	2.8	2.3	4.2	5.8	4.2	5.8	.....	6.0	5.4
2	5.0	2.8	2.3	4.2	5.8	4.2	5.8	.....	6.0	4.8
3	4.2	4.2	4.2	4.2	5.8	4.2	5.0	.....	.....	5.4
4	4.2	5.0	4.2	4.2	5.8	5.8	5.8	.....	.....	4.8
5	4.2	4.2	3.5	4.2	5.8	5.8	7.8	.....	.....	4.8
6	5.0	4.2	2.8	4.2	5.8	5.8	7.8	.....	.....	4.8
7	5.0	3.5	2.8	3.5	5.8	6.8	7.8	.....	.....	4.3
8	4.2	3.5	2.8	3.5	5.0	5.8	10	.....	1.2	4.8
9	5.0	2.8	2.3	4.2	5.0	5.8	.....	.....	1.2	4.8
10	5.0	2.8	2.3	4.2	4.2	5.0	.....	.....	1.0	4.8
11	5.0	2.8	4.2	5.8	5.8	4.2	.....	.....	1.0	5.4
12	4.2	3.5	4.2	3.5	5.8	4.2	.....	.....	2.0	6.0
13	4.2	3.5	4.2	2.8	5.0	4.2	.....	.....	3.3	5.4
14	4.2	2.8	3.5	3.5	5.0	3.5	.....	.....	2.0	6.6
15	3.5	2.8	2.8	4.2	4.2	3.5	.....	.....	2.8	6.6
16	5.0	2.8	2.8	4.2	3.5	3.5	.....	.....	3.3	7.2
17	5.0	2.8	2.8	3.5	3.5	3.5	.....	.....	3.8	6.0
18	5.8	2.8	4.2	5.8	3.5	4.2	.....	.....	3.3	6.6
19	5.0	2.3	4.2	5.8	4.2	5.8	.....	.....	3.8	5.4
20	5.0	2.8	4.2	5.8	4.2	5.8	.....	.....	4.8	5.4
21	5.0	2.8	3.5	5.0	5.0	5.8	.....	.....	4.3	5.4
22	3.5	2.3	4.2	5.8	4.2	5.8	.....	6.0	4.3	6.0
23	3.5	2.3	3.5	6.8	3.5	5.8	.....	6.6	5.4	4.8
24	3.5	2.3	4.2	6.8	3.5	5.8	.....	6.6	5.4	4.8
25	3.5	4.2	5.8	5.8	3.5	.....	.....	7.2	4.8	5.4
26	4.2	2.8	6.8	5.0	2.8	.....	.....	5.4	4.8	4.3
27	3.5	2.3	6.8	5.0	3.5	.....	.....	5.4	3.8	4.3
28	3.5	2.3	5.8	6.8	5.0	.....	.....	3.8	3.8	4.3
29	3.5	2.3	1.9	5.8	5.0	.....	.....	5.4	4.3	4.8
30	2.8	2.3	4.2	5.8	4.2	.....	.....	4.8	3.3	6.6
31	2.8	2.3	.....	5.8	.....	.....	.....	.....	3.3	.....

NOTE.—Discharge determined from rating curves applicable as follows: July 1, 1915, to Jan. 8, 1916, fairly well defined. Apr. 22 to June 5, 1916, poorly defined. June 6–30, 1916, poorly defined. Gage heights not recorded on days for which discharge is not given. Ditch broken part of time.

Monthly discharge of Olowalu ditch near Olowalu, Maui, for the year ending June 30, 1916.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July	5.8	2.8	4.29	6.64	133	408
August	5.0	2.3	3.00	4.64	93	285
September	6.8	1.9	3.78	5.85	113	348
October	6.8	2.8	4.84	7.49	150	460
November	5.8	2.8	4.66	7.21	140	429
December 1–24	6.8	3.5	4.96	7.67	119	365
January 1–8	10	5.0	6.98	10.8	56	171
April 22–30	7.2	3.8	5.69	8.80	51	157
June	7.2	4.3	5.33	8.25	160	491

UKUMEHAME STREAM NEAR OLOWALU, MAUI.

LOCATION.—Half a mile above upper ditch intake, 2 miles above Government road at the 14-mile post, and 4 miles by road and trail east of Olowalu.

RECORDS AVAILABLE.—August 14, 1911, to June 30, 1916.

GAGE.—Gurley printing water-stage recorder installed February 20, 1916, replaced vertical staff installed April 23, 1913, 200 feet below present gage, and washed out January 18, 1916.

DISCHARGE MEASUREMENTS.—Made by wading or from footbridge 900 feet below gage.

CHANNEL AND CONTROL.—One channel at all stages; straight for 50 feet above and below gage; right bank steep and high; left bank slopes gradually; very rough stream bed composed of boulders and gravel. Controls at both sites somewhat shifting.

EXTREMES OF DISCHARGE.—Maximum stage recorded during period of record, 9.0 feet estimated gage height of flood of January 18, 1916; no estimate of discharge possible; minimum stage recorded, 0.60 foot October 4 and 5, 1913 (discharge, 2.3 million gallons per day, or 3.6 second-feet).

Minimum stage recorded during year, 0.9 foot August and September (discharge, 4.3 million gallons per day, or 6.7 second-feet).

DIVERSIONS.—None above station.

REGULATION.—None.

UTILIZATION.—Irrigation of sugar cane.

ACCURACY.—Gage read twice daily. Determinations July 1 to December 31 fair for all stages; those for period February 20 to June 30, after installation of water-stage recorder, good for low and medium stages.

Discharge measurements of Ukumehame Stream near Olowalu, Maui, during the year ending June 30, 1916.

Date.	Made by—	Gage height (feet).	Discharge.	
			Second-feet.	Million gallons per day.
July 21	H. A. R. Austin	1.04	9.0	5.8
Aug. 27	R. D. Klise	.95	6.5	4.2
Mar. 1	....do	[a].72	13	8.2
Apr. 22	H. A. R. Austin	.64	10	6.6
May 24	....do	1.02	20	13
June 10	....do	.90	15	9.7

[a] New location and datum.

Daily discharge, in million gallons, of Ukumehame Stream near Olowalu, Maui, for the year ending June 30, 1916.

Date.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Feb.	Mar.	Apr.	May.	June.
1	9.1	5.2	4.3	8.0	28	5.2	.....	9.3	7.0	40	11
2	5.2	4.8	4.3	6.9	77	5.2	.....	9.3	7.0	39	11
3	6.0	5.2	5.2	9.1	37	5.2	.....	8.5	7.0	32	11
4	6.0	26	5.2	18	28	5.2	.....	14	7.0	34	11
5	5.2	12	4.8	28	24	5.2	.....	12	7.0	28	11
6	8.0	5.2	4.8	26	21	4.8	.....	10	7.0	28	11
7	6.0	5.2	4.3	18	11	4.8	.....	20	7.0	32	11
8	6.0	5.2	4.3	21	8.0	4.8	.....	18	7.0	27	11
9	9.1	4.8	4.3	11	6.0	4.8	.....	15	7.0	22	11
10	6.9	4.8	4.3	18	6.0	4.8	.....	15	7.0	18	11
11	24	4.3	16	8.0	52	4.8	.....	15	7.0	16	11
12	21	21	12	18	37	4.8	.....	15	7.0	15	10
13	14	6.9	4.8	24	11	4.8	.....	15	7.0	14	10
14	6.9	4.8	4.8	16	9.1	4.8	.....	18	7.0	14	13
15	5.2	4.8	4.3	6.9	6.9	4.8	.....	18	7.0	13	13
16	12	4.8	4.3	6.9	6.0	4.8	.....	14	6.2	13	13
17	6.9	4.8	4.3	5.2	6.0	4.8	.....	13	7.0	13	11
18	14	4.8	4.3	8.0	6.0	4.8	.....	13	7.0	13	12
19	8.0	4.8	4.8	11	6.9	18	.....	13	7.7	12	11
20	8.0	4.8	4.8	21	6.0	8.0	8.5	13	7.0	13	11
21	12	4.8	4.8	31	8.0	6.9	8.5	12	8.5	12	14
22	14	4.8	4.8	12	8.0	6.9	8.5	13	7.0	13	16
23	5.2	4.8	4.8	14	6.9	6.9	8.5	10	7.7	15	13
24	5.2	4.3	21	8.0	6.0	6.9	8.5	10	7.7	14	12
25	6.9	5.2	11	6.9	6.0	11	8.5	10	7.0	13	11
26	5.2	4.8	12	18	5.2	34	8.5	8.5	7.0	13	18
27	8.0	4.8	11	6.9	5.2	18	8.5	8.5	36	12	17
28	6.9	4.8	14	43	5.2	11	7.7	8.5	32	12	21
29	5.2	4.8	12	60	5.2	8.0	7.7	7.0	26	11	17
30	5.2	4.8	11	43	4.8	8.0	.....	7.0	22	11	17
31	5.2	4.3	.....	34	.....	8.0	.....	7.0	.....	11	.....

NOTE.—Discharge determined from fairly well defined rating curves applicable as follows: July 1 to Dec. 31, 1915, and Feb. 20 to June 30, 1916. No record Jan. 1 to Feb. 19, 1916.

Monthly discharge of Ukumehame Stream near Olowalu, Maui, for year ending June 30, 1916.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July	24	5.2	8.60	13.3	266	818
August	26	4.3	6.34	9.81	196	603
September	21	4.3	7.22	11.2	217	665
October	60	5.2	18.3	28.3	566	1,740
November	77	4.8	15.1	23.4	453	1,390
December	34	4.8	7.74	12.0	240	736
February 20–29	8.5	7.7	8.34	12.9	83	256
March	20	7.0	12.2	18.9	380	1,160
April	39	6.2	10.1	15.6	304	930
May	40	11	18.8	29.1	583	1,790
June	21	10	12.7	19.6	381	1,170

WAIKAPU STREAM NEAR WAIKAPU, MAUI.

LOCATION.—300 feet below intake of Palolo ditch, 1½ miles west of Waikapu, and 4 miles by road southwest of Wailuku.

RECORDS AVAILABLE.—December 1, 1910, to June 30, 1916.

GAGE.—Vertical staff on left bank installed April 26, 1916, to replace staff gage at old location 200 feet downstream. Old gage washed out January 7, 1916.

DISCHARGE MEASUREMENTS.—Made by wading.

CHANNEL AND CONTROL.—One channel at all stages; straight for 100 feet above and 25 feet below gage; left bank high and nearly vertical; right bank sloper gently. Control composed of large boulders; fairly permanent between extreme floods.

EXTREMES OF DISCHARGE.—Highest flood on record occurred on morning of January 18, 1916, when water reached a height of about 10 feet, datum of old gage (discharge not estimated). Minimum stage recorded, 0.25 foot (old datum) February 26 to March 4, 1914 (discharge, 0.1 million gallons per day or 0.15 second-foot).

Minimum stage for the year, 1.2 feet (old datum) September 13–17 (discharge, 0.3 million gallons per day, or 0.46 second-foot).

DIVERSIONS.—Nearly all low-water flow is diverted above station by South Side Waikapu ditch and Palolo ditch.

REGULATION.—Natural flow has been increased by development tunnels near the headwaters.

UTILIZATION.—Flow at low and medium stages is diverted for irrigation of sugar cane.

ACCURACY.—Determinations fair for low and medium stages; those for high and fluctuating stages approximate only, as gage is read but twice daily.

Discharge measurements of Waikapu Stream near Waikapu, Maui, during the year ending June 30, 1916.

Date.	Made by—	Gage height (feet).	Discharge.	
			Second-feet.	Million gallons per day.
July 23	H. A. R. Austin	1.34	1.1	0.7
Jan. 3	C. T. Bailey	1.57	4.6	3.0
Apr. 26	H. A. R. Austin	*a* .96	5.1	3.3
May 23	.....do	1.14	10	6.5
June 12	.....do	1.04	6.7	4.3

a New location and datum.

Daily discharge, in million gallons, of Waikapu Stream near Waikapu, Maui, for the year ending June 30, 1916.

Date.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Apr.	May.	June.
1	2.9	1.0	0.6	1.0	40	2.3	4.4	.....	170	5.6
2	1.0	.6	.5	7.1	52	2.9	1.8	.....	46	5.6
3	1.0	3.6	1.0	8.4	13	1.8	1.8	.....	38	5.6
4	1.3	1.3	.6	1.3	21	11	1.8	.....	43	4.8
5	1.0	1.0	.6	1.0	7.1	2.3	63	.....	25	5.6
6	2.9	1.0	.5	.6	4.4	49	34	.....	58	4.8
7	1.3	1.0	.6	.6	2.9	7.1	5.2	.....	25	4.8
8	1.0	1.0	.5	.6	1.0	1.8	.....	.....	27	4.8
9	3.6	1.0	.5	3.6	2.3	1.8	.....	.....	25	4.8
10	1.0	.6	.5	1.3	1.8	1.3	.....	.....	18	4.8
11	1.0	.6	3.6	4.4	77	1.0	.....	.....	16	4.8
12	1.0	1.0	.6	.6	7.1	1.0	.....	.....	13	4.8
13	1.0	.6	.3	.6	5.2	1.0	.....	.....	12	4.8
14	1.0	.6	.3	.6	2.9	1.0	.....	.....	8.8	22
15	1.0	.6	.3	13	1.3	1.0	.....	.....	6.6	8.8
16	9.7	.6	.3	1.0	1.0	1.0	.....	.....	6.6	10
17	34	.5	.3	.6	1.0	6.2	.....	.....	7.6	6.6
18	6.2	.5	.5	8.4	1.0	21	.....	.....	6.6	6.6
19	1.8	.5	.5	1.3	19	17	.....	.....	6.6	4.8
20	1.0	.6	.5	11	4.4	2.3	.....	.....	7.6	4.8
21	1.0	.5	.5	31	4.4	3.6	.....	.....	6.6	10
22	1.0	.5	.6	2.9	8.4	3.6	.....	.....	6.6	12
23	1.0	.6	.5	6.2	2.3	1.3	.....	.....	18	5.6
24	1.0	.6	.6	1.0	1.8	1.0	.....	.....	19	4.8
25	1.3	1.0	9.7	.6	1.3	1.0	.....	.....	18	4.8
26	1.0	.6	2.3	.5	1.3	105	.....	3.4	12	24
27	2.3	.6	1.3	.5	1.3	60	.....	5[illegible]	7.6	18
28	1.0	.6	2.3	40	1.3	6.2	.....	3[illegible]	7.6	24
29	1.0	.6	5.2	26	1.0	4.4	.....	1[illegible]	7.6	.... 5.6
30	1.0	.6	1.0	11	1.3	3.6	.....	1[illegible]	5.6	14
31	1.0	.6	.....	10	.....	2.3	.....	.....	5.6	.....

NOTE.—Discharge determined from rating curves applicable as follows: July 1, 1915, to Jan. 7, 1916, well defined below 50 million gallons per day. Apr. 26 to June 30, 1916, well defined below 10 million gallons per day. High-water extension of rating curve not based on current-meter measurements. No record Jan. 8 to Apr. 25, 1916.

Monthly discharge of Waikapu Stream near Waikapu, Maui, for year ending June 30, 1916.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July	34	1.0	2.82	4.36	87	268
August	3.6	.5	.81	1.25	25	77
September	9.7	.3	1.24	1.92	37	114
October	40	.5	6.35	9.82	197	604
November	77	1.0	9.66	14.9	290	889
December	105	1.0	10.5	16.2	326	999
January 1–7	63	1.8	16.0	24.8	112	344
April 26–30	56	3.4	25.3	39.1	126	388
May	170	5.6	22.0	34.0	681	2,090
June	24	4.8	8.40	13.0	252	773

PALOLO DITCH NEAR WAIKAPU, MAUI.

LOCATION.—200 feet below intake, 1½ miles west of Waikapu, and 5½ miles by road southwest of Wailuku.

RECORDS AVAILABLE.—November 21, 1910, to June 30, 1916.

GAGE.—Vertical staff on left bank.

DISCHARGE MEASUREMENTS.—Made by wading.

CHANNEL AND CONTROL.—Channel is cut in earth and soft rock; straight for 50 feet above and below gage; clean and usually free from vegetation. Control, a small wooden culvert 1 foot below gage; fairly permanent.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year 1.14 feet at 9 a. m., September 12 (discharge, 3.5 million gallons per day, or 5.4 second-feet); maximum stage recorded during period of record, 1.33 feet at 2 p. m., December 7, 1913 (discharge, 4.7 million gallons per day, or 7.3 second-feet); ditch occasionally dry.

DIVERSIONS.—None above station.

REGULATION.—Water may be turned out of ditch by gates.

UTILIZATION.—Irrigation of sugar cane and taro.

ACCURACY.—Gage read twice daily. Records good for all stages; discharge determined from well-defined rating curve and reliable gage heights.

Discharge measurements of Palolo ditch near Waikapu, Maui, during the year ending June 30, 1916.

Date.	Made by—	Gage height (feet).	Discharge.	
			Second-feet.	Million gallons per day.
July 23	H. A. R. Austin	1.01	4.0	2.6
Aug. 23	do	.96	3.9	2.5
Jan. 3	C. T. Bailey	.84	2.9	1.9
Mar. 6	R. D. Klise	.39	.55	.35
May 23	H. A. R. Austin	.91	3.9	2.5
June 12	do	1.05	4.6	3.0

Daily discharge, in million gallons, of Palolo ditch near Waikapu, Maui, for the year ending June 30, 1916.

Date.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	2.4	3.0	2.7	3.0	3.3	2.2	2.2	1.3	1.1	1.3	2.0	3.3
2	2.4	3.0	2.7	3.3	3.3	2.2	2.2	1.5	1.1	1.3	1.7	3.3
3	2.2	3.0	2.7	3.0	3.3	2.2	2.0	.6	1.1	1.3	1.7	3.3
4	2.2	3.0	2.7	2.2	3.3	2.2	2.0	.6	1.1	1.3	3.0	3.3
5	2.2	2.7	2.7	2.2	2.7	2.2	2.2	.6	1.3	1.3	.9	3.3
6	2.4	2.7	2.7	2.2	2.7	2.4	2.0	.9	.05	1.3	.9	3.3
7	2.2	2.7	2.7	2.2	2.7	2.4	2.0	.75	.2	1.3	.9	3.3
8	2.2	2.7	2.7	2.2	2.7	2.4	2.7	1.1	.5	1.3	.9	3.0
9	2.2	2.7	2.7	2.7	2.7	2.4	.75	1.1	.6	1.3	.9	3.0
10	2.4	2.7	2.7	2.7	2.7	2.4	.5	1.1	.6	1.7	.9	3.0
11	2.4	2.7	3.6	3.0	1.3	2.4	.3	1.1	.6	1.7	.9	3.0
12	2.4	2.7	3.3	2.7	1.7	2.2	.6	1.1	.6	1.7	2.0	3.0
13	2.4	2.7	2.7	2.7	1.7	2.2	.6	1.1	.6	1.7	2.0	3.0
14	2.4	2.7	2.7	2.4	2.0	2.2	.6	1.1	.75	1.7	2.2	3.3
15	2.7	2.7	2.7	2.7	2.2	2.2	.5	1.1	.75	1.7	2.2	3.3
16	2.7	2.7	2.7	2.7	2.2	2.2	.5	1.3	.6	1.7	2.2	3.0
17	3.0	2.7	2.7	2.4	2.2	2.7	.6	1.3	.6	1.7	2.2	3.0
18	2.7	2.7	2.7	2.7	2.2	2.7	.....	1.3	.75	1.7	2.2	3.0
19	2.4	2.7	2.7	2.7	2.7	2.7	.....	1.3	.75	2.0	2.2	3.0
20	2.4	2.7	2.7	3.0	2.7	2.7	.4	1.1	.75	2.0	2.2	3.0
21	2.4	2.7	2.7	3.0	2.7	2.7	.9	1.1	.75	2.0	2.2	3.3
22	2.4	2.7	2.4	2.7	2.7	2.7	2.0	1.1	.75	1.7	2.2	3.3
23	2.7	2.7	2.4	2.7	2.7	2.4	1.7	1.1	.75	2.0	2.2	3.3
24	2.7	2.7	2.7	2.7	2.4	2.4	1.7	1.1	.75	2.0	2.2	3.3
25	2.7	2.7	3.0	2.7	2.2	2.4	1.5	1.1	.75	2.0	2.4	3.3
26	2.7	2.7	3.0	2.4	2.2	3.0	1.7	1.1	.75	1.7	2.2	3.3
27	3.0	2.7	2.7	2.4	2.2	2.2	1.3	1.1	.75	.05	2.2	3.3
28	2.7	2.7	3.0	3.3	2.2	2.2	1.5	1.1	.75	2.0	2.2	3.3
29	2.7	2.7	3.0	3.3	2.2	2.2	1.5	1.1	.75	1.1	2.2	3.3
30	2.7	2.7	3.0	3.3	2.2	2.2	1.5	.....	1.3	.4	2.2	3.3
31	3.0	2.7	.....	3.3	.....	2.2	1.5	.....	1.3	.....	2.7	.....

NOTE.—Discharge determined from well-defined rating curve. No flow Jan. 18 and 19.

Monthly discharge of Palolo ditch near Waikapu, Maui, for year ending June 30, 1916.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July	3.0	2.2	2.52	3.90	78	240
August	3.0	2.7	2.64	4.08	82	251
September	3.6	2.4	2.78	4.30	83	256
October	3.3	2.2	2.73	4.22	84	260
November	3.3	1.3	2.47	3.82	74	227
December	3.0	2.2	2.38	3.68	74	226
January 1–17, 20–31	2.7	.3	1.36	2.10	39	121
February	1.5	.6	1.08	1.67	31	96
March	1.3	.05	.77	1.19	24	73
April	2.0	.05	1.53	2.37	46	141
May	3.0	.9	1.90	2.94	59	181
June	3.3	3.0	3.19	4.94	96	294
The period	3.6	.05	2.12	3.28	770	2,370

SOUTH SIDE WAIKAPU DITCH NEAR WAIKAPU, MAUI.

LOCATION.—One mile below intake, 1½ miles west of Waikapu, and about 5½ miles by road southwest of Wailuku.

RECORDS AVAILABLE.—November 21, 1910, to June 30, 1916.

GAGE.—Vertical staff on right bank.

DISCHARGE MEASUREMENTS.—Made from plank over ditch 400 feet below gage.

CHANNEL AND CONTROL.—Channel is cut in earth and soft rock; section fairly uniform; banks vertical. Control not well defined but fairly permanent between times of cleaning ditch.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 0.96 foot at 9 a. m. January 8 (discharge, 12 million gallons per day, or 19 second-feet); ditch dry December 17–19 and January 18–23.

Maximum stage recorded during period of record, 1.25 feet at 9 a. m. May 8, 1914 (discharge, 16 million gallons per day, or 25 second-feet); ditch occasionally dry.

DIVERSIONS.—None above station.

REGULATION.—Practically none.

UTILIZATION.—Irrigation of sugar cane.

ACCURACY.—Gage read twice daily. Discharge determined from well-defined rating curve and reliable gage-height record; records good for all stages.

Discharge measurements of South Side Waikapu ditch near Waikapu, Maui, during the year ending June 30, 1916.

Date.	Made by—	Gage height (feet).	Discharge.	
			Second-feet.	Million gallons per day.
July 23	H. A. R. Austin	0.47	6.5	4.2
Jan. 3	C. T. Bailey	.64	11	7.0
Mar. 6	R. D. Klise	.60	10	6.6
May 23	H. A. R. Austin	.60	9.6	6.2

Daily discharge, in million gallons, of South Side Waikapu ditch near Waikapu, Maui, for the year ending June 30, 1916.

Date.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	8.4	4.1	2.8	5.5	9.2	6.2	7.0	7.0	7.0	7.0	2.8	6.2
2	5.5	4.1	2.8	7.7	10	6.2	6.2	7.7	7 7	7.0	1.2	6.2
3	5.5	7.0	4.8	7.0	7.7	5.5	7.0	7.0	7.0	7.0	1.2	6.2
4	6.2	6.2	4.8	5.5	7.7	7.7	6.2	7.0	7.0	6.2	1.2	6.2
5	4.8	4.8	3.4	4.1	6.2	6.2	11	7.0	3.4	6.2	.5	6.2
6	7.7	4.1	2.8	4.1	6.2	10	9.2	4.1	6.2	7.0	1.2	6.2
7	6.2	4.1	4.1	3.4	5.5	7.7	7.7	7.7	4.8	6.2	.8	6.2
8	5.5	3.4	3.4	3.4	5.5	6.2	11	7.7	8.4	6.2	.8	7.0
9	7.7	3.4	2.8	5.5	5.5	6.2	9.2	7.7	6.2	6.2	.5	6.2
10	5.5	3.4	2.8	4.8	5.5	5.5	10	7.7	7.0	6.2	.5	6.2
11	5.5	3.4	7.0	6.2	8.4	5.5	9.2	7.7	6.2	6.2	.5	6.2
12	4.8	5.5	4.8	4.1	6.2	4.8	9.2	7.7	6.2	6.2	.5	6.2
13	4.8	4.8	3.4	3.4	4.8	4.8	8.4	2.2	6.2	5.5	1.7	6.2
14	4.8	4.1	3.4	3.4	4.1	4.8	7.7	7.7	7.7	5.5	2.2	9.2
15	5.5	3.4	3.4	7.0	4.8	4.8	7.0	7.7	6.2	5.5	6.2	7.0
16	8.4	3.4	2.8	5.5	4.8	4.1	6.2	7.7	7.0	5.5	6.2	7.0
17	11	3.4	3.4	4.1	4.8	.....	8.4	7.7	6.2	5.5	7.0	6.2
18	8.4	3.4	2.8	7.0	4.8	.....	.....	7.7	6.2	5.5	6.2	7.2
19	7.0	3.4	2.8	6.2	7.7	.....	.....	7.7	7.0	6.2	6.2	5.5
20	6.2	3.4	2.8	7.7	6.2	5.5	.....	7.7	7.0	6.2	7.0	5.5
21	4.8	3.4	2.2	8.4	6.2	6.2	.....	7.7	6.2	7.7	6.2	7.7
22	4.8	3.4	2.8	6.2	7.0	7.7	.....	7.7	6.2	6.2	6.2	8.4
23	4.1	3.4	2.2	7.0	6.2	6.2	.....	7.7	6.2	8.4	7.7	6.2
24	4.1	3.4	4.1	5.5	5.5	5.5	6.2	7.7	6.2	7.7	7.0	5.5
25	5.5	4.1	7.7	4.8	4.8	5.5	7.0	7.7	6.2	7.0	7.0	6.2
26	4.8	3.4	6.2	4.1	4.8	12	7.7	7.0	6.2	5.5	6.2	9.2
27	7.0	3.4	5.5	4.1	4.8	11	7.0	7.7	7.0	2.2	6.2	8.4
28	4.1	3.4	5.5	9.2	5.5	7.0	6.2	7.0	7.0	2.2	6.2	8.4
29	4.1	3.4	7.0	8.4	4.8	6.2	6.2	7.0	6.2	2.2	6.2	6.2
30	4.1	3.4	5.5	7.7	4.8	7.0	4.1	.....	6.2	1.7	6.2	8.4
31	4.1	3.4	.....	7.7	.....	6.2	7.0	.....	6.2	.....	6.2	.....

NOTE.—Discharge determined from well-defined rating curve. Ditch dry on days for which discharge is not given.

Monthly discharge of South Side Waikapu ditch near Waikapu, Maui, for year ending June 30, 1916.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July	11	4.1	5.84	9.04	18[illegible]	556
August	7.0	3.4	3.90	6.03	12[illegible]	371
September	7.7	2.2	4.11	6.36	123	378
October	9.2	3.4	5.76	8.91	17[illegible]	548
November	10	4.1	6.00	9.28	18[illegible]	552
December 1–16, 20–31	12	4.1	6.51	10.1	18[illegible]	559
January 1–17, 24–31	11	4.1	7.68	11.9	19[illegible]	589
February	7.7	2.2	7.22	11.2	20[illegible]	643
March	8.4	3.4	6.46	10.0	20[illegible]	615
April	8.4	1.7	5.79	8.96	174	533
May	7.7	.5	4.05	6.27	12[illegible]	385
June	9.2	5.5	6.75	10.4	203	621

HANAWI STREAM NEAR NAHIKU, MAUI.

LOCATION.—200 feet above Koolau ditch crossing and trail bridge, 2 miles southwest of Nahiku post office and 6½ miles east of Upper Keanae.

RECORDS AVAILABLE.—January 9, 1914, to January 6, 1916. Gage shelter wrecked by flood of January 18, 1916, and station discontinued.

GAGE.—Stevens water-stage recorder.

DISCHARGE MEASUREMENTS.—Made by wading or from footbridge 100 feet above gage.

CHANNEL AND CONTROL.—Channel at gage is a pool with nearly vertical rock walls. Control is rock ledge; probably permanent.

EXTREMES OF DISCHARGE.—Flood of January 18, 1916, reached a stage of about 20 feet (determination of discharge not possible); minimum stage recorded, 0.8 foot February 3 to March 12, 1914, and August 16 and September 1, 1915 (discharge, 1.8 million gallons per day, or 2.5 second-feet).

DIVERSION.—None above station.

REGULATION.—None.

UTILIZATION.—Normal flow is diverted into Koolau ditch for irrigation of sugar cane.

ACCURACY.—Determinations based on well-defined rating curve and a continuous gage-height record; good for all stages.

The following discharge measurement was made by R. D. Klise:

February 1, 1916: Gage height, 1.40 feet; discharge, 9.8 second-feet.

Daily discharge, in million gallons, of Hanawi stream near Nahiku, Maui, for the year ending June 30, 1916.

Date.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.
1	.....	3.8	1.8	16	108	9.8	9.8
2	.....	3.8	2.3	16	60	9.8	11
3	.....	5.0	5.8	19	296	9.8	12
4	.....	5.0	8.0	8.0	76	11	67
5	.....	2.8	3.3	7.2	26	8.9	34
6	.....	2.8	2.8	7.2	28	50	19
7	.....	2.8	3.3	11	25	18	.....
8	.....	2.8	2.8	11	76	9.8	.....
9	.....	2.3	2.3	15	256	8.9	.....
10	.....	2.3	2.8	17	428	8.0	.....
11	.....	2.3	9.8	11	102	7.2	.....
12	.....	4.4	9.8	8.9	28	7.2	.....
13	.....	2.8	5.0	8.0	28	6.5	.....
14	.....	2.3	6.5	8.0	37	6.5	.....
15	.....	2.3	5.0	16	39	7.2	.....
16	18	1.8	5.8	8.9	28	30	.....
17	48	2.3	4.4	7.2	25	8.0	.....
18	13	3.3	3.8	9.8	34	9.8	.....
19	6.5	3.8	4.4	12	80	28	.....
20	5.8	3.8	3.8	29	28	16	.....
21	5.0	3.3	3.8	26	25	16	.....
22	4.4	3.3	8.0	17	20	22	.....
23	4.4	3.3	8.0	22	17	9.8	.....
24	3.8	3.8	.....	12	16	8.0	.....
25	4.4	3.8	.....	13	15	20	.....
26	4.4	3.8	.....	20	13	128	.....
27	5.0	2.8	30	20	13	32	.....
28	4.4	2.8	35	30	12	12	.....
29	3.8	2.3	21	67	11	9.8	.....
30	3.8	2.3	15	41	9.8	9.8	.....
31	3.8	2.3	.....	39	.....	8.9	.....

NOTE.—Discharge determined from rating curve well defined below 200 million gallons per day. Gage height not recorded on days for which discharge is not given.

Monthly discharge of Hanawi Stream near Nahiku, Maui, for the year ending June 30, 1916.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons	Acre-feet.
	Maximum.	Minimum.	Mean.			
July 16–31	48	3.8	8.66	13.4	138	425
August	5.0	1.8	3.11	4.81	96	296
October	67	7.2	17.8	27.5	553	1,690
November	428	9.8	65.3	101	1,960	6,010
December	128	6.5	17.6	27.2	547	1,670
January 1–6	67	9.8	25.5	39.5	153	470

WEST KOPILIULA STREAM NEAR KEANAE, MAUI.

LOCATION.—600 feet above Koolau ditch crossing and highway bridge, 4½ miles by trail east of Upper Keanae, and 6 miles east of Keanae post office.

RECORDS AVAILABLE.—January 3, 1914, to June 30, 1916.

GAGE.—Friez water-stage recorder.

DISCHARGE MEASUREMENTS.—Made by wading or from footbridge 300 feet below gage.

CHANNEL AND CONTROL.—Channel at gage is a large pool at foot of falls; banks rock and nearly vertical. Control at outlet of pool composed of large boulders; seldom shifts.

EXTREMES OF DISCHARGE.—Maximum stage recorded during period of record, 9.25 feet at 5.30 a. m. January 18, 1916 (discharge, computed from extension of rating curve, approximately 2,000 million gallons per day, or 3,090 second-feet); minimum stage recorded (0.55 foot March 21, 1914, discharge, 1.8 million gallons per day, or 2.8 second-feet).

Minimum stage recorded during year, 0.65 foot August and September (discharge 2.6 million gallons per day, or 4.0 second-feet).

DIVERSIONS.—None above station.

REGULATION.—None.

UTILIZATION.—Normal flow is diverted into Koolau ditch for irrigation of sugar cane.

ACCURACY.—Determinations fair for all stages with the exception of extreme floods.

Discharge measurements of West Kopiliula Stream near Keanae, Maui, during the year ending June 30, 1916.

Date.	Made by—	Gage height (feet).	Discharge.	
			Second-feet.	Million gallons per day.
Feb. 1	R. D. Klise	1.19	10	6.7
Apr. 14	H. A. R. Austin	.98	4.8	3.1

Daily discharge, in million gallons, of West Kopiliula Stream near Keanae, Maui, for the year ending June 30, 1916.

Date.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	17	4.0	2.6	28	188	8.2	8.2	8.8	18	5.8	365	53
2	8.2	4.0	3.0	32	144	9.0	8.2	8.8	17	4.9	365	46
3	6.8	5.0	6.0	26	232	8.2	7.5	6.8	7.8	4.9	241	103
4	8.2	4.5	9.0	14	116	9.0	8.2	7.8	28	4.9	365	40
5	9.8	4.0	3.5	10	24	7.5	110	21	46	4.0	270	24
6	17	4.0	3.0	9.0	20	66	43	21	11	4.0	478	16
7	12	3.5	3.5	12	18	22	22	8.8	57	4.0	158	13
8	9.8	3.5	3.0	9.0	53	10	515	7.8	14	3.4	196	13
9	9.8	3.0	2.6	14	103	8.2	402	6.8	8.8	4.0	80	11
10	6.8	3.0	4.0	17	173	7.5	130	5.8	26	5.8	28	9.8
11	6.0	4.0	12	14	116	6.8	32	5.8	11	3.4	28	11
12	5.5	6.0	14	10	24	6.0	17	5.8	7.8	3.4	38	12
13	5.5	3.5	6.8	9.0	22	6.0	14	6.8	20	3.4	26	11
14	5.5	3.5	6.8	8.2	40	5.5	12	6.8	166	4.0	20	35
15	5.5	3.0	5.0	22	46	6.0	10	6.8	205	12	16	18
16	17	3.0	6.8	12	21	10	9.8	5.8	28	5.8	14	14
17	85	3.0	5.0	9.0	16	6.0	232	5.8	13	9.8	17	16
18	14	4.0	4.0	14	26	8.2	578	4.9	11	17	17	20
19	6.8	4.0	5.0	16	116	35	196	2.8	8.8	2[illegible]	17	14
20	5.5	4.0	4.5	50	40	22	38	4.9	7.8	5[illegible]	28	17
21	5.0	3.5	4.0	46	32	18	18	4.9	11	4[illegible]	35	21
22	4.5	3.5	18	28	24	32	13	2.8	43	12	32	21
23	4.0	4.0	9.0	28	17	12	12	2.8	26	4[illegible]	22	13
24	4.0	5.0	40	14	14	9.0	11	2.8	12	2[illegible]	14	11
25	4.5	4.0	40	16	12	32	11	2.8	11	8.8	12	12
26	4.5	5.0	85	32	10	166	17	2.8	9.8	7.8	11	24
27	5.0	3.5	80	28	9.8	46	14	30	7.8	8.8	9.8	57
28	4.5	3.0	90	61	9.8	21	11	8.8	7.8	2[illegible]	11	110
29	4.0	3.0	57	130	9.0	14	9.8	4.9	6.8	17	21	32
30	4.0	2.6	26	110	8.2	10	9.8	.....	7.8	13	14	28
31	4.0	2.6	.....	103	.....	9.0	9.8	.....	6.8	.....	26	.....

NOTE.—Discharge determined from rating curves fairly well defined below 300 million gallons per day, applicable as follows: July 1, 1915, to Jan. 18, 1916, and Jan. 19 to June 30, 1916. Discharge Sept. 27 to Oct. 2, Nov. 2–6 and 9–12, Dec. 11–18 determined by comparison with record of flow of West Wailuaiki Stream; Apr. 22–29, by comparison with record of East Wailuaiki Stream.

Monthly discharge of West Kopiliula Stream near Keanae, Maui, for year ending June 30, 1916.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July	85	4.0	9.99	15.5	310	950
August	6.0	2.6	3.75	5.80	116	357
September	90	2.6	18.6	28.8	559	1,710
October	130	8.2	30.0	46.4	931	2,850
November	232	8.2	56.1	86.8	1,680	5,160
December	166	5.5	20.5	31.7	636	1,950
January	578	7.5	81.6	126	2,530	7,760
February	30	2.8	7.66	11.9	222	682
March	205	6.8	27.8	43.0	862	2,640
April	50	3.4	12.3	19.0	379	1,130
May	478	9.8	96.0	149	2,970	9,130
June	110	9.8	27.5	42.5	826	2,530
The year	578	2.6	32.9	50.9	12,000	36,800

EAST WAILUAIKI STREAM NEAR KEANAE, MAUI.

LOCATION.—1,000 feet above Koolau ditch crossing and trail, 3¾ miles east of Upper Keanae, and about 6¼ miles east of Keanae post office.

RECORDS AVAILABLE.—December 21, 1913, to June 30, 1916.

GAGE.—Stevens water-stage recorder, installed April 17, 1914, to replace original Friez recorder.

DISCHARGE MEASUREMENTS.—Made by wading or from footbridge 800 feet below gage.

CHANNEL AND CONTROL.—Channel at gage is a large pool at foot of falls; banks nearly vertical walls of rock. Control composed of large boulders and rock ledge; fairly permanent.

EXTREMES OF DISCHARGE.—Maximum stage recorded during period of record, 8.35 feet at 8 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, 0.60 foot March 5–8, 1914, and August 14 and 15, 1915 (discharge, 2.5 million gallons per day, or 3.9 second-feet).

DIVERSIONS.—None above station.

REGULATION.—None.

UTILIZATION.—Normal flow is diverted into Koolau ditch for irrigation of sugar cane.

ACCURACY.—Determinations January 19 to June 30 fair for low and medium stages.

Discharge measurements of East Wailuaiki Stream near Keanae, Maui, during the year ending June 30, 1916.

Date.	Made by—	Gage height (feet).	Discharge.	
			Second-feet.	Million gallons per day.
Jan. 31	R. D. Klise	1.08	14	8.9
Apr. 14	H. A. R. Austin	.89	7.4	4.8
June 17	....do	1.30	23	15

Daily discharge, in million gallons, of East Wailuaiki Stream near Keanae, Maui, for the year ending June 30, 1916.

Date.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	20	3.9	5.3	28	155	9.6	9.6	7.2	18	6.1	635	48
2	8.2	3.9	5.3	28	162	11	9.6	7.2	22	5.3	300	40
3	7.2	4.5	9.6	30	270	11	8.2	6.1	11	5.3	230	95
4	8.2	4.5	18	16	125	13	9.6	6.1	20	4.5	355	30
5	11	3.3	8.2	13	33	9.6	125	25	48	4.5	270	20
6	20	3.3	7.2	11	30	102	48	25	11	4.5	442	14
7	14	3.3	6.1	13	22	30	22	8.2	30	4.5	170	11
8	11	3.3	6.1	11	62	14	442	7.2	14	4.5	230	11
9	11	2.9	5.3	18	148	11	442	7.2	7.2	5.3	74	9.6
10	7.2	2.9	9.6	22	250	11	170	7.2	25	11	25	9.6
11	6.1	2.9	36	14	155	9.6	52	6.1	9.6	5.3	28	9.6
12	5.3	6.1	33	9.6	33	9.6	22	5.3	7.2	5.3	40	13
13	5.3	3.3	11	8.2	28	8.2	16	5.3	16	5.3	22	14
14	5.3	2.5	9.6	7.2	74	8.2	14	5.3	170	4.5	16	40
15	5.3	2.5	9.6	28	48	8.2	13	5.3	230	13	14	20
16	28	2.9	7.2	11	25	18	11	4.5	25	7.2	20	14
17	110	2.9	4.5	8.2	20	9.6	155	4.5	14	7.2	14	16
18	18	3.9	3.9	14	30	9.6	560	3.9	11	18	14	22
19	9.6	4.5	4.5	16	162	40	210	3.9	8.2	22	14	14
20	7.2	5.3	4.5	68	44	28	30	5.3	8.2	40	28	16
21	6.1	6.1	3.9	40	33	20	18	5.3	8.2	57	33	20
22	6.1	5.3	22	28	30	40	14	4.5	44	11	33	22
23	5.3	5.3	9.6	30	20	13	13	3.9	28	44	22	16
24	5.3	8.2	48	14	14	9.6	11	3.9	13	18	14	13
25	5.3	8.2	68	16	14	30	11	4.5	9.6	9.6	13	13
26	5.3	8.2	68	33	13	230	16	4.5	8.2	7.2	9.6	28
27	5.3	6.1	81	28	11	125	16	25	8.2	8.2	9.6	52
28	4.5	6.1	95	74	11	25	11	9.6	7.2	25	11	125
29	4.5	6.1	48	110	9.6	14	9.6	5.3	7.2	16	28	30
30	3.9	6.1	30	110	9.6	13	8.2	.....	7.2	11	16	28
31	3.9	5.3	.....	88	.....	11	7.2	.....	6.1	.....	22	.....

NOTE.—Discharge determined from rating curves applicable as follows: July 1, 1915, to Jan. 18, 1916, well defined; Jan. 19, to June 30, 1916, fairly well defined. Discharge July 1–15 and Sept. 16–24 determined by comparison with record of flow of West Kopiliula Stream.

Monthly discharge of East Wailuaiki Stream near Keanae, Maui, for year ending June 30, 1916.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July	110	3.9	12.0	18.6	373	1,140
August	8.2	2.5	4.63	7.16	144	440
September	95	3.9	22.6	35.0	678	2,080
October	110	7.2	30.5	47.2	945	2,900
November	270	9.6	68.0	105	2,040	6,260
December	230	8.2	29.1	45.0	902	2,770
January	560	7.2	80.8	125	2,500	7,690
February	25	3.9	7.67	11.9	222	683
March	230	6.1	27.5	42.5	850	2,620
April	57	4.5	13.0	20.1	390	1,200
May	635	9.6	102	158	3,150	9,700
June	125	9.6	27.1	41.9	814	2,500
The year	635	2.5	35.6	55.1	13,000	40,000

WEST WAILUAIKI STREAM NEAR KEANAE, MAUI.

LOCATION.—500 feet above Koolau ditch crossing and trail bridge, 3 miles east of Upper Keanae, and 5½ miles east of Keanae post office.

RECORDS AVAILABLE.—January 1, 1914, to June 30, 1916.

GAGE.—Stevens water-stage recorder.

DISCHARGE MEASUREMENTS.—Made by wading or from footbridge 100 feet below gage.

CHANNEL AND CONTROL.—Channel at gage is a large deep pool at foot of low waterfall; banks are nearly vertical walls of rock to above high water. Control at outlet of pool composed of rock ledge and large boulders; probably permanent.

EXTREMES OF DISCHARGE.—Flood of January 18, 1916, carried away gage shelter and must have reached a stage of about 13 feet (discharge, possibly 4,000 million gallons per day, or 6,190 second-feet); minimum stage recorded, 0.8 foot March 7–12, 1914 (discharge, 1.6 million gallons per day, or 2.5 second-feet).

Minimum stage recorded during year, 0.9 foot August and September (discharge, 2.5 million gallons per day, or 3.7 second-feet).

DIVERSIONS.—None above station.

REGULATION.—None.

UTILIZATION.—Normal flow is diverted into Koolau ditch for irrigation of sugar cane.

ACCURACY.—Determinations based on well-defined rating curves and continuous gage-height record, good for all stages.

Discharge measurements of West Wailuaiki Stream near Keanae, Maui, during the year ending June 30, 1916.

Date.	Made by—	Gage height (feet).	Discharge.	
			Second-feet.	Million gallons per day.
Feb. 1	R. D. Klise	1.23	11	6.8
Apr. 14	H. A. R. Austin	1.14	7.4	4.8

Daily discharge, in million gallons, of West Wailuaiki Stream near Keanae, Maui, for the year ending June 30, 1916.

Date.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	May.	June.
1	31	3.0	2.5	41	238	7.5	.....	72
2	15	3.0	3.5	46	210	9.8	.....	62
3	9.8	3.5	15	31	368	8.5	.....	136
4	11	4.2	16	16	151	9.8	.....	55
5	15	3.0	6.5	14	34	7.5	.....	31
6	29	3.0	4.2	12	27	117	.....	20
7	23	2.5	5.0	14	23	36	.....	16
8	14	2.5	3.5	11	68	15	.....	16
9	14	2.5	3.0	25	143	11	.....	12
10	8.5	2.5	5.8	36	268	8.5	.....	11
11	7.5	3.0	25	25	167	7.5	.....	12
12	6.5	7.5	23	12	34	6.5	.....	15
13	5.8	5.8	8.5	11	29	6.5	.....	12
14	5.8	4.2	11	9.8	65	5.8	.....	46
15	5.8	3.0	7.5	44	68	6.5	.....	23
16	18	2.5	16	15	25	12	.....	15
17	167	2.5	9.8	11	18	6.5	.....	20
18	29	4.2	6.5	21	36	8.5	.....	25
19	12	5.0	8.5	25	192	52	18	18
20	9.8	5.0	7.5	84	58	31	38	21
21	7.5	3.5	5.8	80	46	27	46	27
22	6.5	3.5	23	41	36	.....	44	27
23	5.8	3.5	11	41	20	.....	26	15
24	5.0	5.8	58	20	15	.....	18	12
25	5.8	5.8	58	20	12	.....	15	15
26	5.0	5.8	97	44	11	.....	12	31
27	5.8	4.2	112	34	9.8	.....	11	76
28	5.0	3.5	123	102	8.5	.....	12	143
29	3.5	3.0	80	159	7.5	.....	27	44
30	3.5	3.0	38	143	6.5	.....	16	38
31	3.0	3.0	.....	117	.....	.....	36	.....

NOTE.—Discharge determined as follows: July 1 to Dec. 21, 1915, and May 19 to June 30, 1916, from well-defined rating curves; Sept. 22–25, by comparison with record of flood of West Kopiliula Stream. No record Dec. 22, 1915, to May 18, 1916.

Monthly discharge of West Wailuaiki Stream near Keanae, Maui, for year ending June 30, 1916.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July	167	3.0	15.9	24.6	494	1,510
August	7.5	2.5	3.77	5.83	117	359
September	123	2.5	26.5	41.0	794	2,440
October	159	9.8	42.1	65.1	1,300	4,010
November	368	6.5	79.8	123	2,390	7,350
December 1–21	117	5.8	19.1	29.6	400	1,230
May 19–31	46	11	24.8	38.7	322	989
June	143	11	35.5	54.9	1,070	3,270

EAST WAILUANUI STREAM NEAR KEANAE, MAUI.

LOCATION.—1,000 feet above Koolau ditch crossing, 2½ miles east of Upper Keanae, and 5 miles east of Keanae post office.

RECORDS AVAILABLE.—January 1, 1914, to June 30, 1916.

GAGE.—Stevens water-stage recorder.

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

CHANNEL AND CONTROL.—Channel at gage a small deep pool at foot of rapids; right bank vertical wall of rock; left bank steep and high. Control at outlet of pool is ledge of rock; probably permanent.

EXTREMES OF DISCHARGE.—Maximum stage recorded, 5.05 feet at 7 p. m. May 1, 1916 (discharge computed from extension of rating curve, approximately 420 million gallons per day, or 650 second-feet); minimum stage recorded, 0.75 foot April 7, 1915 (discharge, 0.25 million gallons per day, or 0.4 second-foot).

Minimum stage recorded during year, 0.95 foot August, September, and April (discharge 1.1 million gallons per day, or 1.7 second-feet).

DIVERSIONS.—None above station.

REGULATION.—None.

UTILIZATION.—Normal flow is diverted into Koolau ditch for irrigation of sugar cane.

ACCURACY.—Determinations based on a well-defined rating curve and a continuous record of gage height; good for all stages except possibly those occurring November 1–29 and January 30 to March 9, for which the discharge was estimated by comparison with West Wailuanui.

Discharge measurements of East Wailuanui Stream near Keanae, Maui, during the year ending June 30, 1916.

Date.	Made by—	Gage height (feet).	Discharge.	
			Second-feet.	Million gallons per day.
Aug. 20	R. D. Klise	1.03	2.2	1.4
Jan. 30	do	1.03	3.4	2.2
Apr. 14	H. A. R. Austin	1.14	3.7	2.4
June 16	do	1.38	8.5	5.5

Daily discharge, in million gallons, of East Wailuanui Stream near Keanae, Maui, for the year ending June 30, 1916.

Date.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	9.0	2.0	1.1	10	47	2.5	3.0	3.5	10	2.0	168	11
2	4.1	2.0	1.5	10	10	3.5	3.0	3.5	8.0	2.0	47	9.0
3	3.5	2.0	4.7	11	84	3.0	2.5	3.0	4.7	2.0	38	17
4	3.5	2.0	5.4	5.4	41	4.7	2.5	3.0	14	1.5	50	9.0
5	3.5	1.5	2.5	4.1	11	3.0	19	11	14	1.5	27	8.0
6	8.0	1.5	2.0	3.5	8.0	23	8.0	8.0	4.7	1.1	64	5.4
7	6.1	1.5	2.5	4.1	6.1	7.0	6.1	4.7	10	1.5	25	4.7
8	4.1	4.7	2.0	3.5	21	4.1	68	3.5	6.1	1.1	41	4.7
9	5.4	1.5	2.0	6.1	36	3.5	44	3.5	3.0	2.0	21	4.1
10	3.5	1.1	2.5	6.1	53	3.0	17	3.5	8.0	3.0	7.0	3.5
11	3.0	1.5	5.4	3.5	47	2.5	10	3.5	2.5	1.5	9.0	4.7
12	2.5	2.5	5.4	3.0	11	2.5	4.7	3.5	2.5	1.1	10	6.1
13	2.5	1.5	3.5	3.0	8.0	2.5	3.5	3.5	9.0	1.1	6.1	5.4
14	2.0	1.1	4.7	2.5	10	2.0	3.5	3.5	34	2.0	4.7	15
15	2.0	1.5	3.5	7.0	11	2.5	3.0	3.5	27	4.7	4.1	11
16	9.0	1.1	4.7	3.5	7.0	5.4	2.5	3.5	5.4	2.0	3.0	6.1
17	36	1.5	3.0	3.0	6.1	2.5	6.1	3.0	4.1	3.5	4.1	6.1
18	8.0	2.0	2.5	6.1	8.0	3.0	38	3.0	4.1	6.1	4.1	8.0
19	3.5	1.5	4.1	6.1	36	10	19	3.0	3.0	9.0	4.1	6.1
20	3.5	2.0	3.0	17	15	8.0	5.4	3.5	2.5	14	11	7.0
21	3.0	2.0	2.5	14	11	8.0	4.1	3.0	4.1	12	9.0	10
22	1.5	1.5	8.0	6.1	11	12	3.5	3.0	9.0	4.7	14	10
23	1.5	1.5	3.5	10	7.0	4.1	3.0	3.0	9.0	14	9.0	6.1
24	2.0	3.5	9.0	4.1	4.7	3.5	3.0	3.0	4.1	10	5.4	4.7
25	2.0	3.5	8.0	4.1	4.7	8.0	2.5	3.0	3.5	4.7	4.7	4.7
26	2.0	3.0	12	10	4.7	17	2.5	3.0	3.5	3.5	4.1	12
27	1.5	2.5	11	5.4	3.5	11	2.5	8.0	3.0	3.5	3.5	19
28	1.5	2.0	17	19	3.5	4.7	2.0	3.5	3.0	7.0	4.7	34
29	2.0	1.5	10	12	3.5	3.5	2.0	3.0	2.5	4.1	11	11
30	2.0	1.5	9.0	10	2.0	3.5	3.5	.....	2.5	6.1	5.4	8.0
31	2.0	1.5	.....	9.0	.....	3.0	3.5	.....	2.0	.....	8.0	.....

NOTE.—Discharge determined from well-defined rating curve. Discharge Nov. 1–29, Jan. 30 to Mar. 9 estimated by comparison with record of flow of West Wailuanui Stream.

Monthly discharge of East Wailuanui Stream near Keanae, Maui, for year ending June 30, 1916.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July	36	1.5	4.64	7.18	144	441
August	4.7	1.1	1.94	3.00	60	185
September	17	1.1	5.20	8.05	156	479
October	19	2.5	7.17	11.1	222	682
November	84	2.0	17.7	27.4	532	1,630
December	23	2.0	5.69	8.80	176	541
January	68	2.0	9.71	15.0	301	924
February	11	3.0	3.90	6.03	113	347
March	34	2.0	7.19	11.1	223	684
April	14	1.1	4.41	6.82	132	406
May	168	3.0	20.2	31.3	627	1,920
June	34	3.5	9.05	14.0	271	833
The year	168	1.1	8.08	12.5	2,960	9,070

WEST WAILUANUI STREAM NEAR KEANAE, MAUI.

LOCATION.—50 feet above Koolau ditch crossing and intake, 2 miles east of Upper Keanae, and 4½ miles east of Keanae post office.

RECORDS AVAILABLE.—December 19, 1913, to June 30, 1916.

GAGE.—Stevens water-stage recorder.

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

CHANNEL AND CONTROL.—One channel at all stages; straight for 100 feet above gage; waterfall 50 feet below gage; bank steep and high. Control low concrete dam 30 feet long.

EXTREMES OF DISCHARGE.—Maximum stage recorded during period of record, 7.03 feet at 6.30 a. m. January 18, 1916 (discharge computed from extension of rating curve, approximately 760 million gallons per day, or 1,180 second-feet); minimum stage recorded, 0.95 foot February 11 to 28, 1914, and July and August, 1915 (discharge, 0.7 million gallons per day, or 1.1 second-feet).

DIVERSIONS.—None above station.

REGULATION.—None.

UTILIZATION.—Irrigation of sugar cane, rice, and taro.

ACCURACY.—Determinations based on a well-defined rating curve and a continuous gage-height record, good for all stages.

Discharge measurements of West Wailuanui Stream near Keanae, Maui, during the year ending June 30, 1916.

Date.	Made by—	Gage height (feet).	Discharge.	
			Second-feet.	Million gallons per day.
Jan. 30	R. D. Klise	1.07	4.8	3.1
June 16	H. A. R. Austin	1.20	12	7.5

Daily discharge, in million gallons, of West Wailuanui Stream near Keanae, Maui, for the year ending June 30, 1916.

Date.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	15	1.8	1.8	15	101	3.2	4.8	4.8	18	3.2	342	18
2	7.0	1.8	1.8	15	134	4.8	4.8	4.8	15	3.2	186	15
3	4.8	1.8	7.0	15	153	4.8	4.8	3.2	7.0	3.2	134	39
4	4.8	1.8	7.0	7.0	82	4.8	4.8	3.2	25	3.2	218	15
5	4.8	.7	3.2	4.8	21	4.8	57	21	25	3.2	192	9.3
6	12	.7	1.8	4.8	15	57	21	15	7.0	4.8	283	7.0
7	9.3	.7	1.8	4.8	9.3	21	15	7.0	18	3.2	108	4.8
8	4.8	7.0	1.8	4.8	39	7.0	322	4.8	9.3	4.8	120	4.8
9	7.0	.7	1.8	7.0	75	7.0	322	4.8	3.2	4.8	57	4.8
10	4.8	.7	1.8	9.3	108	4.8	140	4.8	21	7.0	15	3.2
11	3.2	.7	7.0	7.0	101	4.8	39	4.8	7.0	3.2	18	3.2
12	1.8	1.8	7.0	3.2	21	4.8	15	4.8	4.8	3.2	21	4.8
13	1.8	.7	3.2	3.2	15	4.8	9.3	4.8	12	3.2	12	4.8
14	1.8	.7	4.8	1.8	18	4.8	7.0	4.8	127	3.2	9.3	18
15	1.8	.7	3.2	15	21	4.8	4.8	4.8	160	4.8	7.0	12
16	9.3	.7	7.0	4.8	12	9.3	4.8	4.8	21	3.2	4.8	7.0
17	57	.7	4.8	3.2	9.3	4.8	192	3.2	12	1.8	4.8	7.0
18	9.3	1.8	3.2	7.0	15	4.8	322	3.2	7.0	7.0	4.8	9.3
19	4.8	1.8	4.8	7.0	75	25	140	3.2	7.0	9.3	4.8	7.0
20	4.8	1.8	3.2	29	29	15	21	4.8	4.8	18	12	7.0
21	3.2	1.8	1.8	29	21	12	12	3.2	4.8	25	12	9.3
22	.7	1.8	15	15	21	21	7.0	3.2	15	9.3	15	12
23	.7	3.2	4.8	21	12	9.3	4.8	3.2	15	25	9.3	7.0
24	1.8	3.2	9.3	12	7.0	7.0	4.8	3.2	7.0	15	4.8	4.8
25	1.8	4.8	15	9.3	7.0	45	4.8	3.2	7.0	7.0	3.2	4.8
26	1.8	3.2	51	18	7.0	114	9.3	3.2	4.8	4.8	3.2	15
27	.7	3.2	39	15	4.8	88	7.0	15	4.8	4.8	3.2	25
28	.7	1.8	51	45	4.8	18	4.8	4.8	4.8	18	1.8	69
29	1.8	1.8	29	75	4.8	9.3	3.2	3.2	4.8	9.3	12	18
30	1.8	1.8	18	82	3.2	7.0	4.8	.....	4.8	9.3	4.8	12
31	1.8	1.8	.....	57	.....	7.0	4.8	.....	4.8	.....	7.0	.....

NOTE.—Discharge determined from well-defined rating curve. Discharge July 19 to Aug. 18 determined by comparison with record of flow of East Wailuanui Stream.

Monthly discharge of West Wailuanui Stream near Keanae, Maui, for year ending June 30, 1916.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July	57	0.7	6.02	9.31	187	573
August	7.0	.7	1.85	2.86	58	176
September	51	1.8	10.4	16.1	312	958
October	82	1.8	17.6	27.2	547	1,670
November	153	3.2	38.2	59.1	1,150	3,520
December	114	3.2	17.4	26.9	540	1,660
January	322	3.2	55.4	85.7	1,720	5,270
February	21	3.2	5.48	8.48	159	488
March	160	3.2	19.0	29.4	589	1,810
April	25	1.8	7.50	11.6	225	691
May	342	1.8	59.0	91.3	1,830	5,610
June	69	3.2	12.6	19.5	378	1,160
The year	342	.7	21.0	32.5	7,700	23,600

HONOMANU STREAM NEAR KEANAE, MAUI.

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

RECORDS AVAILABLE.—November 15, 1913, to June 30, 1916.

GAGE.—Stevens 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 period of record, 9.9 feet at 9 p. m. May 1, 1916 (discharge, computed from extension of rating curve, approximately 1,200 million gallons per day, or 1,860 second-feet), minimum stage recorded, 2.20 feet April 7 and 8, 1915 (discharge, 0.25 million gallons per day, or 0.4 second-foot).

Minimum stage recorded during year, 2.15 feet April 6–8 (discharge, 1.3 million gallons per day, or 2 second-feet).

DIVERSIONS.—None above station.

REGULATION.—None.

UTILIZATION.—Normal flow is diverted by Spreckels ditch for irrigation of sugar cane.

ACCURACY.—Determinations based on a well-defined rating curve and a continuous gage-height record; good for all stages.

Discharge measurements of Honomanu Stream near Keanae, Maui, during the year ending June 30, 1916.

Date.	Made by—	Gage height (feet).	Discharge.	
			Second-feet.	Million gallons per day.
Feb. 2	R. D. Klise	2.37	2.8	1.8
Apr. 13	H. A. R. Austin	2.28	2.3	1.5
June 15	do	4.21	105	68

Daily discharge, in million gallons, of Honomanu Stream near Keanae, Maui, for the year ending June 30, 1916.

Date.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	18	1.8	1.7	25	144	2.4	2.9	2.9	10	1.6	690	37
2	6.7	1.7	1.7	21	159	3.6	2.6	2.2	27	1.5	354	33
3	4.0	1.8	12	27	216	3.2	2.6	2.2	8.5	1.5	260	91
4	4.6	2.9	23	8.5	97	5.2	3.2	2.0	8.5	1.4	404	27
5	13	2.2	10	6.0	23	3.2	110	7.6	12	1.4	334	19
6	27	2.9	3.2	4.6	16	74	27	14	3.6	1.3	458	9.5
7	16	2.0	2.6	4.6	12	18	10	3.6	7.6	1.3	225	6.7
8	5.2	1.8	2.6	4.6	41	4.0	404	2.9	6.0	1.3	260	6.7
9	7.6	1.8	2.4	12	63	2.9	458	2.6	2.6	1.5	130	6.0
10	5.2	1.7	2.6	21	68	2.9	183	2.6	13	6.7	27	4.6
11	3.2	1.8	14	18	54	2.9	54	2.4	4.6	1.8	27	6.0
12	2.6	6.7	30	6.0	14	2.6	14	2.4	2.6	1.5	33	8.5
13	2.6	4.6	7.6	4.0	16	2.4	10	2.4	19	1.4	19	8.5
14	2.2	6.7	8.5	3.6	27	2.4	8.5	2.4	167	1.8	9.5	45
15	2.2	4.0	9.5	19	33	2.2	6.7	2.4	216	10	6.7	16
16	13	2.4	.....	7.6	12	2.6	6.0	2.2	18	4.0	4.6	4.6
17	144	2.2	.....	4.0	8.5	2.2	25	2.2	6.0	2.9	8.5	6.7
18	18	3.2	.....	16	19	2.6	278	2.2	3.6	13	7.6	8.5
19	5.2	4.6	.....	18	130	27	144	2.0	2.9	18	7.6	4.0
20	3.6	3.6	.....	58	37	14	25	2.2	2.4	33	19	4.6
21	2.9	2.9	.....	68	41	9.5	12	2.6	4.0	49	18	9.5
22	2.6	2.4	.....	23	23	33	9.5	2.4	25	6.0	19	12
23	2.6	2.2	.....	19	10	5.2	6.7	2.2	8.5	33	12	4.6
24	2.4	4.6	.....	8.5	6.7	3.6	6.0	2.0	3.2	19	6.7	3.6
25	2.6	6.7	.....	10	5.2	10	4.6	1.8	3.2	8.5	4.6	3.2
26	2.6	3.2	103	21	4.6	63	4.0	1.8	2.4	3.6	4.0	19
27	2.6	2.6	85	16	4.0	54	4.0	41	2.2	4.6	3.6	45
28	2.6	2.2	103	103	3.6	9.5	3.2	7.6	2.0	30	3.6	97
29	2.0	2.0	49	116	2.6	4.6	2.9	3.2	1.7	6.7	19	14
30	2.0	1.8	30	110	2.6	3.6	2.6	.....	1.7	18	8.5	12
31	1.8	1.8	.....	79	.....	2.9	3.6	.....	1.6	.....	21	.....

NOTE.—Discharge determined from well-defined rating curve. No record Sept. 16–25.

Monthly discharge of Honomanu Stream near Keanae, Maui, for year ending June 30, 1916.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July	144	1.8	10.7	16.6	331	1,020
August	6.7	1.7	2.99	4.63	93	284
October	116	3.6	27.8	43.0	862	2,640
November	216	2.6	43.1	66.7	1,290	3,970
December	74	2.2	12.2	18.9	379	1,160
January	458	2.6	59.1	91.4	1,830	5,620
February	41	1.8	4.48	6.93	130	399
March	216	1.6	19.2	29.7	596	1,830
April	49	1.3	9.51	14.7	285	876
May	690	3.6	110	170	3,400	10,500
June	97	3.2	19.1	29.6	573	1,760

HAIPUAENA STREAM NEAR HUELO, MAUI.

LOCATION.—200 feet above inflow of Spreckels ditch, about 7 miles by trail east of Huelo.

RECORDS AVAILABLE.—October 19, 1913, to June 30, 1916; also records of combined flow of stream and Spreckles ditch at staff gage station 600 feet below present site December 18, 1910, to September 30, 1913.

GAGE.—Stevens 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 period of record, 5.1 feet at 4.30 a. m. March 1, 1916 (discharge, computed from extension of rating curve, 350 million gallons per day, or 542 second-feet); minimum stage recorded, 0.2 foot March 8, 1914 (discharge, 1.0 million gallons per day, or 1.5 second-feet).

Minimum stage recorded during year, 0.35 foot February 25 (discharge 1.6 million gallons per day, or 2.5 second-feet).

DIVERSIONS.—None above station.

REGULATION.—None.

UTILIZATION.—Normal flow diverted by ditches of East Maui Irrigation Co. for irrigation of sugar cane.

ACCURACY.—Determinations based on a well-defined rating curve; good for all stages.

Discharge measurements of Haipuaena Stream near Huelo, Maui, during the year ending June 30, 1916.

Date.	Made by—	Gage height (feet).	Discharge.	
			Second-feet.	Million gallons per day.
Feb. 2	R. D. Klise	0.45	3.4	2.2
June 15	H. A. R. Austin	1.15	20	13

Daily discharge, in million gallons, of Haipuaena Stream, near Huelo, Maui, for the year ending June 30, 1916.

Date.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	.....	2.5	2.5	20	56	3.4	4.0	3.0	9.5	2.5	231	30
2	.....	2.2	3.0	20	59	5.2	3.4	2.2	15	2.5	119	24
3	.....	3.0	15	20	97	4.5	3.4	2.2	5.9	2.2	97	49
4	.....	4.5	12	8.6	46	7.6	4.0	1.8	5.2	2.2	123	24
5	.....	3.0	5.2	6.8	15	4.0	49	7.6	6.8	2.2	101	18
6	.....	3.4	3.4	5.9	12	40	18	15	3.4	1.8	132	12
7	.....	2.5	4.5	5.9	8.6	14	9.5	4.0	5.9	1.8	85	7.6
8	.....	2.2	3.4	5.9	28	5.2	136	3.4	5.2	1.8	105	8.6
9	.....	1.8	3.0	14	35	4.5	132	3.0	3.0	1.8	46	6.8
10	.....	1.8	5.2	14	35	4.0	62	2.5	11	8.6	18	5.9
11	.....	2.5	18	11	22	3.4	26	2.5	4.5	3.0	20	5.9
12	.....	8.6	14	5.9	9.5	3.4	9.5	2.2	3.4	2.2	24	8.6
13	.....	4.5	6.8	5.2	9.5	3.0	6.8	2.2	18	1.8	14	9.5
14	.....	4.0	5.9	4.5	18	3.0	5.9	2.2	81	3.4	9.5	30
15	3.0	4.0	5.2	18	22	3.0	5.2	2.2	73	11	7.6	18
16	14	2.5	4.5	6.8	9.5	4.0	4.0	2.2	11	5.9	6.8	11
17	70	2.5	4.5	5.2	6.8	3.0	4.5	2.2	5.9	5.2	9.5	12
18	16	4.0	4.0	12	16	4.0	49	2.2	4.5	14	8.6	14
19	5.9	4.5	5.2	12	56	24	43	2.2	4.0	18	8.6	9.5
20	4.5	4.5	4.5	49	20	11	11	3.0	3.4	26	20	11
21	4.0	4.0	3.4	38	22	11	5.9	2.5	5.2	35	18	18
22	3.4	3.4	16	15	14	28	4.5	1.8	20	8.6	20	22
23	3.0	3.0	6.8	20	7.6	5.9	4.0	1.8	11	30	15	11
24	3.0	5.9	24	8.6	5.9	4.5	4.0	1.8	5.2	24	9.5	7.6
25	4.0	6.8	20	9.5	5.2	8.6	3.4	1.6	5.2	11	7.6	7.6
26	3.4	4.5	46	18	4.5	28	3.4	1.8	4.5	6.8	5.9	28
27	4.0	3.4	38	15	4.5	24	3.4	18	4.0	8.6	5.2	40
28	3.4	3.0	49	56	4.5	7.6	3.4	4.5	3.4	16	5.9	70
29	3.0	2.5	30	49	3.4	5.2	3.0	3.0	3.0	6.8	20	18
30	2.5	2.5	26	40	3.4	4.5	3.0	.....	3.0	22	11	18
31	2.5	2.5	.....	35	.....	4.0	4.5	.....	2.5	.....	16	.....

Monthly discharge of Haipuaena Stream near Huelo, Maui, for the year ending June 30, 1916.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July 15–31	70	2.5	8.80	13.6	150	459
August	8.6	1.8	3.55	5.49	11[illegible]	338
September	49	2.5	13.0	20.1	38[illegible]	1,200
October	56	4.5	17.9	27.7	55[illegible]	1,700
November	97	3.4	21.9	33.9	65[illegible]	2,020
December	40	3.0	9.21	14.2	28[illegible]	876
January	136	3.0	20.3	31.4	62[illegible]	1,930
February	18	1.6	3.61	5.58	10[illegible]	321
March	81	2.5	11.2	17.3	34[illegible]	1,070
April	35	1.8	9.56	14.8	28[illegible]	880
May	230	5.2	42.2	65.3	1,310	4,010
June	70	5.9	18.5	28.6	55[illegible]	1,700

NOTE.—Discharge determined from rating curve well defined below 150 millions gallons per day. No record July 1–14.

PUOHAKAMOA STREAM NEAR HUELO, MAUI.

LOCATION.—150 feet above Spreckels ditch inflow and trail crossing, about 7 miles east of Huelo.

RECORDS AVAILABLE.—June 13, 1913, to June 30, 1916 (new station); December 18, 1910, to June 18, 1913 (old station).

GAGE.—Barrett & 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 below gage. Inflow of Spreckels ditch has to be deducted from measurements made at footbridge.

CHANNEL AND CONTROL.—One channel at all stages; curves 100 feet above and below gage; banks steep and high; stream bed very rough and steep. Control composed of large boulders: shifts.

EXTREMES OF DISCHARGE.—Maximum stage recorded during period of record, 7.55 feet at 10 a. m. May 1, 1916 (discharge, computed from extension of rating curve, approximately 800 million gallons per day, or 1,240 second-feet), minimum stage recorded, 0.21 foot (old station) February 7, 1912 (discharge, 2.1 million gallons per day, or 3.2 second-feet).

Minimum stage recorded during year 1.0 foot August 30, 1915 (discharge, 4.4 million gallons per day, or 6.8 second-feet).

DIVERSIONS.—Kula pipe line diverts small amount of water above station at elevation 4,300 feet.

REGULATION.—None.

UTILIZATION.—Normal flow of stream is diverted by East Maui Irrigation Co's ditches for irrigation of sugar cane.

ACCURACY.—Determinations based on a fairly well defined rating curve and continuous gage-height record; fair for all stages.

Discharge measurements of Puohakamoa Stream near Huelo, Maui, during the year ending June 30, 1916.

Date.	Made by—	Gage height (feet).	Discharge.	
			Second-feet.	Million gallons per day.
July 15	H. A. R. Austin	1.43	12	7.8
Feb. 2	R. D. Klise	1.39	10	6.5
June 15	H. A. R. Austin	2.48	39	25

Daily discharge, in million gallons, of Puohakamoa Stream near Huelo, Maui, for the year ending June 30, 1916.

Date.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	38	5.4	4.6	38	141	8.6	8.6	6.6	11	6.0	468	72
2	16	5.4	5.4	46	157	12	8.1	6.3	22	6.0	262	62
3	10	6.6	26	38	254	10	7.7	6.3	11	5.4	229	117
4	14	9.0	19	17	133	18	8.1	6.0	10	5.4	245	67
5	26	6.3	8.6	12	38	10	96	10	12	5.4	189	46
6	56	6.6	6.3	10	28	72	38	38	7.3	5.2	181	28
7	26	5.7	7.7	9.5	20	31	22	10	12	5.2	189	19
8	16	5.2	6.0	9.5	56	15	313	8.6	10	4.9	262	22
9	19	4.9	5.4	18	78	11	296	7.3	6.3	5.2	117	17
10	11	4.9	8.1	22	84	9.5	133	7.0	14	17	46	15
11	9.5	6.0	31	17	56	9.0	62	6.6	9.0	6.3	56	17
12	8.1	15	19	10	26	8.1	22	6.3	7.0	5.2	31	22
13	7.7	8.1	9.0	8.6	26	7.7	18	6.0	26	4.9	22	22
14	7.3	7.0	9.0	7.7	38	7.3	15	6.0	181	7.0	19	72
15	7.0	6.6	8.1	22	67	7.3	12	5.7	165	20	19	42
16	24	5.4	7.3	11	24	9.0	11	5.7	26	11	18	26
17	165	6.0	6.6	8.6	17	7.0	10	5.4	15	9.0	18	28
18	34	7.7	6.0	20	31	9.0	72	5.2	11	24	22	31
19	13	7.0	7.0	22	141	46	90	5.2	10	46	24	20
20	10	7.3	6.6	103	67	26	22	6.0	8.6	56	56	24
21	9.0	7.7	5.4	78	38	24	14	6.0	11	84	51	42
22	8.1	7.3	17	28	56	67	11	5.2	38	16	51	51
23	7.3	10	10	42	19	15	9.5	4.9	22	56	38	22
24	7.0	10	28	18	16	10	9.0	4.6	12	46	24	16
25	8.6	7.7	31	19	14	12	8.6	4.6	11	24	18	16
26	7.3	7.3	78	31	12	51	8.1	5.2	9.0	13	16	67
27	8.6	6.3	72	26	10	46	8.1	19	8.1	13	14	103
28	7.0	5.7	103	141	10	18	7.7	8.6	7.3	26	15	157
29	6.0	4.9	56	72	9.0	11	7.0	5.7	6.6	13	46	46
30	6.0	4.4	42	78	9.0	10	7.0	.....	6.6	26	24	38
31	5.7	4.6	.....	84	.....	9.0	7.0	.....	6.0	.....	38	.....

NOTE.—Discharge determined from fairly well defined rating curve.

Monthly discharge of Puohakamoa Stream near Huelo, Maui, for year ending June 30, 1916.

Month.	Discharge.				Run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons	Acre-feet.
	Maximum.	Minimum.	Mean.			
July	165	5.7	19.3	29.9	598	1,840
August	15	4.4	6.84	10.6	212	651
September	103	4.6	21.6	33.4	648	1,990
October	141	7.7	34.4	53.2	1,070	3,270
November	254	9.0	55.8	86.3	1,670	5,140
December	72	7.0	19.6	30.3	606	1,860
January	313	7.0	43.9	67.9	1,360	4,180
February	38	4.6	7.86	12.2	228	700
March	181	6.0	23.0	35.6	712	2,190
April	84	4.9	19.1	29.6	572	1,760
May	468	14	90.6	140	2,810	8,620
June	157	15	44.2	68.4	1,330	4,070
The year	468	4.4	32.3	50.0	11,870	36,300

ALO STREAM NEAR HUELO, MAUI.

LOCATION.—300 feet above Spreckels ditch inflow and trail crossing, about 5 miles east of Huelo.

RECORDS AVAILABLE.—December 18, 1910, to June 30, 1915.

GAGE.—Friez water-stage recorder installed June 18, 1914. Prior to June 18, 1914, vertical staff at trail bridge 300 feet downstream from present location.

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

CHANNEL AND CONTROL.—Channel at gage is 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 period of record, 4.12 feet at 3.30 p. m. January 8, 1916 (discharge, computed from extension of rating curve, approximately 500 million gallons per day, or 774 second-feet); minimum stage recorded, 1.34 feet (old datum), November 4, 1911 (discharge, 0.06 million gallons per day, or 0.1 second-foot).

Minimum stage recorded during year, 0.45 foot February and September (discharge, 0.8 million gallons per day, or 1.2 second-feet).

DIVERSIONS.—None above station.

REGULATION.—None.

UTILIZATION.—Normal flow of stream diverted by ditches of East Maui Irrigation Co. for irrigation of sugar cane.

ACCURACY.—Determinations based on well-defined rating curve and continuous gage-height record; good for all stages, except extreme floods.

Discharge measurements of Alo Stream near Huelo, Maui, during the year ending June 30, 1916.

Date.	Made by—	Gage height (feet).	Discharge.	
			Second-feet.	Million gallons per day.
Jan. 29	R. D. Klise	0.53	1.5	1.0
June 15	H. A. R. Austin	.93	8.5	5.5

Daily discharge, in million gallons, of Alo Stream near Huelo, Maui, for the year ending June 30, 1916.

Date.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	13	1.3	0.8	13	34	1.3	2.1	1.3	4.0	1.3	158	7.7
2	4.8	1.0	1.0	27	27	2.6	2.1	1.0	3.3	1.3	38	6.7
3	3.3	2.1	7.7	10	74	3.3	1.6	1.0	1.6	1.3	30	13
4	3.3	2.1	10	4.8	24	5.7	2.1	1.0	1.6	1.0	52	6.7
5	4.8	1.3	1.6	3.3	8.8	3.3	14	7.7	1.6	1.0	16	6.7
6	13	1.3	1.3	2.6	7.7	16	7.7	6.7	1.3	1.0	42	4.8
7	7.7	1.3	3.3	2.1	4.8	4.8	12	2.1	2.1	1.0	16	4.0
8	6.7	1.0	1.3	1.6	18	2.6	62	1.6	1.6	1.0	38	5.7
9	7.7	1.0	1.3	6.7	27	2.1	47	1.6	1.3	1.3	18	4.0
10	4.0	1.0	1.6	4.8	16	2.1	16	1.3	4.8	2.6	7.7	3.3
11	3.3	1.6	8.8	2.6	10	1.6	10	1.3	2.1	1.3	10	7.7
12	2.6	5.7	4.8	2.1	5.7	1.3	5.7	1.0	1.6	1.0	10	7.7
13	2.1	2.1	2.6	2.1	5.7	1.3	4.0	1.0	10	1.0	5.7	5.7
14	2.1	1.6	2.6	1.6	7.7	1.3	3.3	1.0	42	2.1	4.8	14
15	1.6	1.6	2.1	7.7	7.7	1.3	2.6	1.0	21	4.0	3.3	8.8
16	12	1.3	2.1	2.6	4.8	3.3	2.6	1.0	5.7	1.3	2.6	6.7
17	24	1.6	1.6	2.1	3.3	1.6	2.1	1.0	3.3	3.3	3.3	6.7
18	7.7	2.1	1.3	4.8	12	4.0	7.7	1.0	2.6	4.8	4.0	7.7
19	4.0	1.6	1.6	4.8	21	10	10	.8	2.1	8.8	4.0	5.7
20	3.3	1.3	1.3	38	7.7	4.8	4.0	1.0	2.1	8.8	13	7.7
21	2.6	1.6	1.3	14	7.7	8.8	2.6	1.0	2.6	12	7.7	12
22	2.1	1.3	6.7	7.7	5.7	12	2.1	.8	6.7	4.0	12	13
23	1.6	1.3	2.6	13	4.0	4.0	2.1	.8	8.8	10	8.8	6.7
24	1.6	1.6	13	5.7	3.3	2.6	1.6	.8	3.3	14	5.7	4.8
25	4.0	2.1	6.7	6.7	2.6	4.8	1.6	.8	3.3	6.7	4.8	4.0
26	2.1	1.6	8.8	10	2.1	10	1.6	.8	2.1	4.0	3.3	16
27	2.6	1.3	8.8	7.7	2.1	8.8	1.6	1.6	2.1	4.0	2.6	18
28	2.1	1.3	14	24	2.1	4.0	1.3	.8	2.1	5.7	3.3	52
29	1.6	1.0	24	13	1.6	3.3	1.3	.8	2.1	4.0	10	12
30	1.6	1.0	14	7.7	1.3	3.3	1.3	.....	1.6	14	4.0	8.8
31	1.3	1.0	.....	12	.....	3.3	1.3	.....	1.6	.....	4.8	.....

NOTE.—Discharge determined from rating curve well defined below 50 million gallons per day.

Monthly discharge of Alo Stream near Huelo, Maui, for year ending June 30, 1916.

Month.	Discharge.				Run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July	24	1.3	4.97	7.69	154	473
August	5.7	1.0	1.58	2.44	49	150
September	24	.8	5.37	8.31	161	494
October	38	1.6	8.57	13.3	266	815
November	74	1.3	12.0	18.6	359	1,100
December	16	1.3	4.49	6.95	139	427
January	62	1.3	7.65	11.8	237	728
February	7.7	.8	1.50	2.32	44	133
March	42	1.3	4.90	7.58	152	466
April	14	1.0	4.25	6.58	128	391
May	158	2.6	17.5	27.1	543	1,660
June	52	3.3	9.61	14.9	288	885
The year	158	.8	6.89	10.7	2,520	7,720

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, 1916.

GAGE.— Friez water-stage recorder installed October 14, 1913, at new datum to replace original staff.

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 a rock ledge and probably permanent.

EXTREMES OF DISCHARGE.—Maximum stage recorded during period of record, 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 during period of record, 1.08 feet September 28, 1912 (discharge, 0.3 million gallons per day, or 0.5 second-foot).

Minimum stage recorded during year, 0.25 foot February 17 and 18, 24 and 25 (discharge, 0.8 million gallons per day, or 1.2 second-feet.)

DIVERSIONS.—A small amount of water is diverted by Kula pipe line above station at elevation 4,300 feet.

REGULATION.—None.

UTILIZATION.—Low-water flow is all diverted by ditches of East Maui Irrigation Co. for irrigation of sugar cane.

ACCURACY.—Determinations based on well-defined rating curve and continuous gage-height record good below 300 million gallons per day.

Discharge measurements of Waikamoi Stream near Huelo, Maui, during the year ending June 30, 1916.

Date.	Made by—	Gage height (feet).	Discharge.	
			Second-feet.	Million gallons per day.
Jan. 29	R. D. Klise	0.45	5.6	3.6
Apr. 13	H. A. R. Austin	.44	2.6	1.7

Daily discharge, in million gallons, of Waiakamoi Stream near Huelo, Maui, for the year ending June 30, 1916.

Date.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	31	2.0	2.0	39	160	3.2	6.0	2.3	7.1	2.3	639	58
2	14	1.6	2.3	39	190	4.8	4.8	1.6	20	2.8	315	44
3	7.1	2.8	35	44	292	6.0	4.0	1.6	6.0	2.3	223	107
4	9.6	12	20	17	141	14	4.0	1.6	7.1	2.0	353	48
5	23	2.3	7.1	12	48	6.0	74	9.6	17	2.0	234	31
6	48	2.8	3.2	9.6	27	74	35	39	6.0	1.6	353	17
7	31	2.0	6.0	9.6	14	27	23	9.6	14	1.6	170	9.6
8	14	1.6	3.2	6.0	53	9.6	535	4.0	12	1.6	190	12
9	20	1.3	2.8	17	80	6.0	470	3.2	4.0	2.0	100	6.0
10	12	1.0	6.0	23	86	4.8	160	2.8	20	9.6	39	4.0
11	7.1	1.3	39	23	53	4.0	48	2.3	7.1	2.8	31	6.0
12	6.0	9.6	27	100	17	4.0	14	1.6	4.0	2.0	39	12
13	4.8	4.8	9.6	86	17	3.2	9.6	1.3	23	2.0	20	12
14	4.0	3.2	9.6	80	27	2.8	6.0	1.3	160	2.8	9.6	58
15	4.0	3.2	7.1	31	39	2.8	3.2	1.3	150	14	4.8	23
16	27	2.8	6.0	14	12	6.0	2.8	1.0	35	7.1	3.2	14
17	123	2.8	4.8	7.1	9.6	4.0	31	.8	14	4.8	6.0	20
18	27	4.0	4.0	23	27	6.0	234	.8	6.0	27	9.6	23
19	12	6.0	4.0	31	93	48	123	1.0	4.0	35	12	14
20	7.1	7.1	4.0	100	44	20	27	1.6	3.2	53	31	17
21	4.8	4.8	3.2	74	44	17	12	2.0	4.8	63	39	35
22	4.0	3.2	23	39	31	53	6.0	1.3	35	9.6	39	44
23	3.2	2.8	9.6	44	14	12	4.8	1.0	27	53	35	17
24	2.8	4.8	48	23	9.6	7.1	4.0	.8	6.0	35	17	7.1
25	4.0	14	44	27	7.1	17	3.2	.8	6.0	17	7.1	6.0
26	4.0	6.0	100	44	6.0	68	3.2	1.3	4.8	7.1	4.8	53
27	4.8	4.0	86	48	6.0	68	3.2	23	4.0	12	3.2	80
28	4.0	2.8	115	107	6.0	17	2.8	4.8	3.2	44	4.0	141
29	2.8	2.3	58	123	4.8	12	2.0	2.8	2.8	12	39	39
30	2.3	2.3	48	86	3.2	9.6	2.0	.....	2.8	39	14	35
31	2.0	2.0	.....	80	.....	6.0	2.8	.....	2.8	.....	27	.....

NOTE.—Discharge determined from rating curve well defined below 300 million gallons per day.

Monthly discharge of Waikamoi Stream near Huelo, Maui, for year ending June 30, 1916.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July	123	2.0	15.2	23.5	470	1,450
August	14	1.0	3.97	6.14	123	378
September	115	2.0	24.6	38.1	738	2,260
October	123	6.0	45.4	70.2	1,410	4,320
November	292	3.2	52.0	80.5	1,560	4,790
December	74	2.8	17.5	27.1	543	1,660
January	535	2.0	60.0	92.8	1,860	5,710
February	39	.8	4.35	6.73	126	387
March	160	2.8	20.0	30.9	619	1,900
April	63	1.6	15.7	24.3	470	1,450
May	639	3.2	97.1	150	3,010	9,240
June	141	4.0	33.1	51.2	993	3,050
The year	639	.8	32.6	50.4	11,900	36,600

NAILILIHAELE STREAM NEAR HUELO, MAUI.

LOCATION.—300 feet above New Hamakua ditch, about 3 miles south of Huelo.

RECORDS AVAILABLE.—October 8, 1913, to June 30, 1916. Also at old staff-gage station below New Hamakua ditch from December 9, 1910, to December 31, 1912.

GAGE.—Barrett & Lawrence water-stage recorder installed October 8 1913.

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 composed of large boulders; fairly permanent.

EXTREMES OF DISCHARGE.—Maximum stage recorded during period of record, 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, 0.73 foot October 29 to November 1, 1913, discharge, 2.3 million gallons per day, or 3.6 second-feet.

Minimum stage recorded during year, 1.0 foot September 1, 2 and 9 and 10 (discharge, 4.0 million gallons per day, or 6.2 second-feet).

DIVERSIONS.—None above station.

REGULATION.—None.

UTILIZATION.—Normal flow is diverted by ditches of East Maui Irrigation Co. for irrigation of sugar cane.

ACCURACY.—Determinations July 1 to April 30 and June 1–30, based on fairly-well defined rating curves and a continuous gage-height record; fair for all stages, those for period May 1–18 only approximate, owing to unusually high water and lack of current-meter measurements for that period.

Discharge measurements of Nailiilihaele Stream near Huelo, Maui, during the year ending June 30, 1916.

Date.	Made by—	Gage height (feet).	Discharge.	
			Second-feet.	Million gallons per day.
Jan. 29	R. D. Klise	1.14	12	7.5
June 13	H. A. R. Austin	[a].95	34	22
14	....do	1.53	101	65

[a] New datum.

Daily discharge, in million gallons, of Nailiilihaele Stream near Huelo, Maui, for the year ending June 30, 1916.

Date.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	53	6.5	4.0	49	185	13	17	6.5	30	9.5	760	50
2	24	6.5	4.0	62	160	20	17	6.5	24	9.5	280	54
3	20	11	20	53	400	27	17	6.5	15	9.5	235	98
4	17	15	17	32	160	35	20	6.5	13	9.5	295	54
5	27	9.5	9.5	27	53	22	86	45	15	8.0	172	46
6	68	9.5	9.5	24	38	150	45	38	13	8.0	312	35
7	42	8.0	11	20	32	42	53	15	35	8.0	198	26
8	30	8.0	8.0	17	80	27	520	13	35	8.0	295	32
9	35	8.0	4.0	32	120	22	400	11	17	6.5	130	26
10	22	6.5	4.0	27	111	20	130	11	35	13	45	22
11	17	8.0	27	22	62	17	160	11	15	9.5	35	22
12	15	20	27	17	38	17	.....	11	13	6.5	38	32
13	13	13	13	15	32	17	.....	11	45	5.2	35	32
14	13	9.5	11	15	49	15	.....	11	235	6.5	24	74
15	11	8.0	11	35	62	15	.....	9.5	198	22	20	54
16	35	8.0	9.5	22	32	20	.....	9.5	38	20	13	38
17	130	9.5	9.5	15	27	17	.....	9.5	27	15	15	38
18	38	11	8.0	22	49	17	.....	9.5	15	32	15	38
19	22	11	8.0	35	160	62	.....	8.0	13	53	.....	32
20	17	11	8.0	86	62	35	.....	6.5	13	49	.....	32
21	15	9.5	8.0	120	42	45	.....	6.5	11	86	.....	54
22	13	8.0	32	38	45	86	15	6.5	11	27	.....	80
23	11	8.0	15	53	32	27	15	6.5	15	49	.....	42
24	9.5	6.5	32	35	24	22	13	6.5	42	42	.....	26
25	15	6.5	35	24	20	20	13	6.5	38	62	.....	24
26	9.5	6.5	38	35	17	42	11	6.5	20	27	.....	59
27	9.5	6.5	58	35	15	58	11	11	20	22	.....	.....
28	9.5	6.5	62	150	13	32	9.5	11	17	22	.....	.....
29	9.5	5.2	62	53	13	22	8.0	6.5	13	24	.....	.....
30	8.0	5.2	49	58	13	20	6.5	.....	11	38	.....	.....
31	6.5	5.2	.....	38	.....	17	6.5	.....	9.5	.....	.....	.....

NOTE.—Discharge determined from fairly well defined rating curves applicable as follows: July 1 to Apr. 30, 1916, May 1–18 and June 1–30. Gage heights not recorded on days for which discharge is not given.

Monthly discharge of Nailiilihaele Stream near Huelo, Maui, for year ending June 30, 1916.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July	130	6.5	24.7	38.2	765	2,350
August	20	5.2	8.75	13.5	271	832
September	62	4.0	20.5	31.7	614	1,890
October	150	15	40.8	63.1	1,270	3,880
November	400	13	71.5	111	2,150	6,580
December	150	13	32.3	50.0	1,000	3,070
February	45	6.5	11.1	17.2	323	988
March	235	9.5	33.9	52.5	1,050	3,230
April	86	5.2	23.6	36.5	707	2,170
May 1–18	760	13	162	251	2,920	8,950
June 1–26	98	22	43.1	66.7	1,120	3,440

KAILUA STREAM NEAR HUELO, MAUI.

LOCATION.—About 800 feet above New Hamakua ditch crossing, 1 mile south of Huelo.

RECORDS AVAILABLE.—June 17, 1913, to June 30, 1916.

GAGE.—Barrett & Lawrence water-stage recorder installed October 1, 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; will seldom shift.

EXTREMES OF DISCHARGE.—Maximum stage recorded during period of record, 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, 1.0 foot, March 5 and 6, 1914 (discharge, 0.6 million gallons per day, or 0.9 second-foot).

Minimum stage recorded during year, 1.1 feet February 18, 19, and 22, 25 (discharge, 1.4 million gallons per day, or 2.2 second-feet).

DIVERSIONS.—A small amount of water is diverted by Old Hamakua ditch above station and is dropped into Oanui Stream.

REGULATION.—None.

UTILIZATION.—Normal flow of stream is diverted by ditches of East Maui Irrigation Co. for irrigation of sugar cane.

ACCURACY.—Determinations fair for all stages. Conditions for current-meter measurements are not of the best, but fairly good rating curves have been developed.

Discharge measurements of Kailua Stream near Huelo, Maui, during the year ending June 30, 1916.

Date.	Made by—	Gage height (feet).	Discharge.	
			Second-feet.	Million gallons per day.
Jan. 28	R. D. Klise	1.36	8.2	5.3
Apr. 13	H. A. R. Austin	1.19	3.6	2.3

Daily discharge, in million gallons, of Kailua Stream near Huelo, Maui, for the year ending June 30, 1916.

Date.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	34	5.8	3.5	44	182	6.5	8.0	4.1	23	3.3	.....	47
2	16	5.0	3.5	38	133	9.2	7.2	4.1	20	3.3	.....	50
3	10	5.8	13	41	282	10	7.2	4.1	9.4	2.5	222	104
4	10	10	19	23	149	18	6.5	4.1	7.1	2.5	.....	53
5	21	7.2	9.2	18	44	9.2	78	18	6.0	2.5	.....	.....
6	53	7.2	6.5	14	34	94	31	31	6.0	2.5	.....	.....
7	34	5.8	6.5	13	25	34	23	8.2	18	2.5	.....	.....
8	16	5.0	5.8	12	74	14	268	6.0	15	2.0	.....	.....
9	23	5.0	5.0	16	82	12	182	5.0	6.0	2.5	.....	.....
10	14	5.0	5.0	25	78	10	138	4.1	23	8.2	.....	.....
11	10	5.0	21	21	60	9.2	60	4.1	7.1	3.3	.....	.....
12	9.2	9.2	23	14	27	8.0	23	3.3	6.0	2.5	47	.....
13	8.0	9.2	9.2	12	25	7.2	18	3.3	21	2.5	.....	.....
14	7.2	6.5	8.0	12	64	6.5	16	3.3	174	2.5	.....	.....
15	6.5	6.5	7.2	29	56	6.5	13	2.5	180	.....	.....	36
16	13	5.0	7.2	19	27	7.2	12	2.0	31	.....	.....	23
17	90	5.0	6.5	13	21	6.5	.....	2.0	16	.....	.....	27
18	60	8.0	5.0	18	47	6.5	.....	1.4	12	.....	18	29
19	16	9.2	4.2	34	144	44	.....	1.4	9.4	.....	18	21
20	10	12	3.5	78	60	27	.....	2.0	8.2	.....	36	23
21	9.2	9.2	3.5	118	60	21	.....	2.0	8.2	71	.....	36
22	8.0	7.2	16	36	47	60	.....	1.4	8.2	.....	.....	56
23	8.0	7.2	13	50	25	14	8.2	1.4	9.4	.....	.....	27
24	7.2	7.2	19	25	21	10	8.2	1.4	41	.....	.....	20
25	8.0	7.2	41	21	16	8.0	8.2	1.4	23	.....	.....	18
26	7.2	8.0	90	36	13	64	7.1	2.5	3.3	.....	.....	53
27	8.0	6.5	118	27	12	53	6.0	2.5	3.3	11	.....	79
28	7.2	6.5	90	166	10	16	5.0	2.5	3.3	38	.....	180
29	6.5	5.8	99	78	8.0	10	4.1	2.5	3.3	.....	.....	60
30	6.5	5.8	64	123	7.2	9.2	4.1	.....	3.3	.....	.....	44
31	5.8	5.0	.....	74	.....	8.0	4.1	.....	3.3	.....	.....	.....

NOTE.—Discharge determined from fairly well defined rating curves applicable as follows: July 1, 1915, to Jan. 18, 1916, and Jan. 19 to June 30, 1916.
Gage heights not recorded on days for which discharge is not given.

Monthly discharge of Kailua Stream near Huelo, Maui, for year ending June 30, 1916.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July	90	5.8	17.5	27.1	542	1,660
August	12	5.0	6.87	10.6	213	654
September	118	3.5	24.2	37.4	725	2,230
October	166	12	40.3	62.4	1,250	3,830
November	282	7.2	61.1	94.5	1,830	5,630
December	94	6.5	20.0	30.9	619	1,900
February	31	1.4	4.54	7.02	132	404
March	180	3.3	22.8	35.3	707	2,170

OANUI STREAM NEAR HUELO, MAUI.

LOCATION.—At New Hamakua ditch crossing, 1 mile south of Huelo post office.

RECORDS AVAILABLE.—December 7, 1910, to December 31, 1911, and June 17, 1913, to June 30, 1916, when station was discontinued.

GAGE.—Vertical staff in two sections.

DISCHARGE MEASUREMENTS.—Made by wading.

CHANNEL AND CONTROL.—Gage is in a deep pool formed by New Hamakua ditch, which crosses the stream in a concrete flume and forms a dam across the stream. Upper side of concrete flume forms permanent control. A stream having a normal flow of about 0.7 million gallons per day enters stream at the gage.

EXTREMES OF DISCHARGE.—Maximum stage recorded during period of record, 5.7 feet at 6.30 a. m. May 1, 1916 (discharge, approximately 300 million gallons per day, or 464 second-feet); minimum stage recorded, 1.75 feet June, 1915 (discharge, 0.4 million gallons per day, or 0.6 second-foot).

DIVERSIONS.—None above station.

REGULATION.—None.

UTILIZATION.—Normal flow is diverted by ditches of East Maui Irrigation Co. for irrigation of sugar cane.

ACCURACY.—Determinations based on a rating curve fairly well defined for low and medium stages, but gage is read only twice daily to half-tenths, and a large percentage of error may be introduced by the fact that the control is very wide in proportion to the amount of flow.

Discharge measurements of Oanui Stream near Huelo, Maui, during the year ending June 30, 1916.

Date.	Made by—	Gage height (feet).	Discharge.	
			Second-feet.	Million gallons per day.
July 15	H. A. R. Austin	1.82	3.1	2.0
May 17	....do	1.89	5.0	3.2

Monthly discharge of Oanui Stream near Huelo, Maui, for Jan. 1, 1914–June 30, 1916.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
1914.						
January	64	1.9	9.22	14.3	286	877
February	5.8	1.9	2.25	3.48	63	193
March	84	1.9	5.69	8.80	176	541
April	45	1.9	10.6	16.4	320	976
May	92	3.8	17.4	26.9	540	1,660
June	56	5.8	10.6	16.4	317	976
1914–15.						
July	45	5.8	15.2	23.5	472	1,450
August	45	5.8	17.9	27.7	556	1,700
September	100	5.8	18.8	29.1	563	1,730
October	45	3.8	9.99	15.5	310	950
November	45	1.9	12.3	19.0	368	1,130
December	36	3.8	8.26	12.8	256	786
January	21	1.9	3.73	5.77	116	355
February	42	1.9	8.66	13.4	243	744
March	16	1.9	4.19	6.48	130	399
April	45	1.9	8.46	13.1	254	779
May	16	1.9	3.02	4.67	94	287
June	21	.4	3.79	5.86	114	349
The year	100	.4	9.52	14.7	3,480	10,700
1915–16.						
July	16	1.9	4.89	7.57	152	465
August	5.8	1.9	2.03	3.14	63	193
September	21	1.9	5.42	8.39	163	499
October	36	1.9	10.4	16.1	322	989
November	68	1.9	15.6	24.1	468	1,440
December	33	1.9	6.79	10.5	210	646
January	108	1.9	10.6	16.4	330	1,010
February	16	1.9	2.94	4.55	85	262
March	52	1.9	6.95	10.8	216	661
April	21	1.9	5.71	8.83	171	526
May	180	3.8	22.7	35.1	704	2,160
June	45	5.8	12.1	18.7	362	1,110
The year	180	1.9	8.87	13.7	3,250	9,960

HOOLAWALIILII STREAM NEAR HUELO, MAUI.

LOCATION.—400 feet above New Hamakua ditch crossing, about 4 miles by trail west of Huelo.

RECORDS AVAILABLE.—April 5, 1911, to June 30, 1916.

GAGE.—Stevens water-gage 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 10 feet wide, formed by concrete control 12 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 period of record, 2.9 feet at 5 p. m. January 8 1916 (discharge computed from extension of rating curve, approximately 520 million gallons per day, or 805 second-feet). minimum stage recorded, 0.07 foot June 2 and 3, 1913 (discharge, 0.85 million gallons per day, or 1.3 second-feet).

Minimum stage recorded during year, 0.10 foot August 28 and February 27 and 29 (discharge, 1.3 million gallons per day, or 2.0 second-feet).

DIVERSIONS.—None above station.

REGULATION.—None.

ACCURACY.—Determinations good below and fair above 30 million gallons per day.

The following discharge measurement was made by R. D. Klise:
January 28, 1916: Gage height, 0.19 feet; discharge, 3.2 second-feet.

Daily discharge, in million gallons, of Hoolawaliilii Stream near Huelo, Maui, for the year ending June 30, 1916.

Date.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	15	4.8	.....	19	100	4.8	4.8	3.2	.....	3.2	.....	3.2
2	9.0	4.8	.....	19	66	4.8	4.8	3.2	.....	3.2	.....	3.2
3	6.5	4.8	.....	19	158	3.2	4.8	2.2	.....	2.2	.....	6.5
4	6.5	4.8	.....	12	52	6.5	4.8	2.2	.....	2.2	.....	4.8
5	6.5	4.8	.....	9.0	28	3.2	15	4.8	.....	2.2	.....	4.8
6	19	4.8	.....	6.5	19	23	9.0	12	.....	2.2	.....	3.2
7	12	4.8	.....	6.5	15	9.0	12	3.2	.....	2.2	.....	2.2
8	12	4.8	.....	6.5	66	4.8	191	3.2	.....	2.2	.....	2.2
9	15	4.8	.....	6.5	59	4.8	118	3.2	.....	2.2	.....	2.2
10	12	4.8	.....	6.5	46	3.2	52	3.2	.....	3.2	.....	2.2
11	9.0	4.8	.....	6.5	28	3.2	23	2.2	.....	2.2	.....	2.2
12	9.0	6.5	.....	4.8	19	3.2	12	2.2	.....	2.2	.....	2.2
13	6.5	4.8	.....	4.8	19	3.2	9.0	2.2	.....	2.2	.....	2.2
14	4.8	3.2	.....	4.8	23	3.2	6.5	2.2	52	2.2	.....	6.5
15	4.8	3.2	.....	9.0	15	3.2	4.8	2.2	46	2.2	.....	4.8
16	6.5	3.2	.....	6.5	12	4.8	4.8	2.2	12	2.2	.....	4.8
17	19	3.2	.....	4.8	12	4.8	3.2	2.2	9.0	2.2	3.2	3.2
18	12	3.2	.....	9.0	40	4.8	4.8	2.2	6.5	3.2	3.2	4.8
19	6.5	2.2	.....	9.0	34	15	23	2.2	6.5	4.8	3.2	3.2
20	6.5	2.2	.....	59	19	6.5	6.5	2.2	4.8	4.8	4.8	3.2
21	6.5	2.2	.....	34	19	9.0	4.8	2.2	4.8	19	4.8	6.5
22	4.8	2.2	.....	19	12	19	4.8	2.2	6.5	6.5	6.5	9.0
23	4.8	2.2	.....	23	9.0	12	4.8	2.2	15	9.0	6.5	6.5
24	4.8	2.2	.....	15	6.5	6.5	3.2	2.2	6.5	15	4.8	4.8
25	6.5	2.2	6.5	15	4.8	4.8	3.2	2.2	6.5	9.0	3.2	4.8
26	4.8	2.2	6.5	23	4.8	12	3.2	2.2	4.8	6.5	3.2	12
27	4.8	2.2	12	34	4.8	12	3.2	1.3	4.8	6.5	2.2	12
28	4.8	1.3	19	34	4.8	6.5	3.2	1.3	3.2	9.0	2.2	59
29	4.8	.....	19	28	4.8	6.5	3.2	1.3	3.2	6.5	6.5	19
30	4.8	.....	28	23	4.8	6.5	3.2	.....	3.2	66	3.2	12
31	4.8	.....	.....	28	.....	6.5	3.2	.....	3.2	.....	2.2	.....

NOTE.—Discharge determined from rating curve well defined below 30 million gallons per day. Discharge Dec. 26 to Jan. 7, Jan. 9–10, and April 21–30 estimated by comparison with record of flow of Hoolawanui Stream.
Gage heights not recorded on days for which discharge is not given.

Monthly discharge of Hoolawaliilii Stream near Huelo, Maui, for year ending June 30, 1916.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July	19	4.8	8.20	12.7	254	780
August 1–28	6.5	1.3	3.61	5.58	101	310
September 25–30	28	6.5	15.2	23.5	91	280
October	59	4.8	16.3	25.2	505	1,550
November	158	4.8	30.2	46.7	905	2,780
December	23	3.2	7.11	11.0	220	676
January	191	3.2	17.9	27.7	554	1,700
February	12	1.3	2.74	4.24	80	244
March 14–31	52	3.2	11.0	17.0	198	608
April	66	2.2	6.87	10.6	206	632
May 17–31	6.5	2.2	3.98	6.16	60	183
June	59	2.2	7.24	11.2	217	667

HOOLAWANUI STREAM NEAR HUELO, MAUI.

LOCATION.—500 feet above crossing of New Hamakua ditch, about 5 miles by trail west of Huelo.

RECORDS AVAILABLE.—December 12, 1910 to June 30, 1916.

GAGE.—Stevens 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 the pool composed of boulders; probably permanent.

EXTREMES OF DISCHARGE.—Maximum stage recorded during period of record, 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-feet); minimum stage recorded 0.04 foot September and October, 1912 (discharge, 1.0 million gallons per day, or 1.6 second-feet).

Minimum stage recorded during year, 0.1 foot February and April (discharge, 1.4 million gallons per day, or 2.2 second-feet).

DIVERSIONS.—None above station.

REGULATION.—None.

ACCURACY.—Determinations based on a well-defined rating curve and continuous gage-height record; good for all stages below 60 million gallons per day.

The following discharge measurement was made by R. D. Klise:

January 28, 1916: Gage height, 0.34 feet; discharge, 3.8 second-feet.

Daily discharge, in million gallons, of Hoolawanui Stream near Huelo, Maui, for the year ending June 30, 1916.

Date.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	14	2.2	.....	24	91	5.0	5.9	3.4	4.2	3.4	202	18
2	7.9	2.2	.....	24	64	5.9	5.0	3.4	6.8	3.4	121	14
3	5.9	2.8	.....	24	136	5.0	5.0	2.8	2.8	2.2	89	35
4	5.9	3.4	.....	16	52	7.9	5.0	2.8	.....	2.2	107	23
5	7.9	2.2	.....	12	32	5.0	19	6.8	.....	2.2	67	19
6	18	2.2	.....	7.9	24	30	12	16	.....	2.2	112	14
7	12	1.8	.....	7.9	21	14	14	5.0	.....	2.2	89	10
8	9.0	1.8	.....	7.9	64	9.0	121	4.2	.....	2.2	99	9.0
9	13	1.8	.....	7.9	58	6.8	107	3.4	.....	2.2	58	6.8
10	7.9	1.8	.....	7.9	47	5.9	52	3.4	.....	3.4	39	5.9
11	6.8	1.8	.....	7.9	32	5.9	35	3.4	.....	2.2	21	5.9
12	5.0	3.4	.....	5.0	24	5.0	21	2.8	.....	1.4	19	6.8
13	4.2	2.2	.....	5.0	24	4.2	16	2.8	6.8	1.4	19	6.8
14	4.2	1.8	.....	5.0	28	4.2	13	2.8	52	2.2	19	18
15	4.2	1.8	.....	12	21	4.2	10	2.8	50	4.2	9.0	13
16	7.9	1.8	.....	5.0	18	5.0	9.0	2.2	19	2.8	7.9	10
17	24	1.8	.....	4.2	18	3.4	7.9	2.2	12	2.8	7.9	10
18	14	2.2	.....	6.8	42	4.2	12	2.2	9.0	5.9	6.8	12
19	7.9	2.2	.....	7.9	37	16	35	2.2	6.8	13	6.8	9.0
20	6.8	2.2	.....	58	24	10	16	2.2	5.9	14	19	10
21	5.0	2.2	.....	37	24	12	12	2.2	5.9	24	13	16
22	5.0	2.2	.....	24	18	23	9.0	1.8	13	7.9	19	23
23	4.2	2.2	.....	28	12	9.0	7.9	1.8	14	13	14	13
24	3.4	2.2	.....	19	9.0	7.9	6.8	1.8	7.9	19	17	10
25	5.0	2.2	5.9	19	5.0	7.9	5.9	1.8	6.8	13	9.0	9.0
26	3.4	1.8	12	28	5.0	16	5.9	1.4	5.9	9.0	6.8	23
27	4.2	1.8	18	37	5.9	18	5.0	2.8	5.0	7.9	5.9	28
28	3.4	1.8	24	37	7.9	10	4.2	1.8	4.2	13	5.9	70
29	2.8	.....	24	32	5.9	9.0	4.2	1.4	4.2	9.0	19	30
30	2.8	.....	32	28	5.0	7.9	4.2	.....	3.4	64	17	23
31	2.2	.....	.....	32	.....	6.8	3.4	.....	3.4	.....	12	.....

NOTE.—Discharge determined from rating curve well defined below 60 million gallons per day. Discharge Aug. 21–28, Sept. 28 to Oct. 15, Oct. 20 to Nov. 27, and Apr. 1–11 estimated by comparison with record of flow Hoolawaliilii Stream. Gage heights not recorded on days for which discharge is not given.

Monthly discharge of Hoolawanui Stream near Huelo, Maui, for year ending June 30, 1916.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July	24	2.2	7.35	11.4	228	699
August 1–28	3.4	1.8	2.14	3.31	60	184
September 25–30	32	5.9	19.3	29.9	116	355
October	58	4.2	18.6	28.8	577	1,770
November	136	5.0	31.8	49.2	955	2,930
December	30	3.4	9.16	14.2	284	871
January	121	3.4	19.0	29.4	589	1,810
February	16	1.4	3.23	5.00	94	287
April	64	1.4	8.51	13.2	255	783
May	202	5.9	38.5	59.6	1,200	3,660
June	70	5.9	16.7	25.8	501	1,540

HONOPOU STREAM NEAR HUELO, MAUI.

LOCATION.—200 feet above New Hamakua ditch crossing, about 6 miles west of Huelo.

RECORDS AVAILABLE.—December 10, 1910, to June 30, 1916.

GAGE.—Stevens water-stage recorder, installed June 19, 1914, at same location and datum 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; probably permanent.

EXTREMES OF DISCHARGE.—Maximum stage recorded during period of record, 3.7 feet at 10 p. m. May 1, 1916 (discharge, computed from extension of rating curve, approximately 160 million gallons per day, or 248 second-feet); minimum stage recorded, 0.4 foot September and October, 1912 (discharge, 0.4 million gallons per day, or 0.6 second-foot).

Minimum stage recorded during year, 0.1 foot August, September, February, April (discharge, 1.0 million gallons per day, or 1.55 second-feet).

DIVERSIONS.—None above station.

REGULATION.—None.

UTILIZATION.—Ordinary flow is diverted by ditches of East Maui Irrigation Co. for irrigation of sugar cane.

ACCURACY.—Discharge below 20 million gallons per day determined from a well defined rating curve, results good; flood estimates fair.

Discharge measurements of Honopou Stream near Huelo, Maui, during the year ending June 30, 1916.

Date.	Made by—	Gage height (feet).	Discharge.	
			Second-feet.	Million gallons per day.
Jan. 28	R. D. Klise	0.23	2.9	1.9
Apr. 12	H. A. R. Austin	.11	1.5	1.0

Daily discharge, in million gallons, of Honopou Stream near Huelo, Maui, for the year ending June 30, 1916.

Date.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	.....	.....	1.0	7.1	27	2.9	4.4	2.2	5.2	2.2	66	5.2
2	.....	.....	1.0	7.1	22	2.9	2.2	2.2	.....	2.2	45	4.4
3	.....	.....	1.0	6.2	41	3.6	2.2	1.6	.....	2.2	33	9.0
4	.....	.....	1.0	4.4	22	4.4	2.2	1.6	.....	1.6	41	6.2
5	.....	.....	1.0	3.6	16	2.9	7.1	3.6	.....	1.6	32	5.2
6	.....	.....	1.0	2.9	11	14	3.6	5.2	.....	1.6	34	5.2
7	.....	.....	1.0	2.9	8.0	6.2	11	2.9	.....	1.6	34	4.4
8	.....	.....	1.0	2.9	18	4.4	46	2.2	.....	1.6	33	4.4
9	.....	.....	1.0	3.6	16	4.4	38	2.2	.....	1.6	28	3.6
10	.....	.....	1.0	2.9	16	3.6	21	2.2	.....	2.2	15	3.6
11	.....	.....	2.2	2.2	11	3.6	15	2.2	.....	1.6	12	3.6
12	.....	.....	2.2	1.6	9.0	2.9	9.0	2.2	.....	1.0	11	3.6
13	.....	.....	1.6	1.6	9.0	2.9	9.0	2.2	2.2	1.0	9.0	3.6
14	2.9	.....	1.0	1.6	11	2.9	8.0	1.6	18	1.6	8.0	8.0
15	2.9	.....	1.0	4.4	2.0	2.9	7.1	1.6	16	1.6	6.8	5.2
16	4.4	.....	1.0	2.2	7.1	3.6	7.1	1.6	8.0	1.6	5.6	4.4
17	.....	.....	1.0	2.2	6.2	2.2	6.2	1.6	6.2	1.6	4.4	4.4
18	.....	.....	1.0	3.6	5.9	2.9	7.1	1.6	5.2	2.9	4.4	5.2
19	.....	1.6	1.0	4.4	5.6	9.0	14	1.6	4.4	3.6	3.6	4.4
20	.....	1.6	1.0	17	5.3	7.1	6.2	1.6	3.6	4.4	6.2	4.4
21	.....	1.6	1.0	10	5.0	7.1	6.2	1.6	3.6	8.0	5.2	6.2
22	.....	1.0	2.2	8.0	4.7	9.0	5.2	1.6	4.4	3.6	7.1	7.1
23	.....	1.0	1.0	9.0	4.4	7.1	4.4	1.0	9.0	4.4	6.2	5.2
24	.....	1.0	2.9	7.1	4.1	6.2	4.4	1.0	3.6	8.0	5.2	4.4
25	.....	1.0	2.2	6.2	3.8	6.2	3.6	1.0	3.6	5.2	4.4	4.4
26	.....	1.0	2.9	9.0	3.6	8.0	3.6	1.0	3.6	4.4	3.6	9.0
27	.....	1.0	4.4	12	3.6	10	2.9	1.6	2.9	4.4	3.6	8.0
28	.....	1.0	7.1	14	3.6	3.6	2.9	1.0	2.9	11	3.6	27
29	.....	1.0	8.0	11	3.6	3.6	2.2	1.6	2.9	7.1	7.1	12
30	.....	1.0	9.0	9.0	2.9	2.9	2.9	.....	2.9	12	4.4	10
31	.....	1.0	.....	10	.....	2.9	2.2	.....	2.2	.....	4.4	.....

NOTE.—Discharge determined from rating curve well defined below 20 million gallons per day. Gage heights not recorded on days for which discharge is not given. Discharge interpolated Nov. 18–25 and May 15 and 16.

Monthly discharge of Honopou Stream near Huelo, Maui, for the year ending June 30, 1916.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
August 19-31	1.6	1.0	1.14	1.76	15	45
September	9.0	1.0	2.12	3.28	64	195
October	17	1.6	6.12	9.47	190	582
November	41	2.9	10.5	16.2	314	967
December	14	2.2	5.03	7.78	156	479
January	46	2.2	8.61	13.3	267	819
February	5.2	1.0	1.90	2.94	55	169
April	12	1.0	3.58	5.54	107	330
May	66	3.6	15.7	24.3	487	1,490
June	27	3.6	6.38	9.87	191	587

NEW HAMAKUA DITCH AT HALEHAKU WEIR, NEAR HUELO, MAUI.

LOCATION.—Just above crossing of Halehaku Stream, about 7 miles by trail west of Huelo post office.

RECORDS AVAILABLE.—January 1, 1910, to June 30, 1916.

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.

DIVERSIONS.—None above station.

REGULATION.—By gates at frequent intervals.

UTILIZATION.—Irrigation of sugar cane.

ACCURACY.—Good.

COOPERATION.—Daily discharge record copied from records of East Maui Irrigation Co.

Daily discharge, in million gallons, of new Hamakua ditch at Halehaku Weir, near Huelo, Maui, for the year ending June 30, 1916.

Date.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	72.1	32.7	21.4	73.6	75.7	38.5	40.9	24.4	35.2	42.1	56.6	56.9
2	69.3	32.2	20.1	70.5	78.6	38.3	40.0	24.4	58.5	38.5	47.8	58.6
3	69.0	34.5	37.2	71.6	73.3	40.9	40.0	24.4	63.5	36.4	49.2	57.9
4	62.5	50.7	61.2	70.7	78.2	55.8	40.0	24.4	61.9	33.4	48.4	49.8
5	69.9	39.7	54.7	69.8	76.3	55.3	40.2	24.4	65.6	31.8	46.1	49.3
6	74.8	35.0	44.7	68.7	72.5	72.1	40.0	24.6	45.5	30.5	46.0	53.0
7	68.7	32.5	52.0	67.7	71.4	73.3	40.0	39.9	40.7	29.1	49.0	53.3
8	70.4	28.5	34.0	66.8	71.5	69.5	39.6	40.1	47.2	27.7	51.1	52.3
9	70.2	25.9	25.6	67.6	70.7	65.8	10.1	38.0	32.9	27.1	46.8	51.3
10	68.3	24.1	28.9	67.8	71.8	59.5	5.4	31.6	45.3	51.6	50.8	49.7
11	68.3	25.2	32.7	65.8	72.4	52.8	7.2	33.3	51.0	51.4	56.1	47.1
12	67.8	53.1	38.5	64.7	57.7	42.9	9.9	31.8	33.5	35.5	56.6	53.1
13	59.6	55.3	35.0	65.1	11.9	37.3	14.3	30.8	41.7	27.5	58.2	50.4
14	52.2	40.1	31.5	64.0	62.2	32.7	13.6	30.0	58.1	28.7	61.3	56.3
15	46.4	37.1	30.7	67.0	75.3	31.2	28.7	28.7	40.3	48.8	58.6	59.6
16	54.3	29.5	23.2	65.2	70.6	52.5	28.9	26.5	16.8	58.5	63.5	60.4
17	66.9	26.0	27.7	65.2	70.7	41.3	26.1	18.7	24.3	48.5	65.2	65.9
18	58.8	34.5	16.0	69.0	71.4	42.9	25.8	15.9	30.8	62.5	65.2	68.5
19	66.8	35.7	11.4	70.2	75.9	61.8	25.6	15.3	33.2	68.9	65.4	65.4
20	68.0	51.5	39.2	76.0	73.0	74.3	17.4	15.8	43.4	67.5	64.7	49.5
21	68.6	42.1	30.2	72.2	71.1	75.2	23.7	22.5	33.6	63.1	58.7	58.7
22	68.8	34.4	49.6	61.8	74.1	71.9	34.8	25.9	55.8	65.3	58.4	67.4
23	64.6	30.8	60.6	63.5	70.6	65.8	38.5	27.0	61.9	65.7	58.1	63.3
24	48.1	35.7	67.9	70.8	68.6	65.3	38.6	25.0	63.6	67.8	62.0	61.2
25	54.0	48.6	67.5	70.8	71.4	61.1	39.3	24.4	65.5	68.9	66.3	63.7
26	49.2	44.9	69.4	74.7	67.9	63.8	41.3	24.7	66.0	70.0	68.5	68.8
27	52.0	35.6	68.9	72.3	58.9	40.1	23.2	48.0	59.2	70.3	70.1	68.4
28	49.9	29.2	66.7	77.6	63.6	39.9	23.2	58.4	60.0	63.7	72.1	69.2
29	39.3	27.2	68.6	73.2	53.6	39.9	23.7	45.2	58.1	62.6	60.8	67.0
30	35.3	25.5	77.9	70.8	39.4	39.9	24.4	.....	56.0	64.1	63.4	69.0
31	33.3	23.6	.....	71.6	.....	39.9	24.4	.....	53.8	.....	66.5	.....

Monthly discharge of new Hamakua ditch at Halehaku weir, near Huelo, Maui, for the year ending June 30, 1916.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July	74.8	33.3	60.2	93.1	1,870	5,730
August	55.3	23.6	35.5	54.9	1,100	3,380
September	77.9	11.4	43.1	66.7	1,290	3,970
October	76.0	61.8	69.2	107	2,150	6,580
November	78.6	11.9	67.3	104	2,020	6,200
December	75.2	31.2	53.0	82.0	1,640	5,040
January	41.3	5.4	28.0	43.3	869	2,660
February	58.4	15.3	29.1	45.0	844	2,590
March	66.0	16.8	48.5	75.0	1,500	4,610
April	70.3	27.1	50.2	77.7	1,510	4,620
May	72.1	46.0	58.4	90.4	1,810	5,560
June	69.2	47.1	58.8	91.0	1,760	5,410
The year	78.6	5.4	50.2	77.7	18,400	56,400

OLD HAMAKUA DITCH AT OPANA WEIR, NEAR HUELO, MAUI.

LOCATION.—A short distance below crossing of Opana Stream, about 8 miles by road west of Huelo post office.

RECORDS AVAILABLE.—January 1, 1910, to December 15, 1915.

GAGE.—Friez water-stage recorder.

DISCHARGE MEASUREMENTS.—By 20-foot Cippoletti weir.

CHANNEL AND CONTROL.—Large pool at weir.

EXTREMES OF DISCHARGE.—See monthly discharge table.

DIVERSIONS.—None above station.

REGULATION.—By gates at frequent intervals.

UTILIZATION.—Irrigation of sugar cane.

ACCURACY.—Records good.

COOPERATION.—Daily discharge record copied from records of East Maui Irrigation Co.

Daily discharge, in million gallons, of old Hamakua ditch at Opana weir, near Huelo, Maui, for the year ending June 30, 1916.

Date.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Date.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	19.7	.....	.....	33.8	58.1	.....	16	4.7	.....	27.1	8.1	36.5	.....
2	8.8	.....	.....	26.6	58.2	.....	17	22.7	.....	26.5	4.2	25.5	.....
3	2.8	.....	0.7	28.6	58.9	.....	18	19.3	.....	26.3	7.2	31.4	.....
4	.....	.....	4.1	16.4	58.6	10.1	19	10.3	.....	23.3	13.4	58.6	.....
5	4.2	.....	.5	12.6	56.8	6.4	20	5.5	.....	.4	42.1	56.9	.....
6	21.3	.....	.6	10.7	52.8	35.3	21	.....	.....	.1	51.5	57.7	.....
7	18.8	.....	.7	8.9	45.6	39.3	22	.....	.....	4.5	35.2	53.4	.....
8	13.0	.....	.1	7.7	43.6	9.3	23	.....	.....	2.2	41.0	38.1	.....
9	22.4	.....	.....	11.0	54.4	3.9	24	.....	.....	5.1	25.8	28.0	.....
10	14.2	.....	3.9	11.6	53.3	3.4	25	.....	.....	12.3	22.8	20.0	.....
11	3.8	.....	25.6	8.6	54.6	1.9	26	.....	.....	29.2	32.6	7.7	.....
12	4.5	.....	28.0	7.2	48.2	.8	27	.....	.....	39.1	26.2	7.6	.....
13	2.4	.....	27.3	4.4	40.2	.8	28	.....	.....	32.9	56.1	9.9	.....
14	.2	.....	27.3	4.0	44.9	.7	29	.....	.....	43.7	55.4	7.3	.....
15	.....	.....	26.5	18.0	53.3	.4	30	.....	.....	37.5	55.3	1.6	.....
							31	.....	.....	.....	56.2	.....	.....

NOTE.—Ditch dry on days for which discharge is not given.

Monthly discharge of old Hamakua ditch at Opana weir, near Huelo, Maui, for the year ending June 30, 1916.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons	Acre-feet.
	Maximum.	Minimum.	Mean.			
July 1–3, 5–14, 16–20	22.7	0.2	11.0	17.0	199	608
September 3–8, 10–30	43.7	.1	16.9	26.1	458	1,400
October	56.2	4.0	24.0	37.1	743	2,280
November	58.9	1.6	40.7	63.0	1,220	3,750
December 4–15	39.3	.4	9.36	14.5	112	345

LOWRIE DITCH AT OPANA WEIR, NEAR HUELO, MAUI.

LOCATION.—A short distance west of Halehaku Gulch, about 7 miles by road northwest of Huelo post office.

RECORDS AVAILABLE.—January 1, 1910, to June 30, 1916.

GAGE.—Friez water-stage recorder.

DISCHARGE MEASUREMENTS.—By sharp-crested weir 16⅓ feet long, with bottom and end contractions.

CHANNEL AND CONTROL.—Large pool back of weir.

EXTREMES OF DISCHARGE.—See monthly discharge table.

DIVERSIONS.—None above station.

REGULATION.—By gates at frequent intervals.

UTILIZATION.—Irrigation of sugar cane.

ACCURACY.—Records good.

COOPERATION.—Daily discharge record copied from records of East Maui Irrigation Co.

Daily discharge, in million gallons, of Lowrie ditch at Opana weir, near Huelo, Maui, for the year ending June 30, 1916.

Date.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	55.8	40.0	24.2	55.6	55.6	47.0	32.8	.....	36.5	40.7	59.7	58.4
2	55.1	33.9	25.4	55.5	55.0	49.9	41.1	.....	57.2	49.1	34.9	58.3
3	55.0	43.1	54.1	55.4	56.1	48.8	35.7	.....	47.6	42.6	23.4	58.6
4	55.4	54.1	52.9	55.2	56.5	55.5	42.1	.....	36.4	40.7	42.5	58.4
5	55.6	37.4	43.9	55.2	55.2	13.6	55.3	.....	25.8	38.8	33.7	58.3
6	55.8	44.0	39.8	55.3	55.2	58.5	56.0	.....	30.5	37.7	34.6	57.1
7	56.5	34.0	45.2	55.1	55.0	52.0	56.7	0.2	28.6	35.9	33.2	58.3
8	55.3	32.3	27.8	55.0	56.4	52.0	56.6	.....	40.2	34.8	31.8	58.9
9	56.1	29.0	29.0	53.7	56.9	48.4	21.4	6.1	20.8	34.1	32.5	56.9
10	54.7	28.1	33.5	53.6	56.7	44.6	15.3	17.3	39.5	53.8	27.2	55.1
11	55.4	29.5	53.5	54.0	55.7	44.6	14.7	16.7	36.6	40.2	46.4	58.6
12	54.5	54.6	54.2	53.8	54.8	45.6	15.9	15.8	26.5	37.1	58.3	58.5
13	49.7	47.9	49.3	52.5	8.0	36.7	14.3	15.3	56.8	35.8	58.2	58.1
14	50.7	41.0	53.3	53.6	2.2	35.1	14.1	24.1	59.5	45.4	58.1	58.1
15	48.4	39.9	46.6	53.1	2.0	36.4	9.6	24.0	57.8	53.8	58.1	57.4
16	52.4	31.6	48.8	52.9	1.9	51.5	8.8	23.1	56.7	47.6	58.0	57.2
17	55.4	30.9	42.3	53.7	1.6	32.6	8.2	17.5	51.8	51.1	57.9	58.0
18	54.6	48.0	31.5	54.6	15.0	45.7	7.5	18.3	49.7	55.8	57.6	58.0
19	54.6	36.9	34.1	54.5	58.3	55.0	21.5	17.4	48.1	52.5	57.6	58.0
20	54.7	45.8	41.3	55.1	55.8	53.4	18.7	22.9	34.7	55.8	58.1	58.0
21	53.0	48.2	31.9	55.3	55.6	55.5	35.4	25.6	46.4	58.4	58.1	58.0
22	46.3	36.3	44.6	55.3	56.5	55.5	25.7	27.5	58.4	57.0	58.0	58.0
23	39.8	35.5	52.6	55.3	55.5	52.5	15.3	28.1	58.3	58.0	58.0	57.9
24	45.4	48.6	53.6	55.1	11.1	47.4	4.9	28.3	55.8	60.2	57.2	57.6
25	37.1	53.6	54.1	55.2	5.6	32.4	.....	27.0	57.3	58.8	57.2	57.6
26	55.3	43.7	54.3	55.6	43.1	56.2	.....	30.9	56.6	58.0	56.7	59.0
27	52.5	40.1	51.8	55.6	43.2	55.2	.....	49.4	54.3	50.0	56.7	58.7
28	50.2	32.9	54.4	55.6	41.9	17.3	.....	48.5	50.5	14.6	57.5	59.6
29	42.7	30.6	55.4	55.7	44.9	.8	.....	42.5	46.6	14.1	58.3	58.0
30	41.1	30.0	55.9	55.4	48.6	.8	.....	.....	49.4	36.2	57.7	57.3
31	37.3	25.4	.....	55.1	.....	2.1	.....	.....	37.1	.....	58.3	.....

NOTE.—No flow on days for which discharge is not given.

Monthly discharge of Lowrie ditch at Opana weir, near Huelo, Maui, for year ending June 30, 1916.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July	56.5	37.1	51.2	79.2	1,590	4,870
August	54.6	25.4	38.9	60.2	1,210	3,700
September	55.9	24.2	44.6	69.0	1,340	4,110
October	55.7	52.5	54.7	84.6	1,700	5,200
November	56.9	1.6	40.6	62.8	1,220	3,740
December	58.5	.8	41.4	64.1	1,280	3,940
January 1–24	56.7	4.9	26.2	40.5	628	1,930
February 7, 9–29	49.4	.2	23.9	37.0	526	1,610
March	59.5	20.8	45.5	70.4	1,410	4,330
April	60.2	14.1	45.0	69.6	1,350	4,140
May	59.7	23.4	50.2	77.7	1,560	4,780
June	59.6	55.1	58.0	89.7	1,740	5,340
The period	60.2	.2	44.1	68.2	15,600	47,700

HAIKU DITCH AT PEAHI WEIR, NEAR HUELO, MAUI.

LOCATION.—In Peahi about 8 miles by road northwest of Huelo post office.

RECORDS AVAILABLE.—January 1, 1910, to June 30, 1916.

GAGE.—Friez water-stage recorder.

DISCHARGE MEASUREMENTS.—Made by sharp-crested weir, 16⅓ feet long, with bottom and end contractions.

CHANNEL AND CONTROL.—Large pool at weir.

EXTREMES OF DISCHARGE.—See monthly discharge table.

DIVERSIONS.—None above station.

REGULATION.—By gates at frequent intervals.

UTILIZATION.—Irrigation of sugar cane.

ACCURACY.—Records good.

COOPERATION.—Daily discharge record copied from records of East Maui Irrigation Co.

Daily discharge, in million gallons, of Haiku ditch at Peahi weir, near Huelo, Maui, for the year ending June 30, 1916.

Date.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	66.5	1.8	1.2	72.9	74.9	8.3	33.5	36.3	4.5	11.2	55.6	83.5
2	52.5	1.8	1.4	71.8	79.1	14.2	11.2	32.2	50.1	4.0	22.2	78.9
3	24.3	7.6	45.6	74.0	78.3	9.3	15.4	29.6	34.3	3.3	22.0	78.6
4	24.5	18.2	63.6	59.8	74.6	53.8	19.6	28.9	15.6	3.0	22.9	79.6
5	53.4	2.7	13.9	43.8	71.1	11.1	63.3	32.1	26.5	2.8	22.0	80.1
6	69.8	2.0	3.5	43.4	71.2	67.3	87.7	75.5	3.7	2.7	22.0	73.6
7	68.1	1.8	13.8	47.8	62.3	60.2	75.0	44.0	13.4	2.6	22.0	66.1
8	57.9	1.8	2.3	42.2	60.0	21.6	66.2	31.8	26.9	2.4	22.0	69.9
9	71.5	1.6	1.6	47.3	70.1	54.9	19.9	19.7	3.1	2.3	21.8	56.4
10	48.8	1.5	1.9	62.8	77.6	28.0	25.8	8.7	28.3	31.3	38.5	47.5
11	22.1	1.9	59.6	61.1	78.0	8.0	70.4	18.5	12.0	7.7	69.6	60.2
12	27.0	46.7	58.0	38.3	75.5	6.4	68.0	13.1	3.6	3.1	71.7	69.1
13	16.8	20.6	23.8	29.0	71.6	5.5	65.5	8.2	45.1	2.2	73.7	68.4
14	14.0	2.9	19.2	24.8	69.6	4.9	62.2	18.3	86.7	2.8	72.5	81.1
15	9.5	2.8	16.8	51.0	70.3	5.1	55.3	15.6	81.2	32.5	68.8	75.1
16	48.0	2.0	9.5	55.1	60.8	12.7	42.2	8.8	78.3	17.3	64.7	69.0
17	83.6	1.6	8.0	25.8	66.1	5.6	33.3	4.3	66.0	14.7	65.9	67.5
18	78.2	13.5	2.6	55.7	73.1	10.9	42.6	3.9	36.0	65.1	71.4	68.4
19	60.6	6.3	2.3	66.7	74.3	49.3	78.1	3.8	18.5	61.1	69.6	66.5
20	29.9	14.3	9.0	75.0	72.8	51.8	54.1	3.8	6.7	63.2	70.7	72.9
21	31.1	4.7	2.3	77.5	70.4	70.9	41.6	3.8	7.0	80.8	73.0	80.8
22	30.6	2.2	36.3	63.0	70.2	84.0	21.9	3.6	68.2	56.2	72.7	72.2
23	28.8	1.8	27.7	69.4	42.5	40.7	20.2	3.4	78.2	65.9	73.0	65.4
24	2.7	8.2	54.2	63.2	51.2	34.6	29.9	3.3	34.7	71.2	72.1	68.5
25	25.7	17.8	62.6	64.8	53.8	10.3	34.4	3.2	50.4	73.0	70.8	68.9
26	15.8	3.1	69.6	68.2	17.4	87.3	35.9	3.3	27.3	51.5	59.7	81.2
27	13.6	2.4	75.7	66.8	20.4	82.6	44.3	40.4	20.4	29.8	58.1	77.8
28	4.1	1.7	69.3	79.3	39.1	55.6	40.7	18.8	30.2	20.2	73.2	81.4
29	2.7	1.7	78.8	73.2	23.5	67.9	37.7	5.0	28.2	18.7	77.8	66.9
30	2.3	1.4	73.8	73.5	8.6	70.1	38.5	.....	31.3	46.1	73.4	64.2
31	1.9	1.4	.....	72.3	.....	63.1	41.5	.....	26.6	.....	74.0	.....

Monthly discharge of Haiku ditch at Peahi weir, near Huelo, Maui, for year ending June 30, 1916.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
July	83.6	1.9	35.0	54.2	1,090	3,330
August	46.7	1.4	6.45	9.98	200	614
September	78.8	1.2	30.3	46.9	908	2,790
October	79.3	24.8	58.7	90.8	1,820	5,580
November	79.1	8.6	60.9	94.2	1,830	5,610
December	87.3	4.9	37.3	57.7	1,160	3,550
January	87.7	11.2	44.4	68.7	1,380	4,220
February	75.5	3.2	18.0	27.8	522	1,600
March	86.7	3.1	33.6	50.2	1,040	3,200
April	80.8	2.2	28.3	43.8	849	2,610
May	77.8	21.8	56.4	87.3	1,750	5,370
June	83.5	47.5	71.3	110	2,140	6,560
The year	87.7	1.2	40.1	62.0	14,700	45,000

MISCELLANEOUS MEASUREMENTS.

Measurements of streams and ditches on the island of Maui at points other than regular gaging stations are listed below:

Miscellaneous measurements on Maui for the year ending June 30, 1916.

Date.	Stream.	Locality.	Gage height (feet).	Discharge.	
				Second-feet.	Million gallons per day.
July 20	Kahakuloa	Just below confluence of main forks, about 3 miles above mouth.	0.96	2.9	1.9
Sept. 22	....do	....do	1.90	32	21
July 23	Left branch of Iao.	Just above confluence with right branch, 3 miles west of Wailuku.	.74	12	8.0
Aug. 22	....do	....do	.66	9.6	6.2
Sept. 28	....do	....do	1.60	73	47
Nov. 27	....do	....do	.80	14	8.9
Aug. 17	South Waiehu ditch (upper).	Intake near Wailuku	.77	5.3	3.4
Dec. 27	....do	....do	.60	2.2	1.4
Mar. 4	....do	....do	.60	.77	.5
Aug. 21	Oopuola	Just above old Spreckels ditch crossing, 2 miles east of Huelo.	1.08	1.0	.65
Apr. 15	....do	....do	1.75	8.4	5.4
Aug. 22	Iao	Just below confluence of main branches, 3 miles west of Wailuku.	.79	25	16
Sept. 27	....do	....do	1.30	68	44
28	....do	....do	1.72	121	78
28	....do	....do	2.35	302	195
Dec. 23	....do	....do	1.15	57	37
Apr. 25	North Waiehu	Below upper diversion near Wailuku	1.22	1.55	1.0
May 22	....do	....do	1.10	2.0	1.3
Feb. 2	Kahoma	500 feet above development tunnel, and 100 feet above upper dam, near Lahaina.	.....	.55	.35
5	....do	....do	.....	.45	.3
5	Springs	20 feet above Kahoma development tunnel near Lahaina.	.....	.2	.1
May 22	Second diversion from South Waiehu.	50 feet below intake near Wailuku	.....	1.65	1.1
22	Third diversion from South Waiehu.	....do	.....	.65	.45

ISLAND OF HAWAII.

UPPER HAMAKUA DITCH AT PUUALALA AND RESERVOIR NO. 3 WEIRS, NEAR WAIMEA, HAWAII.[1]

LOCATION.—Puualala weir is in Lalakea tract, adjacent to forest reserve and close to Kaala Mountain and Pacific Sugar Mill fence. Reservoir No. 3 weir is on a branch from main ditch just before it enters Reservoir No. 3, about 1 mile south of Puualala or main weir.

RECORDS AVAILABLE.—January 1, 1913, to June 30, 1916. Records given herewith show the combined flow of the main ditch and its diversion to Reservoir No. 3 which occurs above the main weir.

GAGE.—Watson water-stage recorder at each weir.

DISCHARGE MEASUREMENTS.—Made by sharp-crested weirs with good stilling basins above.

EXTREMES OF DISCHARGE.—See monthly discharge tables.

DIVERSIONS.—This ditch diverts all normal run-off from upper headwaters of Waipio Gulch.

UTILIZATION.—Irrigation of sugar cane and domestic supply.

ACCURACY.—Records good.

COOPERATION.—Records are furnished by the Hawaiian Irrigation Co. (Ltd.).

Combined daily discharge, in million gallons, of Upper Hamakua ditch at Puualala weir and weir at reservoir No. 3, near Waimea, Hawaii, for the year ending June 30, 1913.

Date.	Jan.	Feb.	Mar.	Apr.	May.	June.	Date.	Jan.	Feb.	Mar.	Apr.	May.	June.
1....	3.4	1.1	1.0	8.2	2.2	2.1	16....	6.4	1.5	5.8	18	17	17
2....	2.1	.9	.7	7.6	3.8	6.2	17....	2.8	7.5	8.8	12	11	12
3....	4.2	.4	.5	3.9	6.3	7.7	18....	1.6	11	4.4	14	13	4.5
4....	2.9	.3	.4	6.7	5.5	2.5	19....	1.2	21	5.0	8.6	18	2.9
5....	2.5	.2	.3	3.4	2.9	1.5	20....	.9	10	2.9	5.7	6.6	2.2
6....	1.5	12	.3	5.9	1.6	1.1	21....	.7	10	12	8.3	2.6	1.6
7....	1.0	11	.3	8.4	.9	1.8	22....	1.1	8.6	17	13	1.5	1.4
8....	.9	2.7	.2	2.8	.6	4.5	23....	.9	3.5	4.8	16	1.4	6.4
9....	1.0	1.5	.2	9.2	.6	5.0	24....	.7	1.6	3.4	6.1	1.6	8.6
10....	3.7	.8	.2	8.0	.5	7.3	25....	.7	2.6	4.1	8.0	2.7	3.9
11....	2.7	.7	.1	20	.4	4.0	26....	.6	14	2.4	5.5	20	6.7
12....	1.7	.5	.1	25	6.2	13	27....	.5	3.1	4.4	15	14	23
13....	23	.4	.05	23	11	25	28....	.5	1.4	25	10	18	28
14....	25	4.3	5.6	20	3.7	20	29....	.4	.....	11	3.8	14	23
15....	19	4.9	2.3	18	12	25	30....	.3	.....	14	2.6	6.2	22
							31....	.2	.....	16	.....	3.6	.....

[1] Called Hamakua ditch at main weir, Puualala, near Waimea, Hawaii, in previous reports.

Combined daily discharge, in million gallons, of Upper Hamakua ditch at Puualala weir and weir at reservoir No. 3, near Waimea, Hawaii, for the years ending June 30, 1914–1916.

Date.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1913–14.												
1	18	1.0	2.7	0.4	.....	1.2	0.3	7.5	.....	4.0	2.4	15
2	16	12	9.1	.3	.....	1.0	.3	3.4	.....	12	1.5	21
3	13	11	10	.2	29	1.1	.2	1.7	.....	3.9	1.0	16
4	13	2.7	5.8	.2	23	5.1	12	12	.....	1.9	3.2	13
5	8.8	1.4	2.3	.1	8.5	20	24	4.1	.....	1.4	19	6.2
6	27	.9	1.8	.2	3.2	14	19	1.3	.....	1.2	16	10
7	21	.6	16	.3	1.7	9.3	6.8	.8	.....	5.1	22	14
8	18	.6	5.7	1.0	1.0	4.6	9.4	.95	.....	5.2	14	10
9	8.6	1.3	2.5	1.3	19	3.5	27	.7	.....	2.3	14	12
10	6.9	1.5	12	.7	21	2.3	14	.6	8.2	2.5	5.0	20
11	9.9	7.5	7.4	.4	16	1.6	5.7	.5	2.6	4.9	7.0	10
12	16	21	12	.1	22	2.0	13	.35	1.2	2.0	21	14
13	17	21	9.5	.1	17	1.5	18	.35	14	1.0	15	16
14	14	11	3.6	.7	10	4.1	13	.35	13	.6	5.6	15
15	8.9	19	3.5	2.9	6.3	14	10	.35	4.3	.45	3.5	16
16	8.7	6.9	1.7	6.3	18	14	10	.25	1.1	.3	6.2	13
17	13	2.8	3.7	1.7	25	14	14	.25	5.0	.2	13	20
18	11	1.6	15	.6	30	13	6.2	.1	2.9	5.8	14	20
19	5.2	1.1	9.7	.2	15	6.6	3.3	.1	.75	13	17	20
20	6.1	.9	5.3	1.6	12	3.2	2.2	.....	1.1	16	14	19
21	10	.9	2.8	2.5	14	2.0	1.8	.....	3.7	23	14	17
22	16	1.5	1.3	1.3	13	1.6	17	.....	1.7	22	13	17
23	6.5	.9	.7	1.9	9.6	13	7.0	.....	.8	23	6.0	16
24	3.7	1.2	.5	1.0	14	4.1	2.8	.....	1.0	17	4.0	18
25	3.4	1.1	.6	.4	14	1.8	2.2	.....	10	25	6.6	21
26	6.4	.7	.6	.1	12	1.2	1.7	.....	13	15	16	19
27	2.8	.6	.3	.1	10	.9	1.1	.....	4.3	8.7	16	21
28	5.3	1.2	.3	.05	3.9	.7	4.4	.....	1.9	5.6	16	19
29	3.0	2.7	.3	.....	2.0	.5	21	.....	14	3.4	14	18
30	1.7	11	.3	.....	1.7	.4	18	.....	14	2.4	6.0	17
31	1.5	5.0	.....	.....	.....	.3	9.0	.....	4.9	.....	9.5	.....
1914–15.												
1	21	14	15	17	15	12	3.6	2.5	3.4	4.3	16	5.6
2	18	18	15	15	12	9.7	10	2.9	2.2	9.6	17	15
3	18	19	15	16	6.8	12	10	2.1	2.9	5.4	5.1	6.2
4	21	15	15	16	5.6	9.1	14	1.3	7.8	2.0	2.8	2.1
5	19	13	14	18	9.3	15	15	19	13	1.3	6.3	1.3
6	16	13	10	18	7.0	13	11	12	13	.65	2.4	1.9
7	16	18	13	17	3.7	7.1	7.0	11	9.3	1.1	1.2	1.5
8	16	18	8.8	14	2.7	4.4	4.6	11	16	.6	.95	2.3
9	17	19	8.3	15	2.1	3.3	3.4	6.2	7.8	13	3.3	.95
10	17	17	16	13	1.8	3.7	3.5	21	3.4	18	1.3	.65
11	17	14	13	12	1.5	2.9	16	15	2.2	20	17	.5
12	17	15	11	8.2	1.3	15	11	24	2.0	16	21	2.2
13	16	15	17	12	1.1	16	9.6	24	2.4	7.7	7.8	3.2
14	17	14	18	7.6	6.6	7.9	4.4	14	22	3.1	2.9	3.7
15	16	15	15	6.5	14	4.0	2.8	8.7	12	1.6	4.2	8.9
16	13	15	19	13	12	2.7	2.1	18	4.3	8.1	2.9	16
17	12	16	19	12	6.4	2.0	1.7	13	4.9	21	2.5	15
18	15	15	18	14	3.5	1.5	1.4	13	4.0	8.4	1.5	4.6
19	7.7	15	18	10	9.7	1.4	1.1	19	2.0	2.3	1.0	16
20	6.9	15	16	7.4	13	14	.95	14	1.3	4.9	1.0	20
21	5.7	15	16	13	9.5	12	.8	13	.95	3.2	.9	11
22	11	15	13	6.8	4.6	6.2	1.0	15	.7	3.1	2.2	7.0
23	17	15	7.9	3.9	3.8	3.7	1.6	19	.55	4.1	5.4	27
24	17	15	6.4	2.8	12	3.2	4.2	14	.6	2.0	3.6	26
25	21	14	4.7	4.2	13	14	2.5	5.7	.55	8.6	1.2	14
26	17	15	7.8	12	13	10	1.1	6.4	.45	19	.75	14
27	12	15	19	14	13	8.2	.75	16	.35	18	.95	6.0
28	15	15	18	12	13	11	.6	6.6	.3	14	1.7	3.9
29	14	16	18	13	13	14	.5	.....	.3	18	2.4	2.3
30	13	14	17	14	13	9.0	.4	.....	.25	15	1.2	13
31	13	14	.....	14	.....	4.5	.45	.....	.25	.....	.85	.....

Combined daily discharge, in million gallons, of Upper Hamakua ditch at Puualala weir and weir at reservoir No. 3, near Waimea, Hawaii, for the years ending June 30, 1914–1916—Continued.

Date.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1915-16.												
1	19	21	0.45	28	17	3.1	7.2	1.8	1.0	7.8	34	20
2	13	9.9	.45	23	12	15	7.2	1.5	.5	4.2	39	20
3	4.6	14	1.0	9.5	12	17	7.2	1.2	2.0	6.8	34	12
4	3.9	17	3.3	6.4	22	16	7.2	.5	1.8	2.2	30	15
5	17	13	2.3	6.7	13	9.0	31	.75	13	2.5	23	18
6	20	14	1.2	8.4	12	20	12	.5	14	1.0	36	12
7	16	4.9	.75	1.9	15	24	8.5	.5	4.0	1.0	31	7.0
8	13	3.6	.7	.75	15	7.9	5.8	.5	3.8	.75	30	5.5
9	21	2.5	1.0	6.0	16	5.6	22	.5	2.0	2.8	24	4.5
10	12	1.7	.6	9.3	17	4.8	8.0	.5	2.2	17	16	4.8
11	6.0	1.2	14	15	18	4.9	11	.5	1.5	7.0	9.8	11
12	3.5	.95	15	6.3	12	2.0	4.8	.25	10	3.0	7.5	22
13	14	.95	5.7	2.5	14	1.5	2.0	.25	16	1.5	5.8	10
14	11	.7	5.5	1.9	16	1.2	14	.25	20	1.5	6.2	17
15	19	.6	12	1.7	13	.95	7.2	.25	30	22	10	12
16	15	4.4	8.0	1.6	9.6	.95	2.5	3.5	18	19	8.5	14
17	22	1.7	3.4	1.6	5.0	1.7	6.5	1.5	10	19	14	19
18	10	.95	4.1	.7	4.0	1.2	17	.5	5.8	20	16	20
19	4.0	1.1	2.9	12	27	13	22	.5	7.2	22	7.0	18
20	2.4	4.0	11	19	23	28	23	.25	5.8	20	8.8	22
21	1.6	2.9	7.5	22	21	15	11	.25	3.5	24	6.2	26
22	1.7	6.6	2.8	14	16	15	6.0	.25	4.2	11	4.0	30
23	.95	7.5	1.7	12	7.3	9.9	3.8	.25	9.8	7.0	10	23
24	.75	2.7	.9	13	6.4	5.3	2.2	.25	5.8	13	11	13
25	.7	7.9	1.0	10	6.8	4.3	1.8	.25	4.8	12	14	13
26	1.9	12	2.7	9.3	7.5	24	2.0	4.0	13	4.8	9.5	22
27	10	3.0	16	14	7.7	16	16	14	5.8	2.5	5.0	30
28	9.4	1.5	8.1	13	8.6	5.8	5.8	9.0	2.5	19	12	19
29	7.2	.85	23	15	7.5	5.5	3.2	2.2	1.2	15	16	26
30	5.5	1.2	30	24	8.4	8.5	2.8	.....	12	14	11	26
31	18	1.0	.....	14	.....	8.5	3.2	.....	6.2	.....	13	.....

Combined monthly discharge of Upper Hamakua ditch at Puualala weir and weir at reservoir No. 3 for years ending June 30, 1913–1916.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
1913.						
January	25	0.2	3.68	5.69	114	350
February	21	.2	4.91	7.60	138	422
March	25	.05	4.94	7.64	153	470
April	25	2.6	10.6	16.4	317	976
May	20	.4	6.75	10.4	209	642
June	28	1.1	9.66	14.9	290	889
The period	28	.05	6.75	10.4	1,220	3,750
1913-14.						
July	27	1.5	10.3	15.9	320	980
August	21	.6	4.92	7.61	153	468
September	16	.3	4.90	7.58	147	451
October 1–28	6.3	.05	.95	1.47	27	82
November 3–30	30	1.0	13.3	20.6	372	1,140
December	20	.3	5.25	8.12	163	499
January	27	.2	9.50	14.7	294	904
February 1–19	12	.1	1.88	2.91	36	110
March 10–31	14	.75	5.61	8.68	123	379
April	25	.2	7.63	11.8	229	702
May	22	1.0	10.8	16.7	336	1,030
June	21	6.2	16.1	24.9	483	1,480
The period	30	.05	7.84	12.1	2,680	8,220

Combined monthly discharge of Upper Hamakua ditch at Puualala weir and weir at Reservoir No. 3, for years ending June 30, 1913–1916—Continued.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
1914–15.						
July	21	5.7	15.2	23.5	472	1,450
August	19	13	15.4	23.8	476	1,470
September	19	4.7	14.1	21.8	422	1,300
October	18	2.8	12.0	18.6	371	1,140
November	15	1.1	8.10	12.5	243	746
December	16	1.4	8.15	12.6	252	775
January	16	.4	4.74	7.33	147	451
February	24	1.3	12.4	19.2	347	1,070
March	22	.25	4.55	7.04	141	433
April	21	.6	8.47	13.1	254	780
May	21	.75	4.49	6.95	139	427
June	27	.5	8.39	13.0	252	772
The year	27	.25	9.64	14.9	3,520	10,800
1915–16.						
July	22	0.7	9.81	15.2	304	933
August	21	.6	5.33	8.25	165	507
September	30	.45	6.24	9.65	187	574
October	28	.7	10.4	16.1	323	989
November	27	4.0	13.0	20.1	390	1,200
December	28	.95	9.54	14.8	296	908
January	31	1.8	9.16	14.2	284	871
February	14	.2	1.60	2.48	46	142
March	30	.5	7.66	11.9	237	729
April	26	.8	10.2	15.8	306	939
May	39	4.0	16.2	25.1	502	1,540
June	30	4.5	17.1	26.5	512	1,570
The year	39	.2	9.71	15.0	3,550	10,900

LOWER HAMAKUA DITCH[1] AT MAIN WEIR, NEAR KUKUIHAELE, HAWAII.

LOCATION.—Just below portal of last tunnel from Waipio Gulch, one-half mile southwest of Pacific Sugar Mill, at Kukuihaele.

RECORDS AVAILABLE.—July 18, 1910, to June 30, 1916.

GAGE.—Watson water-stage recorder.

DISCHARGE.—Measured by weir consisting of six 5-foot panels, sharp-crested and with a good stilling basin above. Current-meter measurements made in ditch below weir have checked weir discharge to within 2 per cent.

Lower Hamakua ditch diverts all run-off from headwaters of the Waipio basin below the upper Hamakua ditch.

EXTREMES OF DISCHARGE.—See monthly discharge table.

UTILIZATION.—Irrigation of sugar cane and domestic supply.

ACCURACY.—Records good.

COOPERATION.—Records for this weir furnished by the Hawaiian Irrigation Co. (Ltd.).

[1] Called New Hamakua ditch in previous reports.

Daily discharge, in million gallons, of Lower Hamakua ditch at main weir, near Kukuihaele, Hawaii, for the years ending June 30, 1914–1916.

Date.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1913–14.												
1	41	26	29	26	24	31	29	34	25	29	32	35
2	42	32	33	25	24	30	28	33	25	34	30	35
3	38	37	42	25	44	30	28	31	25	30	30	34
4	39	30	34	25	42	32	32	34	25	29	31	34
5	33	28	30	25	38	34	34	33	25	28	34	34
6	42	27	29	25	33	34	34	32	25	29	34	35
7	42	26	43	25	31	34	34	31	25	31	34	35
8	42	28	34	25	30	34	33	30	25	33	34	35
9	39	28	31	25	35	34	35	29	25	29	34	35
10	37	28	39	25	34	34	34	29	32	29	34	34
11	36	32	36	25	34	33	34	28	29	29	34	34
12	42	44	38	25	34	33	34	28	28	28	34	34
13	42	52	38	25	34	32	34	28	34	26	34	34
14	41	41	31	26	34	32	34	28	34	26	34	34
15	36	52	30	28	34	34	35	28	30	26	34	34
16	44	37	28	31	35	35	34	27	29	26	34	34
17	39	32	29	27	35	34	34	27	31	26	34	34
18	39	30	43	25	34	34	34	27	32	31	34	34
19	34	29	39	24	34	34	34	27	29	34	34	34
20	34	29	32	26	34	34	34	27	27	34	34	34
21	36	13	29	29	34	33	33	26	28	34	34	34
22	40	29	28	26	34	32	34	26	26	34	34	34
23	35	28	27	27	35	34	34	26	26	34	34	34
24	32	29	26	26	35	34	34	25	26	34	34	34
25	31	28	26	25	34	32	33	25	34	34	34	34
26	33	28	26	24	34	31	32	25	34	34	34	34
27	30	28	26	25	34	31	32	25	31	34	34	34
28	31	28	26	25	34	30	32	25	28	34	34	34
29	30	30	26	24	32	30	32	.....	31	33	34	34
30	29	35	26	24	31	30	34	.....	34	32	34	34
31	28	32	.....	24	.....	29	34	.....	32	.....	34	.....
1914–15.												
1	34	34	34	36	34	34	34	35	39	40	53	39
2	34	34	34	36	34	34	34	35	40	41	53	47
3	34	34	34	34	34	34	35	35	39	42	48	44
4	34	34	34	34	34	34	35	35	39	38	44	37
5	34	34	33	34	34	34	34	38	40	37	43	36
6	34	34	32	35	34	34	34	37	40	36	41	38
7	34	34	34	34	34	33	34	38	39	38	41	37
8	34	34	34	34	34	35	34	37	39	36	39	37
9	34	34	34	35	34	34	34	37	40	42	43	36
10	34	34	34	34	34	34	34	38	40	49	39	25
11	34	34	34	34	34	34	34	36	40	55	45	34
12	34	34	34	34	34	34	34	38	40	54	51	38
13	34	34	34	34	34	35	34	37	40	49	48	39
14	24	34	34	34	34	34	34	38	40	43	42	39
15	34	34	34	34	34	34	34	38	40	40	42	41
16	34	34	34	35	34	34	34	38	43	46	47	49
17	34	34	33	35	34	34	34	39	40	55	42	49
18	34	34	34	34	34	34	34	38	40	49	39	40
19	34	34	34	35	34	34	34	39	40	45	38	45
20	34	34	34	34	34	34	34	38	40	46	38	52
21	34	34	34	34	34	34	34	38	39	42	38	48
22	34	34	34	34	34	34	34	38	38	44	39	42
23	34	34	34	34	34	34	34	38	38	45	43	53
24	34	34	35	34	34	35	34	39	38	42	41	54
25	34	34	35	34	34	35	34	39	38	46	37	52
26	34	34	35	34	34	35	34	38	37	51	37	52
27	34	34	34	34	34	34	34	38	37	54	37	45
28	34	34	35	34	34	34	34	39	37	53	38	42
29	34	34	35	34	34	34	34	.....	36	53	39	39
30	34	34	34	34	34	34	34	.....	36	52	37	49
31	34	34	.....	34	.....	34	34	.....	36	.....	36	.....

Daily discharge, in million gallons, of Lower Hamakua ditch at main weir, near Kukuihaele, Hawaii, for the years ending June 30, 1914–1916—Continued.

Date.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1915–16.												
1	53	54	34	54	58	34	35	35	34	34	41	56
2	50	52	34	54	56	34	35	34	33	34	48	54
3	42	50	35	51	53	34	35	34	31	39	16	37
4	41	54	36	41	54	34	35	34	32	34	23	35
5	50	50	36	37	43	35	36	34	41	32	28	52
6	54	51	34	37	42	35	35	33	41	31	20	50
7	52	44	34	36	41	35	35	32	35	31	19	45
8	48	42	34	35	41	36	35	32	33	31	24	44
9	55	39	34	41	42	34	35	32	32	34	29	43
10	52	39	34	57	41	35	35	32	32	44	34	42
11	45	37	49	51	41	34	35	31	30	38	34	43
12	41	37	50	40	41	34	35	31	33	36	34	45
13	50	37	39	37	41	35	35	31	46	33	34	45
14	49	37	38	36	36	35	36	30	40	31	34	46
15	55	38	50	35	36	35	35	30	36	45	34	46
16	56	41	44	34	3[illegible]	35	35	34	36	54	34	46
17	55	36	36	34	35	35	35	32	35	53	34	46
18	50	37	37	34	36	35	36	30	35	54	36	46
19	44	36	39	46	36	34	36	30	34	55	37	51
20	41	40	45	44	36	34	37	30	35	58	42	51
21	40	38	41	57	36	34	36	30	35	58	35	52
22	39	41	36	52	34	35	36	30	36	50	37	54
23	38	43	35	48	34	34	35	30	36	43	39	52
24	37	39	34	51	34	35	36	30	36	52	45	50
25	37	55	34	43	34	35	36	30	36	50	48	49
26	39	50	35	43	34	35	36	37	40	51	47	54
27	50	39	48	47	34	35	37	43	36	37	45	54
28	49	36	33	49	34	35	35	40	34	51	49	53
29	44	36	49	45	34	35	35	38	33	48	52	54
30	44	34	58	61	34	35	35	.....	40	40	46	53
31	50	34	.....	53	.....	35	35	.....	36	.....	50	.....

Monthly discharge of Lower Hamakua ditch at main weir, near Kukuihaele, Hawaii, for years ending June 30, 1914–1916.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
1913–14.						
July	44	28	36.7	56.8	1,140	3,490
August	52	13	31.5	48.7	976	3,000
September	43	26	31.8	49.0	954	2,920
October	31	24	25.5	39.4	792	2,430
November	44	24	33.8	52.3	1,010	3,110
December	35	29	32.5	50.3	1,010	3,090
January	35	28	33.1	51.2	1,030	3,150
February	34	25	28.4	43.9	794	2,440
March	34	25	28.7	44.4	890	2,730
April	34	26	30.8	47.7	924	2,840
May	34	30	33.6	50.2	1,040	3,200
June	35	34	34.2	52.9	1,030	3,150
The year	52	13	31.7	49.0	11,600	35,600
1914–15.						
July	34	34	34.0	52.6	1,050	3,230
August	34	34	34.0	52.6	1,050	3,230
September	35	32	34.0	52.6	1,020	3,130
October	36	34	34.3	53.1	1,060	3,260
November	34	34	34.0	52.6	1,020	3,130
December	35	33	34.1	52.8	1,060	3,250
January	35	34	34.1	52.8	1,060	3,250
February	39	35	37.5	58.0	1,050	3,220
March	43	36	39.0	60.3	1,210	3,710
April	55	36	45.4	70.2	1,360	4,180
May	53	36	41.9	64.8	1,300	3,980
June	54	25	42.6	65.9	1,280	3,920
The year	55	25	37.0	57.2	13,500	41,500

Monthly discharge of Lower Hamakua ditch at main weir, near Kukuʻhaele, Hawaii, for years ending June 30, 1914–1916—Continued.

Month.	Discharge.				Total run-off.	
	Million gallons per day.			Second-feet (mean).	Million gallons.	Acre-feet.
	Maximum.	Minimum.	Mean.			
1915–16.						
July	56	37	46.8	72.4	1,450	4,450
August	55	34	41.8	64.7	1,300	3,980
September	58	33	39.2	60.7	1,180	3,610
October	61	34	44.6	69.0	1,380	4,240
November	58	34	39.5	61.1	1,190	3,640
December	36	34	34.7	53.7	1,080	3,300
January	37	35	35.4	54.8	1,100	3,370
February	43	30	32.7	50.6	949	2,910
March	46	30	35.5	54.9	1,100	3,380
April	58	31	42.7	66.1	1,280	3,930
May	52	16	36.4	56.3	1,130	3,460
June	56	35	48.3	74.7	1,450	4,450
The year	61	16	39.8	61.6	14,600	44,700

MISCELLANEOUS MEASUREMENTS.

Measurements of streams and ditches on the island of Hawaii at points other than regular gaging stations are listed below:

Miscellaneous measurements on island of Hawaii July 1, 1914–June 30, 1916.

Date.	Stream.	Locality.	Discharge.	
			Second-feet.	Million gallons per day.
1914.				
July 30	Waikoloa	1,500 feet above Lyons ditch intake, near Waimea	34.7	22.5
30	Akona ditch	50 feet below intake, near Waimea	4.4	2.8
30	Lyons ditch	500 feet below intake, near Waimea	8.9	5.8
30	Waikoloa	At bridge, near Akona's store, Waimea	71	46
Dec. 28	Kohala ditch	At Hawi Weir, Hawi	23	15
1915.				
Jan. 3	Waikoloa	800 feet below bridge, Waimea	6.0	3.9
7	Kipahu	300 feet above confluence with Wailuku River, near Hilo.	28	18
7	Wailuku River	500 feet above Piihonua bridge, near Hilo	64	41
15	Waiau	500 feet above confluence with Wailuku River, near Hilo.	28	18
Apr. 4	South Branch of Waikoloa.	About 3,600 feet elevation, on boundary between Government and Waikoloa lands, near Waimea.	.5	.35
4	Main Branch of Waikoloa.	do	1.95	1.25
4	Waikoloa	Elevation 3,250 feet, 1,000 feet above intake of 6-inch pipe line, Waimea water supply.	2.55	1.65
May 29	do	do	2.75	1.75
29	do	do	2.95	1.9
June 7	do	do	2.25	1.45
Aug. 15	do	do	2.35	1.55
29	do	do	2.35	1.55
Apr. 4	do	Elevation 2,950 feet, 1,000 feet below intake of 6-inch pipe line, Waimea water supply.	1.55	1.0
4	do	do	1.35	.85
May 29	do	do	2.15	1.4
June 7	do	do	1.35	.85
Aug. 14	do	do	1.65	1.05
29	do	do	1.35	.85
June 17	Pelekuaiao ditch	Confluence with Lyons ditch, near Kamuela	1.35	.85
20	Waikoloa	300 feet below Akona's store, Waimea	15	9.7
20	Lyons ditch	500 feet below intake, near Waimea	.25	.15

Miscellaneous measurements on island of Hawaii July 1, 1914–June 30, 1916—Contd.

Date.	Stream.	Locality.	Discharge.	
			Second-feet.	Million gallons per day.
1915.				
Aug. 19	Waikoloa	100 feet below Akona bridge and at intake of Akona ditch, Waimea.	0.3	0.2
19	....do	400 feet above Lyons dam, at lower edge of pool, near Waimea.	1.45	.95
29	....do	....do	1.5	.95
Dec. 24	Kehena ditch	100 feet above Honokane Weir, near Kohala	3.9	2.5
27	Kohala ditch	200 feet above Niulii Weir, Kohala	48	31
28	....do	20 feet above Awini Weir, Honokane, near Kohala	27	17
29	Waikoloa	400 feet above Lyons ditch intake, at lower edge of pool, near Waimea.	3.6	2.3
30	Koiawe	300 feet above diversion weir to upper Hamakua ditch, near Waimea.	28	18
30	Upper Hamakua ditch.	Elevation 4,000 feet below Alakahi intake, near Waimea.	5.9	3.8
30	Kawainui	Elevation 4,080 feet, in Upper Hamakua ditch, 50 feet below intake, near Waimea.	4.0	2.6
1916.				
Jan. 3	Lower Hamakua ditch.	200 feet below main weir, near Kukuihaele	54	35
4	....do	300 feet below Kawainui intake, near Waipio	24	16
4	....do	Below intake from Alakahi Gulch, near Waipio	47	30
4	....do	Above intake from Koiawe Stream, near Waipio	48	31
4	....do	Below intake from Waimea Stream, near Waipio	60	39
4	Alakahi	40 feet below diversion weir to Lower Hamakua ditch, near Waipio.	3.3	2.1
4	Kawainui	400 feet below intake of Lower Hamakua ditch, near Waipio.	10	6.5
4	....do	Above intake of Lower Hamakua ditch near Waipio	34	22
5	Waima	Old weir, 150 feet above junction with Waipio Stream	59	38
5	....do	300 feet below Lower Hamakua ditch flume crossing	35	23

RAIN GAGING.

The rainfall of the Hawaiian Islands is extremely variable, ranging from a few inches at several low-level, leeward localities to more than 600 inches per annum, at elevations above 2,000 feet and on the windward sides of the islands. Valleys lying on the same sides of the islands and within a few miles of each other may have a variation in mean annual precipitaion of several hundred per cent. The rainfall may also vary greatly in the same valley for different elevations. As a rule the zones of heaviest precipitation are on the windward sides of the islands, 2,000 to 3,000 feet above sea level.

Generally the daily rain gages maintained by the United States Weather Bureau are located at low levels. Lack of funds and the absence of inhabitants at high-level localities have prevented the maintenance of Weather Bureau stations at high levels, although in a number of cases daily records are furnished that bureau by occupants and caretakers of mountain houses and ranches. The data furnished by the Weather Bureau are therefore generally of little value in their relation to stream run-off.

When high levels have been accessible and funds available high-level rain gages, which are read at monthly, bimonthly, or longer periods, have been established by this office and some valuable records obtained. To determine the precipitation of the Territory accu-

rately would require the installation of thousands of gages and the construction of hundreds of miles of trails. For this reason and because of the extreme and variable porosity of the soil, it is impossible to determine any consistent relation between rainfall and stream run-off.

Acknowledgment for cooperation in furnishing rainfall data is due to the following companies and individuals:

Kauai: Kekaha Sugar Co.; Hawaiian Sugar Co.; Grove Farm Plantation, W. F. Sanborn, of Princeville Ranch; Kauai Electric Co.; and J. McClellan.

Oahu: F. Meyer; Hawaiian Department of the United States Army; Koolau Agricultural Co.; and Hawaii Preserving Co.

Maui: Wailuku Sugar Co.; Honolua Ranch; Hawaiian Commercial & Sugar Co.; Maui Board of Supervisors; Pioneer Mill Co.; and Olowalu Sugar Co.

Hawaii: Hawaii Mill Co.; W. S. May; C. F. Clark; C. R. Willard; Alex. Valentine; Honokaa Sugar Co.; Pacific Sugar Mill; Hawaiian Irrigation Co.; Kukaiau Ranch Co.; and Waiakea Sugar Co.

The tables on pages ——— show the precipitation at stations maintained by the Geological Survey and precipitation data furnished from private sources which are not included in United States Weather Bureau records, to which those interested in further data are referred.

Rainfall stations in Hawaii.

KAUAI.

1. Waialeale, on summit of ridge at headwaters of Hanapepe, Wainiha, Hanalei, and Olokele streams, and North and South Forks of Wailua River; about 25 miles by road and trail northeast of Waimea; 5,075 feet above sea level.

2. Intake of Wainiha Power Co.'s canal, 6 miles back of Hanalei; 700 feet above sea level; records furnished by Kauai Electric Co.

3. About 50 feet below Kauai Electric Co.'s power house, at tailrace, 7 miles west of Hanalei; 125 feet above sea level; records furnished by Kauai Electric Co.

4. Summit Camp (Wainiha ridge), Hanalei; about 30 feet southwest of house at Summit camp on power line; 6 miles from Kapaka; 1,900 feet above sea level; gage read by employee of Kauai Electric Co.

5. Kapaka, at lineman's camp, about 50 feet north of house, and 5 miles south of Hanalei; 635 feet above sea level; gage read by employee of Kauai Electric Co.

6. About 40 feet north of Sanborn's residence, 2 miles from Hanalei; 105 feet above sea level; records furnished by Princeville ranch.

7. Pilaa, about 200 feet north of Government road and 200 feet west of assistant overseer's house; about 2 miles south of Kilauea; 300 feet above sea level. Gage read by Mr. Buch, an employee of Kilauea Sugar Plantation Co.

8. Kaloko, on embankment of Kaloko reservoir about 3 miles southeast of Kilauea; 740 feet above sea level. Gage read by Mr. Buch, an employee of Kilauea Sugar Plantation Co.

9. Residence of W. S. Newlun about 4½ miles west of Kapaa; 375 feet above sea level.

10. Mount Nonou, near house of Elmer M. Cheatham on west slope of Mount Nonou, about 4 miles west of Kapaa; 350 feet above sea level.

11. North Wailua, at stream gaging station on North Wailua River, about 1 mile upstream from Kanaha ditch intake, and about 10 miles northwest of Lihue; 650 feet above sea level.

12. Waiahi, on South Wailua River, near Lihue Electric Co.'s power plant, 7 miles from Lihue; 600 feet above sea level.

13. Aakukui, near plantation camp, about 5 miles southwest of Lihue; 350 feet above sea level; records furnished by Grove Farm.

14. Reservoir No. 6, Grove Farm; at reservoir No. 6 on Grove Farm Plantation, about 5 miles west of Lihue; 400 feet above sea level.

15. Hiloa-Manawaiopuna divide, on ridge between east and west branches of Hanapepe Stream, about 10 miles northeast of Eleele; 2,080 feet above sea level.

16. Hanapepe Valley, on left bank of Hanapepe ditch, 3 miles above Koula, and about 8 miles north of Eleele; 530 feet above sea level; records furnished by Hawaiian Sugar Co.

17. Camp No. 2, about 2 miles northwest of Hanapepe and 7 miles southeast of Waimea; 250 feet above sea level; records furnished by Hawaiian Sugar Co.

18. Olokele mauka, on ridge on left side of Olokele Stream above intake of Olokele ditch, and about 18 miles by road and trail from Waimea; 2,100 feet above sea level; records furnished by Hawaiian Sugar Co.

19. Keanakua, near Halekua camp, on ridge about 16 miles by road and trail north-northeast of Waimea; 4,450 feet above sea level.

20. Kahana, near Halekua camp, on ridge about 16 miles by road and trail via Kaholuamanu from Waimea; 3,750 feet above sea level.

21. Kaholuamanu, about 12 miles by road and trail northeast of Waimea; 3,650 feet above sea level.

22. Waimea, in Mr. J. McClellan's yard; 10 feet above sea level; Mr. McClellan aids in obtaining record.

23. Camp No. 7, about 2 miles northeast of Waimea; 150 feet above sea level; records furnished by Hawaiian Sugar Co.

24. Pali trail, half a mile mauka of Kekaha ditch where trail crosses and about 2 miles mauka from Waimea; 850 feet above sea level; records furnished by Kekaha Sugar Co.

25. Hukipo, 3 miles northwest of Waimea; 400 feet above sea level; records furnished by Kekaha Sugar Co.

26. Waialae, near Kaholuamanu; 14 miles by road and trail north of Waimea, near Waialae gaging station; 3,600 feet above sea level.

27. Mohihi-Koaie divide, on ridge about 24 miles by road and trail north of Waimea; 3,950 feet above sea level.

28. Mohihi, on ridge at head of Mohihi Valley and about 23 miles by road and trail northeast of Waimea; 3,500 feet above sea level.

29. Kilohana, near Alakai swamp, about 23 miles by road and trail northeast of Waimea; 4,023 feet above sea level.

30. Waiakoali, about 22 miles by road via Halemanu north of Waimea; 3,450 feet above sea level.

31. Paukahana, about 21 miles north of Waimea by road and trail; 3,723 feet above sea level.

32. Lehuamakanoi, about 22 miles by road and trail north of Waimea; 3,932 feet above sea level.

33. Puu Lua, near wagon road from Kekaha to Halemanu, about 12 miles north of Waimea; 3,500 feet above sea level.

34. Kokee, on mesa half a mile above Knudsen's camp near head of Kokee Stream and about 19 miles north of Waimea; 3,550 feet above sea level.

OAHU.

1. Nuuanu Pali, on the water reservation, near the Pali road, about 200 yards toward Honolulu from top of Pali; 1,136 feet above sea level.

2. Manoa, at residence of E. H. Hipple, in upper Manoa Valley, about 500 feet west of highway bridge over the East Branch of Manoa Stream; 300 feet above sea level.

3. Residence of J. K. Maui in upper Kalihi Valley, 550 feet above sea level.

4. Ditch tenders' house at U. S. Army reservoir in upper valley of the South Kaukonahua Stream; 1,200 feet above sea level.

5. Wahiawa Water Co. intake, about 150 yards downstream on left bank of North Fork of Kaukonahua Stream from Wahiawa Water Co.'s ditch intake, on trail 8 miles north of Wahiawa; 1,200 feet above sea level. (Described in Water-Supply Paper 430 as at Waialua Agricultural Co. ditch intake.)

6. Hawaii Preserving Co. office, Wahiawa; 950 feet above sea level; records are furnished by Hawaii Preserving Co.

7. Makaha, near Waianae, on property of Waianae Plantation; 1,400 feet above sea level; records furnished by F. Meyer, manager Waianae Plantation.

8. Ditch and trail tender's house in upper Punaluu Valley, about 2 miles from Punaluu railroad station; 300 feet above sea level.

MAUI.

1. In H. B. Penhallow's yard, Wailuku; 390 feet above sea level; records furnished by Wailuku Sugar Co.

2. Yard at Wailuku Sugar Co.'s office, Wailuku; 175 feet above sea level; records furnished by Wailuku Sugar Co.

3. Waikapu Gulch, on left bank of the South Branch of Waikapu Stream, about 4 miles by trail from Waikapu and 6 miles from Wailuku; 1,535 feet above sea level.

4. Waikamoi Gulch, on Kula pipe line at reservoir; 3 miles from Olinda and 7 miles from Makawao; 4,200 feet above sea level; records furnished by board of supervisors, County of Maui.

5. Puohakamoa, on Kula pipe line about 1,000 feet below intake at Puohakamoa Gulch; 4 miles east of Olinda and 8 miles from Makawao; 4,300 feet above sea level; record furnished by board of supervisors, County of Maui.

6. Olowalu Sugar Co.'s mill in Olowalu; 10 feet above sea level; records furnished by Olowalu Sugar Co.

7. West slope of Puu Kukui at top of left bank of Honokawai Gulch; about 6 miles east of Kaanapali and 10 miles from Lahaina; 4,300 feet above sea level; records furnished by the Pioneer Mill Co.

8. West slope of Puu Kukui, about one-half of a mile south of Honokawai Gulch; about 4½ miles east of Kaanapali and 8½ miles from Lahaina; 2,500 feet above sea level; records furnished by Pioneer Mill Co.

9. Honokawai Gulch at junction with Amalu Stream; on trestle supporting Honokawai flume about 1,000 feet below intake; about 3½ miles from Kaanapali and 7½ miles from Lahaina; 1,500 feet above sea level; records furnished by Pioneer Mill Co.

10. Camp on ridge between Honokahau and Kahakuloa gulches beside trail leading to top of Mount Eke; about 12 miles from Honokahau; 2,300 feet above sea level.

11. Honokahau Gulch at ditchman's house on left bank of stream, 150 feet below ditch intake; about 8 miles from Honokahau; 800 feet above sea level; records furnished by Honolua Ranch Co.

12. Rim of extinct crater of Mount Eke; 14 miles by trail from Honokahau; 4,500 feet above sea level.

13. In Waihee Gulch on bank of Spreckel's ditch at elevation about 275 feet above sea level, about 5 miles from Wailuku.

14. Waihee, on roof of building formerly used as plantation office; 3½ miles from Wailuku; 125 feet above sea level; records furnished by Wailuku Sugar Co.

15. Waiehu, at T. Burlem's house on old Spreckels ditch just south of South Waiehu Gulch; 250 feet above sea level.

16. Iao Valley on small plateau or tableland between north and south branches of Iao Stream, about 1 mile above the junction; about 4 miles west of Wailuku; 1,500 feet above sea level.

HAWAII.

1. Kemole House, 12 miles southeast of Waimea; 5,500 feet above sea level; records furnished by Parker ranch.

2. Pohakuloa, 20 miles southeast of Waimea; 5,700 feet above sea level; records furnished by Parker ranch.

3. Puuhinei Paddock, 14 miles south of Waimea; 1,500 feet above sea level; records furnished by Parker ranch.

4. Puuanuanu Paddock, 14 miles south-southeast of Waimea; 7,500 feet above sea level; records furnished by Parker ranch.

5. Punohu Paddock, 10 miles east of Waimea; 4,200 feet above sea level; records furnished by Parker ranch.

6. Kaauhuhu, on property of W. S. May, about 3 miles northwest of Hawi; 1,400 feet above sea level; records furnished by W. S. May.

7. Kohala Mountain pipe line, 3 miles north of Waimea; 3,700 feet above sea level; records furnished by Parker ranch.

8. Upper Kawainui, in the Kohala Mountains, near the line of the upper Hamakua ditch, near Kukuihaele; 4,080 feet above sea level; records furnished by Hawaiian Irrigation Co.

9. Lower Kawainui, in Waipio Valley, near the line of the lower Hamakua ditch, near Kukuihaele; 1,040 feet above sea level; records furnished by Hawaiian Irrigation Co.

10. Alakahi–Waipio, in Waipio Valley, Kohala Mountains, near the line of the upper Hamakua ditch; 3,870 feet above sea level; records furnished by Hawaiian Irrigation Co.

11. Alakahi–Waipio, in Waipio Valley, Kohala Mountains, along the line of the lower Hamakua ditch, near Kukuihaele; 1,030 feet above sea level; records furnished by Hawaiian Irrigation Co.

12. Upper Koiawe, along the line of the upper Hamakua ditch, Waipio Valley, near Kukuihaele; 3,350 feet above sea level; records furnished by Hawaiian Irrigation Co.

13. Lower Koiawe, near the line of the lower Hamakua ditch in Waipio Valley near Kukuihaele; 1,000 feet above sea level; records furnished by Hawaiian Irrigation Co.

14. Waimea, in Waipio Valley along the line of the lower Hamakua ditch, near Kukuihaele; 980 feet above sea level; records furnished by Hawaiian Irrigation Co.

15. Puu Alala; on Upper Hamakua ditch at boundary east of Government land, about 5 miles northeast of Waimea Village; 2,800 feet above sea level.

16. Ahualoa homesteads, at ditch tender's house, near the Parker ranch, Honokaa; 2,551 feet above sea level; records furnished by civil engineer's office of Honokaa Sugar Co. and Pacific Mill.

17. Upper Hope A, on lands of Kukaiau Ranch Co.; 5,000 feet above sea level. Referred to in previous reports as "Upper Hapea."

18. Lower Hope A, on lands of Kukaiau Ranch Co; 4,000 feet above sea level. Referred to in previous reports as "Lower Hapea."

19. Kaala, on lands of Kukaiau Ranch Co.; 5,500 feet above sea level.

20. Puu Kea, on lands of Kukaiau Ranch Co.; 8,565 feet above sea level.

21. Halepiula, on lands of Kukaiau Ranch Co; 6,000 feet above sea level.

22. Puuhala, on lands of Kukaiau Ranch Co.; 6,500 feet above sea level.

23. Puu Kihe, on top of Kihe hill on the side of Mauna Kea, about 10 miles south of Kukaiau; 7,822 feet above sea level; records furnished by Kukaiau Ranch Co.

24. Umikoa, on property of Kukaiau Ranch Co. near ranch house; 3,400 feet above sea level; records furnished by Kukaiau Ranch Co.

25. Old Dairy, on property of Kukaiau Ranch Co.; 4,000 feet above sea level; records furnished by Kukaiau Ranch Co.

26. United States engineer's office at Hilo Breakwater, Hilo; 15 feet above sea level; records furnished by United States engineer's office.

Precipitation, in inches, at rainfall measurement stations maintained during the year ending June 30, 1916.

Island of Kauai.

No.	Station.	Records available.	Gage.	Readings.	Year ending June 30—	Precipitation. July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	Year.[a]	Estimated evaporation from rain gage.
1	Waialeale	Sept. 9,1910–June 30,1916[b]	10:1	Irregular	[c]1916													561.0	
2	Intake Wainiha power canal.	Feb. 1,1907–June 30,1916	Records furnished by Kauai Electric Co.	Daily...	1916	7.40	10.73	15.66	23.14	37.50	19.95	37.08	6.79	15.11	12.65	33.39	15.50	234.90	
3	Power house, Wainiha.	....do	....do	...do	1916	5.68	9.58	6.82	12.66	19.90	11.80	21.78	4.07	6.50	5.31	20.61	8.15	132.86	
4	Summit Camp, Hanalei.	Sept. 18,1910–June 30,1916	....do	...do	1916	14.76	15.12	19.91	19.05	34.10	21.58	35.37	10.26	22.86	9.68	20.98	13.81	237.48	
5	Kapaka	....do	....do	...do	1916	7.59	11.74	9.83	13.16	25.12	15.08	22.23	6.72	13.24	6.48	21.99	10.71	163.39	
6	Sanborn's House, Hanalei.	Mar. 11,1910–June 30,1916	Records furnished by W. F. Sanborn.	...do	1916	2.62	3.79	10.04	7.93	16.50	12.37	14.93	3.99	7.74	5.48	7.29	7.05	99.73	
7	Pilaa	June 1,1914–June 30,1916	Records furnished by T. B. Buch.	...do	1916	2.66	1.72	2.97	3.42	11.53	9.11	14.95	2.73	6.50	1.81	3.39	3.28	64.07	
8	Kaloko	....do	....do	...do	1916	6.64	4.39	7.87	7.85	14.22	23.21	16.60	6.00	11.00	1.80	4.00	5.60	109.98	
9	Newlun's House	Jan. 1,1914–June 30,1916	Records furnished by W. S. Newlun.	...do	1916	7.7	6.5	7.9	7.3	15.1	24.0	21.4	10.8	9.2	2.3	8.7	6.1	127.0	
10	Mount Nonou	Feb. 1,1915–June 30,1916	Records furnished by E. M. Cheatham.	...do	1915								2.2	.5	9.4	1.2	6.0		
					1916	4.0	4.8	7.5	5.8	11.2	19.5	14.0	5.5	8.6	3.4	6.2	4.8	95.3	
11	North Wailua	Sept. 25,1914–June 30,1916	2:1	Irregular	[d]1915													87.0	2.0
					1916													152.4	3.0
12	Waiahi	Aug. 8,1910–June 30,1916	2:1	Monthly	1916	13.8	7.6	14.2	13.4	17.8	19.4	19.9	6.5	15.0	8.6	10.2	8.4	158.8	4.0
13	Aakukui	June 1,1909–June 30,1916	Records furnished by Grove farm.	Daily...	1916	4.57	4.34	12.16	6.80	9.38	15.00	15.91	5.71	12.28	2.52	5.30	3.38	97.35	
14	Reservoir No. 6	Jan. 1,1914–June 30,1916	....do	...do	1914							4.11	.61	3.78	4.96	12.94	6.11		
					1915	5.01	4.50	20.12	3.28	6.44	7.18	.64	2.91	1.51	4.92	1.99	6.81	65.31	
					1916	5.18	4.72	8.84	6.96	10.98	14.61	15.40	5.46	13.33	2.67	5.47	4.55	98.17	
15	Hilea - Manawaiopuna divide.	Aug. 24,1910–June 30,1916	2:1	Monthly	1916	23.8	22.6	22.4	29.6	47.7	32.4	35.2	10.3	18.4	14.4	25.4	26.6	312.3	3.0
16	Hanapepe Valley	Jan. 1,1905–June 30,1916	Records furnished by Hawaiian Sugar Co.	Daily...	1916	10.00	10.82	13.64	17.46	24.64	20.90	20.57	6.01	11.92	7.16	15.89	10.50	169.51	
17	Camp No. 2	....do	....do	...do	1916	4.26	.91	2.94	1.65	5.71	13.47	11.38	3.13	3.48	1.20	0	.06	48.19	
18	Olokele mauka	Apr. 1,1911–June 30,1916	....do	Monthly	1916	9.2	10.5	18.8	14.4	23.1	22.4	23.3	6.2	19.0	9.4	14.9	13.1	187.3	3.0
19	Keanakua	Sept. 6,1910–June 30,1916	2:1	Irregular	1916													167.5	3.0
20	Kahana	Aug. 1,1910–June 30,1916	....do	...do	1916													149.7	3.0

21	Kaholuamanu	Mar. 11, 1913–June 30, 1916	do	do	1916													108.9	3.0
22	Waimea	Jan. 1, 1913–June 30, 1916	Records furnished by Jas. McClellan.	Daily	1916	.33	.33	0	.08	2.49	8.98	9.20	1.58	5.13	.56	.06	.25	28.99	
23	Camp No. 7	Jan. 1, 1914–June 30, 1916	Records furnished by Hawaiian Sugar Co.	do	1916	.94	.35	1.39	.20	2.95	10.65	10.90	1.65	5.02	.87	0	.05	34.97	
24	Pali trail	Jan. 1, 1911–June 30, 1916	Records furnished by Kekaha Sugar Co.	do	1916	0	.6	1.2	0	2.05	3.7	3.8	2.0	4.8	0	0	0	18.15	
25	Hukipo	do	do	do	1916	.9	.35	.3	0	2.15	7.5	6.4	2.0	4.45	0	0	0	24.05	
26	Waialae	July 31, 1910–June 30, 1916	2:1	Irregular	1916													152.3	3.0
27	Mohihi-Koaie divide	June 24, 1910–June 30, 1916	2:1	do	1916													147.5	3.0
28	Mohihi	June 21, 1910–June 30, 1916	2:1	do	1916													145.3	3.0
29	Kilohana	June 18, 1910–June 30, 1916	5:1	do	[e] 1916													313.5	
30	Waiakoali	June 4, 1910–June 30, 1916	2:1	do	1916													134.6	3.0
31	Paukahana	do	2:1	do	1916													130.2	3.0
32	Lehuamakanoi	June 18, 1910–June 30, 1916	5:1	do	1916													193.2	2.0
33	Puu Lua	June 5, 1910–June 30, 1916	2:1	do	1916													54.3	4.0
34	Kokee	June 6, 1910–June 30, 1916	2:1	do	1916													77.4	3.0

Island of Oahu.

1	Nuuanu Pali	Sept. 23, 1910–June 30, 1916	2:1	Monthly	1916	13.0	5.0	9.0	7.7	32.5	16.9	31.2	4.0	13.4	7.2	11.1	3.9	154.9	
2	Manoa	May 17, 1915–June 30, 1916	1:10	Daily	1915												3.64		
					1916	14.90	7.93	13.25	18.63	22.47	13.96	21.72	3.06	11.33	9.04	28.14	11.85	176.28	
3	Kalihi	Sept. 8, 1914–June 30, 1916	1:10	do	1916	11.90	6.35	12.34	14.46	23.56	15.72	28.09	.99	13.25	6.03	24.23	6.98	163.90	
4	Army Reservoir	Aug. 1, 1914–June 30, 1916	1:10	do	1916	6.76	4.33	12.77	11.74	21.30	12.89	26.08	9.57	6.34	7.43	19.90	19.62	158.73	
5	Wahiawa Water Co. intake	May 30, 1913–June 30, 1916	2:1	Monthly[f]	1916													256.3	0.8
6	Hawaii Preserving Co.	Mar. 1, 1913–June 30, 1916	1:10	Daily	1916	1.48	.84	3.84	5.27	13.03	12.30	20.76	0	5.52	4.03	4.39	5.44	76.90	
7	Makaha	Aug. 1, 1912–June 30, 1916	1:10	do	1916	3.96	2.12	3.47	2.83	11.26	18.70	27.38	7.12	5.86	3.67	7.51	2.78	96.66	
8	Upper Punaluu Valley	Apr. 28, 1915–June 30, 1916	1:10	do	1916	11.95	6.10	5.99	10.75	14.74	12.25	24.20	5.19	5.69	9.68	15.69	5.17	127.40	

[a] Includes estimated evaporation from rain gage.
[b] Broken record.
[c] May 21, 1915–May 23, 1916.
[d] Sept. 25, 1914–June 30, 1915.
[e] July 9, 1915–July 9, 1916.
[f] Approximately.

Precipitation, in inches, at rainfall measurement stations maintained during the year ending June 30, 1916—Continued.

Island of Maui.

No.	Station.	Records available.	Gage.	Readings.	Year ending June 30—	Precipitation.													Estimated evaporation from rain gage.
						July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	Year.[a]	
1	Penhallow's residence, Wailuku.	Nov. 1,1896–June 30, 1916	Records furnished by Wailuku Sugar Co.	Daily...	1916	0.64	0.05	1.90	4.57	6.25	5.06	22.96	1.27	8.80	6.26	5.24	0.69	63.69	.....
2	Wailuku.....	May 1,1887–June 30, 1916	.....do.....	...do.....	1916	.45	.02	1.41	2.50	6.96	4.50	23.95	1.01	8.14	5.78	4.25	.53	59.50	.....
3	Waikapu Gulch....	Nov. 3,1910–June 30, 1916	2:1.....	Monthly	1916	5.8	2.4	5.8	11.0	17.0	13.8	46.8	2.4	.....	.....	.....	.....	.....	.....
4	Waikamoi Gulch...	Oct. 12,1910–May 31, 1916[b]	Records furnished by Maui county engineer.	Daily...	1916	21.70	25.25	28.88	32.17	38.51	(b)	(b)	(b)	26.87	22.68	[c]87.58	.....	.....	.....
5	Puohakamoa.....	May 1,1911–Apr. 30, 1916	.....do.....	...do.....	1916	20.79	24.66	31.84	32.42	38.84	.....	.....	.....	30.71	20.89	.....	.....	.....	.....
6	Olowalu.....	Jan. 1,1907–June 30, 1916	Records furnished by Olowalu Co.	...do.....	1916	0	0	.20	1.45	7.41	10.08	45.32	1.69	11.03	8.88	1.04	0	87.10	.....
7	Puu Kukui (upper slope).	Oct. 11,1913–June 30, 1916	Records furnished by Pioneer Mill Co.	Monthly	1916	21.0	18.0	23.0	38.0	32.0	38.5	50.0	12.4	25.8	23.0	45.0	33.0	362.7	3.0
8	Puu Kukui (lower slope).	Oct. 13,1913–June 30, 1916	.....do.....	...do.....	1916	6.0	4.0	6.0	13.0	10.0	14.2	34.4	5.8	11.4	9.8	30.6	14.0	162.2	3.0
9	Honokawai Gulch..	Oct. 17,1911–June 30, 1916	.....do.....	...do.....	1916	6.9	3.9	10.6	15.4	20.1	13.8	33.8	3.6	11.7	11.1	30.9	12.3	177.1	3.0
10	Honokahau Ridge..	Mar. 10,1913–June 30, 1916	2:1.....	...do.....	1916	9.2	5.2	10.6	17.8	13.6	15.6	32.4	5.8	14.8	[d]32.8	[e] 9.2	9.0	179.0	3.0
11	Honokahau Gulch..	Feb. 1,1907–Feb. 29, 1916	Records furnished by Honolua ranch.	Daily...	1916	12.07	5.68	12.59	19.74	17.04	14.44	35.87	5.44	.....	.....	.....	.....	.....	.....
12	Mount Eke.....	Mar. 10,1913–June 30, 1916	2:1.....	Monthly	1916	14.6	8.4	15.4	22.6	16.4	19.4	37.0	7.6	23.6	[d]39.2	[e]13.4	22.4	243.0	3.0
13	Waihee, upper.....	July 1,1915–June 30, 1916	Records furnished by H. C. & S. Co.	Daily...	1916	.39	.06	1.72	3.35	6.23	5.69	35.71	.77	10.74	8.02	3.96	.69	77.33	.....
14	Waihee, lower.....	Jan. 1,1899–Oct. 31, 1907 Jan. 1,1910–June 30, 1916	Records furnished by Wailuku Sugar Co.	...do.....	1916	.85	.40	2.58	2.56	5.43	5.89	28.82	1.70	8.21	4.22	4.63	1.69	66.98	.....
15	Waiehu.....	.....do.....	Records furnished by H. C. & S. Co.	...do.....	1916	.76	.60	1.54	3.16	6.44	6.76	35.58	2.46	11.29	7.74	3.96	.81	81.10	.....
16	Iao Valley tableland.	Apr. 12,1911–June 30,1916[b]	2:1.....	Monthly[f]	1916	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	238.6	3.0

Island of Hawaii.

1	Kemole House	Sept. 1, 1914–June 30, 1916	Records furnished by Parker ranch.	Monthly	1916	1.4	1.0	5.8	2.0	2.4	1.6	6.4	0.2	1.2	2.6	5.4	0.2	30.2	.....
2	Pohakuloa	.....do	.....do	...do	1916	0	0	2.8	1.8	3.0	1.4	3.6	0	0	1.8	6.2	0	20.6	.....
3	Puuhinei Paddock	.....do	.....do	...do	1916	.4	.8	3.0	.6	2.4	1.6	7.0	1.0	1.0	1.4	2.2	0	21.4	.....
4	Puuanuanu Paddock.	.....do	.....do	...do	1916	2.4	2.4	8.6	6.2	8.0	2.8	8.6	.6	3.4	3.4	3.8	1.0	51.2	.....
5	Punohu Paddock	Nov. 1, 1914–June 30, 1916	.....do	...do	1916	3.6	1.2	1.6	5.6	6.0	4.2	7.6	1.8	7.0	11.2	10.4	2.4	62.6	.....
6	Kaauhuhu	Mar. 18, 1913–June 30, 1916	Records furnished by W. S. May, Hawi.	Daily	1916	4.71	2.05	1.37	4.15	(g)	(g)	18.32	3.84	6.25	18.52	8.43	8.71	.....	.....
	Kohala Mountain pipe line.	Sept. 1, 1914–June 30, 1916	Records furnished by Parker ranch.	Monthly	1916	11.2	3.6	6.0	12.6	9.6	9.0	1.4	2.8	11.4	14.6	15.0	16.6	113.8	.....
8	Upper Kawainui	Sept. 1, 1910–June 30, 1916	Records furnished by Hawaiian Irrigation Co.	Daily	1916	21.83	12.16	13.06	19.88	17.22	16.73	15.86	5.45	18.22	22.35	42.46	26.71	231.93	.....
9	Lower Kawainui	.....do	.....do	...do	1916	10.73	6.10	8.56	14.16	15.32	14.26	17.59	3.51	16.28	18.84	41.20	17.04	183.59	.....
10	Alakahi, Waipio Upper.	Jan. 1, 1913–June 30, 1916	.....do	...do	1916	19.13	8.91	11.06	17.95	13.28	15.14	13.87	4.45	16.83	18.81	37.07	21.95	198.45	.....
11	Alakahi, Waipio Lower.	Sept. 1, 1910–June 30, 1916	.....do	...do	1916	7.35	4.06	6.47	18.05	11.11	11.24	15.18	2.63	11.65	12.78	30.65	10.44	141.61	.....
12	Upper Koiawe	Jan. 1, 1912–June 30, 1916	.....do	...do	1916	15.17	6.65	7.68	14.17	13.53	13.66	14.75	2.82	14.58	19.13	32.48	18.94	173.56	.....
13	Lower Koiawe	Sept. 1, 1910–June 30, 1916	.....do	...do	1916	7.28	5.10	5.29	8.73	7.62	9.73	14.50	2.22	8.46	11.63	28.67	9.86	119.09	.....
14	Waimea	Apr. 1, 1913–June 30, 1916	.....do	...do	1916	6.94	2.31	3.27	8.11	7.10	8.40	12.85	1.52	5.62	7.13	28.66	6.14	98.05	.....
15	Puu Alala	July 1, 1915–June 30, 1916	.....do	...do	1916	5.61	1.65	3.58	6.51	7.53	6.65	12.99	1.46	8.36	7.59	16.78	5.82	84.53	.....
16	Ahualoa homesteads.	Jan. 1, 1912–June 30, 1916	.....do	...do	1916	10.15	1.91	4.76	9.41	10.79	14.44	12.12	3.19	13.81	14.15	32.31	7.25	134.29	.....
17	Upper Hope A	Mar. 1, 1902–June 30, 1916	Records furnished by Kukaiau ranch.	Weekly	1916	1.10	.50	4.90	2.20	6.48	2.39	5.04	2.02	5.40	0	16.69	.58	50.30	3.0
18	Lower Hope A	Apr. 1, 1909–June 30, 1916	.....do	...do	1916	1.40	.80	2.70	6.30	8.00	3.05	8.70	2.40	7.95	0	22.10	0	66.40	3.0
19	Kaala	Jan. 14, 1913–June 30, 1916	.....do	...do	1916	1.76	.50	2.20	13.50	9.33	4.99	7.07	3.20	5.95	0	25.55	1.20	78.25	3.0
20	Puu Kea	June 1, 1914–June 30, 1916	.....do	Monthly	1916	0	0	3.9	1.0	5.8	2.2	6.8	.2	3.3	0	12.0	0	38.2	3.0
21	Halepiula	Dec. 1, 1914–June 30, 1916	.....do	...do	1916	3.3	.5	6.0	4.3	8.2	8.1	6.2	2.3	5.6	0	22.8	0	65.3	3.0
22	Puuhala	Feb. 1, 1914–June 30, 1916	.....do	...do	1916	7.2	2.6	8.8	14.4	33.4	8.8	7.2	1.2	8.0	11.2	23.4	5.8	135.0	3.0
23	Puu Kihe	Mar. 1, 1903–June 30, 1916[h]	.....do	...do	1916	0	0	7.0	3.5	11.2	3.8	8.4	.8	4.2	0	19.8	0	61.7	3.0
24	Umikoa	Jan. 1, 1895–June 30, 1916	.....do	Daily	1916	2.28	.98	3.33	10.24	11.35	5.08	9.34	5.77	9.64	2.80	36.51	1.30	98.62	.....
25	Old Dairy	Jan. 1, 1915–June 30, 1916	.....do	Weekly	1915	.....	.....	.....	.....	.....	.....	2.50	2.40	3.05	3.20	1.75	.90	.....	.....
					1916	1.60	.60	1.85	6.12	6.80	2.65	8.45	2.44	7.75	0	23.40	0	61.66	.....
26	Hilo Breakwater	July 20, 1911–Apr. 30, 1916[c]	Record furnished by U. S. engineer office.	Daily	1916	9.52	4.40	.....	16.60	37.40	13.80	13.00	2.40	9.60	9.76	.....	.....	.....	.....

[a] Includes estimated evaporation from rain gage.
[b] Record broken.
[c] Rain gage overflowed on May 3.
[d] Period Apr. 1–May 10.
[e] Period May 11–31.
[f] Approximately.
[g] No record.
[h] Broken.

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