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SURFACE WATER SUPPLY OF HAWAII

JULY 1, 1917, TO JUNE 30, 1918

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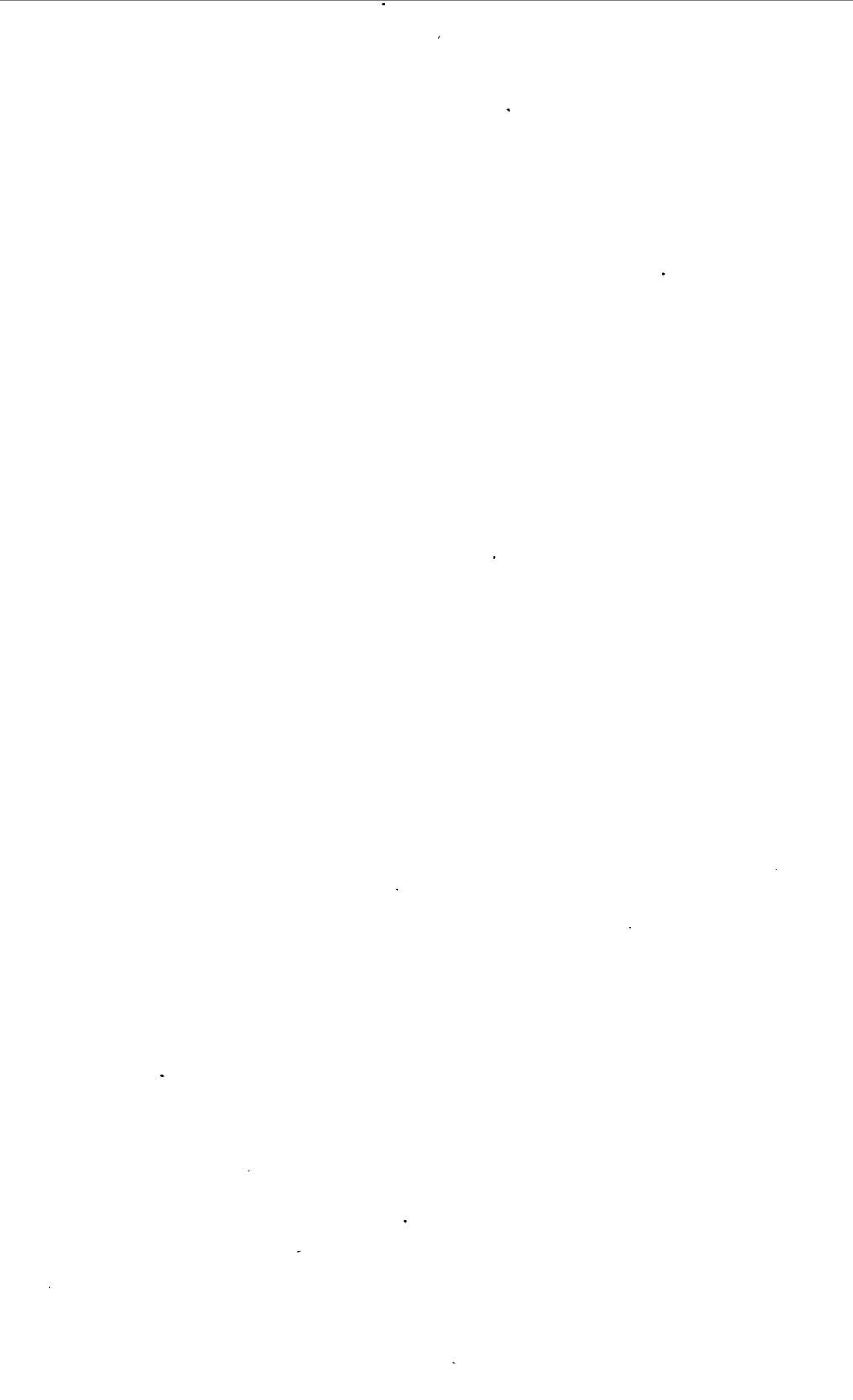
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SURFACE WATER SUPPLY OF HAWAII, JULY 1, 1917, TO JUNE 30, 1918.

AUTHORITY FOR INVESTIGATIONS.

This volume contains results of measurements of the flow of certain streams and ditches and records of rainfall in the Territory of Hawaii made during the year ending June 30, 1918. The investigations leading to the report were made by the United States Geological Survey in cooperation with the Territory of Hawaii, under the general sanction of the organic law of the Survey (Stat. L., vol. 20, p. 394), which contains the following paragraph:

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

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

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

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

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

On April 4, 1913, the governor of the Territory of Hawaii approved the following acts providing (act 56) for the creation and maintenance

of a division of hydrography under the board of agriculture and forestry, and (act 57) appropriating the revenues from water licenses for the use of the board of commissioners of agriculture and forestry toward forest protection and hydrographic surveying.

Section 1 of act 56 reads:

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

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

Section 1 of act 57 reads:

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

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

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

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

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

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

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

ACT 27.

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

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

SEC. 3. All unexpended balances of appropriations heretofore made for said division, the expenditure of which is now by law vested in the board of commissioners of agriculture and forestry, are hereby transferred to the commissioner of public lands and the expenditure thereof vested in said commissioner.

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

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; from July 1, 1913, to March 23, 1917, by the Board of Commissioners of Agriculture and Forestry; and since this date by the Commissioner of Public Lands.

OTHER COOPERATION.

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

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

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

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

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

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

Cooperation in the collection of records for whose accuracy responsibility has not rested with the Survey has been acknowledged in the descriptions of the stations. Special acknowledgment is due to the following individuals and companies cooperating under plans 1, 2, and 3: Island of Kauai—Hawaiian Sugar Co., 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, and Laie Plantation; Island of Maui—Wailuku Sugar Co., Pioneer Mill Co., Olowalu Sugar Co., Honolua Ranch, and East Maui Irrigation Co.

SCOPE OF WORK.

The investigations of the surface waters of the Territory are not complete nor do they include all the streams and ditches that might advantageously be studied. They include, however, as many of the streams and ditches on the 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 yield 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 section in the stream remain the same the discharge will be approximately the same for any given gage height.

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 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, if the end contractions are complete and the velocity of approach is wanting or negligibly small, and if the head on the crest is measured at a distance back of the overfall at least as great as the length of the weir crest length, the Francis formula will give good results. On the other hand, if these essential conditions are not complied with—if the weir is improperly constructed and there is leakage around and under it, and especially if the velocity of approach is considerable and the contractions are imperfect, the Francis formula will not give accurate results.

Observations made on various types of weirs in Hawaii show that not all the weirs in use in the Territory 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 in 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 ascertained by soundings which are taken at such distances apart as will show 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; on large streams, which must be measured from bridges or cables, a lead weight and sounding line must be used. The size of weights depends on the swiftness of the current and depth of water. The weights are torpedo shaped, so as to offer as little resistance as possible to the moving water.

On streams whose beds 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

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 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. The ratio of revolutions per second

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

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 very closely the mean velocity of water flowing in open channels; and that in a completed measurement it seldom varies as much as 1 per cent from the result obtained by the vertical velocity-curve method. It is very extensively used by 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 measurements is, however, greater than in the 0.2 and 0.8 method and the general results are not so 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 sub-surface 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 using 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 but should not be used with the Price meter, which will revolve when it is moved vertically.

In practical work on rough streams, such as many of those in Hawaii, the meter should be held at 0.6 depth if the stream is less than 1 foot deep. For depths of 1 foot or more 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 multiplying 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 boulders and rocks, so that a satisfactory measuring section may 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, classified 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

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

stage except by wading. Such stations are usually on ditches or wide shallow streams, which do not fluctuate greatly. On many streams, 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 two-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 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.

DEFINITION OF TERMS.

The volume of water flowing in a stream—the “run-off” or “discharge”—is expressed in various terms, each of which has become associated more or less definitely with a certain class of work. These terms may be divided into two groups: (1) Those which represent a rate of flow, as “second-feet,” “gallons per minute,” “gallons per

day," "miner's inches," and "run-off in second-feet per square mile," and (2) those which represent the actual quantity of water, as "run-off in depth in inches," "million gallons," and "acre-feet." They may be defined as follows:

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

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

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

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

"Run-off in inches" is the depth to which the drainage area would be covered if all the water flowing from it in a given period were 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 measuring water is the "million gallons." This is used with two meanings—(1) to indicate a rate of flow and (2) to express an actual quantity of water. In the former sense "million gallons per day" is inferred, 1,000,000 gallons being taken as the unit of quantity and 24 hours as the unit of time. With this meaning the term is generally used in connection with pumping and irrigation. In the latter sense "million gallons" as an absolute quantity is used in the measurement of storage capacities of reservoirs.

The following convenient approximate relations exist between second-feet, million gallons per day, and acre-feet: 1 second-foot flowing 24 hours equals about 2 acre-feet; 1,000,000 gallons equals about 3 acre-feet; and 1 second-foot equals approximately two-thirds 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 discharge 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 equals 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 0.3719 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: $\frac{\text{Sec.-ft.} \times \text{fall in feet}}{11} = \text{net horsepower on water}$

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 kinds of channels which they represent. The discharge measurements for all classes of stations, when plotted with gage heights in feet as ordinates and discharge 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 to 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 places 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 from the measurements made in 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 accurate results.

At low or medium stages slight changes 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 excellent 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 the rating curve is different for every day of the year and that the curves are 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 then to be pursued.

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 data are filled in, so far as feasible, by means of comparison with records for adjacent streams. The attempt is made to complete records for 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 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 so wide a diversity in the character and porosity of the rocks of the drainage basins that the determination of a general relation between rainfall and run-off is of no value. For this reason information concerning drainage areas has been omitted in the various station descriptions.

ACCURACY OF FIELD DATA AND COMPUTED RESULTS.

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

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

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

DIVISION OF WORK.

The data were collected and prepared for publication under the direction of C. T. Bailey, acting district engineer, Honolulu, Hawaii, by James E. Stewart, office engineer, W. V. Hardy, R. D. Klise, H. A. R. Austin, W. C. Woodward, J. B. Mann, A. H. Wong, E. E. Goo, John Kaheaku, and Earl Smith. The manuscript has been prepared by James E. Stewart and reviewed by C. T. Bailey.

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 dates show 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, 1918.

KAUAI ISLAND.

Waimea River near Waimea, 1910-

Poomau River:

Kawaikoi Stream near Waimea, 1909-1917.

Waiakoali Stream near Waimea, 1909-1912.

Mohihi Stream near Waimea, 1909-1912.

Waiahulu Stream near Waimea, 1916-

Koaie Stream near Waimea, 1916-

Waialae River near Waimea, 1910-1916.

Waialae River at elevation 800 feet, near Waimea, 1916-

Kekaha ditch at Camp No. 1, near Waimea, 1910-1915, 1917-

Kekaha ditch at flume No. 3, near Waimea, 1910-1912.

Kekaha ditch at flume No. 4, near Waimea, 1916-17.

Kekaha ditch at siphon near Waimea, 1910-1912.

Kekaha ditch at tunnel No. 12, near Waimea, 1910-1914.

Kekaha ditch below tunnel No. 12, near Waimea, 1916-

Waimea ditch near Waimea, 1911-1913, 1916-

Kamenehune ditch near Waimea, 1911-

Makaweli River near Waimea, 1911-1917.

Halekua Stream near Waimea, 1912-13.

Olokele River near Waimea, 1915-1917.

Olokele ditch at tunnel No. 12, near Makaweli, 1904-1917.

Olokele ditch at weir, near Makaweli, 1912-1917.

Poowaiomahaihai ditch near Waimea, 1911-1913.

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

Hanapepe River at Koula, near Eleele, 1910-1916, 1917-

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, 1910-1917.

Manuahi Stream near Eleele, 1917-

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 elevation 650 feet near Lihue, 1914-

Kanaha ditch near Lihue, 1910-

East Branch of North Fork of Wailua River near Lihue, 1912-

Uhau Iole Stream at elevation 750 feet, near Lihue, 1912.

Keahua Stream at elevation 750 feet, near Lihue, 1912.

Kawi Stream at elevation 750 feet, 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 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 elevation 1, 140 feet 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 elevation 625 feet, near Hanalei, 1914-

Hanalei River near Hanalei, 1911-

China ditch near Hanalei, 1911-

Kuna ditch near Hanalei, 1912-13, 1916-

Lumahai River near Hanalei, 1914-1917.

Lumahai River near Wainiha, 1912.

Waioli Stream near Hanalei, 1914-

Wainiha River near Hanalei, 1914-1917.

Wainiha River, East Channel, near Wainiha, 1912-1916.

Wainiha River, West Channel, near Wainiha, 1911-1916.

Wainiha canal at intake, near Wainiha, 1910-1916.

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.

Maole ditch, mauka station, near Honolulu, 1917-

Maole ditch, makai station, near Honolulu, 1917-

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, 1915-16, 1918-

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, 1912-1916.

Kailua Stream near Kailua, 1912-1916.

Wong Leong's ditch near Kailua, 1912-1916.

Makawao Stream near Kailua, 1912-1916.

Makawao Spring near Kailua, 1914-1916.

Kaimi Stream near Kailua, 1912-1916.

Main spring near Kailua, 1914-1916.

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, 1911-1916.

Waiahole Stream at Waiahole, near Waikane, 1911-12.

Waihi Stream near Waikane, 1911.

Halona Stream near Waikane, 1911.

Waiuanu Stream near Waikane, 1911.

Waikane Stream near Waikane, 1911-12.

Kahana Stream near Kahana, 1914-1917.

East Branch of Kahana Stream near Kahana, 1914-1917.

Punaluu Stream at elevation 539 feet, near Punaluu, 1915-1918.

Punaluu Stream at elevation 250 feet, near Punaluu, 1914-1918.

Punaluu Stream near Hauula, 1906-7.

Waihoi Stream near Punaluu, 1915-1917.

Kaluanui Stream near Hauula, 1906-7, 1915-1917.

Kaipapau Stream near Hauula, 1906-7.

Koloa Stream near Laie, 1914-

Wailele Stream near Laie, 1914-

East Branch of Kahawainui Stream near Laie, 1914-1918.

East Branch of Malaekahana Stream near Kahuka, 1914-1918.

Middle Branch of Malaekahana Stream near Kahuka, 1914-1918.

Kaukonahua Stream:

North Fork of Kaukonahua 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-

Kaukonahua Stream—Continued.

South Fork of Kaukonahua Stream above United States Army reservoir, near Wahiawa, 1911, 1913-1917.

United States Army ditch at reservoir, near Wahiawa, 1914-15.

South Fork of Kaukonahua Stream below United States Army reservoir near Wahiawa, 1914-1917.

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, 1910-1917.

South Waiehu ditch near Wailuku, 1912-1915.

North Waiehu Stream near Wailuku, 1912-1917.

North Waiehu ditch near Wailuku, 1910-11, 1916-17.

Waihee Stream near Waihee, 1910-1912, 1913-1917.

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, 1913-1917.

Honolua ditch near Honokahau, 1911-12.

Honokawai Stream near Lahaina, 1911; 1912-1917.

Honokawai Stream at weir No. 1, near Lahaina, 1901.

Honokawai ditch near Lahaina, 1912-1917.

Kahoma Stream near Lahaina, 1911-12; 1913-1917.

Kahoma Stream at weir No. 1, near Lahaina, 1901.

Kahoma Stream at weir No. 2, near Lahaina, 1901.

Kahoma development tunnel near Lahaina, 1911-1917.

Lahainaluna Stream above pipe line intake, near Lahaina, 1916-

Lahainaluna Stream near Lahaina, 1911-1916.

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; 1913-1917.

Kauaula Stream at weir No. 3, near Lahaina, 1901.

Kauaula ditch near Lahaina, 1911-1917.

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, 1911-1917.

Olowalu Stream near Olowalu, 1913-1916.

Olowalu ditch near Olowalu, 1911-

Ukumehame Stream near Olowalu, 1911-12; 1913-

Waikapu Stream near Waikapu, 1910-1917.

Palolo (Everett) ditch near Waikapu, 1910-1917.

South Side Waikapu ditch near Waikapu, 1910-1917.

EAST MAUI.

Koolau ditch region:

- Hanawi Stream near Nahiku, 1914-15.
- West Kopiliula Stream near Keanae, 1914-1917.
- East Wailuaiki Stream near Keanae, 1913-1917.
- West Wailuaiki Stream near Keanae, 1914-1917.
- East Wailuanui Stream near Keanae, 1914-1917.
- West Wailuanui Stream near Keanae, 1913-1917.
- Koodau ditch near Keanae, 1910-1912, 1917-
- 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 below Kaaiea gulch, near Huelo, 1917-
- Spreckels ditch at station No. 7, near Huelo, 1911-1912.
- Spreckels ditch at station No. 8, near Huelo, 1911-1913.

Center ditch region:

- Manuel Luis ditch at Puohakamoa gulch, near Huelo, 1917-
- Center ditch at Waikamoi, near Huelo, 1918-
- Center ditch, near Huelo, 1910-1912.

Hamakua ditch region:

- Naililihale Stream, near Huelo, 1910-1912; 1913-1918.
- Kailua Stream, near Huelo, 1910-1912; 1913-1918.
- Oanui Stream, near Huelo, 1910-11; 1913-1916.
- Hoolawalilili 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.
- Opana ditch, near Huelo, 1910-1912.
- New Hamakua ditch at Naililihale 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.
- New Hamakua ditch at Honopou, near Huelo, 1918-
- Old Hamakua ditch at Honopou, near Huelo, 1918-
- Old Hamakua (Kauhikoa) 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-

MOLOKAI ISLAND.

Halawa Stream, near Halawa, 1917-

HAWAII ISLAND.

Hilo group:

81 stations at elevation 2,700 feet, in forest back of Hilo, 1911-1913.

Wailuku River, near Hilo, 1911-1913, 1918-

Hilo Boarding School ditch, near Hilo, 1918-

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 elevation 360 feet, near Waipio, 1901-2.

New Hamakua ditch at Waima Stream, near Waipio, 1912.

Lower Hamakua ditch at main weir, near Kukuihaele, 1910-

Upper Hamakua ditch at Puualala and reservoir No. 3 weirs, near Kukuihaele, 1913-

Kawainui Branch of Waipio River, near Waipio, 1911-12.

Kawainui Stream at elevation 2,120 feet, near Waipio, 1901-2.

Kawainui Stream at elevation 1,435 feet, near Waipio, 1901-2.

Kawainui Stream at elevation 775 feet, near Waipio, 1901-2.

Branch No. 3 of Kawainui Stream at elevation 1,700 feet, near Waipio, 1901-2.

Branch No. 2 of Kawainui Stream at elevation 1,405 feet, near Waipio, 1901-2.

Branch No. 1 of Kawainui Stream at elevation 1,330 feet, near Waipio, 1901-2.

Alakahi Stream at elevation 1,200 feet, near Waipio, 1901-2.

Alakahi Stream at elevation 730 feet, near Waipio, 1901-2.

Koiawe Stream at elevation 610 feet, near Waipio, 1901-2.

Waima Stream at elevation 790 feet, near Waipio, 1901-2.

Waima Stream at elevation 385 feet, near Waipio, 1901-2.

Kohala group:

Honokane Stream—

East Branch of Honokane Stream at elevation 1,300 feet, near Honokane, 1901.

East Branch of Honokane Stream at elevation 770 feet, near Honokane, 1901.

West Branch of Honokane Stream at elevation 1,370 feet, near Honokane, 1901.

West Branch of Honokane Stream at elevation 775 feet, near Honokane, 1901.

Kohala ditch above Honokane gulch, near Kohala, 1908-

Kohala ditch at Awini weir, near Kohala, 1907-1917.

Kohala ditch at Niulii weir, near Kohala, 1907-1917.

Kehena ditch at Honokane mauka, near North Kohala, 1912-13.

Kehena ditch, near Kohala, 1917-

Kau group:

Waiohinu Springs, mauka station, near Naalehu, 1917-

Waiohinu Springs, makai station, near Naalehu, 1917-

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, 1918.

GAGE.—Vertical and inclined staff installed October 5, 1911, read by A. B. Blackstadt. July 9, 1910, to October 4, 1911, staff gage about a mile downstream.

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 high; bed of stream sandy. Control composed of sand, gravel, and boulders; shifting.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 12.6 feet at 4.30 p. m. October 16 (discharge, 4,700 million gallons per day, or 7,280 second-feet); minimum stage recorded, 4.35 feet September 12 and 13, October 10 and 12 (discharge, 1.5 million gallons per day, or 2.3 second-feet).

1910-1918: Maximum stage recorded, 18.8 feet at 4.30 p. m. January 25, 1916 (discharge, computed from extension of the rating curve, about 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.—Stage-discharge relation not permanent. Rating curves well defined July 1 to October 15 and October 16 to June 30, but date of change of stage-discharge relation uncertain. Gage read to hundredths twice daily. Records good, except those for October to January, which are fair.

Discharge measurements of Waimea River near Waimea, Kauai, during the year ending June 30, 1918.

[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. |
| Nov. 12..... | 4.80 | 11.7 | 7.6 | Mar. 13..... | 7.50 | 775 | 501 |
| Jan. 24..... | 7.00 | 516 | 333 | Apr. 29..... | 6.03 | 147 | 95 |
| Feb. 20..... | 6.60 | 304 | 196 | May 28..... | 5.20 | 38 | 25 |
| | | | | 30..... | 5.34 | 47 | 31 |

Daily discharge, in million gallons, of Waimea River near Waimea, Kauai, for the year ending June 30, 1918.

| Day. | July. | Aug. | Sept. | Oct. | Nov. | Dec. | Jan. | Feb. | Mar. | Apr. | May. | June. |
|---------|-------|------|-------|-------|-------|------|-------|-------|-------|-------|------|-------|
| 1..... | 34 | 6.0 | 2.5 | 5.0 | 7.0 | 56 | 14 | 47 | 172 | 151 | 79 | 40 |
| 2..... | 10 | 5.0 | 2.0 | 5.0 | 32 | 23 | 12 | 69 | 110 | 225 | 74 | 56 |
| 3..... | 10 | 10 | 2.0 | 7.0 | 382 | 18 | 12 | 74 | 1,080 | 184 | 74 | 14 |
| 4..... | 87 | 42 | 2.0 | 6.0 | 84 | 10 | 12 | 79 | 900 | 142 | 110 | 10 |
| 5..... | 12 | 62 | 2.0 | 7.0 | 26 | 10 | 10 | 79 | 825 | 125 | 125 | 8.5 |
| 6..... | 14 | 16 | 2.0 | 6.0 | 43 | 29 | 10 | 312 | 700 | 162 | 79 | 6.0 |
| 7..... | 8.5 | 7.0 | 2.0 | 7.0 | 23 | 125 | 12 | 400 | 312 | 210 | 69 | 6.0 |
| 8..... | 24 | 8.5 | 2.0 | 7.0 | 20 | 103 | 103 | 36 | 184 | 172 | 133 | 5.0 |
| 9..... | 352 | 7.0 | 2.0 | 2.5 | 18 | 79 | 79 | 96 | 133 | 142 | 64 | 5.0 |
| 10..... | 110 | 6.0 | 2.0 | 1.5 | 14 | 69 | 74 | 125 | 1,320 | 259 | 51 | 7.0 |
| 11..... | 46 | 5.0 | 2.0 | 2.0 | 10 | 74 | 84 | 142 | 1,490 | 151 | 51 | 23 |
| 12..... | 51 | 5.0 | 1.5 | 1.5 | 14 | 69 | 79 | 151 | 550 | 103 | 133 | 18 |
| 13..... | 21 | 46 | 1.5 | 21 | 6.0 | 74 | 79 | 90 | 452 | 103 | 96 | 29 |
| 14..... | 14 | 51 | 2.0 | 46 | 5.0 | 43 | 103 | 84 | 312 | 117 | 43 | 23 |
| 15..... | 14 | 46 | 3.0 | 5.0 | 5.0 | 40 | 133 | 74 | 348 | 117 | 43 | 51 |
| 16..... | 8.5 | 21 | 5.0 | 1,080 | 5.0 | 23 | 90 | 60 | 277 | 103 | 36 | 60 |
| 17..... | 38 | 56 | 14 | 277 | 3.0 | 16 | 26 | 600 | 259 | 84 | 36 | 40 |
| 18..... | 46 | 94 | 62 | 90 | 3.0 | 18 | 14 | 900 | 210 | 3,950 | 64 | 16 |
| 19..... | 46 | 8.5 | 51 | 43 | 3.0 | 14 | 1,520 | 330 | 210 | 1,880 | 47 | 36 |
| 20..... | 68 | 7.0 | 12 | 29 | 3.0 | 10 | 365 | 172 | 125 | 900 | 36 | 56 |
| 21..... | 56 | 6.0 | 4.0 | 23 | 10 | 23 | 117 | 1,050 | 84 | 510 | 29 | 23 |
| 22..... | 56 | 5.0 | 2.5 | 51 | 18 | 32 | 110 | 312 | 79 | 435 | 23 | 60 |
| 23..... | 8.5 | 5.0 | 2.0 | 56 | 6.0 | 16 | 90 | 142 | 69 | 259 | 36 | 43 |
| 24..... | 30 | 5.0 | 2.5 | 51 | 5.0 | 14 | 69 | 110 | 69 | 184 | 23 | 40 |
| 25..... | 68 | 6.0 | 2.5 | 51 | 10 | 16 | 510 | 90 | 74 | 133 | 40 | 40 |
| 26..... | 56 | 5.0 | 3.0 | 51 | 60 | 32 | 365 | 90 | 64 | 133 | 23 | 14 |
| 27..... | 24 | 5.0 | 34 | 8.5 | 172 | 79 | 600 | 90 | 51 | 172 | 43 | 40 |
| 28..... | 24 | 3.0 | 38 | 7.0 | 64 | 117 | 510 | 330 | 43 | 142 | 117 | 23 |
| 29..... | 14 | 4.0 | 18 | 7.0 | 36 | 43 | 550 | ..... | 36 | 90 | 96 | 16 |
| 30..... | 12 | 3.0 | 18 | 7.0 | 60 | 23 | 242 | ..... | 32 | 84 | 32 | 12 |
| 31..... | 12 | 3.0 | ..... | 18 | ..... | 16 | 125 | ..... | 125 | ..... | 36 | ..... |

Monthly discharge of Waimea River near Waimea, Kauai, for the year ending June 30, 1918.

| Month. | Discharge. | | | Total run-off. | |
|----------------|--------------------------|----------|-------|------------------|------------|
| | Million gallons per day. | | | Million gallons. | Acro-feet. |
| | Maximum. | Minimum. | Mean. | | |
| July..... | 352 | 8.5 | 44.3 | 68.5 | 4,210 |
| August..... | 94 | 3.0 | 18.0 | 27.8 | 1,710 |
| September..... | 62 | 1.5 | 9.96 | 15.4 | 917 |
| October..... | 1,080 | 1.5 | 63.8 | 98.7 | 6,070 |
| November..... | 382 | 3.0 | 38.2 | 59.1 | 3,520 |
| December..... | 125 | 10 | 42.4 | 65.6 | 4,030 |
| January..... | 1,520 | 10 | 197 | 305 | 18,700 |
| February..... | 1,050 | 36 | 219 | 339 | 18,800 |
| March..... | 1,490 | 32 | 345 | 534 | 32,800 |
| April..... | 3,950 | 84 | 381 | 589 | 35,100 |
| May..... | 133 | 23 | 62.6 | 96.9 | 5,960 |
| June..... | 60 | 5.0 | 27.4 | 42.4 | 2,520 |
| The year..... | 3,950 | 1.5 | 120 | 186 | 134,000 |

WAIAHULU STREAM NEAR WAIMEA, KAUAI.

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

RECORDS AVAILABLE.—February 25 to October 21, 1916; October 25, 1917, to June 30, 1918.

GAGE.—Stevens water-stage recorder installed October 25, 1917, to replace original Gurley printing water-stage recorder destroyed by flood of December 18, 1916.

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 during year, 8.71 feet at 12.45 p. m., April 18 (discharge, computed from extension of rating curve, 1,200 million gallons per day, or 1,860 second-feet); minimum stage recorded, 2.6 feet October 25 and 26 and January 10 (discharge, 24 million gallons per day, or 37 second-feet).

1915–1918: Flood December 18, 1916, reached a stage of about 15 feet (discharge not estimated); minimum stage recorded, 1.8 feet October 3 and 4, 1916 (discharge, 13 million gallons per day, or 20 second-feet¹).

DIVERSIONS.—None.

REGULATION.—None.

UTILIZATION.—For irrigation of sugar cane, rice, and taro, and for power and domestic supply.

ACCURACY.—Stage-discharge relation changed by flood of April 10–11. Rating curves applicable as follows: October 25 to April 10, well defined below 100 million gallons per day and poorly defined above that point; April 11 to June 30, fairly well defined below 65 million gallons per day and poorly defined above that point. Operation of water-stage recorder satisfactory. Records good for low and medium stages, but poor for high stages.

Discharge measurements of Waiahulu Stream near Waimea, Kauai, during the year ending June 30, 1918.

[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. 17..... | 2.77 | 24 | 15 | Jan. 11..... | 2.56 | 35 | 23 |
| Oct. 12..... | 2.73 | 22 | 14 | Feb. 16..... | 3.20 | 97 | 63 |
| 14..... | 2.88 | 32 | 21 | Mar. 28..... | 3.11 | 89 | 57 |
| 17..... | 3.59 | 152 | 98 | May 7..... | 3.08 | 70 | 45 |
| 17..... | 3.32 | 109 | 71 | 8..... | 3.39 | 99 | 64 |
| 18..... | 2.99 | 70 | 45 | June 25..... | 3.05 | 61 | 39 |
| 19..... | 2.81 | 52 | 34 | | | | |

¹ Published as 26 second-feet in Water-Supply Paper 465.

Daily discharge, in million gallons, of Waiahulu Stream near Waimea, Kauai, for the year ending June 30, 1918.

| Day. | Oct. | Nov. | Dec. | Jan. | Feb. | Mar. | Apr. | May. | June. |
|------|------|-------|------|------|-------|------|-------|------|-------|
| 1 | | 28 | 61 | 30 | 79 | 395 | 46 | 76 | 36 |
| 2 | | 70 | 50 | 30 | 70 | 415 | 74 | 67 | 33 |
| 3 | | 190 | 46 | 30 | 66 | 181 | 181 | 67 | 33 |
| 4 | | 70 | 42 | 28 | 61 | 150 | 285 | 81 | 30 |
| 5 | | 70 | 50 | 26 | 190 | 181 | 275 | 67 | 28 |
| 6 | | 57 | 74 | 26 | 173 | 143 | 100 | 48 | 28 |
| 7 | | 50 | 136 | 33 | 70 | 89 | 79 | 45 | 28 |
| 8 | | 74 | 61 | 33 | 100 | 74 | 79 | 72 | 26 |
| 9 | | 53 | 66 | 28 | 181 | 70 | 181 | 48 | 26 |
| 10 | | 50 | 61 | 24 | 84 | 66 | 715 | 52 | 33 |
| 11 | | 46 | 61 | 26 | 106 | 181 | 630 | 67 | 42 |
| 12 | | 39 | 50 | 42 | 136 | 143 | 325 | 140 | 39 |
| 13 | | 36 | 50 | 26 | 158 | 123 | 162 | 81 | 45 |
| 14 | | 33 | 46 | 39 | 100 | 130 | 126 | 59 | 33 |
| 15 | | 33 | 42 | 94 | 70 | 117 | 102 | 52 | 30 |
| 16 | | 33 | 39 | 42 | 106 | 143 | 92 | 52 | 39 |
| 17 | | 33 | 39 | 33 | 295 | 136 | 86 | 52 | 45 |
| 18 | | 33 | 36 | 33 | 428 | 84 | 568 | 56 | 33 |
| 19 | | 33 | 33 | 345 | 207 | 66 | 430 | 52 | 45 |
| 20 | | 33 | 36 | 235 | 130 | 66 | 335 | 48 | 81 |
| 21 | | 61 | 42 | 111 | 181 | 61 | 267 | 45 | 86 |
| 22 | | 53 | 50 | 136 | 165 | 61 | 212 | 45 | 67 |
| 23 | | 39 | 39 | 158 | 106 | 57 | 162 | 56 | 72 |
| 24 | | 53 | 39 | 79 | 89 | 53 | 133 | 48 | 45 |
| 25 | 24 | 50 | 39 | 70 | 84 | 53 | 120 | 59 | 42 |
| 26 | 24 | 89 | 46 | 216 | 79 | 53 | 114 | 45 | 39 |
| 27 | 26 | 111 | 50 | 652 | 74 | 53 | 133 | 45 | 45 |
| 28 | 26 | 70 | 89 | 198 | 136 | 57 | 97 | 48 | 45 |
| 29 | 26 | 57 | 53 | 136 | ..... | 89 | 86 | 56 | 42 |
| 30 | 28 | 74 | 46 | 123 | ..... | 70 | 76 | 59 | 42 |
| 31 | 28 | ..... | 39 | 89 | ..... | 53 | ..... | 42 | ..... |

Monthly discharge of Waiahulu Stream near Waimea, Kauai, for the year ending June 30, 1918.

| Month. | Discharge. | | | Total run-off. | |
|---------------|--------------------------|----------|-------|---------------------|------------|
| | Million gallons per day. | | | Second-foot (mean). | Acre-feet. |
| | Maximum. | Minimum. | Mean. | | |
| October 24-31 | 28 | 24 | 26.0 | 40.2 | 182 |
| November | 190 | 28 | 57.4 | 88.8 | 1,720 |
| December | 136 | 33 | 52.0 | 80.5 | 1,610 |
| January | 652 | 24 | 102 | 158 | 3,170 |
| February | 428 | 61 | 130 | 201 | 3,630 |
| March | 415 | 53 | 117 | 181 | 3,610 |
| April | 715 | 46 | 209 | 323 | 6,270 |
| May | 140 | 42 | 59.0 | 91.3 | 1,830 |
| June | 86 | 26 | 41.9 | 64.8 | 1,260 |
| The period | ..... | ..... | ..... | ..... | 23,300 |
| | | | | | 71,500 |

KOAE STREAM NEAR WAIMEA, KAUAI.

LOCATION.—About one-third of a mile above confluence with Waiahulu Stream, 12 miles north of Waimea.

RECORDS AVAILABLE.—July 19, 1916, to June 30, 1918; record fragmentary.

GAGE.—Gurley printing water-stage recorder.

DISCHARGE MEASUREMENTS.—Made by wading or from cable.

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

EXTREMES OF DISCHARGE.—1915-1918: Maximum stage recorded, 7.0 feet (staff gage reading) at 10 a. m. and 2 p. m. October 16, 1917 (discharge, approximately 700 million gallons per day, or 1,080 second-feet); minimum stage recorded, 1.45 feet June 30, 1918 (discharge, 0.3 million gallons per day, or 0.5 second-feet).

DIVERSION.—None.

REGULATION.—None.

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

ACCURACY.—Stage-discharge relation not permanent. Rating curves fairly well defined applicable as follows: July 1 to September 21; October 7 to January 26 and February 19 to June 30; January 27 to February 18. Operation of water-stage recorder satisfactory except September 22 to October 19. Staff gage readings October 7–19. Records fair.

Discharge measurements of Koaie Stream near Waimea, Kauai, during the year ending June 30, 1918.

[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. 18..... | 2.35 | 30 | 19 | Jan. 11..... | 2.13 | 23 | 15 |
| Oct. 12..... | 2.15 | 25 | 16 | Feb. 14..... | 2.42 | 56 | 36 |
| 17..... | 2.98 | 112 | 72 | Mar. 29..... | 2.48 | 55 | 35 |
| 18..... | 2.57 | 62 | 40 | May 7..... | 2.38 | 44 | 28 |
| 19..... | 2.35 | 44 | 29 | 8..... | 2.84 | 94 | 61 |

Daily discharge, in million gallons, of Koaie Stream near Waimea, Kauai, for the year ending June 30, 1918.

| Day. | July. | Aug. | Sept. | Oct. | Nov. | Dec. | Jan. | Feb. | Mar. | Apr. | May. | June. |
|---------|-------|------|-------|-------|-------|------|------|-------|------|-------|------|-------|
| 1..... | 16.2 | 16.2 | 16.2 | ..... | 12.2 | 14.0 | 30 | 27 | 43 | 24 | 27 | 4.0 |
| 2..... | 16.2 | 16.2 | 16.2 | ..... | 24 | 9.0 | 24 | 27 | 74 | 30 | 27 | 2.2 |
| 3..... | 33 | 18.5 | 16.2 | ..... | 62 | 7.5 | 18.5 | 24 | 79 | 94 | 30 | 1.5 |
| 4..... | 50 | 18.5 | 16.2 | ..... | 24 | 7.5 | 18.5 | 21.2 | 99 | 162 | 43 | 2.2 |
| 5..... | 27 | 18.5 | 16.2 | ..... | 18.5 | 12.2 | 18.5 | 27 | 84 | 114 | 33 | 4.0 |
| 6..... | 21.2 | 16.2 | 16.2 | ..... | 16.2 | 12.2 | 16.2 | 58 | 79 | 50 | 30 | 1.5 |
| 7..... | 24 | 21.2 | 14.0 | 16.2 | 14.0 | 18.5 | 16.2 | 24 | 36 | 33 | 30 | 1.0 |
| 8..... | 24 | 21.2 | 14.0 | 16.2 | 18.5 | 12.2 | 36 | 43 | 27 | 30 | 46 | .5 |
| 9..... | 79 | 18.5 | 14.0 | 16.2 | 14.0 | 21.2 | 24 | 46 | 24 | 43 | 27 | 1.0 |
| 10..... | 40 | 18.5 | 14.0 | 16.2 | 16.2 | 14.0 | 16.2 | 24 | 24 | 220 | 24 | 3.0 |
| 11..... | 30 | 18.5 | 14.0 | 16.2 | 14.0 | 12.2 | 16.2 | 89 | 114 | 235 | 24 | 1.5 |
| 12..... | 27 | 40 | 14.0 | 16.2 | 14.0 | 9.0 | 43 | 50 | 70 | 138 | 50 | 1.0 |
| 13..... | 21.2 | 43 | 18.5 | 21.2 | 14.0 | 27 | 21.2 | 58 | 58 | 99 | 40 | 18.5 |
| 14..... | 18.5 | 62 | 24 | 21.2 | 14.0 | 10.5 | 58 | 43 | 70 | 70 | 24 | 12.2 |
| 15..... | 18.5 | 30 | 24 | 18.5 | 14.0 | 7.5 | 30 | 27 | 50 | 46 | 18.5 | 12.2 |
| 16..... | 18.5 | 43 | 24 | 528 | 14.0 | 4.0 | 14 | 54 | 66 | 36 | 21.2 | 12.2 |
| 17..... | 33 | 33 | 18.5 | 109 | 12.2 | 4.0 | 10.5 | 99 | 58 | 33 | 33 | 10.5 |
| 18..... | 27 | 24 | 24 | 36 | 12.2 | 3.0 | 12.2 | 150 | 33 | 199 | 30 | 4.0 |
| 19..... | 24 | 21.2 | 21.2 | 27 | 12.2 | 5.0 | 114 | 84 | 27 | 150 | 21.2 | 2.2 |
| 20..... | 18.5 | 21.2 | 12.2 | 21.2 | 12.2 | 9.0 | 66 | 54 | 21.2 | 104 | 14.0 | 9.0 |
| 21..... | 16.2 | 18.5 | 10.5 | 18.5 | 16.2 | 16.2 | 40 | 89 | 21.2 | 84 | 9.0 | 27 |
| 22..... | 16.2 | 18.5 | ..... | 18.5 | 16.2 | 9.0 | 50 | 58 | 16.2 | 66 | 9.0 | 12.2 |
| 23..... | 18.5 | 18.5 | ..... | 21.2 | 12.2 | 2.2 | 66 | 30 | 12.2 | 54 | 7.5 | 4.0 |
| 24..... | 18.5 | 24 | ..... | 21.2 | 12.2 | 3.0 | 30 | 30 | 14.0 | 33 | 14.0 | 3.0 |
| 25..... | 27 | 24 | ..... | 18.5 | 14.0 | 4.0 | 24 | 24 | 18.5 | 40 | 9.0 | 3.0 |
| 26..... | 24 | 18.5 | ..... | 18.5 | 27 | 5.0 | 84 | 21.2 | 14.0 | 36 | 6.2 | 1.0 |
| 27..... | 21.2 | 18.5 | ..... | 16.2 | 58 | 62 | 156 | 21.2 | 12.2 | 40 | 12.2 | 10.5 |
| 28..... | 18.5 | 16.2 | ..... | 16.2 | 24 | 70 | 84 | 46 | 21.2 | 36 | 18.5 | 7.5 |
| 29..... | 21.2 | 16.2 | ..... | 16.2 | 14.0 | 36 | 62 | ..... | 36 | 30 | 50 | 1.0 |
| 30..... | 18.5 | 16.2 | ..... | 16.2 | 24 | 27 | 62 | ..... | 36 | 27 | 36 | .3 |
| 31..... | 16.2 | 16.2 | ..... | 16.2 | ..... | 27 | 40 | ..... | 27 | ..... | 9.0 | ..... |

NOTE.—No gage-height record Sept. 22 to Oct. 6; discharge estimated from flow of Waialae River near Waimea as follows: Sept. 22–26, 10 million gallons per day; Sept. 27–30, 25 million gallons per day; Oct. 1–6, 20 million gallons per day.

Monthly discharge of Koaie Stream near Waimea, Kauai, for the year ending June 30, 1918.

| Month. | Discharge. | | | | Total run-off. | |
|----------------|--------------------------|----------|-------|---------------------|------------------|------------|
| | Million gallons per day. | | | Second-foot (mean). | Million gallons. | Acre-feet. |
| | Maximum. | Minimum. | Mean. | | | |
| July..... | 79 | 16.2 | 25.3 | 39.1 | 783 | 2,410 |
| August..... | 62 | 16.2 | 23.4 | 36.2 | 725 | 2,230 |
| September..... | | | 16.9 | 26.1 | 508 | 1,560 |
| October..... | 528 | 16.2 | 38.6 | 59.7 | 1,200 | 3,670 |
| November..... | 62 | 12.2 | 19.0 | 29.4 | 570 | 1,750 |
| December..... | 70 | 2.2 | 15.5 | 24.0 | 481 | 1,480 |
| January..... | 156 | 10.5 | 42.0 | 65.0 | 1,300 | 4,000 |
| February..... | 150 | 21.2 | 48.2 | 74.6 | 1,350 | 4,140 |
| March..... | 114 | 12.2 | 44.0 | 68.1 | 1,300 | 4,190 |
| April..... | 235 | 24 | 77.5 | 120 | 2,330 | 7,140 |
| May..... | 50 | 6.2 | 25.1 | 38.8 | 777 | 2,390 |
| June..... | 27 | .3 | 57.9 | 89.6 | 174 | 533 |
| The year..... | 528 | .3 | 31.7 | 49.0 | 11,600 | 35,500 |

WAIALAE RIVER AT ELEVATION 800 FEET, NEAR WAIMEA, KAUAI.

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

RECORDS AVAILABLE.—December 31, 1915, to June 30, 1918.

GAGE.—Gurley printing water-stage recorder.

DISCHARGE MEASUREMENTS.—Made by wading or from cable.

CHANNEL AND CONTROL.—One channel at all stages; straight in vicinity of gage; banks steep and high. Control composed of boulders; shifting.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 5.47 feet at 6.30 a. m. April 11 (discharge, 670 million gallons per day, or 1,040 second-feet); minimum stage recorded, 0.9 foot September 4-12 (discharge, 4.0 million gallons per day, or 6.2 second-feet).

Maximum stage recorded, 6.55 feet at 10.30 p. m. December 18, 1916 (discharge not estimated); minimum stage recorded, 1.1 feet June 27-30 (discharge, 4.0 million gallons per day, or 6.2 second-feet).

DIVERSIONS.—None.

REGULATION.—None.

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

ACCURACY.—Stage-discharge relation not permanent. Rating curves fairly well defined, applicable as follows: July 1 to October 16, and March 12 to April 11; October 17 to January 19; January 20 to March 11, and April 12 to June 30. Operation of water-stage recorder satisfactory. Records fair.

Discharge measurements of Waialae River at elevation 800 feet, near Waimea, Kauai, during the year ending June 30, 1918.

[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. |
| Aug. 10..... | 1.05 | 9.7 | 6.3 | Feb. 14..... | 1.42 | 39 | 25 |
| Oct. 19..... | 1.30 | 26 | 17 | Mar. 27..... | 1.36 | 24 | 16 |
| 25..... | 1.10 | 16.4 | 11 | May 2..... | 1.28 | 29 | 18 |
| Jan. 10..... | 1.06 | 13.3 | 8.6 | June 26..... | 1.20 | 22 | 14 |
| 12..... | 1.52 | 37 | 24 | | | | |

Daily discharge, in million gallons, of Waialae River at elevation 800 feet, near Waimea, Kauai, for the year ending June 30, 1918.

| Day. | July. | Aug. | Sept. | Oct. | Nov. | Dec. | Jan. | Feb. | Mar. | Apr. | May. | June. |
|---------|-------|------|-------|------|-------|------|------|-------|------|-------|------|-------|
| 1..... | 7.5 | 7.5 | 4.8 | 5.5 | 7.5 | 15 | 10 | 32 | 50 | 10 | 19 | 12 |
| 2..... | 7.5 | 6.5 | 4.8 | 8.8 | 12 | 10 | 8.8 | 29 | 128 | 15 | 19 | 10 |
| 3..... | 19 | 7.5 | 4.8 | 8.8 | 65 | 7.5 | 7.5 | 26 | 76 | 50 | 17 | 10 |
| 4..... | 38 | 7.5 | 4.0 | 10 | 21 | 7.5 | 7.5 | 24 | 121 | 88 | 21 | 8.8 |
| 5..... | 15 | 8.8 | 4.0 | 8.8 | 19 | 17 | 7.5 | 24 | 82 | 50 | 21 | 8.8 |
| 6..... | 10 | 7.5 | 4.0 | 6.5 | 15 | 21 | 7.5 | 60 | 82 | 19 | 17 | 8.8 |
| 7..... | 12 | 10 | 4.0 | 6.5 | 10 | 19 | 12 | 26 | 46 | 13 | 21 | 8.8 |
| 8..... | 12 | 10 | 4.0 | 5.5 | 12 | 13 | 21 | 21 | 35 | 13 | 26 | 7.5 |
| 9..... | 76 | 6.5 | 4.0 | 4.8 | 10 | 35 | 13 | 35 | 32 | 32 | 17 | 7.5 |
| 10..... | 24 | 5.5 | 4.0 | 4.8 | 12 | 26 | 8.8 | 26 | 35 | 196 | 15 | 7.5 |
| 11..... | 17 | 5.5 | 4.0 | 4.8 | 12 | 24 | 8.8 | 35 | 230 | 256 | 13 | 7.5 |
| 12..... | 13 | 21 | 4.0 | 5.5 | 7.5 | 26 | 21 | 42 | 94 | 114 | 21 | 7.5 |
| 13..... | 10 | 26 | 6.5 | 13 | 6.5 | 32 | 12 | 46 | 65 | 128 | 21 | 15 |
| 14..... | 10 | 38 | 10 | 17 | 6.5 | 19 | 42 | 29 | 94 | 55 | 15 | 15 |
| 15..... | 8.8 | 12 | 10 | 10 | 6.5 | 15 | 21 | 19 | 50 | 32 | 13 | 17 |
| 16..... | 7.5 | 19 | 10 | 221 | 6.5 | 12 | 13 | 70 | 88 | 29 | 12 | 19 |
| 17..... | 21 | 13 | 10 | 55 | 5.5 | 12 | 10 | 82 | 65 | 38 | 19 | 13 |
| 18..... | 15 | 8.8 | 19 | 24 | 5.5 | 8.8 | 13 | 221 | 32 | 440 | 19 | 10 |
| 19..... | 12 | 7.5 | 15 | 17 | 5.5 | 8.8 | 188 | 82 | 24 | 256 | 13 | 10 |
| 20..... | 8.8 | 6.5 | 7.5 | 13 | 6.5 | 8.8 | 70 | 65 | 19 | 212 | 12 | 17 |
| 21..... | 7.5 | 5.5 | 5.5 | 13 | 7.5 | 12 | 35 | 196 | 26 | 121 | 12 | 24 |
| 22..... | 7.5 | 5.5 | 5.5 | 13 | 8.8 | 10 | 46 | 70 | 19 | 70 | 12 | 13 |
| 23..... | 7.5 | 7.5 | 4.8 | 19 | 6.5 | 7.5 | 60 | 82 | 17 | 50 | 12 | 12 |
| 24..... | 6.5 | 12 | 4.8 | 13 | 5.5 | 7.5 | 29 | 35 | 19 | 42 | 10 | 17 |
| 25..... | 8.8 | 7.5 | 4.8 | 10 | 7.5 | 10 | 32 | 32 | 19 | 35 | 10 | 12 |
| 26..... | 12 | 6.5 | 6.5 | 8.8 | 19 | 15 | 150 | 29 | 17 | 32 | 13 | 8.8 |
| 27..... | 8.8 | 5.5 | 24 | 8.8 | 60 | 70 | 164 | 26 | 15 | 29 | 46 | 24 |
| 28..... | 8.8 | 5.5 | 15 | 7.5 | 26 | 42 | 76 | 60 | 15 | 26 | 21 | 13 |
| 29..... | 7.5 | 4.8 | 12 | 7.5 | 19 | 17 | 70 | ..... | 15 | 24 | 50 | 8.8 |
| 30..... | 7.5 | 4.8 | 7.5 | 7.5 | 26 | 13 | 65 | ..... | 15 | 21 | 29 | 7.5 |
| 31..... | 7.5 | 4.8 | ..... | 8.8 | ..... | 12 | 38 | ..... | 12 | ..... | 15 | ..... |

Monthly discharge of Waialae River at elevation 800 feet, near Waimea, Kauai, for the year ending June 30, 1918.

| Month. | Discharge. | | | | Total run-off. | |
|---------------|--------------------------|----------|-------|---------------------|------------------|-------------|
| | Million gallons per day. | | | Second-feet (mean). | Million gallons. | Acres-feet. |
| | Maximum. | Minimum. | Mean. | | | |
| July..... | 76 | 6.5 | 14.0 | 21.7 | 434 | 1,330 |
| August.... | 38 | 4.8 | 9.82 | 15.2 | 304 | 934 |
| September.. | 24 | 4.0 | 7.63 | 11.8 | 229 | 702 |
| October..... | 221 | 4.8 | 18.3 | 28.3 | 567 | 1,740 |
| November.... | 65 | 5.5 | 14.6 | 22.6 | 438 | 1,340 |
| December.... | 70 | 7.5 | 17.9 | 27.7 | 553 | 1,700 |
| January..... | 188 | 7.5 | 40.9 | 63.3 | 1,270 | 3,890 |
| February.... | 221 | 19 | 54.4 | 84.2 | 1,520 | 4,670 |
| March..... | 230 | 12 | 52.8 | 81.7 | 1,640 | 5,020 |
| April..... | 440 | 10 | 83.2 | 129 | 2,500 | 7,660 |
| May..... | 50 | 10 | 18.7 | 28.9 | 581 | 1,780 |
| June..... | 24 | 7.5 | 12.0 | 18.6 | 361 | 1,100 |
| The year..... | 440 | 4.0 | 28.5 | 44.1 | 10,400 | 31,900 |

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

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

RECORDS AVAILABLE.—October 26, 1917, to June 30, 1918. Staff at Flume No. 4, 1 mile below intake, February 25, 1916, to August 2, 1917; weir, 85 feet above present site, November 8, 1907, to June 30, 1915.

GAGE.—Vertical staff, read by Manuel Arruda.

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

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

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 3.40 feet at 8.30 a. m., March 27 (discharge, 63 million gallons per day, or 99 second-feet); water occasionally shut off.

1907-1918: Maximum stage recorded, 29½ inches on weir, April, 1910 (discharge, 66 million gallons per day, or 102 second-feet); water occasionally shut off.

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

REGULATION.—By head gate.

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

ACCURACY.—Stage-discharge relation permanent. Rating curves well defined for both stations. Gage read to hundredths twice daily. Records good for all stages.

Discharge measurements of Kekaha ditch at camp No. 1, near Waimea, Kauai, during the year ending June 30, 1918.

[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. |
| Jan. 10..... | 2.94 | 82 | 53 | Mar. 27..... | 3.40 | 98 | 63 |
| 12..... | 2.82 | 77 | 50 | May 2..... | 3.20 | 89 | 58 |
| Feb. 14..... | 3.34 | 98 | 63 | June 26..... | 3.10 | 87 | 56 |

Daily discharge, in million gallons, of Kekaha ditch at camp No. 1, near Waimea, Kauai, for the year ending June 30, 1918.

| Day. | July. | Aug. | Oct. | Nov. | Dec. | Jan. | Feb. | Mar. | Apr. | May | June. |
|---------|-------|-------|-------|-------|------|------|-------|------|-------|-----|-------|
| 1..... | 45 | 45 | ..... | 42 | 62 | 53 | 29 | 54 | 62 | 54 | 25 |
| 2..... | 46 | 44 | ..... | 62 | 59 | 51 | 41 | 54 | 62 | 59 | 24 |
| 3..... | 60 | ..... | ..... | 62 | 53 | 46 | 41 | 54 | 62 | 61 | 56 |
| 4..... | 62 | ..... | ..... | 62 | 50 | 49 | 52 | 62 | 62 | 26 | 54 |
| 5..... | 62 | ..... | ..... | 62 | 57 | 51 | 52 | 59 | 62 | 52 | 53 |
| 6..... | 58 | ..... | ..... | 62 | 45 | 45 | 62 | 54 | 62 | 52 | 53 |
| 7..... | 53 | ..... | ..... | 62 | 62 | 46 | 62 | 54 | 27 | 53 | 52 |
| 8..... | 56 | ..... | ..... | 62 | 62 | 53 | 62 | 54 | 62 | 53 | 52 |
| 9..... | 56 | ..... | ..... | 62 | 24 | 52 | 62 | 54 | 62 | 53 | 52 |
| 10..... | 56 | ..... | ..... | 62 | 30 | 52 | 62 | 54 | 62 | 54 | 59 |
| 11..... | 56 | ..... | ..... | 61 | 30 | 49 | 62 | 42 | 61 | 58 | 60 |
| 12..... | 56 | ..... | ..... | 51 | 48 | 52 | 62 | 41 | 59 | 60 | 60 |
| 13..... | 58 | ..... | ..... | 45 | 52 | 52 | 62 | 41 | 59 | 60 | 60 |
| 14..... | 58 | ..... | ..... | 43 | 52 | 52 | 62 | 41 | 59 | 60 | 60 |
| 15..... | 56 | ..... | ..... | 42 | 52 | 52 | 62 | 41 | 59 | 60 | 60 |
| 16..... | 50 | ..... | ..... | 42 | 52 | 62 | 51 | 35 | 59 | 60 | 60 |
| 17..... | 56 | ..... | ..... | 41 | 52 | 56 | 41 | 30 | 59 | 60 | 60 |
| 18..... | 56 | ..... | ..... | 41 | 50 | 53 | 52 | 41 | 59 | 60 | 60 |
| 19..... | 0 | ..... | ..... | 39 | 48 | 51 | 46 | 41 | 38 | 60 | 60 |
| 20..... | 0 | ..... | ..... | 40 | 50 | 41 | 41 | 41 | 19 | 60 | 60 |
| 21..... | 0 | ..... | ..... | 62 | 51 | 52 | 41 | 41 | 19 | 60 | 60 |
| 22..... | 45 | ..... | ..... | 62 | 52 | 52 | 41 | 41 | 23 | 60 | 60 |
| 23..... | 46 | ..... | ..... | 50 | 51 | 62 | 35 | 41 | 27 | 60 | 60 |
| 24..... | 53 | ..... | ..... | 52 | 49 | 62 | 48 | 41 | 34 | 60 | 60 |
| 25..... | 53 | ..... | ..... | 59 | 38 | 45 | 54 | 41 | 40 | 60 | 60 |
| 26..... | 53 | ..... | 44 | 54 | 52 | 30 | 54 | 62 | 41 | 60 | 59 |
| 27..... | 53 | ..... | 44 | 62 | 52 | 29 | 54 | 62 | 17 | 60 | 59 |
| 28..... | 48 | ..... | 43 | 62 | 52 | 29 | 54 | 62 | 22 | 60 | 60 |
| 29..... | 45 | ..... | 40 | 62 | 52 | 29 | ..... | 62 | 52 | 59 | 57 |
| 30..... | 45 | ..... | 31 | 62 | 52 | 18 | ..... | 62 | 52 | 57 | 53 |
| 31..... | 45 | ..... | 36 | ..... | 52 | 18 | ..... | 62 | ..... | 60 | ..... |

NOTE.—No record at either flume No. 4 or camp No. 1 Aug. 3 to Oct. 25.

Monthly discharge of Kekaha ditch at camp No. 1, near Waimea, Kauai, for the year ending June 30, 1918.

| Month. | Discharge. | | | Total run-off. | |
|---------------------|--------------------------|----------|-------|------------------|------------|
| | Million gallons per day. | | | Million gallons. | Acre-feet. |
| | Maximum. | Minimum. | Mean. | | |
| July (28 days)..... | 62 | 45 | 53.1 | 82.2 | 4,560 |
| October 26-31..... | 44 | 31 | 39.7 | 61.4 | 731 |
| November..... | 62 | 39 | 54.4 | 84.2 | 1,630 |
| December..... | 62 | 24 | 49.3 | 77.1 | 1,540 |
| January..... | 62 | 18 | 46.6 | 72.1 | 1,440 |
| February..... | 62 | 29 | 51.7 | 80.0 | 1,450 |
| March..... | 62 | 30 | 49.2 | 76.1 | 1,520 |
| April..... | 62 | 17 | 48.1 | 74.4 | 1,440 |
| May..... | 61 | 26 | 57.1 | 88.3 | 1,770 |
| June..... | 60 | 24 | 55.6 | 86.0 | 1,670 |
| | | | | | 5,120 |

KEKAHA DITCH BELOW TUNNEL NO. 12, NEAR WAIMEA, KAUAI.¹

LOCATION.—About 7½ miles below intake, 2 miles by trail from Waimea, and half a mile below diversion for Waimea domestic supply.

RECORDS AVAILABLE.—April 17, 1908, to June 30, 1914, and July 20, 1916, to June 30, 1918.

GAGE.—Vertical staff.

DISCHARGE MEASUREMENTS.—Made from plank at gage.

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

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 3.54 feet at 8 a. m. March 5 and April 13 (discharge 49 million gallons per day, or 76 second-feet); minimum, water shut off occasionally.

1916-18. Maximum stage recorded, 3.6 feet December 1, 1916 (discharge, 50 million gallons per day, or 76 second-feet); minimum, water shut off occasionally.

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

REGULATION.—By head gates.

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

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

Discharge measurements of Kekaha ditch below tunnel No. 12, near Waimea, Kauai, during the year ending June 30, 1918.

[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. |
| Nov. 12..... | 3.12 | 64 | 41 | Mar. 10..... | 3.40 | 71 | 46 |
| Jan. 24..... | 3.47 | 72 | 47 | Apr. 10..... | 3.26 | 69 | 44 |
| Feb. 6..... | 3.36 | 71 | 46 | May 30..... | 3.12 | 65 | 42 |

¹ Published as "Kekaha ditch at Weir below tunnel No. 12, near Waimea, Kauai," in Water-Supply Paper 318, and as "Kekaha ditch at tunnel No. 12, near Waimea, Kauai," in Water-Supply Papers 336 and 430.

Daily discharge, in million gallons, of Kekaha ditch below tunnel No. 12, near Waimea, Kauai, for the year ending June 30, 1918.

| Day. | July. | Aug. | Sept. | Oct. | Nov. | Dec. | Jan. | Feb. | Mar. | Apr. | May. | June. |
|---------|-------|------|-------|-------|-------|------|------|-------|------|-------|-------|-------|
| 1..... | 37 | 36 | 29 | 31 | 32 | 43 | 38 | 18 | 45 | 41 | 34 | 39 |
| 2..... | 40 | 36 | 30 | 29 | 32 | 42 | 38 | 26 | 45 | 41 | 37 | ..... |
| 3..... | 43 | 43 | 31 | 37 | 31 | 40 | 37 | 27 | 48 | 40 | 40 | 39 |
| 4..... | 39 | 48 | 30 | 36 | 46 | 40 | 36 | 26 | 45 | 46 | 35 | 41 |
| 5..... | 41 | 46 | 29 | 35 | 48 | 36 | 35 | 45 | 49 | 44 | ..... | 40 |
| 6..... | 41 | 40 | 29 | 32 | 48 | 32 | 35 | 46 | 43 | 42 | 38 | 40 |
| 7..... | 37 | 46 | 30 | 32 | 46 | 43 | 34 | 45 | 44 | ..... | 39 | 39 |
| 8..... | 35 | 41 | 29 | 30 | 46 | 43 | 43 | 45 | 44 | 42 | 39 | 38 |
| 9..... | 40 | 41 | 29 | 29 | 46 | 20 | 41 | 46 | 44 | 41 | 39 | 39 |
| 10..... | 39 | 38 | 29 | 28 | 46 | 28 | 39 | 45 | 47 | 44 | 39 | 41 |
| 11..... | 40 | 42 | 29 | 26 | 46 | 28 | 37 | 45 | 27 | 48 | 41 | 41 |
| 12..... | 39 | 45 | 29 | 28 | 43 | 30 | 41 | 45 | 34 | 48 | 43 | 41 |
| 13..... | 39 | 40 | 34 | 29 | 37 | 35 | 39 | 45 | 37 | 49 | 45 | 41 |
| 14..... | 39 | 48 | 38 | 46 | 35 | 35 | 37 | 45 | 32 | 47 | 46 | 41 |
| 15..... | 36 | 48 | 45 | 44 | 35 | 38 | 41 | 45 | 32 | 45 | 46 | 41 |
| 16..... | 38 | 46 | 45 | 45 | 34 | 35 | 39 | 45 | 36 | 45 | 46 | 40 |
| 17..... | 43 | 46 | 38 | 28 | 32 | 35 | 41 | 36 | 26 | 45 | 45 | 40 |
| 18..... | 41 | 41 | 45 | 28 | 32 | 37 | 39 | 36 | 26 | 37 | 45 | 40 |
| 19..... | 39 | 40 | 48 | 36 | 32 | 35 | 41 | 44 | 34 | 48 | 46 | 38 |
| 20..... | ..... | 37 | 40 | 48 | 32 | 35 | 41 | 35 | 31 | 16 | 45 | 40 |
| 21..... | ..... | 34 | 32 | 36 | 48 | 37 | 38 | 34 | 30 | 16 | 44 | 38 |
| 22..... | 39 | 32 | 31 | 36 | 48 | 39 | 44 | 35 | 31 | 16 | 44 | 35 |
| 23..... | 39 | 32 | 29 | 6 | 42 | 36 | 48 | 32 | 31 | 16 | 45 | 36 |
| 24..... | 39 | 37 | 29 | 6 | 36 | 35 | 47 | 32 | 32 | 16 | 41 | 38 |
| 25..... | 43 | 39 | 29 | 6 | 47 | 36 | 46 | 39 | 32 | ..... | 46 | 37 |
| 26..... | 40 | 36 | 30 | ..... | 46 | 38 | 34 | 39 | 32 | 29 | 45 | 37 |
| 27..... | 40 | 32 | 41 | 36 | 47 | 45 | 39 | 41 | 39 | 29 | 41 | 35 |
| 28..... | 38 | 31 | 39 | 34 | 46 | 41 | 20 | 41 | 39 | ..... | 41 | 37 |
| 29..... | 34 | 31 | 46 | 34 | 44 | 39 | 26 | ..... | 39 | 37 | 41 | 35 |
| 30..... | 33 | 30 | 45 | 34 | 44 | 38 | 18 | ..... | 41 | 37 | 39 | 35 |
| 31..... | 37 | 30 | ..... | 34 | ..... | 38 | 18 | ..... | 42 | ..... | 39 | ..... |

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

Monthly discharge of Kekaha ditch below tunnel No. 12, near Waimea, Kauai, for the year ending June 30, 1918.

| Month. | Discharge. | | | | Total run-off. | |
|------------------------|--------------------------|----------|-------|---------------------|------------------|------------|
| | Million gallons per day. | | | Second-feet (mean). | Million gallons. | Acre-feet. |
| | Maximum. | Minimum. | Mean. | | | |
| July (29 days)..... | 43 | 33 | 38.9 | 60.2 | 1,130 | 3,460 |
| August..... | 48 | 30 | 39.1 | 60.5 | 1,210 | 3,720 |
| September..... | 48 | 29 | 34.6 | 53.5 | 1,040 | 3,190 |
| October (30 days)..... | 48 | 6 | 31.3 | 48.4 | 939 | 2,880 |
| November..... | 48 | 31 | 40.9 | 63.3 | 1,230 | 3,770 |
| December..... | 45 | 20 | 36.5 | 56.5 | 1,130 | 3,470 |
| January..... | 48 | 18 | 37.1 | 57.4 | 1,150 | 3,530 |
| February..... | 46 | 18 | 38.7 | 59.9 | 1,080 | 3,330 |
| March..... | 49 | 26 | 37.3 | 57.7 | 1,160 | 3,550 |
| April (27 days)..... | 49 | 16 | 37.4 | 57.9 | 1,010 | 3,100 |
| May (30 days)..... | 46 | 34 | 41.8 | 64.7 | 1,250 | 3,850 |
| June (29 days)..... | 41 | 35 | 38.7 | 59.9 | 1,120 | 3,440 |
| The year..... | ..... | ..... | ..... | ..... | 13,500 | 41,300 |

WAIMEA DITCH NEAR WAIMEA, KAUAI.

LOCATION.—1½ miles below intake, at lower portal of tunnel No. 22, 2½ miles north of Waimea, and 1 mile below old station.

RECORDS AVAILABLE.—November 4, 1911, to September 30, 1913, and February 23, 1916, to June 30, 1918.

GAGE.—Vertical staff.

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

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

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 1.30 feet at 8 a. m.

July 26 (discharge, 6.1 million gallons per day, or 9.5 second-feet); ditch occasionally dry.

1916-1918: Maximum stage recorded, 1.3 feet June 20, 1916 (discharge, 7.0 million gallons per day, or 11 second-feet); ditch occasionally dry.

DIVERSIONS.—Ditch diverts from Waimea River.

UTILIZATION.—Irrigation of sugar cane and domestic supply.

ACCURACY.—Stage-discharge relation practically permanent. Rating curve well defined. Gage read to half tenths twice daily. Records good.

Discharge measurements of Waimea ditch near Waimea, Kauai, during the year ending June 30, 1918.

[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. |
| Nov. 12..... | 0.80 | 4.3 | 2.8 | Mar. 13..... | 0.55 | 2.1 | 1.3 |
| Jan. 24..... | .79 | 4.2 | 2.7 | Apr. 30..... | .84 | 4.5 | 2.9 |
| Feb. 20..... | .60 | 2.2 | 1.5 | May 30..... | .80 | 4.0 | 2.6 |

Daily discharge, in million gallons, of Waimea ditch near Waimea, Kauai, for the year ending June 30, 1918.

| Day. | July. | Aug. | Sept. | Oct. | Nov. | Dec. | Jan. | Feb. | Mar. | Apr. | May. | June. |
|---------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|------|-------|
| 1..... | 4.4 | 4.7 | 3.3 | 4.7 | 2.7 | 3.6 | ..... | 1.1 | ..... | 3.3 | 2.7 | 2.7 |
| 2..... | 3.0 | 3.3 | 3.3 | 4.7 | 3.6 | 3.3 | 1.1 | 1.1 | ..... | 2.7 | 2.4 | 2.7 |
| 3..... | 4.4 | 3.3 | 3.3 | 5.0 | 5.4 | 2.7 | 1.1 | 1.1 | ..... | 2.1 | 2.4 | 2.1 |
| 4..... | 5.4 | 2.4 | 3.3 | 5.0 | 4.0 | 3.0 | 1.1 | 2.1 | ..... | .9 | 3.3 | 2.1 |
| 5..... | 4.7 | ..... | 3.3 | 4.7 | 2.7 | 3.3 | 1.6 | 2.1 | ..... | ..... | 3.6 | 2.1 |
| 6..... | 4.0 | 3.0 | 3.3 | ..... | 3.6 | 3.0 | 1.4 | 2.1 | ..... | ..... | 2.7 | 2.7 |
| 7..... | 3.6 | 2.7 | 3.3 | ..... | 3.0 | 2.1 | 1.1 | 1.6 | ..... | ..... | 3.3 | 2.7 |
| 8..... | 4.7 | 4.7 | 3.3 | 3.3 | 4.0 | 1.6 | 2.4 | 1.1 | 3.3 | ..... | 4.0 | 2.7 |
| 9..... | 4.7 | 3.6 | 3.0 | 3.6 | 4.7 | 2.1 | ..... | 2.1 | 3.0 | ..... | 2.4 | 2.7 |
| 10..... | 4.0 | 3.0 | 3.0 | 3.6 | 4.0 | 1.6 | ..... | 1.1 | 2.1 | 2.7 | 3.0 | 3.3 |
| 11..... | 4.0 | 3.3 | 3.0 | 3.3 | 4.7 | 1.4 | ..... | 1.4 | 3.6 | 1.1 | 3.0 | 3.6 |
| 12..... | 4.0 | 3.3 | 3.3 | 3.3 | 2.7 | 1.6 | ..... | 3.0 | ..... | ..... | 4.0 | 3.3 |
| 13..... | 4.0 | 5.4 | 3.6 | 3.3 | 2.7 | 2.7 | ..... | ..... | 1.4 | ..... | 3.3 | 4.4 |
| 14..... | 3.6 | 5.4 | 4.7 | 5.4 | 2.7 | 2.7 | ..... | ..... | ..... | ..... | 2.7 | 4.7 |
| 15..... | 4.0 | 4.0 | 5.0 | 5.4 | 2.7 | 2.4 | ..... | 2.1 | ..... | .6 | 3.3 | 4.7 |
| 16..... | 3.3 | 4.0 | 5.4 | ..... | 3.0 | 1.6 | ..... | 2.1 | ..... | .9 | 2.4 | 4.7 |
| 17..... | 4.7 | 4.0 | 4.7 | ..... | 3.0 | 1.6 | ..... | ..... | ..... | 1.6 | 2.7 | 4.7 |
| 18..... | 5.4 | 4.0 | 5.4 | ..... | 2.7 | 1.1 | ..... | ..... | ..... | 4.0 | 2.7 | 4.7 |
| 19..... | 5.4 | 4.4 | 5.4 | ..... | 2.7 | 1.1 | ..... | ..... | 2.1 | ..... | 3.0 | 3.3 |
| 20..... | 5.4 | 4.0 | 4.0 | ..... | 2.7 | 1.1 | ..... | 1.6 | 1.1 | ..... | 2.7 | 4.0 |
| 21..... | 5.4 | 4.0 | 4.0 | 2.4 | 3.3 | 2.1 | ..... | ..... | .9 | ..... | 2.1 | 4.7 |
| 22..... | 4.4 | 4.0 | 3.6 | 2.7 | 4.0 | 2.1 | ..... | ..... | .7 | ..... | 2.1 | 4.0 |
| 23..... | 3.3 | 4.0 | 3.3 | 3.0 | 3.0 | 1.1 | ..... | ..... | .9 | ..... | 3.3 | 4.0 |
| 24..... | 4.0 | 4.0 | 3.6 | 3.0 | 3.3 | 1.1 | 2.7 | ..... | 1.1 | ..... | 2.7 | 4.0 |
| 25..... | 5.4 | 4.7 | 3.6 | 2.7 | 4.0 | ..... | ..... | ..... | 1.4 | ..... | 3.3 | 4.0 |
| 26..... | 6.1 | 4.0 | 4.0 | 2.7 | 3.0 | 1.6 | ..... | ..... | 2.1 | ..... | 2.7 | 4.0 |
| 27..... | 5.8 | 3.3 | 5.4 | ..... | 3.0 | 1.6 | ..... | ..... | 1.6 | ..... | 2.7 | 4.0 |
| 28..... | 4.7 | 3.3 | 5.4 | 1.1 | 3.6 | 2.1 | 1.6 | ..... | 1.6 | .9 | 3.3 | 3.3 |
| 29..... | 4.7 | 3.3 | 5.0 | 1.1 | 3.6 | 1.6 | ..... | ..... | 2.7 | 1.6 | 3.0 | 3.3 |
| 30..... | 4.7 | 3.3 | 4.7 | 1.8 | 3.3 | 1.4 | ..... | ..... | 3.3 | 2.4 | 3.0 | 3.3 |
| 31..... | 3.6 | 3.3 | ..... | 4.7 | ..... | 1.1 | 1.1 | ..... | 3.0 | ..... | 2.4 | ..... |

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

Monthly discharge of Waimea ditch near Waimea, Kauai, for the year ending June 30, 1918.

| Month. | Discharge. | | | | Total run-off. | |
|-------------------------|--------------------------|----------|-------|---------------------|------------------|------------|
| | Million gallons per day. | | | Second-foot (mean). | Million gallons. | Acre-feet. |
| | Maximum. | Minimum. | Mean. | | | |
| July..... | 6.1 | 3.0 | 4.48 | 6.93 | 139 | 426 |
| August (30 days)..... | 5.4 | 2.4 | 3.79 | 5.86 | 114 | 349 |
| September..... | 5.4 | 3.0 | 3.98 | 6.16 | 120 | 366 |
| October (23 days)..... | 5.4 | 1.1 | 3.50 | 5.42 | 80 | 247 |
| November..... | 5.4 | 2.7 | 3.38 | 5.23 | 101 | 311 |
| December (30 days)..... | 3.6 | 1.1 | 1.98 | 3.06 | 59 | 182 |
| January (10 days)..... | 2.7 | 1.1 | 1.52 | 2.35 | 15 | 47 |
| February (15 days)..... | 3.0 | 1.1 | 1.71 | 2.65 | 26 | 79 |
| March (18 days)..... | 3.6 | .7 | 1.99 | 3.08 | 36 | 110 |
| April (13 days)..... | 4.0 | .6 | 1.91 | 2.96 | 25 | 76 |
| May..... | 4.0 | 2.1 | 2.72 | 4.21 | 84 | 259 |
| June..... | 4.7 | 2.1 | 3.55 | 5.49 | 106 | 327 |
| The year..... | | | | | 905 | 2,780 |

KAMENEHUNE DITCH NEAR WAIMEA, KAUAI.

LOCATION.—200 feet below wire suspension bridge across Waimea River, about 2 miles above Waimea; reached by wagon road up the right side of Waimea River.

RECORDS AVAILABLE.—October 9, 1911, to June 30, 1918.

GAGE.—Vertical staff on right bank read by A. B. Blackstad.

DISCHARGE MEASUREMENTS.—Made from plank.

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

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 1.60 feet at 4 p. m. May 27 (discharge, 3.8 million gallons per day, or 5.9 second-feet); minimum stage recorded, 0.6 foot January 17 and 18, February 3-5 and 8-9 (discharge, 0.2 million gallons per day, or 0.3 second-feet).

1911-1918: Maximum stage recorded, 1.8 feet at 7.30 a. m. July 4, 1916 (discharge, 5.5 million gallons per day, or 8.5 second-feet); ditch occasionally dry.

DIVERSIONS.—Diverts from Waimea River.

REGULATION.—By head gates.

UTILIZATION.—Irrigation of rice and taro.

ACCURACY.—Stage-discharge relation not permanent. Rating curve fairly well defined, applicable July 1 to May 24 and May 25 to June 30. Gage read to hundredths twice daily. Records poor below and fair above 1 million gallons per day.

Discharge measurements of Kamenehune ditch near Waimea, Kauai, during the year ending June 30, 1918.

[Made by W. V. Hardy.]

| Date. | Gage height (feet). | Discharge. | | Date. | Gage height (feet). | Discharge. | |
|--------------|---------------------|--------------|--------------------------|--------------|---------------------|--------------|--------------------------|
| | | Second-foot. | Million gallons per day. | | | Second-foot. | Million gallons per day. |
| Nov. 12..... | 1.11 | 2.9 | 1.9 | Mar. 10..... | 1.29 | 3.9 | 2.5 |
| Jan. 13..... | .88 | 1.3 | .85 | Apr. 29..... | 1.00 | 1.9 | 1.2 |
| Feb. 16..... | 0.82 | 0.95 | 0.6 | May 30..... | 1.27 | 4.5 | 2.9 |

Daily discharge, in million gallons, of Kamenehune ditch near Waimea, Kauai, for the year ending June 30, 1918.

| Day. | July. | Aug. | Sept. | Oct. | Nov. | Dec. | Jan. | Feb. | Mar. | Apr. | May. | June. |
|---------|-------|------|-------|------|-------|------|------|-------|------|-------|------|-------|
| 1..... | 2.5 | 1.7 | 1.3 | 1.9 | 1.7 | 2.1 | 1.1 | 0.7 | 1.7 | 2.1 | 1.3 | 2.5 |
| 2..... | 1.7 | 1.5 | 1.5 | 2.1 | 2.1 | 1.7 | 1.1 | .3 | 1.7 | 3.2 | 1.3 | 2.3 |
| 3..... | 1.7 | 2.1 | 1.5 | 2.1 | 2.8 | 1.7 | 1.1 | .2 | 2.3 | 3.0 | 1.5 | 1.3 |
| 4..... | 2.3 | 2.5 | 1.5 | 2.1 | 2.5 | 1.5 | 1.1 | .2 | 2.3 | 2.5 | 2.1 | 1.7 |
| 5..... | 2.1 | 2.8 | 1.5 | 2.1 | 2.1 | 1.7 | 1.1 | .2 | 2.5 | 2.3 | 1.9 | 1.7 |
| 6..... | 1.7 | 2.1 | .5 | 2.3 | 2.3 | 2.1 | 1.1 | 1.7 | 2.1 | 2.8 | 1.7 | 2.1 |
| 7..... | 1.1 | 1.7 | .7 | 2.1 | 1.9 | 2.3 | .9 | .4 | 1.9 | 3.4 | 1.3 | 2.8 |
| 8..... | 2.1 | 2.1 | 1.5 | 2.3 | 1.9 | 2.3 | 2.3 | .2 | 1.5 | 2.8 | 2.3 | 2.5 |
| 9..... | 2.5 | 1.7 | 1.3 | 2.3 | 1.9 | 2.1 | 1.7 | .2 | 1.3 | 2.3 | 1.5 | 2.5 |
| 10..... | 2.1 | 1.7 | 1.7 | 2.1 | 1.7 | 2.1 | 1.3 | .5 | 2.3 | 2.3 | 1.3 | 2.5 |
| 11..... | 1.9 | 1.7 | 1.3 | 2.1 | 1.7 | 2.1 | 1.3 | .9 | 1.9 | 1.7 | 1.7 | 2.5 |
| 12..... | 2.1 | 1.7 | 2.3 | 1.3 | 1.7 | 2.5 | .7 | 1.3 | 1.3 | 1.3 | 2.5 | 2.5 |
| 13..... | 1.7 | 2.3 | 2.3 | 2.3 | 1.7 | 2.3 | .7 | 1.1 | 1.1 | 1.7 | 2.5 | 2.5 |
| 14..... | 1.5 | 2.8 | 2.5 | 2.1 | 1.3 | 1.1 | 1.5 | .9 | 1.1 | 1.3 | 2.3 | 2.5 |
| 15..... | 1.5 | 1.9 | 2.8 | 1.7 | 1.3 | .7 | 1.7 | .5 | 1.1 | 1.3 | 1.5 | 2.5 |
| 16..... | .9 | 1.7 | 2.1 | 1.5 | 1.3 | .4 | 1.3 | .5 | .9 | 1.3 | 1.7 | 2.5 |
| 17..... | 1.7 | 2.1 | 2.1 | 1.1 | 1.7 | 1.1 | .2 | 2.3 | .9 | 1.3 | 1.3 | 2.5 |
| 18..... | 2.5 | 1.5 | 2.3 | .9 | 1.7 | 1.3 | .2 | 1.7 | 1.3 | 2.1 | 2.1 | 1.7 |
| 19..... | 2.3 | 1.7 | 2.3 | 1.3 | 1.7 | 1.5 | 2.1 | 1.3 | 1.5 | 1.3 | 1.3 | 2.3 |
| 20..... | 2.8 | 1.3 | 1.9 | 1.9 | 1.5 | 1.3 | 1.5 | 1.3 | 1.9 | 1.3 | 1.3 | 2.8 |
| 21..... | 2.3 | 1.3 | 1.5 | 1.7 | 1.9 | 1.5 | 1.3 | 1.7 | 1.9 | 1.7 | 1.1 | 2.5 |
| 22..... | 2.8 | 1.9 | 1.7 | 2.1 | 2.1 | 1.7 | 1.3 | 1.5 | 1.9 | 1.7 | .9 | 2.8 |
| 23..... | .7 | 1.5 | 2.1 | 2.5 | 1.7 | 1.3 | 1.3 | 1.3 | 1.3 | 1.7 | 1.1 | 2.5 |
| 24..... | 2.3 | 1.5 | 2.1 | 2.1 | 1.7 | 1.3 | 1.1 | 1.3 | .9 | 1.7 | .4 | 2.5 |
| 25..... | 2.8 | 1.5 | 2.1 | 1.9 | 1.7 | 1.3 | 1.9 | 1.3 | .5 | 1.3 | 2.1 | 2.1 |
| 26..... | 2.5 | 1.3 | 2.1 | 1.9 | 2.1 | 1.9 | 1.5 | 1.3 | .5 | 1.5 | 1.7 | 2.5 |
| 27..... | 2.4 | 1.1 | 2.3 | 1.7 | 2.1 | 2.1 | 1.3 | 1.3 | .9 | 1.7 | 3.0 | 2.5 |
| 28..... | 2.5 | .9 | 2.3 | 1.7 | 2.5 | 1.9 | 1.3 | 1.9 | 1.5 | 1.7 | 3.8 | 2.5 |
| 29..... | 2.3 | 1.3 | 2.1 | 2.1 | 2.5 | 1.7 | 1.3 | ..... | 1.3 | 1.3 | 3.4 | 2.5 |
| 30..... | 2.1 | 1.7 | 1.9 | 1.7 | 2.1 | 1.3 | 1.3 | ..... | 1.3 | 1.3 | 2.8 | 2.5 |
| 31..... | 1.7 | 1.7 | ..... | 1.9 | ..... | 1.1 | 1.3 | ..... | 2.5 | ..... | 2.1 | ..... |

Monthly discharge of Kamenehune ditch near Waimea, Kauai, for the year ending June 30, 1918.

| Month. | Discharge. | | | Total run-off. | | |
|----------------|--------------------------|----------|-------|------------------------|---------------------|----------------|
| | Million gallons per day. | | | Second-foot (mean). | Million gallons. | Acre- feet. |
| | Maximum. | Minimum. | Mean. | | | |
| July..... | 2.8 | 0.7 | 2.04 | 3.16 | 63 | 194 |
| August..... | 2.8 | .9 | 1.75 | 2.71 | 54 | 166 |
| September..... | 2.8 | .5 | 1.84 | 2.85 | 55 | 169 |
| October..... | 2.5 | .9 | 1.90 | 2.94 | 59 | 181 |
| November..... | 2.8 | 1.3 | 1.90 | 2.94 | 57 | 175 |
| December..... | 2.5 | .4 | 1.65 | 2.55 | 51 | 157 |
| January..... | 2.3 | .2 | 1.25 | 1.93 | 39 | 119 |
| February..... | 2.3 | .2 | 1.00 | 1.55 | 28 | 86 |
| March..... | 2.5 | .5 | 1.51 | 2.34 | 47 | 144 |
| April..... | 3.4 | 1.3 | 1.90 | 2.94 | 57 | 175 |
| May..... | 3.8 | .4 | 1.83 | 2.83 | 57 | 174 |
| June..... | 2.8 | 1.3 | 2.37 | 3.67 | 71 | 218 |
| The year..... | 3.8 | .2 | 1.75 | 2.71 | 638 | 1,960 |

HANAPEPE RIVER AT KOULA, NEAR ELEELE, KAUAI.

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

RECORDS AVAILABLE.—May 13, 1917, to June 30, 1918. August 18, 1910, to December 15, 1916, at old site half a mile above present gage.

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

DISCHARGE MEASUREMENTS.—Made by wading at gage.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 9.0 feet at 9.10 a. m.

March 11 (discharge, 2,000 million gallons per day, or 3,090 second-feet); minimum stage recorded, 0.6 foot May and June (discharge, 11 million gallons per day, or 17 second-feet).

1910-1918: Maximum stage at old station above inflow of Manuahi Stream occurred December 18, 1916 (water-stage recorder and shelter carried away by flood and stage not recorded). Minimum stage 0.95 foot December 30 and 31, 1913 (discharge, 7.1 million gallons per day, or 11 second-feet).

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

REGULATION.—By diversions only.

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

ACCURACY.—Stage-discharge relation not permanent, but a sufficient number of discharge measurements were secured to define rating curves fairly well. Rating curves applicable as follows: July 1 to January 19; January 20 to February 21; February 22 to March 11, and March 12 to June 30. Gage read twice daily to hundredths. Records fair for low and medium stages but may be considerably in error for high and fluctuating stages.

Discharge measurements of Hanapepe River at Koula, near Eleele, Kauai, during the year ending June 30, 1918.

[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 27..... | 0.96 | 28 | 18 | Jan. 23..... | 1.15 | 72 | 47 |
| Aug. 23..... | .90 | 22 | 14 | Feb. 18..... | 2.12 | 257 | 166 |
| Sept. 10..... | .88 | 21 | 14 | Mar. 4..... | 1.25 | 55 | 35 |
| Oct. 1..... | .94 | 29 | 19 | Apr. 9..... | .69 | 23 | 15 |
| Nov. 13..... | .87 | 24 | 16 | May 25..... | 1.03 | 62 | 40 |
| Dec. 29..... | 1.52 | 87 | 56 | June 27..... | 1.22 | 88 | 57 |

Daily discharge, in million gallons, of Hanapepe River at Koula, near Eleele, Kauai, for the year ending June 30, 1918.

| Day. | July. | Aug. | Sept. | Oct. | Nov. | Dec. | Jan. | Feb. | Mar. | Apr. | May. | June. |
|---------|-------|------|-------|------|-------|------|-------|-------|-------|-------|------|-------|
| 1..... | 16 | 16 | 18 | 18 | 28 | 25 | 20 | 40 | 31 | 16 | 18 | 36 |
| 2..... | 16 | 22 | 16 | 18 | 71 | 14 | 20 | 59 | 46 | 116 | 16 | 21 |
| 3..... | 50 | 18 | 14 | 25 | 28 | 16 | 16 | 75 | 28 | 250 | 16 | 16 |
| 4..... | 95 | 20 | 16 | 18 | 115 | 18 | 14 | 70 | 83 | 612 | 187 | 16 |
| 5..... | 28 | 16 | 14 | 18 | 38 | 60 | 16 | 59 | 159 | 75 | 136 | 14 |
| 6..... | 22 | 16 | 14 | 18 | 20 | 122 | 16 | 179 | 55 | 54 | 24 | 14 |
| 7..... | 55 | 28 | 16 | 16 | 18 | 50 | 16 | 45 | 34 | 45 | 36 | 14 |
| 8..... | 31 | 20 | 16 | 16 | 16 | 38 | 18 | 32 | 22 | 36 | 21 | 14 |
| 9..... | 259 | 16 | 16 | 16 | 16 | 65 | 28 | 28 | 122 | 18 | 16 | 11 |
| 10..... | 60 | 16 | 16 | 16 | 25 | 65 | 28 | 28 | 1,280 | 116 | 14 | 11 |
| 11..... | 122 | 25 | 16 | 14 | 14 | 46 | 28 | 136 | 1,610 | 280 | 40 | 11 |
| 12..... | 46 | 101 | 16 | 60 | 14 | 65 | 16 | 70 | 700 | 136 | 59 | 130 |
| 13..... | 31 | 42 | 16 | 22 | 14 | 50 | 14 | 36 | 575 | 350 | 16 | 179 |
| 14..... | 25 | 136 | 16 | 22 | 14 | 46 | 239 | 32 | 230 | 123 | 11 | 320 |
| 15..... | 25 | 31 | 89 | 22 | 14 | 42 | 25 | 28 | 150 | 64 | 11 | 32 |
| 16..... | 25 | 159 | 25 | 965 | 14 | 22 | 18 | 270 | 1,230 | 64 | 16 | 54 |
| 17..... | 136 | 50 | 16 | 71 | 14 | 20 | 16 | 123 | 123 | 40 | 32 | 21 |
| 18..... | 46 | 34 | 25 | 50 | 14 | 16 | 20 | 179 | 86 | 1,260 | 36 | 18 |
| 19..... | 25 | 20 | 22 | 38 | 14 | 16 | 1,190 | 98 | 70 | 700 | 21 | 14 |
| 20..... | 22 | 18 | 16 | 38 | 14 | 16 | 80 | 104 | 54 | 187 | 18 | 36 |
| 21..... | 25 | 18 | 18 | 60 | 16 | 16 | 75 | 780 | 50 | 116 | 16 | 28 |
| 22..... | 22 | 16 | 16 | 89 | 14 | 14 | 64 | 108 | 45 | 104 | 14 | 14 |
| 23..... | 20 | 16 | 16 | 55 | 14 | 14 | 45 | 65 | 40 | 92 | 14 | 18 |
| 24..... | 20 | 42 | 16 | 20 | 20 | 14 | 24 | 55 | 75 | 70 | 21 | 45 |
| 25..... | 25 | 22 | 16 | 16 | 14 | 20 | 24 | 42 | 28 | 59 | 28 | 18 |
| 26..... | 20 | 20 | 20 | 25 | 101 | 22 | 700 | 211 | 28 | 59 | 16 | 18 |
| 27..... | 20 | 16 | 55 | 16 | 136 | 193 | 80 | 31 | 18 | 54 | 150 | 40 |
| 28..... | 18 | 16 | 60 | 16 | 42 | 38 | 86 | 184 | 21 | 50 | 45 | 24 |
| 29..... | 34 | 16 | 31 | 16 | 28 | 38 | 45 | ..... | 18 | 24 | 750 | 16 |
| 30..... | 18 | 16 | 20 | 20 | 50 | 31 | 59 | ..... | 18 | 18 | 110 | 14 |
| 31..... | 20 | 16 | ..... | 16 | ..... | 42 | 50 | ..... | 16 | ..... | 36 | ..... |

Monthly discharge of Hanapepe River at Koula, near Eleele, Kauai, for the year ending June 30, 1918.

| Month. | Discharge. | | | | Total run-off. | |
|----------------|--------------------------|----------|-------|---------------------|------------------|------------|
| | Million gallons per day. | | | Second-foot (mean). | Million gallons. | Acre-feet. |
| | Maximum. | Minimum. | Mean. | | | |
| July..... | 259 | 16 | 44.4 | 68.7 | 1,380 | 4,220 |
| August..... | 159 | 16 | 32.8 | 50.7 | 1,020 | 3,120 |
| September..... | 89 | 14 | 22.7 | 35.1 | 681 | 2,090 |
| October..... | 965 | 14 | 59.0 | 91.3 | 1,830 | 5,610 |
| November..... | 136 | 14 | 31.7 | 49.0 | 950 | 2,920 |
| December..... | 193 | 14 | 40.5 | 62.7 | 1,250 | 3,850 |
| January..... | 1,190 | 14 | 99.7 | 154 | 3,090 | 9,480 |
| February..... | 780 | 28 | 113 | 175 | 3,170 | 9,710 |
| March..... | 1,610 | 16 | 227 | 351 | 7,040 | 21,600 |
| April..... | 1,260 | 16 | 173 | 268 | 5,180 | 15,900 |
| May..... | 750 | 11 | 62.7 | 97.0 | 1,940 | 5,960 |
| June..... | 320 | 11 | 40.6 | 62.8 | 1,220 | 3,740 |
| The year..... | 1,610 | 11 | 78.8 | 122 | 28,800 | 88,200 |

HANAPEPE DITCH AT KOULA, NEAR ELEELE, KAUAI.

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

RECORDS AVAILABLE.—January 1, 1910, to June 30, 1918.

GAGE.—Vertical staff read by S. W. Holmer and D. E. Horner.

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, 3.20 feet at 7 a. m. April 10 (discharge, 36 million gallons per day, or 56 second-feet); minimum stage recorded, 0.4 foot October 25 and April 24 (discharge, 2.3 million gallons per day, or 3.6 second-feet).

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

DIVERSIONS.—Diverts part of flow of Hanapepe River.

REGULATION.—By head gates.

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

ACCURACY.—Stage-discharge relation practically permanent. Rating curve fairly well defined. Gage read to hundredths once daily. Records fair, except those for January and February, which are poor.

Discharge measurements of Hanapepe ditch at Koula, near Eleele, Kauai, during the year ending June 30, 1918.

| Date. | Made by— | Gage height (feet). | Discharge. | |
|----------------------|--------------|---------------------|--------------|--------------------------|
| | | | Second-feet. | Million gallons per day. |
| Nov. 13 | W. V. Hardy | 2.64 | 43 | 28 |
| 17 | D. E. Horner | 2.55 | 41 | 26 |
| 27 | do. | .74 | 8.3 | 5.3 |
| Dec. 11 | do. | 1.09 | 13.7 | 8.8 |
| 16 | do. | 2.30 | 35 | 23 |
| 23 ^a | do. | 2.38 | 40 | 26 |
| 29 | W. V. Hardy | 1.34 | 17.6 | 11 |
| Jan. 30 | do. | 3.09 | 54 | 35 |
| Feb. 18 ^a | do. | 2.10 | 27 | 17 |
| Mar. 11 | do. | 2.62 | 40 | 26 |
| Apr. 9 | do. | 3.06 | 51 | 33 |
| May 25 | do. | 3.03 | 51 | 33 |

^a Measurement discredited by the other measurements made during year.

Daily discharge, in million gallons, of Hanapepe ditch at Koula, near Eleele, Kauai, for the year ending June 30, 1918.

| Day. | July. | Aug. | Sept. | Oct. | Nov. | Dec. | Jan. | Feb. | Mar. | Apr. | May. | June. |
|------|-------|------|-------|------|-------|------|------|-------|------|-------|-------|-------|
| 1 | 34 | 33 | 32 | 29 | 30 | 34 | 18 | 34 | 34 | 32 | 32 | 34 |
| 2 | 34 | 34 | 30 | 34 | 12 | 34 | 22 | 13 | 34 | 34 | 32 | 33 |
| 3 | 34 | 33 | 29 | 34 | 12 | 30 | 22 | 14 | 34 | 12 | 32 | 33 |
| 4 | 34 | 33 | 32 | 32 | 14 | 28 | 22 | 14 | 34 | 3.0 | 34 | 33 |
| 5 | 34 | 32 | 28 | 34 | 16 | 30 | 22 | 14 | 35 | 3.0 | 34 | 33 |
| 6 | 34 | 31 | 28 | 31 | 34 | 34 | 22 | 18 | 35 | 3.0 | 34 | 32 |
| 7 | 34 | 34 | 28 | 30 | 34 | 34 | 22 | 33 | 35 | 8.2 | 34 | 31 |
| 8 | 34 | 34 | 30 | 30 | 32 | 7.8 | 24 | 30 | 35 | 14 | 34 | 30 |
| 9 | 34 | 32 | 28 | 29 | 32 | 11 | 7.3 | 32 | 35 | 34 | 33 | 29 |
| 10 | 34 | 31 | 28 | 27 | 31 | 8.2 | 6.4 | 28 | 24 | 36 | 33 | 28 |
| 11 | 34 | 34 | 27 | 27 | 33 | 9.1 | 6.4 | 32 | 27 | 35 | 33 | 29 |
| 12 | 34 | 34 | 28 | 27 | 33 | 8.2 | 24 | 34 | 12 | 34 | 34 | 34 |
| 13 | 34 | 34 | 30 | 26 | 28 | 8.2 | 24 | 33 | 14 | 34 | 34 | 34 |
| 14 | 34 | 34 | 28 | 27 | 28 | 8.2 | 34 | 30 | 14 | 34 | 33 | 34 |
| 15 | 34 | 34 | 32 | 34 | 28 | 8.2 | 32 | 28 | 16 | 34 | 32 | 34 |
| 16 | 34 | 34 | 34 | 33 | 27 | 8.2 | 28 | 29 | 20 | 34 | 34 | 34 |
| 17 | 34 | 34 | 30 | 34 | 27 | 22 | 27 | 33 | 20 | 34 | 35 | 33 |
| 18 | 34 | 34 | 34 | 7.8 | 27 | 24 | 28 | 20 | 18 | 34 | 35 | 33 |
| 19 | 34 | 34 | 32 | 12 | 26 | 26 | 30 | 14 | 20 | 34 | 34 | 32 |
| 20 | 34 | 34 | 28 | 12 | 27 | 27 | 30 | 14 | 22 | 3.0 | 34 | 34 |
| 21 | 34 | 34 | 32 | 18 | 26 | 26 | 6.4 | 16 | 23 | 3.0 | 34 | 34 |
| 22 | 34 | 33 | 28 | 18 | 29 | 25 | 10 | 16 | 22 | 3.0 | 33 | 34 |
| 23 | 34 | 32 | 28 | 34 | 27 | 24 | 11 | 15 | 22 | 3.8 | 32 | 33 |
| 24 | 34 | 34 | 28 | 3.0 | 27 | 24 | 28 | 15 | 22 | 2.3 | 32 | 34 |
| 25 | 34 | 34 | 28 | 2.3 | 32 | 23 | 27 | 15 | 34 | 10 | 34 | 34 |
| 26 | 34 | 34 | 32 | 32 | 28 | 22 | 33 | 16 | 34 | 9.1 | 33 | 34 |
| 27 | 34 | 32 | 34 | 34 | 33 | 26 | 26 | 33 | 35 | 10 | 34 | 34 |
| 28 | 34 | 31 | 34 | 32 | 7.3 | 13 | 26 | 34 | 35 | 10 | 34 | 34 |
| 29 | 34 | 31 | 34 | 31 | 34 | 12 | 26 | ..... | 34 | 11 | 34 | 35 |
| 30 | 34 | 30 | 33 | 30 | 33 | 14 | 34 | ..... | 34 | 28 | 34 | 32 |
| 31 | 34 | 31 | ..... | 34 | ..... | 14 | 34 | ..... | 33 | ..... | ..... | ..... |

NOTE.—No gage-height record May 31; discharge interpolated.

Monthly discharge of Hanapepe ditch at Koula, near Eleele, Kauai, for the year ending June 30, 1918.

| Month. | Discharge. | | | | Total run-off. | |
|----------------|--------------------------|----------|-------|---------------------|------------------|------------|
| | Million gallons per day. | | | Second-feet (mean). | Million gallons. | Acre-feet. |
| | Maximum. | Minimum. | Mean. | | | |
| July..... | 34 | 34 | 34.0 | 52.6 | 1,050 | 3,220 |
| August..... | 34 | 30 | 33.0 | 51.1 | 1,020 | 3,140 |
| September..... | 34 | 27 | 30.2 | 46.7 | 907 | 2,780 |
| October..... | 34 | 2.3 | 26.4 | 40.8 | 818 | 2,510 |
| November..... | 34 | 7.3 | 26.9 | 41.6 | 807 | 2,480 |
| December..... | 34 | 7.8 | 20.1 | 31.1 | 624 | 1,910 |
| January..... | 34 | 6.4 | 23.0 | 35.6 | 712 | 2,190 |
| February..... | 34 | 13 | 23.5 | 36.4 | 657 | 2,020 |
| March..... | 35 | 12 | 27.3 | 42.2 | 846 | 2,600 |
| April..... | 36 | 2.3 | 19.3 | 29.9 | 579 | 1,780 |
| May..... | 35 | 32 | 33.5 | 51.8 | 1,040 | 3,190 |
| June..... | 34 | 28 | 32.8 | 50.7 | 983 | 3,020 |
| The year..... | 36 | 2.3 | 27.5 | 42.5 | 10,000 | 30,800 |

MANUAHI STREAM AT KOULA, NEAR ELEELE, KAUAI.

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

RECORDS AVAILABLE.—May 13, 1917, to June 30, 1918.

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

DISCHARGE MEASUREMENTS.—Made by wading at gage.

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

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 3.60 feet at 5 p. m. March 11 (discharge, 200 million gallons per day, or 310 second-feet); minimum stage, 0.4 foot September 11 (discharge, 0.3 million gallons per day, or 0.45 second-feet).

DIVERSIONS.—No diversions before junction with Hanapepe River.

REGULATION.—None.

ACCURACY.—Stage-discharge relation practically permanent. Rating curve fairly well defined below 2 million gallons per day and well defined above that point, Gage read to hundredths twice daily. Records fair.

Discharge measurements of Manuahi Stream at Koula, near Eleele, Kauai, from May 13 1917, to June 30, 1918.

| Date. | Made by— | Gage height (feet). | Discharge. | |
|---------------|-------------------|---------------------|--------------|--------------------------|
| | | | Second-feet. | Million gallons per day. |
| May 13..... | W. V. Hardy..... | 0.49 | 2.1 | 1.4 |
| 24..... | do..... | .76 | 4.2 | 2.7 |
| June 18..... | do..... | 1.04 | 14.5 | 10.0 |
| 19..... | D. E. Horner..... | .95 | 8.3 | 5.3 |
| July 27..... | W. V. Hardy..... | .66 | 3.1 | 2.0 |
| Aug. 23..... | do..... | .58 | 2.5 | 1.6 |
| Sept. 10..... | do..... | .45 | .75 | .5 |
| Oct. 1..... | do..... | .63 | 2.4 | 1.5 |
| Nov. 13..... | do..... | .55 | 1.6 | 1.0 |
| 17..... | D. E. Horner..... | .51 | 1.2 | .8 |
| Dec. 28..... | W. V. Hardy..... | .96 | 9.5 | 6.2 |
| Jan. 22..... | do..... | 1.00 | 11.8 | 7.7 |
| Feb. 18..... | do..... | 1.50 | 47 | 30 |
| Mar. 10..... | do..... | 1.15 | 23 | 15 |
| Apr. 9..... | do..... | .63 | 2.8 | 1.8 |
| May 25..... | do..... | .99 | 11.5 | 7.5 |
| June 27..... | do..... | .72 | 3.8 | 2.5 |

Daily discharge, in million gallons, of Manuahi Stream at Koula, near Eleele, Kauai, from May 13, 1917, to June 30, 1918.

| Day. | May. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. | Jan. | Feb. | Mar. | Apr. | May. | June. |
|---------|------|-------|-------|------|-------|------|-------|------|------|-------|------|-------|------|-------|
| 1..... | | 33 | 1.7 | 1.7 | 1.2 | 1.6 | 2.0 | 3.5 | 1.3 | 3.5 | 4.4 | 2.3 | 2.6 | 2.3 |
| 2..... | | 15 | 1.7 | 1.7 | 1.2 | 1.6 | 26 | 2.0 | 1.3 | 3.5 | 5.6 | 2.6 | 2.6 | 2.0 |
| 3..... | | 12 | 2.0 | 1.5 | .8 | 1.3 | 21 | 1.3 | 1.0 | 4.4 | 3.5 | 3.7 | 2.6 | 1.7 |
| 4..... | | 15 | 3.1 | 1.5 | 1.1 | 1.6 | 16 | 1.6 | .7 | 14 | 9.5 | 9.5 | 9.5 | 1.7 |
| 5..... | | 14 | 2.3 | 1.3 | .7 | 1.3 | 12 | 26 | 1.0 | 7.5 | 21 | 3.7 | 3.1 | 1.7 |
| 6..... | | 17 | 2.0 | 1.3 | .7 | 1.6 | 5.6 | 89 | 1.0 | 7.5 | 4.4 | 2.6 | 2.6 | 1.7 |
| 7..... | | 11 | 2.6 | 2.0 | .6 | 1.0 | 3.5 | 47 | 1.3 | 2.9 | 2.9 | 2.3 | 4.5 | 1.5 |
| 8..... | | 20 | 2.0 | 1.7 | .6 | .7 | 1.6 | 4.4 | 2.0 | 2.9 | 2.0 | 2.0 | 2.3 | 1.5 |
| 9..... | | 8.3 | 7.5 | 1.3 | .5 | .7 | 1.6 | 16 | 1.3 | 2.9 | 9.5 | 2.0 | 2.3 | 1.5 |
| 10..... | | 6.3 | 5.7 | 1.3 | .5 | .7 | 1.6 | 16 | 1.0 | 2.4 | 21 | 2.3 | 2.0 | 1.3 |
| 11..... | | 4.5 | 4.5 | 1.5 | .3 | .5 | 1.3 | 3.5 | .7 | 2.9 | 200 | 26 | 2.0 | 1.3 |
| 12..... | | 3.3 | 3.1 | 7.5 | .5 | 2.4 | 1.3 | 12 | 2.0 | 2.4 | 143 | 21 | 2.3 | 1.3 |
| 13..... | 1.4 | 3.3 | 3.1 | 2.6 | .5 | 2.9 | 1.0 | 4.4 | 1.6 | 2.4 | 93 | 44 | 2.0 | 2.3 |
| 14..... | 1.5 | 2.5 | 2.3 | 5.7 | .5 | 2.9 | 1.0 | 4.4 | 74 | 2.0 | 50 | 12 | 1.7 | 2.0 |
| 15..... | 1.5 | 2.5 | 2.6 | 3.1 | 9.5 | 4.4 | .7 | 2.9 | 9.5 | 2.0 | 29 | 7.5 | 1.7 | 2.3 |
| 16..... | 1.4 | 2.5 | 2.3 | 16 | 2.4 | 190 | .7 | 2.0 | 3.5 | 93 | 134 | 4.5 | 2.0 | 2.6 |
| 17..... | 3.9 | 2.6 | 3.1 | 9.5 | .7 | 26 | .7 | 2.0 | 2.4 | 35 | 29 | 3.1 | 12 | 1.7 |
| 18..... | 74 | 4.9 | 4.5 | 4.5 | 5.6 | 26 | .7 | 1.6 | 2.9 | 38 | 18 | 170 | 2.6 | 1.5 |
| 19..... | 19 | 4.2 | 3.1 | 3.7 | 3.5 | 12 | .7 | 1.3 | 134 | 21 | 12 | 113 | 2.3 | 1.3 |
| 20..... | 14 | 2.8 | 2.3 | 2.6 | 1.6 | 12 | 1.0 | 1.6 | 24 | 16 | 9.5 | 50 | 2.0 | 1.3 |
| 21..... | 4.2 | 2.3 | 2.6 | 2.3 | 1.6 | 2.9 | 1.0 | 1.6 | 9.5 | 161 | 7.5 | 35 | 2.0 | 1.3 |
| 22..... | 4.5 | 2.1 | 2.3 | 2.0 | 1.3 | 16 | .7 | 1.3 | 5.6 | 35 | 5.7 | 21 | 1.7 | 1.3 |
| 23..... | 3.9 | 2.1 | 2.6 | 1.7 | 1.0 | 9.5 | .7 | 1.3 | 3.5 | 18 | 4.5 | 16 | 1.7 | 1.3 |
| 24..... | 3.1 | 2.0 | 2.3 | 1.7 | 1.0 | 4.4 | 1.0 | 1.3 | 2.9 | 12 | 9.5 | 12 | 1.7 | 1.3 |
| 25..... | 2.5 | 1.9 | 2.6 | 1.5 | .7 | 2.9 | .7 | 1.6 | 2.9 | 7.5 | 3.1 | 7.5 | 3.1 | 1.3 |
| 26..... | 2.3 | 1.7 | 2.3 | 1.5 | 1.0 | 2.4 | 2.0 | 2.0 | 78 | 5.6 | 3.1 | 5.7 | 1.7 | 1.3 |
| 27..... | 3.1 | 1.6 | 1.7 | 1.3 | 5.6 | 2.0 | 26 | 12 | 21 | 4.4 | 3.1 | 4.5 | 12 | 2.0 |
| 28..... | 3.3 | 1.6 | 1.7 | 1.3 | 14 | 1.6 | 5.6 | 5.6 | 14 | 7.5 | 2.6 | 4.5 | 4.5 | 1.0 |
| 29..... | 2.9 | 1.7 | 1.7 | 1.3 | 7.5 | 1.6 | 2.9 | 3.5 | 5.6 | ..... | 2.6 | 3.7 | 14 | .7 |
| 30..... | 31 | 1.7 | 1.7 | 1.3 | 2.0 | 2.0 | 5.6 | 2.9 | 5.6 | ..... | 2.6 | 3.1 | 3.7 | .7 |
| 31..... | 34 | ..... | 2.0 | 1.3 | ..... | 1.6 | ..... | 2.4 | 4.4 | ..... | 2.4 | ..... | 3.1 | ..... |

NOTE.—No gage-height record March 31; discharge interpolated.

Monthly discharge of Manuahi Stream at Koula, near Eleele, Kauai, for the years ending June 30, 1917 and 1918.

| Month. | Discharge. | | | | Total run-off. | |
|-----------------|--------------------------|----------|-------|---------------------|------------------|------------|
| | Million gallons per day. | | | Second-foot (mean). | Million gallons. | Acre-feet. |
| | Maximum. | Minimum. | Mean. | | | |
| 1917. | | | | | | |
| May 13-31..... | 74 | 1.4 | 11.1 | 17.2 | 212 | 647 |
| June..... | 33 | 1.6 | 6.78 | 10.5 | 203 | 624 |
| The period..... | | | | | | 1,270 |
| 1918. | | | | | | |
| July..... | 7.5 | 1.7 | 2.74 | 4.24 | 85 | 261 |
| August..... | 16 | 1.3 | 2.88 | 4.46 | 89 | 274 |
| September..... | 14 | .3 | 2.29 | 3.54 | 69 | 211 |
| October..... | 190 | .5 | 10.9 | 16.9 | 338 | 1,040 |
| November..... | 26 | .7 | 4.87 | 7.54 | 146 | 448 |
| December..... | 89 | 1.3 | 8.97 | 13.9 | 278 | 853 |
| January..... | 134 | .7 | 13.5 | 20.9 | 420 | 1,280 |
| February..... | 161 | 2.0 | 18.5 | 28.6 | 517 | 1,590 |
| March..... | 200 | 2.0 | 27.4 | 42.4 | 848 | 2,610 |
| April..... | 170 | 2.0 | 19.9 | 30.8 | 597 | 1,830 |
| May..... | 14 | 1.7 | 3.67 | 5.68 | 114 | 349 |
| June..... | 2.6 | .7 | 1.56 | 2.41 | 47 | 144 |
| The year..... | 200 | .3 | 9.72 | 15.0 | 3,550 | 10,900 |

SOUTH FORK OF WAILUA RIVER NEAR LIHUE, KAUAI.

LOCATION.—1 mile above Waiehu Falls and about 7 miles northeast of Lihue.

RECORDS AVAILABLE.—December 10, 1911, to June 30, 1918.

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; somewhat shifting.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 17.85 feet at 9.30 a. m. March 11 (discharge, 17,800 million gallons per day, or 27,600 second-feet); minimum stage recorded, 2.5 feet January 5 and 7-12 (discharge, 12 million gallons per day, or 19 second-feet).

1911-1918: Maximum stage recorded during 1918; 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.—Stage discharge relation not permanent. Rating curves fairly well defined and applicable July 1 to August 16, August 17 to March 11, and March 12 to June 30. Operation of water-stage recorder satisfactory except for short period given in footnote to table of daily discharge. Records poor.

Discharge measurements of South Fork of Wailua River near Lihue, Kauai, during the year ending June 30, 1918.

[Made by W. V. Hardy.]

| Date. | Gage height (feet). | Discharge. | |
|--------------|---------------------|--------------|--------------------------|
| | | Second-feet. | Million gallons per day. |
| Sept. 3..... | 2.74 | 40.7 | 26 |
| Apr. 24..... | 3.89 | 184 | 119 |
| June 7..... | 3.53 | 129 | 83 |

NOTE.—A discharge measurement published in Water Supply Paper 430 has been revised as follows: Made by J. C. Dort: June 22, 1914: Gage height, 8.20 feet; discharge, 2,930 second-feet, or 1,890 million gallons per day.

Daily discharge, in million gallons, of South Fork of Wailua River near Lihue, Kauai, for the year ending June 30, 1918.

| Day. | July. | Aug. | Sept. | Oct. | Nov. | Dec. | Jan. | Feb. | Mar. | Apr. | May. | June. |
|---------|-------|------|-------|------|-------|-------|------|-------|-------|-------|-------|-------|
| 1..... | 26 | 45 | 110 | 37 | 29 | 70 | 41 | 82 | 145 | 112 | ..... | 95 |
| 2..... | 26 | 50 | 60 | 55 | 65 | 60 | 29 | 76 | 154 | 385 | ..... | 84 |
| 3..... | 50 | 45 | 29 | 55 | 274 | 55 | 23 | 70 | 182 | 805 | ..... | 79 |
| 4..... | 82 | 45 | 29 | 45 | 76 | 55 | 17 | 82 | 263 | 570 | ..... | 79 |
| 5..... | 37 | 45 | 29 | 29 | 76 | ..... | 12 | 88 | 516 | 285 | 235 | 84 |
| 6..... | 41 | 41 | 23 | 29 | 50 | ..... | 14 | 192 | 469 | 143 | 100 | 79 |
| 7..... | 50 | 76 | 23 | 29 | 41 | ..... | 12 | 102 | 252 | 100 | 124 | 79 |
| 8..... | 37 | 55 | 26 | 23 | 37 | ..... | 12 | 88 | 222 | 90 | 95 | 74 |
| 9..... | 212 | 55 | 23 | 17 | 37 | 136 | 12 | 102 | 296 | 106 | 74 | 69 |
| 10..... | 136 | 50 | 23 | 17 | 55 | 118 | 12 | 88 | 726 | 245 | 69 | 64 |
| 11..... | 192 | 65 | 20 | 17 | 33 | 127 | 12 | 136 | 2,540 | 590 | 84 | 64 |
| 12..... | 82 | 136 | 20 | 23 | 29 | 110 | 12 | 136 | 2,100 | 335 | 100 | 136 |
| 13..... | 45 | 88 | 29 | 33 | 29 | 110 | 14 | 82 | 1,890 | 430 | 79 | 188 |
| 14..... | 41 | 182 | 29 | 60 | 33 | 118 | 163 | 65 | 610 | 298 | 64 | 130 |
| 15..... | 41 | 370 | 127 | 45 | 29 | 102 | 29 | 65 | 650 | 188 | 59 | 95 |
| 16..... | 37 | 880 | 88 | 424 | 23 | 110 | 20 | 118 | 1,400 | 196 | 180 | ..... |
| 17..... | 82 | 253 | 50 | 127 | 23 | 95 | 14 | 182 | 1,010 | 143 | 690 | ..... |
| 18..... | 70 | 202 | 50 | 50 | 23 | 88 | 14 | 274 | 360 | 955 | 136 | ..... |
| 19..... | 45 | 154 | 163 | 41 | 23 | 88 | 88 | 154 | 180 | 730 | 100 | ..... |
| 20..... | 55 | 136 | 154 | 37 | 29 | 88 | 55 | 172 | 112 | 205 | 118 | ..... |
| 21..... | 76 | 127 | 163 | 41 | 60 | 88 | 26 | 344 | 79 | 164 | 90 | ..... |
| 22..... | 65 | 118 | 154 | 76 | 33 | 88 | 23 | 308 | 100 | 59 | 124 | ..... |
| 23..... | 60 | 127 | 154 | 110 | 26 | 78 | 29 | 172 | 118 | 124 | 84 | 64 |
| 24..... | 55 | 274 | 154 | 55 | 37 | 76 | 26 | 145 | 130 | 124 | 74 | 79 |
| 25..... | 70 | 182 | 154 | 45 | 37 | 76 | 45 | 172 | 124 | 106 | 84 | 74 |
| 26..... | 65 | 154 | 182 | 50 | 118 | 82 | 274 | 296 | 118 | 106 | 69 | 79 |
| 27..... | 60 | 127 | 88 | 37 | 202 | 127 | 182 | 172 | 118 | ..... | 118 | 100 |
| 28..... | 60 | 118 | 60 | 33 | 102 | 127 | 172 | 212 | 124 | ..... | 95 | 84 |
| 29..... | 55 | 118 | 50 | 33 | 110 | 88 | 118 | ..... | 118 | ..... | 552 | 69 |
| 30..... | 50 | 110 | 45 | 37 | 102 | 60 | 163 | ..... | 112 | ..... | 245 | 64 |
| 31..... | 45 | 110 | ..... | 37 | ..... | 50 | 110 | ..... | 106 | ..... | 130 | ..... |

NOTE.—Water-stage recorder not operating and discharge estimated, Dec. 5-8, 55 million gallons per day; Apr. 27 to May 4, 100 million gallons per day, and June 16-22, 80 million gallons per day. Discharge interpolated Mar. 30, no record.

Monthly discharge of South Fork of Wailua River near Lihue, Kauai, for the year ending June 30, 1918.

| Month. | Discharge. | | | | Total run-off. | |
|----------------|--------------------------|----------|-------|---------------------|------------------|------------|
| | Million gallons per day. | | | Second feet (mean). | Million gallons. | Acre-feet. |
| | Maximum. | Minimum. | Mean. | | | |
| July..... | 212 | 26 | 66.1 | 102 | 2,050 | 6,290 |
| August..... | 880 | 45 | 146 | 226 | 4,540 | 13,900 |
| September..... | 182 | 20 | 77.0 | 119 | 2,310 | 7,090 |
| October..... | 424 | 17 | 56.4 | 87.3 | 1,750 | 5,370 |
| November..... | 274 | 23 | 61.4 | 95.0 | 1,840 | 5,650 |
| December..... | 136 | 50 | 86.7 | 134 | 2,690 | 8,250 |
| January..... | 274 | 12 | 57.2 | 88.5 | 1,770 | 5,440 |
| February..... | 344 | 65 | 149 | 231 | 4,180 | 12,800 |
| March..... | 2,540 | 79 | 494 | 764 | 15,300 | 47,000 |
| April..... | 955 | 59 | 266 | 412 | 7,990 | 24,500 |
| May..... | 690 | 59 | 141 | 218 | 4,370 | 13,400 |
| June..... | 188 | 64 | 85.7 | 133 | 2,570 | 7,890 |
| The year..... | 2,540 | 12 | 141 | 218 | 51,400 | 158,000 |

HANAMAULU DITCH NEAR LIHUE, KAUAI.

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

RECORDS AVAILABLE.—July 1, 1910, to June 30, 1918.

GAGE.—Vertical staff read by S. Koike. New datum September 30, 1911.

DISCHARGE MEASUREMENTS.—Made in flume

CHANNEL AND CONTROL.—Wooden flume; straight for 20 feet above and below gage.

Control is rock section at end of flume; probably permanent.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 2.66 feet at 8.10 a. m. October 16 (discharge, 27 million gallons per day, or 42 second-feet); ditch dry December 6-11.

1910-1918: Maximum stage recorded, 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.—For irrigation of sugar cane and for domestic supply.

ACCURACY.—Stage-discharge relation not permanent. Rating curves fairly well defined, applicable July 1 to April 2 and April 3 to June 30. Gage read to hundredths once daily. Record fair.

Discharge measurements of Hanamaulu ditch near Lihue, Kauai, during the year ending June 30, 1918.

[Made by W. V. Hardy.]

| Date. | Gage height (feet). | Discharge. | |
|--------------|---------------------|--------------|--------------------------|
| | | Second-feet. | Million gallons per day. |
| Sept. 2..... | 2.24 | 30 | 19 |
| Apr. 25..... | .92 | 5.5 | 3.5 |
| 25..... | .78 | 4.7 | 3.0 |

Daily discharge, in million gallons, of Hanamaulu ditch near Lihue, Kauai, for the year ending June 30, 1918.

| Day. | July. | Aug. | Sept. | Oct. | Nov. | Dec. | Jan. | Feb. | Mar. | Apr. | May. | June. |
|---------|-------|------|-------|------|-------|-------|------|-------|------|-------|------|-------|
| 1..... | 17 | 19 | 20 | 19 | 19 | 21 | 17 | 9.4 | 8.2 | 2.9 | 3.6 | 20 |
| 2..... | 20 | 19 | 19 | 20 | 22 | 20 | 17 | 9.4 | 8.2 | 5.2 | 14 | 20 |
| 3..... | 22 | 19 | 21 | 20 | 12 | 19 | 17 | 8.8 | 7.6 | 8.2 | 19 | 20 |
| 4..... | 25 | 20 | 21 | 20 | 12 | 17 | 17 | 8.8 | 8.2 | 4.0 | 19 | 19 |
| 5..... | 21 | 19 | 20 | 20 | 12 | 14 | 17 | 8.8 | 8.8 | 3.2 | 18 | 19 |
| 6..... | 22 | 19 | 20 | 19 | 11 | ..... | 17 | 10 | 7.1 | 2.9 | 19 | 19 |
| 7..... | 22 | 21 | 20 | 19 | 18 | ..... | 17 | 8.2 | 7.1 | 2.6 | 19 | 19 |
| 8..... | 21 | 20 | 19 | 19 | 18 | ..... | 18 | 8.2 | 6.6 | 2.3 | 17 | 19 |
| 9..... | 24 | 19 | 19 | 19 | 18 | ..... | 17 | 8.2 | 6.6 | 3.2 | 16 | 19 |
| 10..... | 22 | 19 | 19 | 19 | 19 | ..... | 16 | 7.6 | 7.1 | 4.0 | 14 | 18 |
| 11..... | 22 | 20 | 19 | 19 | 19 | ..... | 16 | 7.6 | 14 | 4.4 | 14 | 18 |
| 12..... | 20 | 22 | 19 | 19 | 19 | 5.6 | 18 | 8.2 | 2.9 | 4.4 | 17 | 22 |
| 13..... | 19 | 20 | 19 | 20 | 19 | 5.6 | 17 | 7.1 | 2.3 | 5.2 | 17 | 21 |
| 14..... | 18 | 22 | 20 | 19 | 4.8 | 5.6 | 24 | 7.1 | 1.2 | 5.2 | 16 | 20 |
| 15..... | 18 | 20 | 19 | 19 | 19 | 5.2 | 17 | 7.1 | 1.4 | 5.2 | 14 | 20 |
| 16..... | 20 | 14 | 19 | 26 | 18 | 7.1 | 17 | 7.1 | 1.7 | 4.8 | 20 | 22 |
| 17..... | 24 | 14 | 20 | 19 | 18 | 6.6 | 18 | 7.1 | 1.0 | 4.4 | 12 | 19 |
| 18..... | 20 | 11 | 19 | 18 | 18 | 6.1 | 18 | 7.6 | .8 | 8.2 | 21 | 18 |
| 19..... | 20 | 21 | 19 | 18 | 17 | 8.2 | 23 | 7.1 | .7 | 3.2 | 20 | 18 |
| 20..... | 19 | 20 | 19 | 19 | 20 | 8.2 | 19 | 7.1 | 3.6 | 2.9 | 23 | 19 |
| 21..... | 19 | 20 | 20 | 19 | 20 | 8.8 | 18 | 6.1 | 3.2 | 2.3 | 18 | 19 |
| 22..... | 19 | 20 | 19 | 19 | 19 | 8.8 | 18 | 5.2 | 1.7 | 2.0 | 21 | 19 |
| 23..... | 19 | 21 | 19 | 8.8 | 19 | 8.8 | 17 | 9.4 | 3.6 | 1.7 | 20 | 19 |
| 24..... | 18 | 20 | 19 | 19 | 21 | 8.8 | 19 | 10 | 3.6 | 1.7 | 20 | 22 |
| 25..... | 20 | 19 | 19 | 19 | 20 | 8.2 | 19 | 9.4 | 3.2 | 3.6 | 22 | 20 |
| 26..... | 19 | 19 | 19 | 20 | 22 | 8.2 | 4.0 | 9.4 | 3.2 | 3.6 | 19 | 20 |
| 27..... | 19 | 19 | 19 | 19 | 22 | 9.4 | 2.9 | 9.4 | 3.2 | 3.6 | 21 | 19 |
| 28..... | 17 | 20 | 21 | 19 | 21 | 8.8 | 3.6 | 10 | 2.9 | 3.6 | 20 | 19 |
| 29..... | 19 | 20 | 19 | 20 | 22 | 17 | 10 | ..... | 2.9 | 3.2 | 12 | 19 |
| 30..... | 20 | 20 | 19 | 20 | 20 | 17 | 10 | ..... | 2.9 | 3.2 | 21 | 22 |
| 31..... | 19 | 20 | ..... | 19 | ..... | 18 | 9.4 | ..... | 2.9 | ..... | 21 | ..... |

NOTE.—Ditch dry Dec. 6-11.

Monthly discharge of Hanamaulu ditch near Lihue, Kauai, for the year ending June, 30, 1918.

| Month. | Discharge. | | | Total run-off. | |
|-------------------------|--------------------------|----------|-------|---------------------|------------|
| | Million gallons per day. | | | Second-foot (mean). | Acre-feet. |
| | Maximum. | Minimum. | Mean. | | |
| July..... | 25 | 17 | 20.1 | 31.1 | 624 |
| August..... | 22 | 11 | 19.2 | 29.7 | 596 |
| September..... | 21 | 19 | 19.4 | 30.0 | 583 |
| October..... | 26 | 8.8 | 19.1 | 29.6 | 592 |
| November..... | 22 | 4.8 | 18.0 | 27.8 | 539 |
| December (25 days)..... | 21 | 5.2 | 10.8 | 16.7 | 271 |
| January..... | 24 | 2.9 | 15.7 | 24.3 | 488 |
| February..... | 10 | 5.2 | 8.19 | 12.7 | 229 |
| March..... | 14 | .7 | 4.46 | 6.90 | 138 |
| April..... | 8.2 | 1.7 | 3.80 | 5.88 | 114 |
| May..... | 23 | 3.6 | 17.7 | 27.4 | 548 |
| June..... | 22 | 18 | 19.6 | 30.3 | 587 |
| The year..... | | | | | 5,310 |
| | | | | | 16,300 |

LIHUE DITCH NEAR LIHUE, KAUAI.

LOCATION.—Half a mile below intake and 6 miles northwest of Lihue.

RECORDS AVAILABLE.—August 1, 1917, to June 30, 1918. July 1, 1910, to April 30, 1917, at old site 1 mile below present gage.

GAGE.—Vertical staff read by S. Koike.

DISCHARGE MEASUREMENTS.—Made in flume at gage.

CHANNEL AND CONTROL.—Wooden flume 50 feet long. Ditch enters a long tunnel 20 feet below gage. Control not well defined.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 1.58 feet at 8.40 a. m. October 16 (discharge, 10.2 million gallons per day, or 15.8 second-feet); ditch occasionally dry.

1910-1918: Maximum stage recorded, 1.6 feet at old site, April, May, and June, 1916 (discharge, 14 million gallons per day, or 22 second-feet); ditch occasionally dry.

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

REGULATION.—By headgates.

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

ACCURACY.—Stage-discharge relation practically permanent. Rating curve fairly well defined between 6 and 10 million gallons per day. Gage read to hundredths once daily. Record fair.

The following discharge measurement was made by W. V. Hardy:

September 2, 1917: Gage height, 1.28 feet; discharge, 10.9 second-feet, or 7 million gallons per day.

Daily discharge, in million gallons, of Lihue ditch near Lihue, Kauai, for the year ending June 30, 1918.

| Day. | Aug. | Sept. | Oct. | Nov. | Dec. | Jan. | Feb. | Mar. | May. | June. |
|---------|------|-------|------|-------|------|-------|-------|-------|-------|-------|
| 1..... | 8.2 | 8.2 | 7.2 | 7.2 | 7.7 | 7.2 | ..... | 4.0 | ..... | 5.3 |
| 2..... | 8.2 | 8.2 | 7.7 | 7.7 | 7.7 | 7.2 | ..... | 3.6 | ..... | 4.4 |
| 3..... | 8.2 | 7.2 | 7.7 | 8.8 | 7.2 | 6.7 | ..... | 3.6 | ..... | 4.4 |
| 4..... | 8.8 | 7.2 | 8.2 | 8.2 | 7.2 | 6.7 | ..... | 4.0 | ..... | 3.6 |
| 5..... | 8.2 | 7.7 | 7.7 | 8.2 | 8.2 | 6.7 | ..... | 6.2 | 2.6 | 3.6 |
| 6..... | 8.2 | 7.7 | 7.7 | 7.7 | 7.7 | 7.2 | ..... | 5.3 | 2.6 | 3.2 |
| 7..... | 9.8 | 7.7 | 7.7 | 7.7 | 7.2 | 7.2 | ..... | 5.3 | 2.6 | 3.2 |
| 8..... | 8.8 | 7.7 | 7.7 | 7.2 | 7.2 | 6.7 | ..... | 5.3 | 2.9 | 5.8 |
| 9..... | 8.2 | 7.7 | 7.2 | 7.2 | 7.2 | 6.7 | ..... | 4.8 | 5.3 | 5.8 |
| 10..... | 8.2 | 7.2 | 7.2 | 8.2 | 7.2 | 7.2 | ..... | 5.3 | 5.3 | 5.3 |
| 11..... | 8.2 | 7.7 | 7.2 | 7.7 | 7.2 | 7.2 | ..... | 9.8 | 5.3 | 5.3 |
| 12..... | 9.3 | 7.7 | 7.2 | 7.2 | 7.2 | 8.2 | ..... | 1.6 | 5.3 | 8.2 |
| 13..... | 8.8 | 7.7 | 8.2 | 7.2 | 6.7 | 7.2 | ..... | 1.4 | 6.2 | 7.7 |
| 14..... | 9.3 | 8.2 | 7.7 | 7.7 | 6.2 | 9.3 | ..... | 1.1 | 6.2 | 7.7 |
| 15..... | 9.8 | 7.7 | 7.2 | 7.2 | 6.2 | 6.7 | ..... | 1.4 | 5.8 | 7.7 |
| 16..... | 9.3 | 7.7 | 10.4 | 7.2 | 6.2 | 6.7 | ..... | 1.6 | 7.2 | 8.2 |
| 17..... | 7.2 | 7.7 | 7.7 | 7.2 | 6.2 | 7.2 | ..... | .7 | 8.2 | 7.2 |
| 18..... | 7.2 | 7.7 | 7.2 | 6.7 | 6.2 | 7.2 | ..... | .7 | 6.2 | 6.7 |
| 19..... | 8.2 | 7.7 | 8.2 | 7.2 | 6.7 | 9.3 | ..... | .7 | 6.2 | 6.7 |
| 20..... | 8.2 | 7.7 | 8.2 | 8.2 | 6.2 | 7.7 | ..... | .7 | 7.7 | 7.2 |
| 21..... | 7.7 | 8.2 | 8.2 | 8.2 | 8.2 | 7.2 | ..... | .6 | 6.7 | 5.3 |
| 22..... | 7.7 | 7.7 | 8.2 | 7.7 | 7.7 | 7.2 | ..... | .6 | 7.7 | 5.3 |
| 23..... | 8.8 | 7.7 | 8.8 | 7.7 | 7.7 | 7.2 | ..... | .6 | 6.7 | 5.3 |
| 24..... | 8.8 | 7.7 | 8.2 | 8.2 | 7.7 | 7.7 | ..... | ..... | 6.2 | 5.3 |
| 25..... | 8.2 | 7.2 | 8.2 | 8.2 | 7.2 | 7.7 | ..... | ..... | 7.2 | 6.7 |
| 26..... | 8.2 | 7.7 | 8.2 | 8.8 | 7.2 | ..... | 4.4 | ..... | 6.7 | 6.7 |
| 27..... | 7.7 | 7.7 | 7.7 | 8.2 | 8.2 | ..... | 4.4 | ..... | 7.2 | 6.2 |
| 28..... | 8.2 | 8.2 | 7.7 | 8.2 | 7.7 | ..... | 4.0 | ..... | 6.7 | 6.2 |
| 29..... | 8.2 | 7.7 | 7.2 | 8.2 | 7.7 | ..... | ..... | ..... | 7.7 | 6.2 |
| 30..... | 8.2 | 7.7 | 7.2 | 8.2 | 7.2 | ..... | ..... | ..... | 7.2 | 7.2 |
| 31..... | 8.8 | ..... | 7.2 | ..... | 7.2 | ..... | ..... | ..... | 5.3 | ..... |

NOTE.—No water in ditch Jan. 26 to Feb. 25 and Mar. 24 to May 4.

Monthly discharge of Lihue ditch near Lihue, Kauai, for the year ending June 30, 1918.

| Month. | Discharge. | | | | Total run-off. | |
|------------------------|--------------------------|----------|-------|---------------------|------------------|------------|
| | Million gallons per day. | | | Second feet (mean). | Million gallons. | Acre-feet. |
| | Maximum. | Minimum. | Mean. | | | |
| August..... | 9.8 | 7.2 | 8.41 | 13.0 | 261 | 800 |
| September..... | 8.2 | 7.2 | 7.72 | 11.9 | 232 | 711 |
| October..... | 10.4 | 7.2 | 7.81 | 12.1 | 242 | 743 |
| November..... | 8.8 | 6.7 | 7.77 | 12.0 | 233 | 715 |
| December..... | 8.2 | 6.2 | 7.20 | 11.1 | 223 | 685 |
| January (25 days)..... | 9.3 | 6.7 | 7.33 | 11.3 | 183 | 562 |
| February (3 days)..... | 4.4 | 4.0 | 4.27 | 6.61 | 13 | 39 |
| March (23 days)..... | 9.8 | .6 | 3.00 | 4.64 | 69 | 212 |
| May (27 days)..... | 8.2 | 2.6 | 5.96 | 9.22 | 161 | 493 |
| June..... | 8.2 | 3.2 | 5.92 | 9.16 | 178 | 545 |
| The period..... | ..... | ..... | ..... | ..... | 1,800 | 5,500 |

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

LOCATION.—2 miles above intake of Kanaha ditch and 10 miles northwest of Lihue.

RECORDS AVAILABLE.—September 21, 1914, to June 30, 1918. Records available for old station at elevation 500 feet, August 1 to October 28, 1910, and December 28, 1910, to September 25, 1914.

GAGE.—Stevens 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, 7.78 feet at 10.45 p. m., March 12 (discharge, 1,700 million gallons per day, or 2,640 second-feet); minimum stage recorded, 1.25 feet January 10, 11, and 17 (discharge, 19 million gallons per day, or 29 second-feet).

1914-1918: 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.

REGULATION.—None.

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

ACCURACY.—Stage-discharge relation practically permanent. Rating curve well defined. Operation of water-stage recorder unsatisfactory at times. Records fair when water-stage recorder was operating.

Discharge measurements of North Fork of Wailua River at elevation 650 feet, near Lihue Kauai, during the year ending June 30, 1918.

[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. |
| Aug. 7..... | 1.56 | 47 | 31 | Apr. 19..... | 3.12 | 355 | 230 |
| 28..... | 1.47 | 41 | 26 | 19..... | 3.90 | 636 | 411 |
| Nov. 23..... | 1.33 | 32 | 21 | 19..... | 3.40 | 434 | 280 |
| Apr. 19..... | 2.39 | 166 | 107 | June 6..... | 1.77 | 75 | 49 |

Daily diasharge in million gallons of North Fork of Wailua River at elevation 650 feet, near Lihue, Kauai, for the year ending June 30, 1918.

| Day. | July. | Aug. | Sept. | Oct. | Nov. | Dec. | Jan. | Feb. | Mar. | Apr. | June. |
|---------|-------|------|-------|-------|-------|------|------|-------|------|-------|-------|
| 1..... | 28 | 28 | 30 | ----- | 23 | 38 | 23 | 42 | 88 | 38 | ----- |
| 2..... | 28 | 28 | 25 | ----- | 42 | 32 | 21 | 38 | 49 | 56 | ----- |
| 3..... | 49 | 25 | 25 | ----- | 72 | 30 | 21 | 35 | 94 | 228 | ----- |
| 4..... | 56 | 28 | 25 | ----- | 38 | 28 | 21 | 32 | 56 | 228 | ----- |
| 5..... | 32 | 25 | 23 | 25 | 46 | 32 | 21 | 46 | 158 | 128 | ----- |
| 6..... | 35 | 25 | 23 | 28 | 32 | 28 | 21 | 88 | 200 | 77 | 49 |
| 7..... | 42 | 32 | 23 | 25 | 30 | 32 | 21 | 46 | 142 | 56 | 46 |
| 8..... | 35 | 23 | 23 | 23 | 35 | 28 | 21 | 38 | 77 | 52 | 46 |
| 9..... | 120 | 23 | 23 | 21 | 30 | 38 | 21 | 72 | 82 | 88 | 42 |
| 10..... | 60 | 21 | 21 | 21 | 42 | 30 | 19 | 46 | 94 | 128 | 42 |
| 11..... | 106 | 28 | 21 | 21 | 30 | 30 | 19 | 56 | 270 | 94 | 42 |
| 12..... | 49 | 49 | 25 | 23 | 28 | 30 | 25 | 68 | 730 | 158 | 56 |
| 13..... | 38 | 38 | 28 | 32 | 28 | 38 | 23 | 56 | 550 | 218 | 106 |
| 14..... | 38 | 77 | 30 | 28 | 28 | 35 | 42 | 52 | 565 | 135 | 94 |
| 15..... | 32 | 77 | 46 | 23 | 25 | 32 | 60 | 38 | 182 | 100 | 49 |
| 16..... | 32 | 191 | 35 | 150 | 25 | 28 | 25 | 38 | 209 | 100 | 49 |
| 17..... | 56 | 56 | 56 | 52 | 23 | 30 | 21 | 77 | 332 | 88 | 42 |
| 18..... | 46 | 42 | 52 | 35 | 23 | 25 | 19 | 77 | 120 | 565 | 38 |
| 19..... | 32 | 35 | 32 | 30 | 23 | 25 | 49 | 64 | 72 | 238 | 35 |
| 20..... | 30 | 32 | 28 | 28 | 28 | 25 | 25 | 72 | 60 | 106 | 35 |
| 21..... | 32 | 30 | 30 | 38 | 42 | 25 | 23 | 60 | 72 | 82 | 35 |
| 22..... | 30 | 28 | 28 | 42 | 28 | 23 | 23 | 150 | 60 | 72 | 35 |
| 23..... | 30 | 30 | 28 | 56 | 23 | 23 | 23 | 72 | 49 | ----- | 35 |
| 24..... | 30 | 82 | 30 | 30 | 28 | 23 | 23 | 56 | 46 | ----- | 46 |
| 25..... | 32 | 38 | 30 | 32 | 25 | 23 | 21 | 49 | 64 | ----- | 49 |
| 26..... | 30 | 32 | ----- | 42 | 60 | 23 | 64 | 100 | 46 | ----- | 46 |
| 27..... | 28 | 28 | ----- | 28 | 77 | 28 | 49 | 82 | 46 | ----- | 42 |
| 28..... | 46 | 28 | ----- | 28 | 46 | 35 | 52 | 49 | 42 | ----- | 42 |
| 29..... | 30 | 32 | ----- | 25 | 49 | 25 | 72 | ----- | 46 | ----- | 35 |
| 30..... | 30 | 28 | ----- | 25 | 60 | 23 | 88 | ----- | 42 | ----- | 32 |
| 31..... | 30 | 28 | ----- | 28 | ----- | 23 | 49 | ----- | 35 | ----- | ----- |

NOTE.—No gage height record Sept. 26 to Oct. 4 and Apr. 23 to June 5. Discharge estimated at 28 million gallons per day Sept. 26 to Oct. 4.

Monthly discharge of North Fork of Wailua River at elevation 650 feet, near Lihue, Kauai, for the year ending June 30, 1918.

| Month. | Discharge. | | | Total run-off. | |
|-----------------|--------------------------|----------|-------|------------------|------------|
| | Million gallons per day. | | | Million gallons. | Acre-feet. |
| | Maximum. | Minimum. | Mean. | | |
| July..... | 120 | 28 | 41.7 | 64.5 | 3,970 |
| August..... | 191 | 21 | 40.9 | 63.3 | 3,890 |
| September..... | 56 | 21 | 29.3 | 45.3 | 2,700 |
| October..... | 150 | 21 | 33.9 | 52.5 | 3,230 |
| November..... | 77 | 23 | 36.3 | 56.2 | 3,340 |
| December..... | 38 | 23 | 28.6 | 44.3 | 2,720 |
| January..... | 88 | 19 | 32.4 | 50.1 | 3,080 |
| February..... | 150 | 32 | 60.7 | 93.9 | 5,220 |
| March..... | 730 | 35 | 151 | 234 | 14,400 |
| April 1-22..... | 565 | 38 | 138 | 214 | 9,320 |
| June 6-30..... | 106 | 32 | 46.7 | 72.3 | 3,580 |

KANAHUA 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, 1918.

GAGE.—Vertical staff. New datum May 28, 1913. Read by S. Koike.

DISCHARGE MEASUREMENTS.—Made in wooden flume at gage.

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

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 2.56 feet at 10.20 a. m. October 16 (discharge, 20 million gallons per day, or 31 second-feet); no flow March 19-22.

1910-1918: Maximum stage recorded, 2.6 feet July 24-26, 1913 (discharge, 22 million gallons per day, or 34 second-feet); ditch occasionally dry.

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

REGULATION.—By head gates.

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

ACCURACY.—Stage-discharge relation not permanent. Rating curves fairly well defined and applicable July 1 to October 16 and October 17 to June 30. Gage read to hundredths once daily. Records fair.

Discharge measurements of Kanaha ditch near Lihue, Kauai, during the year ending June 30, 1918.

[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. |
| Aug. 28..... | 1.93 | 25 | 16 | Apr. 20..... | 0.67 | 7.6 | 4.9 |
| Sept. 3..... | 2.06 | 27 | 18 | June 7..... | 1.88 | 23 | 14.7 |
| Nov. 23..... | 2.12 | 25 | 16 | | | | |

Daily discharge, in million gallons, of Kanaha ditch near Lihue, Kauai, for the year ending June 30, 1918.

| Day. | July. | Aug. | Sept. | Oct. | Nov. | Dec. | Jan. | Feb. | Mar. | Apr. | May. | June. |
|---------|-------|------|-------|------|-------|------|------|-------|-------|-------|------|-------|
| 1..... | 14.3 | 15.2 | 17.0 | 17.9 | 17.0 | 17.9 | 10.6 | 9.1 | 6.0 | 6.7 | 7.5 | 15.8 |
| 2..... | 14.3 | 16.1 | 16.1 | 18.4 | 18.7 | 17.4 | 10.6 | 9.1 | 6.0 | 7.1 | 7.1 | 15.4 |
| 3..... | 17.0 | 16.6 | 17.4 | 18.8 | 17.9 | 17.0 | 13.0 | 9.4 | 5.6 | 9.1 | 9.8 | 14.2 |
| 4..... | 17.9 | 19.7 | 18.4 | 18.8 | 17.4 | 17.0 | 13.0 | 9.1 | 6.4 | 6.7 | 11.0 | 15.4 |
| 5..... | 16.1 | 16.6 | 17.0 | 18.8 | 17.0 | 17.9 | 13.0 | 9.4 | 6.7 | 6.4 | 11.4 | 15.4 |
| 6..... | 14.3 | 16.1 | 17.0 | 18.8 | 17.0 | 17.0 | 14.6 | 10.6 | 6.0 | 6.4 | 9.8 | 15.0 |
| 7..... | 15.6 | 19.2 | 17.9 | 18.8 | 17.0 | 17.9 | 13.4 | 9.4 | 5.6 | 6.0 | 12.2 | 14.6 |
| 8..... | 16.1 | 25.6 | 18.4 | 17.9 | 17.0 | 17.0 | 13.8 | 9.4 | 5.6 | 6.0 | 11.4 | 15.4 |
| 9..... | 19.7 | 16.1 | 18.4 | 17.9 | 17.0 | 17.0 | 12.2 | 9.8 | 5.2 | 6.0 | 12.6 | 15.0 |
| 10..... | 18.4 | 16.1 | 16.1 | 17.4 | 17.0 | 17.0 | 12.6 | 9.4 | 5.2 | 6.7 | 12.2 | 15.0 |
| 11..... | 19.2 | 17.0 | 17.4 | 17.9 | 16.6 | 16.2 | 12.2 | 9.8 | 4.0 | 6.7 | 12.6 | 14.6 |
| 12..... | 17.0 | 19.2 | 17.9 | 19.2 | 16.2 | 14.2 | 15.0 | 9.8 | 3.7 | 7.1 | 14.2 | 16.2 |
| 13..... | 17.0 | 17.9 | 17.9 | 19.2 | 15.8 | 14.2 | 13.8 | 9.4 | 3.3 | 6.7 | 13.4 | 15.4 |
| 14..... | 16.1 | 17.0 | 18.8 | 18.8 | 15.4 | 13.8 | 16.6 | 9.1 | 3.7 | 6.4 | 13.0 | 15.4 |
| 15..... | 15.2 | 18.8 | 19.7 | 18.4 | 17.0 | 13.4 | 13.0 | 9.1 | 3.7 | 6.0 | 13.0 | 16.2 |
| 16..... | 16.6 | 17.9 | 18.8 | 22.0 | 16.2 | 13.4 | 14.2 | 9.1 | 3.7 | 6.0 | 14.2 | 16.2 |
| 17..... | 20.2 | 17.4 | 17.9 | 17.0 | 16.6 | 12.6 | 12.2 | 9.4 | 2.9 | 6.0 | 15.0 | 14.6 |
| 18..... | 17.0 | 17.0 | 17.9 | 16.2 | 15.8 | 12.2 | 13.8 | 9.4 | 2.9 | 7.1 | 13.8 | 14.6 |
| 19..... | 17.0 | 15.6 | 17.4 | 17.0 | 16.2 | 11.8 | 15.8 | 9.4 | ..... | 5.2 | 13.0 | 16.2 |
| 20..... | 16.6 | 17.4 | 19.7 | 17.0 | 17.0 | 11.4 | 15.4 | 9.1 | ..... | 5.2 | 13.8 | 16.2 |
| 21..... | 16.1 | 17.4 | 19.2 | 17.4 | 17.9 | 11.4 | 14.6 | 8.7 | ..... | 5.2 | 14.2 | 15.4 |
| 22..... | 15.6 | 17.0 | 19.2 | 17.4 | 17.9 | 11.4 | 14.6 | 8.3 | ..... | 5.2 | 13.0 | 15.8 |
| 23..... | 15.2 | 17.0 | 18.8 | 17.9 | 16.6 | 10.6 | 13.8 | 8.3 | 2.9 | 7.1 | 13.8 | 15.8 |
| 24..... | 16.6 | 19.2 | 18.4 | 16.2 | 18.7 | 10.6 | 13.8 | 7.9 | 2.9 | 6.7 | 14.6 | 16.2 |
| 25..... | 17.9 | 18.4 | 17.9 | 15.4 | 18.3 | 10.6 | 14.2 | 8.3 | 2.6 | 8.3 | 15.4 | 16.2 |
| 26..... | 17.0 | 17.4 | 17.0 | 15.8 | 18.7 | 10.2 | 15.8 | 7.5 | 7.5 | 8.3 | 14.2 | 16.2 |
| 27..... | 16.1 | 17.4 | 19.7 | 15.0 | 18.7 | 11.4 | 15.4 | 6.7 | 7.1 | 7.9 | 15.4 | 15.8 |
| 28..... | 18.4 | 16.1 | 17.0 | 14.6 | 18.7 | 11.4 | 13.8 | 6.4 | 7.5 | 7.9 | 14.2 | 14.6 |
| 29..... | 15.2 | 18.4 | 19.2 | 14.2 | 18.7 | 11.0 | 9.8 | ..... | 7.1 | 7.5 | 15.4 | 14.2 |
| 30..... | 16.6 | 17.0 | 18.8 | 17.4 | 17.4 | 11.0 | 9.4 | ..... | 7.1 | 7.5 | 13.2 | 13.8 |
| 31..... | 16.6 | 17.0 | ..... | 16.6 | ..... | 10.6 | 9.4 | ..... | 6.7 | ..... | 15.8 | ..... |

NOTE.—Ditch dry Mar. 19-22.

Monthly discharge of Kanaha ditch near Lihue, Kauai, for the year ending June 30, 1918.

| Month. | Discharge. | | | | Total run-off. | |
|----------------------|--------------------------|----------|-------|---------------------------|---------------------|------------|
| | Million gallons per day. | | | Second feet (mean). | Million gallons. | Acre-feet. |
| | Maximum. | Minimum. | Mean. | | | |
| July..... | 20.2 | 14.3 | 16.7 | 25.8 | 517 | 1,590 |
| August..... | 25.6 | 15.2 | 17.6 | 27.2 | 545 | 1,670 |
| September..... | 19.7 | 10.1 | 18.1 | 28.0 | 542 | 1,670 |
| October..... | 22.0 | 14.2 | 17.6 | 27.2 | 544 | 1,670 |
| November..... | 18.7 | 15.4 | 17.2 | 26.6 | 517 | 1,580 |
| December..... | 17.9 | 10.2 | 13.8 | 21.4 | 426 | 1,310 |
| January..... | 16.6 | 9.4 | 13.3 | 20.6 | 413 | 1,260 |
| February..... | 10.6 | 6.4 | 8.94 | 13.8 | 250 | 768 |
| March (27 days)..... | 7.5 | 2.6 | 5.10 | 7.89 | 138 | 423 |
| April..... | 9.1 | 5.2 | 6.70 | 10.4 | 201 | 617 |
| May..... | 15.8 | 7.1 | 12.9 | 20.0 | 401 | 1,230 |
| June..... | 16.2 | 13.8 | 15.4 | 23.8 | 461 | 1,420 |
| The year..... | | | | | 4,960 | 15,200 |

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

LOCATION.—400 feet above confluence with North Fork and about 8 miles north of Lihue.
RECORDS AVAILABLE.—July 27, 1912, to June 30, 1918.

GAGE.—Stevens water-stage recorder, December 31, 1914, to June 30, 1918; 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 year, 6.75 feet at 9.45 a. m. March 11 (discharge, about 1,600 million gallons per day, or 2,480 second-feet); minimum stage recorded, 1.8 feet September 10-12, October 10-13, and January 2 (discharge, 9.0 million gallons per day, or 14 second-feet).

1912-1918: Maximum stage recorded, 8.9 feet at 8 a. m. March 3, 1916 (discharge, about 3,000 million gallons per day, or 4,640 second-feet); minimum stage recorded, 1.6 feet March, 1915 (discharge, 7 million gallons per day, or 11 second-feet).

DIVERSIONS.—None.

REGULATION.—None.

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

ACCURACY.—Stage-discharge relation practically permanent. Rating curve well defined. Operation of water-stage recorder satisfactory. Records good.

Discharge measurements of East Branch of North Fork of Wailua River, near Lihue, Kauai, during the year ending June 30, 1918.

[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. |
| Aug. 4..... | 1.99 | 29 | 18 | Apr. 18..... | 3.45 | 349 | 225 |
| Aug. 27..... | 1.95 | 26 | 17 | 18..... | 4.25 | 731 | 472 |
| Sept. 2..... | 1.90 | 22 | 14 | 18..... | 3.80 | 526 | 340 |
| Nov. 23..... | 1.88 | 17.8 | 12 | 20..... | 2.60 | 115 | 74 |
| Apr. 17..... | 2.41 | 81 | 53 | 24..... | 2.31 | 69 | 45 |
| Apr. 18..... | 2.94 | 181 | 117 | June 6..... | 2.12 | 42 | 27 |

Daily discharge, in million gallons, of East Branch of North Fork of Wailua River near Lihue, Kauai, for the year ending June 30, 1918.

| Day. | July. | Aug. | Sept. | Oct. | Nov. | Dec. | Jan. | Feb. | Mar. | Apr. | May. | June. |
|---------|-------|------|-------|------|-------|------|------|-------|------|-------|------|-------|
| 1..... | 20 | 17 | 17 | 14 | 17 | 27 | 14 | 24 | 31 | 24 | 31 | 27 |
| 2..... | 20 | 17 | 17 | 14 | 53 | 24 | 9 | 20 | 31 | 24 | 27 | 24 |
| 3..... | 24 | 17 | 12 | 27 | 44 | 20 | 14 | 20 | 31 | 58 | 31 | 27 |
| 4..... | 44 | 14 | 12 | 17 | 27 | 20 | 14 | 24 | 27 | 63 | 31 | 31 |
| 5..... | 27 | 17 | 12 | 14 | 27 | 20 | 14 | 27 | 48 | 31 | 31 | 31 |
| 6..... | 20 | 14 | 12 | 14 | 20 | 20 | 14 | 35 | 35 | 27 | 31 | 27 |
| 7..... | 24 | 17 | 12 | 14 | 20 | 27 | 14 | 31 | 31 | 27 | 31 | 31 |
| 8..... | 24 | 14 | 12 | 12 | 20 | 20 | 14 | 27 | 31 | 24 | 31 | 31 |
| 9..... | 24 | 14 | 12 | 12 | 20 | 27 | 14 | 27 | 27 | 24 | 27 | 31 |
| 10..... | 74 | 14 | 9 | 9 | 27 | 24 | 14 | 24 | 92 | 27 | 27 | 31 |
| 11..... | 40 | 14 | 9 | 9 | 17 | 24 | 14 | 27 | 490 | 35 | 27 | 44 |
| 12..... | 58 | 20 | 9 | 9 | 17 | 24 | 17 | 24 | 280 | 35 | 31 | 74 |
| 13..... | 35 | 17 | 12 | 9 | 17 | 31 | 17 | 24 | 113 | 27 | 27 | 40 |
| 14..... | 27 | 35 | 27 | 20 | 17 | 27 | 17 | 27 | 44 | 27 | 27 | 48 |
| 15..... | 27 | 27 | 35 | 14 | 14 | 27 | 99 | 24 | 35 | 27 | 24 | 27 |
| 16..... | 27 | 121 | 27 | 99 | 14 | 24 | 35 | 27 | 58 | 27 | 44 | 31 |
| 17..... | 24 | 68 | 24 | 31 | 14 | 24 | 31 | 31 | 31 | 40 | 31 | 27 |
| 18..... | 27 | 35 | 17 | 20 | 14 | 20 | 20 | 35 | 31 | 167 | 27 | 24 |
| 19..... | 31 | 24 | 14 | 20 | 12 | 20 | 27 | 31 | 31 | 99 | 27 | 24 |
| 20..... | 27 | 20 | 14 | 17 | 20 | 20 | 24 | 31 | 31 | 74 | 31 | 27 |
| 21..... | 24 | 20 | 14 | 24 | 24 | 20 | 24 | 92 | 31 | 63 | 27 | 31 |
| 22..... | 24 | 17 | 12 | 24 | 17 | 20 | 24 | 40 | 31 | 58 | 35 | 27 |
| 23..... | 24 | 17 | 12 | 20 | 14 | 17 | 24 | 31 | 27 | 48 | 31 | 24 |
| 24..... | 20 | 35 | 14 | 17 | 17 | 27 | 20 | 31 | 27 | 35 | 27 | 24 |
| 25..... | 20 | 20 | 14 | 24 | 14 | 14 | 24 | 35 | 27 | 35 | 27 | 24 |
| 26..... | 20 | 20 | 17 | 24 | 31 | 12 | 35 | 31 | 27 | 35 | 27 | 24 |
| 27..... | 20 | 17 | 27 | 17 | 44 | 14 | 31 | 31 | 27 | 35 | 27 | 24 |
| 28..... | 20 | 17 | 20 | 17 | 27 | 40 | 27 | 35 | 27 | 44 | 24 | 20 |
| 29..... | 20 | 14 | 20 | 17 | 35 | 24 | 27 | ..... | 27 | 35 | 35 | 20 |
| 30..... | 20 | 17 | 17 | 17 | 40 | 20 | 35 | ..... | 24 | 31 | 27 | 20 |
| 31..... | 20 | 17 | ..... | 17 | ..... | 17 | 27 | ..... | 24 | ..... | 27 | ..... |

Monthly discharge of East Branch of North Fork of Wailua River near Lihue, Kauai, for the year ending June 30, 1918.

| Month. | Discharge. | | | | Total run-off. | |
|----------------|--------------------------|----------|-------|---------------------|------------------|------------|
| | Million gallons per day. | | | Second-foot (mean). | Million gallons. | Acre-feet. |
| | Maximum. | Minimum. | Mean. | | | |
| July..... | 74 | 20 | 27.6 | 42.7 | 856 | 2,630 |
| August..... | 121 | 14 | 19.6 | 30.3 | 607 | 1,860 |
| September..... | 35 | 9 | 16.1 | 24.9 | 482 | 1,480 |
| October..... | 99 | 9 | 19.8 | 30.6 | 613 | 1,880 |
| November..... | 53 | 12 | 23.1 | 35.7 | 694 | 2,130 |
| December..... | 40 | 12 | 22.1 | 34.2 | 685 | 2,100 |
| January..... | 99 | 9 | 23.5 | 36.4 | 727 | 2,240 |
| February..... | 92 | 20 | 30.9 | 47.8 | 866 | 2,660 |
| March..... | 490 | 24 | 58.9 | 91.1 | 1,830 | 5,600 |
| April..... | 167 | 24 | 43.5 | 67.3 | 1,310 | 4,000 |
| May..... | 44 | 24 | 29.3 | 45.3 | 908 | 2,790 |
| June..... | 74 | 20 | 29.8 | 46.1 | 895 | 2,740 |
| The year..... | 490 | 9 | 28.7 | 44.4 | 10,500 | 32,100 |

KAPAA RIVER NEAR KEALIA, KAUAI.

LOCATION.—A quarter of a mile below confluence of two main branches, $1\frac{1}{2}$ miles above intake of Kapahi ditch, and 6 miles northwest of Kealia.

RECORDS AVAILABLE.—June 23, 1915, to June 30, 1918. 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 below gage; right bank vertical; left bank high with gentle slope. Control fairly permanent between extreme floods.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 8.52 feet at 4 p. m. March 16 (discharge, 750 million gallons per day, or 1,150 second-feet); minimum stage recorded, 1.75 feet October 8–12 and November 16–19 (discharge, 11 million gallons per day, or 17 second-feet).

1915–1918: Maximum stage recorded, 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).

1910–1915: Maximum stage recorded, 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.—For irrigation of sugar cane and for domestic supply.

ACCURACY.—Insufficient number of discharge measurements to make certain that stage-discharge relation was permanent. Rating curve fairly well defined. Operation of water-stage recorder unsatisfactory at times as shown in footnote to table of daily discharge.

Discharge measurements of Kapaa River near Kealia, Kauai, during the year ending June 30, 1918.

[Made by W. V. Hardy.]

| Date. | Gage height (feet). | Discharge. | |
|--------------|---------------------|--------------|--------------------------|
| | | Second-feet. | Million gallons per day. |
| Mar. 24..... | 3.06 | 124 | 80 |
| June 4..... | 1.98 | 22 | 14 |

Daily discharge, in million gallons, of Kapaa River near Kealia, Kauai, for the year ending June 30, 1918.

| Day. | July. | Aug. | Sept. | Oct. | Nov. | Dec. | Jan. | Feb. | Mar. | Apr. | May. | June. |
|---------|-------|------|-------|------|-------|------|------|-------|------|-------|------|-------|
| 1..... | 20 | 20 | 18 | 12 | 12 | 16 | 13 | 26 | 20 | 24 | 13 | 19 |
| 2..... | 20 | 20 | 16 | 12 | 40 | 13 | 13 | 17 | 20 | 107 | 12 | 17 |
| 3..... | 44 | 20 | 16 | 13 | 48 | 13 | 13 | 14 | 24 | 188 | 17 | 17 |
| 4..... | 34 | 22 | 16 | 13 | 17 | 13 | 13 | 18 | 56 | 122 | 31 | 18 |
| 5..... | 22 | 20 | 16 | 12 | 16 | 13 | 13 | 48 | 127 | 48 | 22 | 18 |
| 6..... | 28 | 20 | 16 | 12 | 14 | 17 | 13 | 60 | 97 | 22 | 16 | 17 |
| 7..... | 26 | 20 | 16 | 12 | 16 | 24 | 13 | 22 | 37 | 22 | 24 | 17 |
| 8..... | 28 | 20 | 16 | 11 | 16 | 14 | 13 | 44 | 31 | 22 | 17 | 17 |
| 9..... | 92 | 20 | 16 | 11 | 14 | 18 | 13 | 56 | 20 | 44 | 16 | 18 |
| 10..... | 44 | 20 | 14 | 11 | 20 | 17 | 12 | 20 | 65 | 117 | 16 | 20 |
| 11..... | 78 | 18 | 14 | 11 | 13 | 14 | 14 | 34 | 164 | 152 | 22 | 20 |
| 12..... | 31 | 34 | 14 | 11 | 12 | 14 | 13 | 26 | 182 | 74 | 40 | 37 |
| 13..... | 28 | 34 | 14 | 12 | 12 | 17 | 18 | 28 | 152 | 20 | 22 | 31 |
| 14..... | 28 | 28 | 16 | 13 | 12 | 14 | 24 | 20 | 92 | 18 | 20 | 28 |
| 15..... | 24 | 122 | 17 | 12 | 12 | 13 | 24 | 17 | 188 | 14 | 20 | 24 |
| 16..... | 22 | 56 | 31 | 37 | 11 | 17 | 16 | 16 | 194 | 14 | 56 | 28 |
| 17..... | 40 | 28 | 37 | 24 | 11 | 14 | 16 | 17 | 65 | 13 | 40 | 18 |
| 18..... | 31 | 24 | 22 | 16 | 11 | 13 | 16 | 22 | 40 | 78 | 20 | 18 |
| 19..... | 22 | 22 | 17 | 12 | 11 | 13 | 16 | 18 | 44 | 37 | 18 | 20 |
| 20..... | 20 | 22 | 16 | 11 | 20 | 13 | 16 | 28 | 31 | 18 | 26 | 22 |
| 21..... | 22 | 22 | 16 | 14 | 24 | 17 | 16 | 48 | 26 | 20 | 22 | 26 |
| 22..... | 20 | 20 | 16 | 16 | 14 | 13 | 20 | 40 | 24 | 20 | 31 | 20 |
| 23..... | 20 | 20 | 16 | 16 | 12 | 12 | 22 | 20 | 24 | 13 | 22 | 18 |
| 24..... | 20 | 28 | 17 | 12 | 13 | 12 | 18 | 17 | 52 | 12 | 19 | 17 |
| 25..... | 20 | 22 | 16 | 12 | 12 | 12 | 22 | 20 | 17 | 12 | 20 | 14 |
| 26..... | 20 | 20 | 14 | 22 | 28 | 13 | 44 | 26 | 17 | 17 | 18 | 16 |
| 27..... | 20 | 16 | 18 | 13 | 24 | 13 | 88 | 18 | 16 | 18 | 26 | 17 |
| 28..... | 20 | 16 | 16 | 13 | 18 | 13 | 40 | 44 | 24 | 13 | 22 | 15 |
| 29..... | 20 | 16 | 14 | 13 | 17 | 13 | 20 | ..... | 31 | 13 | 37 | 15 |
| 30..... | 20 | 16 | 13 | 16 | 24 | 13 | 26 | ..... | 17 | 13 | 24 | 14 |
| 31..... | 20 | 16 | ..... | 14 | ..... | 13 | 17 | ..... | 14 | ..... | 21 | ..... |

NOTE.—Gage-height record Aug. 24-31, Oct. 17, 18, 27-29, Dec. 26 to Jan. 25, May 1, 6, 13, 18, 19, 21, 23-26-31, June 1, 4, and 27-30 believed unreliable; discharge for these periods ascertained by comparison with record of Kapahi ditch.

Monthly discharge of Kapaa River near Kealia, Kauai, for the year ending June 30, 1918.

| Month. | Discharge. | | | | Total run-off. | |
|----------------|--------------------------|----------|-------|---------------------|------------------|------------|
| | Million gallons per day. | | | Second-feet (mean). | Million gallons. | Acre-feet. |
| | Maximum. | Minimum. | Mean. | | | |
| July..... | 92 | 20 | 29.2 | 45.2 | 904 | 2,780 |
| August..... | 122 | 16 | 25.9 | 40.1 | 802 | 2,460 |
| September..... | 37 | 13 | 17.1 | 26.4 | 514 | 1,570 |
| October..... | 37 | 11 | 14.2 | 22.0 | 459 | 1,350 |
| November..... | 48 | 11 | 17.5 | 27.1 | 524 | 1,610 |
| December..... | 24 | 12 | 14.3 | 22.1 | 444 | 1,300 |
| January..... | 88 | 12 | 20.5 | 31.7 | 635 | 1,950 |
| February..... | 60 | 14 | 28.0 | 43.3 | 784 | 2,410 |
| March..... | 194 | 14 | 61.6 | 95.3 | 1,910 | 5,860 |
| April..... | 188 | 12 | 43.5 | 67.3 | 1,300 | 4,000 |
| May..... | 56 | 12 | 23.5 | 36.4 | 730 | 2,240 |
| June..... | 37 | 14 | 19.9 | 30.8 | 596 | 1,830 |
| The year..... | 194 | 11 | 26.3 | 40.7 | 9,590 | 29,400 |

KAPAHU 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; July 1, 1915, to June 30, 1918.

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 year, 1.63 feet at 5.30 a. m. January 26 (discharge, 90 million gallons per day, or 139 second-feet); minimum stage recorded, 0.15 foot April 7 (discharge, 2.5 million gallons per day, or 3.9 second-feet).

Maximum stage recorded during period of record, 1.98 feet¹ at 2 a. m. September 16, 1915 (discharge, 120 million gallons per day, or 186 second-feet); water shut off November 23 and 24, 1916.

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

REGULATION.—Flow regulated by head gates.

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

ACCURACY.—Stage-discharge relation permanent. Rating curve well defined.

Operation of water-stage recorder satisfactory, except as shown in footnote to table of daily discharge. Records excellent when water-stage recorder was operating; poor or worse for interpolated periods, owing to control of flow by head gates.

Daily discharge, in million gallons, of Kapahu ditch near Kealia, Kauai, for the year ending June 30, 1918.

| Day. | July. | Aug. | Sept. | Oct. | Nov. | Dec. | Jan. | Feb. | Mar. | Apr. | May. | June. |
|---------|-------|------|-------|------|-------|------|------|-------|-------|-------|------|-------|
| 1..... | 10.5 | 13.3 | 15.2 | 10.5 | 10.1 | 8.9 | 12.5 | 8.5 | 10.5 | 8.1 | 12.5 | 18.5 |
| 2..... | 10.9 | 14.7 | 10.5 | 10.1 | 12.9 | 8.9 | 12.5 | 10.1 | 9.3 | 7.8 | 9.7 | 16.5 |
| 3..... | 27.3 | 13.7 | 9.7 | 11.7 | 13.7 | 8.9 | 12.1 | 10.1 | 8.5 | 6.4 | 8.1 | 16.5 |
| 4..... | 24.0 | 16.0 | 9.3 | 11.7 | 13.7 | 12.9 | 12.1 | 9.7 | 8.5 | 4.4 | 12.1 | 17.5 |
| 5..... | 13.7 | 14.2 | 9.3 | 10.9 | 12.9 | 13.3 | 12.1 | 7.4 | 8.5 | 4.1 | 13.7 | 18.0 |
| 6..... | 18.0 | 13.7 | 9.3 | 10.5 | 12.1 | 12.1 | 12.1 | 6.4 | 7.0 | 2.8 | 15.6 | 17.0 |
| 7..... | 17.0 | 13.7 | 9.3 | 10.1 | 12.9 | 7.4 | 12.1 | 6.4 | 6.4 | 2.5 | 14.2 | 16.0 |
| 8..... | 17.5 | 13.3 | 9.3 | 9.3 | 14.2 | 6.0 | 12.1 | 6.4 | 10.1 | 6.4 | 16.0 | 14.2 |
| 9..... | 15.2 | 13.3 | 9.7 | 9.3 | 13.3 | 6.0 | 12.1 | 7.0 | 11.7 | 15.6 | 14.2 | 14.2 |
| 10..... | 6.0 | 13.3 | 9.7 | 8.9 | 16.0 | 6.0 | 12.1 | 7.0 | 8.1 | 9.3 | 12.5 | 12.5 |
| 11..... | 10.1 | 15.2 | 9.7 | 8.9 | 12.5 | 7.8 | 13.3 | 7.8 | ..... | 5.0 | 18.5 | 13.7 |
| 12..... | 11.7 | 26.8 | 9.7 | 9.3 | 11.7 | 10.5 | 12.9 | 8.1 | ..... | 4.7 | 23.0 | 32.0 |
| 13..... | 11.7 | 27.3 | 9.7 | 9.3 | 10.9 | 10.9 | 17.5 | 8.1 | ..... | 4.4 | 22.0 | 18.5 |
| 14..... | 11.7 | 25.2 | 12.5 | 12.5 | 10.5 | 10.9 | 22.5 | 11.7 | ..... | 4.4 | 17.5 | 14.7 |
| 15..... | 11.7 | 12.5 | ..... | 10.9 | 10.5 | 10.9 | 22.5 | 12.9 | ..... | 4.4 | 16.0 | 16.0 |
| 16..... | 11.3 | 9.7 | ..... | 28.4 | 10.5 | 11.3 | 14.7 | 8.9 | ..... | 6.0 | 25.2 | 19.5 |
| 17..... | 10.9 | 18.0 | ..... | 22.5 | 9.3 | 11.3 | 14.2 | 6.0 | ..... | 7.0 | 23.0 | 17.5 |
| 18..... | 10.9 | 20.0 | ..... | 15.2 | 9.7 | 11.3 | 13.7 | 6.0 | 3.8 | 6.4 | 19.5 | 14.7 |
| 19..... | 10.9 | 17.0 | ..... | 9.7 | 9.7 | 11.3 | 15.2 | 8.1 | 4.1 | 5.0 | 17.0 | 17.5 |
| 20..... | 13.3 | 17.0 | ..... | 8.9 | 17.0 | 11.3 | 16.0 | 8.9 | ..... | 4.7 | 23.0 | 20.0 |
| 21..... | 12.9 | 16.5 | ..... | 12.5 | 24.0 | 11.7 | 15.6 | 7.0 | ..... | 5.0 | 20.5 | 22.0 |
| 22..... | 12.5 | 16.5 | 10.9 | 19.7 | 13.3 | 10.9 | 19.5 | 6.7 | ..... | 5.0 | 19.0 | 17.0 |
| 23..... | 12.5 | 15.6 | 9.7 | 10.9 | 11.3 | 11.3 | 20.5 | 8.9 | 10.1 | 6.4 | 22.0 | 17.5 |
| 24..... | 12.5 | 27.3 | 9.7 | 11.7 | 12.9 | 11.3 | 16.0 | 10.1 | 8.1 | 6.7 | 19.0 | 17.0 |
| 25..... | 13.3 | 21.5 | 9.7 | 8.9 | 11.3 | 11.7 | 20.0 | 10.1 | 7.0 | 5.6 | 20.0 | 13.3 |
| 26..... | 15.2 | 17.0 | 10.5 | 11.7 | 24.0 | 12.1 | 39.8 | 10.1 | 9.3 | 5.6 | 17.5 | 14.7 |
| 27..... | 14.2 | 15.6 | 17.5 | 12.9 | 12.1 | 12.5 | 12.5 | 10.1 | 9.3 | 5.6 | 42.0 | 16.5 |
| 28..... | 14.2 | 15.2 | 14.7 | 12.1 | 9.3 | 12.9 | 7.4 | 10.5 | 6.7 | 5.6 | 22.0 | 14.2 |
| 29..... | 13.7 | 14.7 | 13.3 | 12.9 | 9.3 | 12.5 | 7.4 | ..... | 6.0 | 5.6 | 19.0 | 14.2 |
| 30..... | 13.3 | 15.2 | 12.1 | 10.9 | 8.9 | 12.1 | 7.4 | ..... | 5.6 | 7.8 | 23.5 | 13.7 |
| 31..... | 13.3 | 15.2 | ..... | 9.3 | ..... | 12.1 | 7.0 | ..... | 5.6 | ..... | 21.0 | ..... |

NOTE.—No gage-height record and discharge estimated Sept. 15-21, 11 million gallons per day; Mar. 11-17 and 20-22, 7 million gallons per day.

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

Monthly discharge of Kapahi ditch near Kealia, Kauai, for the year ending June 30, 1918.

| Month. | Discharge. | | | | Total run-off. | |
|----------------|--------------------------|----------|-------|---------------------|------------------|------------|
| | Million gallons per day. | | | Second-foot (mean). | Million gallons. | Acre-feet. |
| | Maximum. | Minimum. | Mean. | | | |
| July..... | 27.3 | 6.0 | 13.6 | 21.0 | 422 | 1,290 |
| August..... | 27.3 | 9.7 | 16.7 | 25.8 | 518 | 1,590 |
| September..... | 17.5 | 9.3 | 10.9 | 16.9 | 328 | 1,000 |
| October..... | 28.4 | 8.9 | 11.7 | 18.1 | 362 | 1,110 |
| November..... | 24.0 | 8.9 | 12.7 | 19.6 | 380 | 1,170 |
| December..... | 13.3 | 6.0 | 10.6 | 16.4 | 329 | 1,010 |
| January..... | 39.8 | 7.0 | 14.8 | 22.9 | 457 | 1,410 |
| February..... | 12.9 | 6.0 | 8.54 | 13.2 | 239 | 734 |
| March..... | 11.7 | 5.6 | 7.55 | 11.7 | 234 | 718 |
| April..... | 15.6 | 2.5 | 5.94 | 9.19 | 178 | 547 |
| May..... | 25.2 | 8.1 | 18.1 | 28.0 | 561 | 1,720 |
| June..... | 32.0 | 12.5 | 16.8 | 26.0 | 505 | 1,550 |
| The year..... | 39.8 | 2.5 | 12.4 | 19.2 | 4,510 | 13,800 |

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, 1918. 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, 1918. 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, 7.40 feet at 5.30 p. m. March 16 (discharge, approximately 710 million gallons per day, or 1,100 second-feet); minimum stage recorded, 1.7 feet September 26 and 27 (discharge, 4.3 million gallons per day, or 6.7 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.—Stage-discharge relation not permanent. Three rating curves fairly well defined, applicable July 1 to August 15, August 16 to April 3, and April 4 to June 30. Operation of water-stage recorder satisfactory except as shown in footnote to table of daily discharge. Records fair.

Discharge measurements of Anahola River near Kealia, Kauai, during the year ending June 30, 1918.

[Made by W. V. Hardy.]

| Date. | Gage height (feet). | Discharge. | | Date. | Gage height (feet). | Discharge. | |
|-----------|---------------------|--------------|--------------------------|---------------|---------------------|--------------|--------------------------|
| | | Second-foot. | Million gallons per day. | | | Second-foot. | Million gallons per day. |
| Aug. | 1.93 | 15.3 | 9.9 | Mar. 25. | 2.12 | 18.2 | 12 |
| 27. | 1.88 | 10.3 | 6.7 | June 3. | 2.00 | 11.2 | 7.2 |

Daily discharge, in million gallons, of Anahola River near Kealia, Kauai, for the year ending June 30, 1918.

| Day. | July. | Aug. | Sept. | Oct. | Nov. | Dec. | Jan. | Feb. | Mar. | Apr. | May. | June. |
|----------|-------|------|-------|------|-------|------|------|-------|------|-------|------|-------|
| 1. | 11 | 7.2 | 6.2 | 5.5 | 5.5 | 7.0 | 5.5 | 15 | 9.2 | 51 | 7.0 | 7.0 |
| 2. | 26 | 9.5 | 6.2 | 5.5 | 20 | 7.0 | 5.5 | 11 | 8.1 | 148 | 7.0 | 7.0 |
| 3. | 23 | 8.4 | 6.2 | 5.5 | 38 | 7.0 | 5.5 | 9.2 | 8.1 | 267 | 7.0 | 7.0 |
| 4. | 16 | 9.5 | 5.5 | 5.5 | 9.2 | 7.0 | 5.5 | 9.2 | 20 | 118 | 15 | 7.0 |
| 5. | 16 | 7.2 | 5.5 | 5.5 | 8.1 | 9.2 | 5.5 | 30 | 70 | 51 | 15 | 7.0 |
| 6. | 18 | 7.2 | 5.5 | 5.5 | 7.0 | 23 | 5.5 | 70 | 65 | 23 | 12 | 6.2 |
| 7. | 12 | 7.2 | 5.5 | 5.5 | 7.0 | 42 | 5.5 | 15 | 23 | 18 | 34 | 6.2 |
| 8. | 9.5 | 7.2 | 5.5 | 5.5 | 7.0 | 11 | 5.5 | 80 | 12 | 14 | 12 | 8.1 |
| 9. | 9.5 | 7.2 | 5.5 | 5.5 | 7.0 | 12 | 5.5 | 56 | 11 | 20 | 8.1 | 9.2 |
| 10. | 8.4 | 7.2 | 5.5 | 5.5 | 9.2 | 9.2 | 5.5 | 15 | 20 | 70 | 8.1 | 7.0 |
| 11. | 11 | 7.2 | 4.9 | 5.5 | 7.0 | 9.2 | 5.5 | 23 | 130 | 142 | 15 | 6.2 |
| 12. | 8.4 | 11 | 4.9 | 5.5 | 6.2 | 8.1 | 5.5 | 15 | 148 | 70 | 42 | 15 |
| 13. | 8.4 | 12 | 4.9 | 5.5 | 5.5 | 9.2 | 5.5 | 15 | 130 | 26 | 12 | 30 |
| 14. | 7.2 | 8.4 | 12 | 5.5 | 5.5 | 8.1 | 9.2 | 14 | 113 | 20 | 9.2 | 9.2 |
| 15. | 7.2 | 91 | 14 | 4.9 | 5.5 | 7.0 | 26 | 12 | 185 | 15 | 9.2 | 7.0 |
| 16. | 7.2 | 30 | 34 | 30 | 5.5 | 7.0 | 7.0 | 12 | 192 | 20 | 26 | 7.0 |
| 17. | 7.2 | 11 | 34 | 20 | 5.5 | 7.0 | 6.2 | 12 | 91 | 18 | 20 | 7.0 |
| 18. | 7.2 | 8.1 | 11 | 9.2 | 5.5 | 7.0 | 6.2 | 12 | 51 | 75 | 11 | 7.0 |
| 19. | 7.2 | 7.0 | 7.0 | 7.0 | 5.5 | 7.0 | 6.2 | 12 | 30 | 30 | 9.2 | 7.0 |
| 20. | 7.2 | 7.0 | 5.5 | 7.0 | 6.2 | 7.0 | 7.0 | 15 | 23 | 15 | 14 | 7.0 |
| 21. | 7.2 | 6.2 | 5.5 | 6.2 | 12 | 8.1 | 6.2 | 23 | 18 | 11 | 12 | 7.0 |
| 22. | 7.2 | 6.2 | 4.9 | 6.2 | 7.0 | 7.0 | 5.5 | 18 | 18 | 26 | 34 | 6.2 |
| 23. | 7.2 | 5.5 | 4.9 | 5.5 | 5.5 | 7.0 | 6.2 | 9.2 | 14 | 14 | 14 | 6.2 |
| 24. | 14 | 30 | 4.9 | 5.5 | 11 | 6.2 | 6.2 | 9.2 | 18 | 12 | 9.2 | 5.5 |
| 25. | 12 | 8.1 | 4.9 | 6.2 | 7.0 | 6.2 | 7.0 | 20 | 12 | 12 | 12 | 5.5 |
| 26. | 8.4 | 7.0 | 4.3 | 6.2 | 15 | 6.2 | 34 | 15 | 12 | 12 | 8.1 | 6.2 |
| 27. | 7.2 | 7.0 | 4.3 | 5.5 | 14 | 6.2 | 91 | 9.2 | 12 | 12 | 14 | 5.5 |
| 28. | 8.4 | 7.0 | 9.2 | 5.5 | 9.2 | 5.5 | 42 | 14 | 20 | 8.1 | 9.2 | 12 |
| 29. | 8.4 | 6.2 | 8.1 | 5.5 | 9.2 | 6.2 | 15 | ..... | 56 | 8.1 | 34 | 9.2 |
| 30. | 8.4 | 6.2 | 6.2 | 5.5 | 15 | 5.5 | 14 | ..... | 15 | 8.1 | 12 | 12 |
| 31. | 7.2 | 6.2 | ..... | 5.5 | ..... | 5.5 | 11 | ..... | 12 | ..... | 8.1 | ..... |

NOTE.—No gage-height record Oct. 2-5; discharge interpolated.

Monthly discharge of Anahola River near Kealia, Kauai, for the year ending June 30, 1918.

| Month. | Discharge. | | | | Total run-off. | |
|-----------------|--------------------------|----------|-------|---------------------|------------------|------------|
| | Million gallons per day. | | | Second-foot (mean). | Million gallons. | Acre-feet. |
| | Maximum. | Minimum. | Mean. | | | |
| July. | 26 | 7.2 | 10.4 | 16.1 | 323 | 989 |
| August. | 91 | 5.5 | 11.8 | 18.2 | 366 | 1,120 |
| September. | 34 | 4.3 | 7.55 | 11.7 | 226 | 695 |
| October. | 30 | 4.9 | 7.04 | 10.9 | 218 | 670 |
| November. | 38 | 5.5 | 9.36 | 14.5 | 281 | 862 |
| December. | 42 | 5.5 | 9.05 | 14.0 | 281 | 861 |
| January. | 91 | 5.5 | 12.2 | 18.9 | 377 | 1,160 |
| February. | 80 | 9.2 | 20.4 | 31.6 | 570 | 1,750 |
| March. | 192 | 8.1 | 49.9 | 77.2 | 1,550 | 4,750 |
| April. | 267 | 8.1 | 44.5 | 68.8 | 1,330 | 4,100 |
| May. | 42 | 7.0 | 14.8 | 22.9 | 459 | 1,410 |
| June. | 30 | 5.5 | 8.31 | 12.8 | 249 | 765 |
| The year. | 267 | 4.3 | 17.1 | 26.4 | 6,230 | 19,100 |

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, 1918.

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 with a spillway 50 feet below gage. Control when spillway is closed is timber sill on check gate below spillway.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 3.68 feet at 7 p. m. March 16 (discharge, 52 million gallons per day, or 81 second-feet); minimum stage recorded, 1.1 feet October 15 and January 2-5 and 9-10 (discharge, 1.6 million gallons per day, or 2.5 second-feet).

1915-1918: 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. When Kaneha reservoir is full, water is turned out of ditch at spillway just below gage. This affects the stage-discharge relation.

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

ACCURACY.—Stage-discharge relation not permanent. Curve used when spillway is closed, well defined below 20 million gallons per day; curve used when spillway is open, fairly well defined below 20 million gallons per day. Operation of water-stage recorder satisfactory except for 3 days in January. Record good when water was not wasting and recorder operating, fair at other times.

Discharge measurements of Anahola ditch above Kaneha reservoir, near Kealia, Kauai, during the year ending June 30, 1918.

[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. |
| Aug. 2..... | 1.51 | 7.7 | 5.0 | Jan. 29..... | 1.46 | 10.4 | 6.8 |
| 27..... | 1.31 | 5.3 | 3.5 | Mar. 25..... | 1.52 | 7.4 | 4.8 |
| Sept. 28..... | 1.69 | 16.5 | 11 | | | | |

Daily discharge, in million gallons, of Anahola ditch above Kaneha reservoir, near Kealia, Kauai, for the year ending June 30, 1918.

| Day. | July. | Aug. | Sept. | Oct. | Nov. | Dec. | Jan. | Feb. | Mar. | Apr. | May. | June. |
|---------|-------|------|-------|------|-------|------|------|-------|------|-------|------|-------|
| 1..... | 2.2 | 3.4 | 3.4 | 1.9 | 1.9 | 4.4 | 1.9 | 6.4 | 6.4 | 11.2 | 3.9 | 5.4 |
| 2..... | 2.6 | 4.4 | 2.6 | 2.2 | 9.6 | 3.4 | 1.6 | 5.4 | 6.4 | 16.2 | 3.9 | 4.9 |
| 3..... | 6.4 | 2.6 | 2.2 | 3.0 | 8.2 | 3.4 | 1.6 | 4.4 | 6.4 | 13.6 | 4.9 | 4.9 |
| 4..... | 7.0 | 4.9 | 2.2 | 3.0 | 6.4 | 3.4 | 1.6 | 3.9 | 9.6 | 13.6 | 9.6 | 4.4 |
| 5..... | 3.0 | 2.6 | 2.2 | 2.6 | 5.4 | 3.4 | 1.6 | 7.0 | 13.6 | 10.4 | 13.6 | 6.4 |
| 6..... | 3.0 | 2.2 | 1.9 | 2.2 | 4.4 | 6.4 | 2.2 | 8.9 | 13.6 | 8.2 | 9.6 | 4.4 |
| 7..... | 4.9 | 2.2 | 1.9 | 2.2 | 3.9 | 7.0 | 1.9 | 3.0 | 11.2 | 7.6 | 7.0 | 3.9 |
| 8..... | 5.4 | 2.2 | 1.9 | 1.9 | 3.0 | 6.4 | 1.9 | 7.6 | 8.9 | 7.6 | 6.4 | 5.4 |
| 9..... | 12.8 | 2.2 | 1.9 | 1.9 | 3.4 | 7.0 | 1.6 | 7.6 | 7.6 | 13.6 | 6.4 | 7.0 |
| 10..... | 9.6 | 2.2 | 1.9 | 1.9 | 4.9 | 6.4 | 1.6 | 6.4 | 8.9 | 16.2 | 12.8 | 4.9 |
| 11..... | 12.0 | 2.2 | 1.9 | 1.9 | 3.0 | 5.9 | 3.0 | 7.6 | 9.6 | 14.5 | 11.2 | 4.4 |
| 12..... | 8.2 | 5.9 | 1.9 | 1.9 | 2.6 | 5.4 | 2.2 | 6.4 | 6.4 | 12.0 | 12.0 | 8.2 |
| 13..... | 8.9 | 6.4 | 2.6 | 1.9 | 2.2 | 4.9 | 2.6 | 7.0 | 6.4 | 10.4 | 8.2 | 8.2 |
| 14..... | 8.2 | 3.4 | 7.6 | 1.9 | 2.6 | 5.4 | 6.4 | 5.4 | 5.9 | 10.4 | 5.9 | 7.0 |
| 15..... | 6.4 | 11.2 | 7.0 | 1.6 | 2.2 | 3.9 | 7.6 | 4.4 | 7.6 | 10.4 | 5.4 | 6.4 |
| 16..... | 10.4 | 11.2 | 4.9 | 8.9 | 1.9 | 3.9 | 2.6 | 4.9 | 24.0 | 10.4 | 9.6 | 5.9 |
| 17..... | 5.4 | 7.0 | 7.0 | 10.4 | 1.9 | 3.4 | 2.2 | 4.4 | 13.6 | 12.8 | 9.6 | 6.4 |
| 18..... | 3.9 | 4.9 | 4.4 | 3.0 | 1.9 | 3.0 | 2.2 | 4.9 | 12.0 | 15.4 | 6.4 | 4.4 |
| 19..... | 3.9 | 3.9 | 3.4 | 2.6 | 1.9 | 3.0 | 2.2 | 5.4 | 8.9 | 9.6 | 5.4 | 5.4 |
| 20..... | 5.4 | 3.4 | 3.0 | 2.6 | 2.2 | 2.6 | 4.4 | 6.4 | 5.4 | 6.4 | 7.6 | 6.4 |
| 21..... | 4.4 | 3.0 | 3.9 | 2.6 | 6.4 | 2.6 | 2.6 | 6.4 | 6.4 | 6.4 | 5.4 | 7.6 |
| 22..... | 2.2 | 3.0 | 3.0 | 3.0 | 3.4 | 2.6 | 2.6 | 9.6 | 5.4 | 6.4 | 5.9 | 4.9 |
| 23..... | 3.0 | 3.0 | 2.6 | 2.6 | 2.2 | 2.6 | 4.9 | 5.9 | 5.4 | 6.4 | 8.2 | 5.4 |
| 24..... | 3.4 | 9.6 | 4.9 | 2.2 | 4.9 | 2.2 | 2.6 | 5.4 | 7.6 | 5.9 | 13.6 | 5.4 |
| 25..... | 7.0 | 4.9 | 3.9 | 3.0 | 3.0 | 2.2 | 6.3 | 8.2 | 5.4 | 5.4 | 8.9 | 3.9 |
| 26..... | 4.4 | 3.0 | 2.6 | 2.6 | 5.9 | 2.2 | 9.9 | 7.0 | 4.9 | 7.0 | 5.9 | 4.4 |
| 27..... | 3.9 | 3.0 | 4.4 | 2.2 | 7.6 | 2.2 | 13.6 | 4.9 | 5.9 | 7.6 | 8.2 | 4.9 |
| 28..... | 3.9 | 2.6 | 8.2 | 2.2 | 4.9 | 2.2 | 12.0 | 7.6 | 10.4 | 4.9 | 7.6 | 3.9 |
| 29..... | 3.4 | 2.6 | 6.4 | 2.2 | 4.4 | 1.9 | 7.0 | ----- | 9.6 | 4.4 | 9.6 | 3.4 |
| 30..... | 3.0 | 2.6 | 4.9 | 3.9 | 4.9 | 1.9 | 7.0 | ----- | 9.6 | 4.4 | 8.2 | 3.9 |
| 31..... | 2.6 | 2.2 | ----- | 2.6 | ----- | 1.9 | 7.0 | ----- | 7.6 | ----- | 6.4 | ----- |

NOTE.—No gage height record Jan. 25, 26, and 30; discharge interpolated. Water wasting below gage, July 11–21, Sept. 28–30, Nov. 2–7, Dec. 6–12, Jan. 27–29, Feb. 10–14, Feb. 21 to Mar. 19, Mar. 30 to Apr. 6, and Apr. 11–23.

Monthly discharge of Anahola ditch above Kaneha reservoir, near Kealia, Kauai, for the year ending June 30, 1918.

| Month. | Discharge. | | | | Total run-off. | |
|----------------|--------------------------|----------|-------|---------------------|------------------|-------------|
| | Million gallons per day. | | | Second-feet (mean). | Million gallons. | Acres-feet. |
| | Maximum. | Minimum. | Mean. | | | |
| July..... | 12.8 | 2.2 | 5.51 | 8.53 | 171 | 524 |
| August..... | 11.2 | 2.2 | 4.13 | 6.39 | 128 | 393 |
| September..... | 8.2 | 1.9 | 3.69 | 5.71 | 111 | 340 |
| October..... | 10.4 | 1.6 | 2.86 | 4.43 | 89 | 272 |
| November..... | 9.6 | 1.9 | 4.04 | 6.25 | 121 | 372 |
| December..... | 7.0 | 1.9 | 3.78 | 5.85 | 117 | 360 |
| January..... | 13.6 | 1.6 | 4.14 | 6.40 | 128 | 394 |
| February..... | 9.6 | 3.0 | 6.16 | 9.53 | 172 | 529 |
| March..... | 24.0 | 4.9 | 8.73 | 13.5 | 271 | 830 |
| April..... | 16.2 | 4.4 | 9.64 | 14.9 | 289 | 888 |
| May..... | 13.6 | 3.9 | 7.98 | 12.3 | 247 | 759 |
| June..... | 7.6 | 3.4 | 5.40 | 8.36 | 162 | 497 |
| The year..... | 24.0 | 1.6 | 5.50 | 8.51 | 2,010 | 6,160 |

KALIHIWAI RIVER NEAR HANAIEI, 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, 1918.

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; fairly permanent.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 6.07 feet at 8 p. m. March 12 (discharge, about 1,160 million gallons per day, or 1,800 second-feet); minimum stage recorded, 0.8 foot August 10-12 (discharge, 8 million gallons per day, or 12 second-feet).

1914-1918: Maximum stage recorded, 14.4 feet at 6.30 a. m., September 25, 1914 (discharge, computed from extension of rating curve, about 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.

REGULATION.—None.

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

ACCURACY.—Stage-discharge relation practically permanent. Rating curve well defined. Operation of water-stage recorder unsatisfactory, especially after March 10. Records fair when water-stage recorder was operating.

Discharge measurements of Kalihiwai River near Hanalei, Kauai, during the year ending June 30, 1918.

[Made by W. V. Hardy.]

| Date . | Gage height (feet). | Discharge. | |
|--------------|---------------------|--------------|--------------------------|
| | | Second-feet. | Million gallons per day. |
| Aug. 6..... | 0.93 | 15.9 | 10 |
| Dec. 22..... | 1.28 | 40 | 26 |
| Apr. 22..... | 1.32 | 47 | 30 |

Daily discharge, in million gallons, of Kalihiwai River near Hanalei, Kauai, for the year ending June 30, 1918.

| Day. | July. | Aug. | Sept. | Oct. | Nov. | Dec. | Jan. | Feb. | Mar. | Apr. |
|---------|-------|------|-------|-------|-------|------|------|-------|-------|-------|
| 1..... | 15 | 15 | 15 | 17 | 17 | 20 | 13 | 27 | 22 | 22 |
| 2..... | 15 | 15 | 12 | 20 | 68 | 17 | 13 | 20 | 24 | 63 |
| 3..... | 34 | 15 | 12 | 27 | 89 | 15 | 13 | 15 | 24 | 166 |
| 4..... | 34 | 17 | 10 | 34 | 30 | 13 | 13 | 15 | 73 | 125 |
| 5..... | 20 | 12 | 10 | 24 | 24 | 13 | 13 | 53 | 119 | 68 |
| 6..... | 20 | 12 | 10 | ..... | 20 | 20 | 13 | 95 | 101 | 34 |
| 7..... | 22 | 12 | 10 | ..... | 20 | 34 | 13 | 30 | 48 | 34 |
| 8..... | 20 | 12 | 9 | ..... | 17 | 15 | 12 | 89 | 30 | 24 |
| 9..... | 83 | 12 | 9 | ..... | 15 | 24 | 12 | 95 | 34 | 53 |
| 10..... | 43 | 12 | 8 | ..... | 22 | 20 | 13 | 38 | 107 | 151 |
| 11..... | 73 | 12 | 8 | ..... | 15 | 17 | 15 | 58 | ..... | 278 |
| 12..... | 30 | 22 | 8 | ..... | 13 | 15 | 15 | 38 | ..... | 138 |
| 13..... | 22 | 30 | 9 | ..... | 17 | 17 | 22 | 43 | ..... | 131 |
| 14..... | 22 | 24 | 20 | ..... | 17 | 15 | 53 | 30 | ..... | 95 |
| 15..... | 20 | 78 | 20 | ..... | 12 | 13 | 38 | 24 | 166 | 68 |
| 16..... | 20 | 58 | 20 | 131 | 12 | 13 | 20 | 24 | ..... | 63 |
| 17..... | 34 | 24 | 15 | 73 | 12 | 12 | 13 | 22 | ..... | 58 |
| 18..... | 27 | 20 | 13 | 58 | 12 | 10 | 13 | 22 | ..... | 83 |
| 19..... | 20 | 15 | 13 | 53 | 12 | 10 | 15 | 27 | ..... | 63 |
| 20..... | 17 | 13 | 12 | 53 | 12 | 10 | 15 | 34 | ..... | 43 |
| 21..... | 20 | 13 | 12 | 73 | 22 | 10 | 15 | 48 | ..... | 34 |
| 22..... | 17 | 13 | 12 | 68 | 13 | 12 | 15 | 43 | ..... | ..... |
| 23..... | 15 | 13 | 20 | 63 | 12 | 13 | 20 | 24 | ..... | ..... |
| 24..... | 15 | 43 | 15 | 48 | 20 | 13 | 13 | 20 | ..... | ..... |
| 25..... | 22 | 20 | 13 | 63 | 15 | 13 | 12 | 27 | ..... | ..... |
| 26..... | 20 | 17 | 24 | 58 | 38 | 12 | 34 | 38 | ..... | ..... |
| 27..... | 17 | 15 | 27 | 53 | 48 | 12 | 107 | 22 | ..... | ..... |
| 28..... | 15 | 13 | 22 | 20 | 24 | 13 | 48 | 34 | ..... | ..... |
| 29..... | 15 | 13 | 17 | 20 | 22 | 13 | 24 | ..... | 27 | ..... |
| 30..... | 15 | 12 | 17 | 24 | 38 | 13 | 34 | ..... | 24 | ..... |
| 31..... | 15 | 12 | ..... | 20 | ..... | 13 | 20 | ..... | 17 | ..... |

NOTE.—No gage height record Sept. 14-15, Oct. 1 and 6-15; discharge estimated. Mean discharge, Oct. 6-15, 20 million gallons per day.

Monthly discharge of Kalihiwai River near Hanalei, Kauai, for the year ending June 30, 1918.

| Month. | Discharge. | | | | Total run-off. | |
|-----------------|--------------------------|----------|-------|---------------------|------------------|------------|
| | Million gallons per day. | | | Second-foot (mean). | Million gallons. | Acre-feet. |
| | Maximum. | Minimum. | Mean. | | | |
| July..... | 83 | 15 | 25.1 | 38.8 | 777 | 2,390 |
| August..... | 78 | 12 | 19.8 | 30.6 | 614 | 1,880 |
| September..... | 27 | 8 | 14.1 | 21.8 | 422 | 1,300 |
| October..... | 131 | 17 | 38.7 | 59.9 | 1,200 | 3,680 |
| November..... | 89 | 12 | 23.6 | 36.5 | 708 | 2,170 |
| December..... | 34 | 10 | 14.8 | 22.9 | 460 | 1,410 |
| January..... | 107 | 12 | 22.2 | 34.3 | 689 | 2,110 |
| February..... | 95 | 15 | 37.7 | 58.3 | 1,060 | 3,240 |
| April 1-21..... | 278 | 22 | 85.4 | 132 | 1,790 | 5,500 |

HANALEI RIVER AT ELEVATION 625 FEET, NEAR HANALEI, KAUAI.

LOCATION.—2 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, 1918.

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.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 5.01 feet at 7.10 p. m. March 12 (discharge, 1,630 million gallons per day, or 2,530 second-feet); minimum stage recorded, 0.35 foot January 6 and 10 (discharge, 14 million gallons per day, or 22 second-feet).

1914-1918: Maximum stage recorded, 9.7 feet (new datum) September 26, 1914 (discharge, computed from extension of rating curve, about 3,800 million gallons per day, or 5,880 second-feet); minimum stage recorded during 1918.

DIVERSIONS.—None.

REGULATION.—None.

UTILIZATION.—Irrigation and domestic supply.

ACCURACY.—Stage-discharge relation practically permanent. Rating curve fairly well defined. Operation of water-stage recorder unsatisfactory, causing frequent gaps in record. Record fair.

Discharge measurements of Hanalei River at elevation 625 feet, near Hanalei, Kauai, during the year ending June 30, 1918.

[Made by W. V. Hardy.]

| Date. | Gage height (feet). | Discharge. | |
|--------------|---------------------|--------------|--------------------------|
| | | Second-feet. | Million gallons per day. |
| Aug. 5..... | 0.72 | 54 | 35 |
| Oct. 6..... | .69 | 53 | 35 |
| Apr. 21..... | 1.27 | 162 | 105 |

Daily discharge, in million gallons, of Hanalei River at elevation 625 feet, near Hanalei, Kauai, for the year ending June 30, 1918.

| Day. | July. | Aug. | Sept. | Oct. | Nov. | Dec. | Jan. | Feb. | Mar. | Apr. | May. | June. |
|---------|-------|------|-------|-------|-------|-------|------|-------|------|-------|------|-------|
| 1..... | 24 | 31 | 35 | 27 | ----- | 53 | 24 | 65 | 43 | 43 | 35 | 65 |
| 2..... | 27 | 27 | 35 | 27 | ----- | 43 | 21 | 48 | 59 | 110 | 35 | 48 |
| 3..... | 65 | 27 | 31 | 35 | ----- | 35 | 21 | 43 | 43 | 305 | 35 | 39 |
| 4..... | 94 | 27 | 31 | 35 | ----- | 31 | 21 | 43 | 190 | 585 | 148 | 43 |
| 5..... | 65 | 43 | 35 | 39 | ----- | 27 | 18 | 102 | 338 | 338 | 190 | 43 |
| 6..... | 53 | 39 | 35 | 35 | ----- | 35 | 14 | 168 | 262 | 148 | 94 | 43 |
| 7..... | 48 | 48 | 35 | 35 | ----- | 72 | 15 | 72 | 72 | 86 | 94 | 39 |
| 8..... | 43 | 39 | 39 | 31 | ----- | 43 | 15 | 110 | 72 | 72 | 110 | 43 |
| 9..... | 158 | 39 | 39 | 27 | ----- | 59 | 16 | 148 | 119 | 65 | 65 | 43 |
| 10..... | 128 | 39 | 39 | 27 | ----- | 43 | 14 | 79 | 212 | ----- | 48 | 43 |
| 11..... | 128 | 43 | 39 | 27 | ----- | 43 | 24 | 102 | 860 | ----- | 53 | 43 |
| 12..... | 86 | 53 | 43 | 27 | ----- | 48 | 24 | 79 | 860 | ----- | 110 | 72 |
| 13..... | 59 | 65 | 59 | 35 | ----- | 53 | 48 | 86 | 670 | ----- | 94 | 94 |
| 14..... | 43 | 148 | 179 | 35 | ----- | 53 | 119 | 65 | 305 | ----- | 65 | 79 |
| 15..... | 39 | 94 | 224 | 31 | ----- | 43 | 53 | 43 | 320 | ----- | 53 | 79 |
| 16..... | 31 | 236 | 224 | 212 | ----- | 43 | 39 | 39 | 465 | ----- | 59 | 86 |
| 17..... | 48 | 102 | 236 | 86 | 31 | ----- | 39 | 59 | 224 | ----- | 262 | 65 |
| 18..... | 43 | 65 | 276 | 53 | 27 | ----- | 39 | 86 | 119 | ----- | 128 | 43 |
| 19..... | 39 | 39 | 212 | 48 | 27 | ----- | 94 | 59 | 94 | ----- | 86 | 39 |
| 20..... | 35 | 31 | 179 | 43 | 35 | ----- | 65 | 94 | 94 | ----- | 79 | 43 |
| 21..... | 31 | 24 | 148 | ----- | 53 | ----- | 59 | 158 | 65 | 110 | 65 | 48 |
| 22..... | 27 | 21 | 138 | ----- | 39 | ----- | 72 | 138 | 53 | 102 | 94 | 39 |
| 23..... | 27 | 18 | 138 | ----- | 35 | ----- | 94 | 53 | 48 | 72 | 102 | 39 |
| 24..... | 27 | 119 | 128 | ----- | 43 | ----- | 65 | 43 | 86 | 65 | 65 | 65 |
| 25..... | 31 | 59 | 128 | ----- | 35 | ----- | 86 | 79 | 79 | 59 | 72 | 53 |
| 26..... | 35 | 43 | 53 | ----- | 110 | ----- | 179 | 86 | 72 | 59 | 65 | 48 |
| 27..... | 31 | 43 | 94 | ----- | 148 | ----- | 390 | 35 | 53 | 72 | 79 | 59 |
| 28..... | 35 | 43 | 59 | ----- | 79 | ----- | 212 | 65 | 65 | 53 | 72 | 48 |
| 29..... | 43 | 35 | 48 | ----- | 65 | ----- | 119 | ----- | 102 | 48 | 565 | 39 |
| 30..... | 27 | 35 | 31 | ----- | 94 | ----- | 138 | ----- | 94 | 43 | 190 | 39 |
| 31..... | 27 | 35 | ----- | ----- | ----- | 27 | 72 | ----- | 53 | ----- | 94 | ----- |

NOTE.—No gage height record Jan. 7 and 8; discharge interpolated.

Monthly discharge of Hanalei River at elevation 625 feet, near Hanalei, Kauai, for the year ending June 30, 1918.

| Month. | Discharge. | | | | Total run-off. | |
|---------------------|--------------------------|----------|-------|---------------------|------------------|------------|
| | Million gallons per day. | | | Second-foot (mean). | Million gallons. | Acre-feet. |
| | Maximum. | Minimum. | Mean. | | | |
| July..... | 153 | 24 | 51.5 | 79.7 | 1,600 | 4,900 |
| August..... | 236 | 21 | 55.2 | 85.4 | 1,710 | 5,250 |
| September..... | 276 | 31 | 99.7 | 154 | 2,990 | 9,180 |
| October 1-20..... | 212 | 27 | 45.8 | 70.9 | 915 | 2,810 |
| November 17-30..... | 148 | 27 | 58.6 | 90.7 | 821 | 2,520 |
| January..... | 390 | 14 | 71.3 | 110 | 2,210 | 6,780 |
| February..... | 168 | 35 | 80.2 | 124 | 2,250 | 6,890 |
| March..... | 860 | 43 | 200 | 309 | 6,190 | 19,000 |
| May..... | 565 | 35 | 107 | 166 | 3,310 | 10,200 |
| June..... | 94 | 39 | 52.3 | 80.9 | 1,570 | 4,820 |

HANALEI RIVER NEAR HANALEI, KAUAI.

LOCATION.—About 5 miles up river from Hanalei.

RECORDS AVAILABLE.—December 28, 1911, to June 30, 1918.

GAGE.—Inclined and vertical staff on left bank read by D. Kamaka.

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 year, 11.72 feet at 4.10 p. m. April 3 (discharged, 4,800 million gallons per day, or 7,440 second-feet); minimum stage recorded, 6.4 feet August 22 (discharge, 63 million gallons per day, or 98 second-feet).

1911-1918: Maximum stage recorded, 17.52 feet at 4 p. m. September 26, 1914 (discharge, computed from extension of rating curve, about 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.

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

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

Discharge measurements of Hanalei River near Hanalei, Kauai, during the year ending June 30, 1918.

[Made by W. V. Hardy.]

| Date. | Gage height (feet). | Discharge. | | Date. | Gage height (feet). | Discharge. | |
|--------------|---------------------|--------------|--------------------------|--------------|---------------------|--------------|--------------------------|
| | | Second-foot. | Million gallons per day. | | | Second-foot. | Million gallons per day. |
| Aug. 26..... | 6.74 | 154 | 100 | Mar. 7..... | 7.42 | 469 | 303 |
| Nov. 30..... | 7.23 | 314 | 203 | May 23..... | 7.10 | 270 | 174 |
| Dec. 5..... | 6.76 | 135 | 87 | June 14..... | 7.10 | 273 | 176 |
| Feb. 12..... | 7.16 | 255 | 165 | | | | |

Daily discharge, in million gallons, of Hanalei River near Hanalei, Kauai, for the year ending June 30, 1918.

| Day. | July. | Aug. | Sept. | Oct. | Nov. | Dec. | Jan. | Feb. | Mar. | Apr. | May. | June. |
|---------|-------|------|-------|-------|-------|------|-------|-------|-------|-------|-------|-------|
| 1..... | 85 | 82 | 85 | 92 | 85 | 109 | 75 | 118 | 68 | 155 | 92 | 155 |
| 2..... | 85 | 92 | 80 | 92 | 590 | 100 | 75 | 109 | 129 | 555 | 92 | 140 |
| 3..... | 205 | 85 | 75 | 85 | 520 | 100 | 75 | 100 | 155 | 3,600 | 100 | 129 |
| 4..... | 188 | 109 | 75 | 80 | 170 | 92 | 85 | 92 | 1,160 | 625 | 625 | 118 |
| 5..... | 109 | 85 | 75 | 85 | 155 | 100 | 75 | 85 | 2,230 | 400 | 1,120 | 118 |
| 6..... | 118 | 82 | 75 | 80 | 118 | 92 | 75 | 520 | 315 | 205 | 225 | 118 |
| 7..... | 129 | 85 | 75 | 80 | 109 | 170 | 75 | 170 | 268 | 170 | 118 | 109 |
| 8..... | 109 | 82 | 75 | 80 | 118 | 109 | 85 | 340 | 225 | 140 | 140 | 109 |
| 9..... | 129 | 82 | 75 | 75 | 109 | 268 | 75 | 315 | 490 | 370 | 129 | 109 |
| 10..... | 155 | 82 | 75 | 75 | 140 | 109 | 92 | 155 | 660 | 1,540 | 118 | 100 |
| 11..... | 625 | 85 | 72 | 75 | 129 | 109 | 80 | 245 | 2,590 | 2,350 | 340 | 109 |
| 12..... | 155 | 188 | 80 | 75 | 109 | 140 | 85 | 155 | 2,650 | 840 | 430 | 225 |
| 13..... | 140 | 170 | 92 | 80 | 85 | 140 | 80 | 340 | 1,340 | 1,590 | 140 | 245 |
| 14..... | 129 | 290 | 520 | 80 | 85 | 118 | 370 | 72 | 1,300 | 520 | 109 | 170 |
| 15..... | 109 | 155 | 520 | 75 | 85 | 100 | 140 | 129 | 800 | 290 | 225 | 140 |
| 16..... | 109 | 555 | 100 | 2,830 | 80 | 100 | 92 | 129 | 2,180 | 205 | 590 | 155 |
| 17..... | 170 | 129 | 555 | 140 | 80 | 92 | 85 | 140 | 370 | 140 | 170 | 129 |
| 18..... | 118 | 109 | 245 | 109 | 80 | 92 | 80 | 155 | 205 | 590 | 140 | 109 |
| 19..... | 92 | 92 | 92 | 92 | 80 | 85 | 245 | 140 | 155 | 290 | 129 | 118 |
| 20..... | 92 | 92 | 85 | 109 | 80 | 92 | 129 | 340 | 170 | 245 | 155 | 155 |
| 21..... | 100 | 85 | 85 | 129 | 140 | 92 | 92 | 555 | 140 | 170 | 68 | 290 |
| 22..... | 92 | 63 | 85 | 92 | 100 | 85 | 85 | 225 | 68 | 205 | 2,410 | 170 |
| 23..... | 92 | 80 | 80 | 85 | 80 | 85 | 118 | 155 | 118 | 140 | 155 | 129 |
| 24..... | 100 | 660 | 85 | 85 | 140 | 80 | 92 | 129 | 109 | 118 | 129 | 118 |
| 25..... | 225 | 100 | 80 | 400 | 92 | 80 | 100 | 188 | 245 | 109 | 205 | 245 |
| 26..... | 109 | 92 | 92 | 315 | 490 | 80 | 430 | 155 | 155 | 129 | 155 | 72 |
| 27..... | 109 | 85 | 225 | 109 | 315 | 80 | 1,040 | 72 | 140 | 155 | 188 | 118 |
| 28..... | 140 | 85 | 100 | 109 | 170 | 80 | 625 | 225 | 118 | 100 | 155 | 205 |
| 29..... | 109 | 92 | 129 | 92 | 140 | 80 | 140 | ----- | 460 | 92 | 1,840 | 118 |
| 30..... | 100 | 85 | 92 | 92 | 340 | 75 | 340 | ----- | 155 | 92 | 1,490 | 109 |
| 31..... | 92 | 85 | ----- | 92 | ----- | 75 | 140 | ----- | 1,490 | ----- | 245 | ----- |

Monthly discharge of Hanalei River near Hanalei, Kauai, for the year ending June 30, 1918.

| Month. | Discharge. | | | | Total run-off. | |
|----------------|--------------------------|----------|-------|---------------------|------------------|------------|
| | Million gallons per day. | | | Second-foot (mean). | Million gallons. | Acre-feet. |
| | Maximum. | Minimum. | Mean. | | | |
| July..... | 625 | 85 | 139 | 215 | 4,320 | 13,200 |
| August..... | 660 | 63 | 137 | 212 | 4,240 | 13,000 |
| September..... | 555 | 72 | 139 | 215 | 4,180 | 12,800 |
| October..... | 2,830 | 75 | 196 | 303 | 6,090 | 18,600 |
| November..... | 590 | 80 | 167 | 258 | 5,010 | 15,400 |
| December..... | 268 | 75 | 104 | 161 | 3,210 | 9,890 |
| January..... | 1,040 | 75 | 173 | 268 | 5,380 | 16,400 |
| February..... | 555 | 72 | 198 | 306 | 5,550 | 17,000 |
| March..... | 2,650 | 68 | 666 | 1,030 | 20,700 | 63,400 |
| April..... | 3,600 | 92 | 538 | 832 | 16,100 | 49,500 |
| May..... | 2,410 | 68 | 394 | 610 | 12,200 | 37,500 |
| June..... | 290 | 72 | 144 | 223 | 4,330 | 13,300 |
| The year..... | 3,600 | 63 | 250 | 387 | 91,300 | 280,000 |

CHINA DITCH NEAR HANALEI, KAUAI.

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

RECORDS AVAILABLE.—March 17, 1914, to June 30, 1918. December 28, 1911, to September 30, 1913, at old station a quarter of a mile below present station.

GAGE.—Vertical staff on left bank read by D. Kamaka.

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, 3.09 feet at 8 a. m. April 3 (discharge, 56 million gallons per day, or 87 second-feet); minimum stage recorded during year, 1.4 feet December 28--31 and 11 days between January 1-17 (discharge, 11 million gallons per day, or 17 second-feet).

1911-1918: Maximum stage recorded during 1918; ditch occasionally dry.

DIVERSIONS.—Diverts part of flow of Hanalei River.

REGULATION.—By head gates.

UTILIZATION.—Irrigation of rice and taro.

ACCURACY.—Stage-discharge relation not permanent. Rating curves fairly well defined between 10 and 25 second-feet and applicable July 1-8, July 9 to November 30, and December 1 to June 30. Gage read to hundredths twice daily. Records fair.

Discharge measurements of China ditch near Hanalei, Kauai, during the year ending June 30, 1918.

[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. |
| Aug. 26..... | 1.88 | 34 | 22 | Feb. 12..... | 1.71 | 27 | 18 |
| 28..... | 1.30 | 23 | 15 | Mar. 7..... | 1.81 | 31 | 20 |
| 29..... | .78 | 15.4 | 10 | May 23..... | 1.66 | 26 | 17 |
| Nov. 30..... | 1.72 | 26 | 17 | June 14..... | 1.69 | 30 | 19 |
| Dec. 5..... | 1.50 | 21 | 13 | | | | |

Daily discharge, in million gallons, of China ditch near Hanalei, Kauai, for the year ending June 30, 1918.

| Day. | July. | Aug. | Sept. | Oct. | Nov. | Dec. | Jan. | Feb. | Mar. | Apr. | May. | June. |
|---------|-------|------|-------|------|-------|------|------|-------|------|-------|------|-------|
| 1..... | 18 | 19 | 22 | 21 | 22 | 15 | 11 | 18 | 15 | 19 | 19 | 19 |
| 2..... | 18 | 20 | 21 | 21 | 23 | 14 | 11 | 16 | 15 | 32 | 19 | 18 |
| 3..... | 22 | 20 | 21 | 20 | 22 | 14 | 11 | 15 | 18 | 44 | 20 | 16 |
| 4..... | 22 | 20 | 21 | 20 | 20 | 13 | 12 | 15 | 25 | 30 | 15 | 16 |
| 5..... | 20 | 20 | 21 | 21 | 19 | 13 | 11 | 19 | 27 | 24 | 27 | 16 |
| 6..... | 20 | 19 | 20 | 20 | 17 | 13 | 11 | 21 | 21 | 19 | 24 | 15 |
| 7..... | 20 | 20 | 20 | 21 | 17 | 18 | 11 | 19 | 24 | 18 | 20 | 15 |
| 8..... | 19 | 19 | 21 | 20 | 17 | 14 | 12 | 20 | 24 | 18 | 21 | 15 |
| 9..... | 23 | 19 | 20 | 20 | 17 | 18 | 11 | 20 | 53 | 18 | 20 | 19 |
| 10..... | 20 | 20 | 20 | 20 | 19 | 14 | 11 | 18 | 33 | 27 | 19 | 15 |
| 11..... | 22 | 21 | 20 | 20 | 16 | 13 | 11 | 20 | 35 | 32 | 24 | 16 |
| 12..... | 20 | 22 | 21 | 20 | 16 | 14 | 12 | 18 | 36 | 25 | 14 | 22 |
| 13..... | 18 | 22 | 22 | 20 | 16 | 14 | 11 | 19 | 30 | 28 | 20 | 22 |
| 14..... | 18 | 20 | 24 | 20 | 16 | 13 | 18 | 15 | 27 | 20 | 19 | 18 |
| 15..... | 18 | 20 | 22 | 20 | 16 | 13 | 13 | 13 | 25 | 19 | 22 | 16 |
| 16..... | 19 | 13 | 21 | 27 | 16 | 13 | 12 | 15 | 28 | 18 | 27 | 18 |
| 17..... | 22 | 23 | 24 | 21 | 16 | 12 | 11 | 19 | 16 | 16 | 22 | 15 |
| 18..... | 20 | 22 | 24 | 19 | 16 | 12 | 13 | 19 | 13 | 22 | 21 | 14 |
| 19..... | 20 | 22 | 21 | 17 | 16 | 12 | 21 | 20 | 13 | 19 | 21 | 18 |
| 20..... | 20 | 22 | 21 | 18 | 16 | 12 | 22 | 24 | 15 | 18 | 24 | 18 |
| 21..... | 20 | 22 | 20 | 18 | 18 | 13 | 20 | 14 | 14 | 16 | 20 | 20 |
| 22..... | 20 | 22 | 20 | 19 | 16 | 12 | 30 | 18 | 13 | 18 | 25 | 18 |
| 23..... | 19 | 22 | 20 | 16 | 16 | 12 | 20 | 16 | 13 | 19 | 15 | 16 |
| 24..... | 20 | 25 | 20 | 18 | 18 | 12 | 16 | 16 | 12 | 21 | 14 | 18 |
| 25..... | 21 | 23 | 20 | 20 | 16 | 12 | 18 | 19 | 19 | 21 | 15 | 18 |
| 26..... | 20 | 22 | 20 | 20 | 21 | 12 | 22 | 18 | 14 | 21 | 13 | 18 |
| 27..... | 20 | 22 | 21 | 17 | 20 | 12 | 15 | 16 | 14 | 22 | 15 | 19 |
| 28..... | 19 | 22 | 20 | 17 | 19 | 11 | 24 | 19 | 18 | 21 | 14 | 18 |
| 29..... | 19 | 22 | 22 | 17 | 18 | 11 | 18 | ..... | 16 | 20 | 26 | 16 |
| 30..... | 19 | 22 | 22 | 17 | 20 | 11 | 20 | ..... | 20 | 20 | 27 | 16 |
| 31..... | 19 | 21 | ..... | 17 | ..... | 11 | 16 | ..... | 18 | ..... | 21 | ..... |

Monthly discharge of China ditch near Hanalei, Kauai, for the year ending June 30, 1918.

| Month. | Discharge. | | | | Total run-off. | |
|----------------|--------------------------|----------|-------|---------------------|------------------|------------|
| | Million gallons per day. | | | Second-foot (mean). | Million gallons. | Acre-feet. |
| | Maximum. | Minimum. | Mean. | | | |
| July..... | 23 | 18 | 19.8 | 30.6 | 615 | 1,880 |
| August..... | 25 | 13 | 20.9 | 32.3 | 648 | 1,990 |
| September..... | 24 | 20 | 21.1 | 32.6 | 632 | 1,940 |
| October..... | 27 | 16 | 19.4 | 30.0 | 602 | 1,850 |
| November..... | 23 | 16 | 17.8 | 27.5 | 535 | 1,640 |
| December..... | 18 | 11 | 13.0 | 20.1 | 403 | 1,240 |
| January..... | 24 | 11 | 15.0 | 23.2 | 465 | 1,430 |
| February..... | 24 | 13 | 17.8 | 27.5 | 499 | 1,530 |
| March..... | 53 | 12 | 21.4 | 33.1 | 664 | 2,040 |
| April..... | 44 | 16 | 22.2 | 34.3 | 665 | 2,040 |
| May..... | 27 | 13 | 20.1 | 31.1 | 623 | 1,910 |
| June..... | 22 | 14 | 17.3 | 26.8 | 518 | 1,590 |
| The year..... | 53 | 11 | 18.8 | 29.1 | 6,870 | 21,100 |

KUNA DITCH NEAR HANALEI, KAUAI.

LOCATION.—A quarter of a mile below intake and about 3 miles southeast of Hanalei.

RECORDS AVAILABLE.—July 1, 1916, to June 30, 1918. January 17, 1912, to September 30, 1913, at old site 500 feet below intake.

GAGE.—Vertical staff read by D. Kamaka.

DISCHARGE MEASUREMENTS.—Made from plank at gage.

CHANNEL AND CONTROL.—Channel about 5 feet wide, 3 feet deep, cut in firm earth straight for 25 feet above and 50 feet below gage. Control not well defined.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 3.32 feet at 8.30 a. m. July 4 (discharge, 29 million gallons per day, or 45 second-feet); minimum stage recorded, 1.44 feet at 12.30 p. m. December 5 (discharge, 4.0 million gallons per day, or 6.2 second-feet).

1912-1918: Maximum stage recorded 6.2 feet December 3, 1912 (discharge, 39 million gallons per day, or 60 second-feet); minimum stage recorded, 3.1 feet January and February, 1913 (discharge, 2.9 million gallons per day, or 4.5 second-feet).

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

REGULATION.—By head gates.

UTILIZATION.—Irrigation of rice and taro.

ACCURACY.—Stage-discharge relation practically permanent. Rating curve well defined. Gage read to hundredths twice daily except as noted under daily discharge table. Records fair.

Discharge measurements of Kuna ditch near Hanalei, Kauai, during the year ending June 30, 1918.

[Made by W. V. Hardy.]

| Date. | Gage height (feet). | Discharge. | | Date. | Gage height (feet). | Discharge. | |
|--------------|---------------------|--------------|--------------------------|--------------|---------------------|--------------|--------------------------|
| | | Second-foot. | Million gallons per day. | | | Second-foot. | Million gallons per day. |
| July 26..... | 2.86 | 32 | 21 | Dec. 5..... | 1.65 | 9.3 | 6.0 |
| Aug. 26..... | 2.62 | 27 | 17 | 5..... | 1.44 | 6.2 | 4.0 |
| Dec. 5..... | 1.87 | 12.6 | 8.1 | Mar. 7..... | 2.43 | 27 | 17 |
| 5..... | 2.03 | 13.6 | 8.8 | June 14..... | 2.70 | 31 | 2.0 |

Daily discharge, in million gallons, of Kuna ditch near Hanalei, Kauai, for the year ending June 30, 1918.

| Day. | July. | Aug. | Sept. | Oct. | Nov. | Dec. | Jan. | Feb. | Mar. | Apr. | May. | June. |
|---------|-------|------|-------|------|-------|------|------|-------|------|-------|------|-------|
| 1..... | 21.4 | 17.7 | 19.1 | 18.4 | 8.6 | 9.2 | 7.5 | 8.6 | 13.6 | 19.8 | 20.6 | 21.4 |
| 2..... | 22.1 | 19.8 | 16.3 | 17.7 | 25.0 | 8.6 | 7.5 | 8.0 | 13.6 | 23.7 | 20.6 | 20.6 |
| 3..... | 25.0 | 18.4 | 16.3 | 17.7 | 25.0 | 8.0 | 7.5 | 7.0 | 14.2 | 23.7 | 22.1 | 19.8 |
| 4..... | 27.0 | 19.8 | 16.3 | 17.0 | 14.2 | 7.5 | 8.6 | 7.0 | 25.0 | 23.7 | 23.7 | 14.2 |
| 5..... | 22.1 | 19.8 | 15.6 | 17.0 | 13.6 | 7.5 | 8.0 | 9.2 | 25.0 | 23.7 | 23.7 | 22.9 |
| 6..... | 22.1 | 19.1 | 14.9 | 17.0 | 9.2 | 8.0 | 8.0 | 25.0 | 25.0 | 13.0 | 22.9 | 21.4 |
| 7..... | 22.1 | 20.6 | 14.2 | 17.7 | 9.2 | 25.0 | 7.5 | 20.6 | 14.9 | 12.3 | 21.4 | 18.4 |
| 8..... | 22.1 | 17.7 | 14.9 | 15.6 | 8.0 | 9.2 | 9.2 | 25.0 | 14.2 | 11.0 | 22.9 | 18.4 |
| 9..... | 26.0 | 17.7 | 14.2 | 14.9 | 8.0 | 25.0 | 7.5 | 25.0 | 25.0 | 17.7 | 22.9 | 19.1 |
| 10..... | 24.5 | 17.0 | 14.2 | 14.9 | 9.8 | 9.8 | 7.0 | 7.5 | 25.0 | 23.7 | 22.9 | 18.4 |
| 11..... | 25.0 | 17.7 | 14.2 | 14.9 | 9.2 | 9.2 | 8.0 | 25.0 | 25.0 | 23.7 | 23.7 | 19.8 |
| 12..... | 23.7 | 20.6 | 16.3 | 14.2 | 8.0 | 9.2 | 8.0 | 18.4 | 25.0 | 23.7 | 23.7 | 22.9 |
| 13..... | 23.7 | 20.6 | 19.8 | 14.9 | 8.0 | 10.4 | 8.6 | 25.0 | 25.0 | 23.7 | 22.9 | 23.7 |
| 14..... | 22.9 | 25.0 | 25.0 | 15.6 | 8.0 | 8.6 | 12.3 | 17.0 | 25.0 | 23.7 | 22.1 | 20.6 |
| 15..... | 22.9 | 19.8 | 25.0 | 14.9 | 7.5 | 9.2 | 9.8 | 16.3 | 25.0 | 23.7 | 22.9 | 20.6 |
| 16..... | 22.9 | 25.0 | 17.0 | 25.0 | 7.5 | 8.6 | 8.6 | 17.0 | 25.0 | 13.0 | 23.7 | 19.1 |
| 17..... | 26.2 | 22.1 | 25.0 | 16.3 | 7.5 | 8.0 | 8.0 | 16.3 | 25.0 | 11.6 | 18.4 | 18.4 |
| 18..... | 24.5 | 21.4 | 25.0 | 12.3 | 7.5 | 8.0 | 8.0 | 17.0 | 11.0 | 23.7 | 22.9 | 17.7 |
| 19..... | 20.6 | 20.6 | 17.0 | 8.6 | 7.5 | 8.0 | 8.0 | 16.3 | 12.3 | 23.7 | 22.1 | 19.1 |
| 20..... | 20.6 | 20.6 | 16.3 | 9.2 | 7.0 | 8.0 | 9.2 | 25.0 | 14.2 | 18.4 | 17.7 | 22.1 |
| 21..... | 20.6 | 19.1 | 16.3 | 9.2 | 9.8 | 8.6 | 8.6 | 25.0 | 18.4 | 13.0 | 21.4 | 23.7 |
| 22..... | 19.8 | 18.4 | 15.6 | 10.4 | 9.2 | 8.0 | 8.6 | 17.0 | 22.9 | 12.3 | 21.4 | 20.6 |
| 23..... | 19.8 | 17.7 | 15.6 | 8.0 | 8.0 | 8.0 | 6.5 | 14.9 | 22.1 | 6.0 | 10.4 | 19.8 |
| 24..... | 20.6 | 25.0 | 17.0 | 9.8 | 9.8 | 8.0 | 5.5 | 13.0 | 22.1 | 7.5 | 22.9 | 23.7 |
| 25..... | 25.3 | 20.6 | 14.9 | 9.8 | 8.0 | 8.0 | 5.0 | 12.3 | 25.0 | 17.0 | 20.6 | 20.6 |
| 26..... | 21.4 | 19.8 | 15.6 | 9.2 | 25.0 | 7.5 | 6.5 | 13.6 | 14.2 | 16.3 | 10.4 | 19.8 |
| 27..... | 19.8 | 18.4 | 20.6 | 8.6 | 13.6 | 7.5 | 25.0 | 13.0 | 14.2 | 18.4 | 20.6 | 23.7 |
| 28..... | 22.1 | 18.4 | 14.9 | 9.8 | 11.0 | 7.5 | 25.0 | 12.3 | 20.6 | 18.4 | 10.4 | 19.8 |
| 29..... | 20.6 | 19.8 | 19.1 | 9.2 | 9.8 | 7.5 | 9.8 | ..... | 25.0 | 16.3 | 23.7 | 19.1 |
| 30..... | 21.4 | 19.1 | 18.4 | 9.2 | 10.4 | 7.5 | 11.0 | ..... | 19.1 | 15.6 | 23.7 | 19.1 |
| 31..... | 19.8 | 18.4 | ..... | 8.6 | ..... | 7.5 | 9.2 | ..... | 18.4 | ..... | 22.1 | ..... |

NOTE.—Gage could not be reached and gage-height record was not recorded July 3, 9, 11, Aug. 14, 16, 24, Sept. 14, 15, 17, 18, Oct. 16, Nov. 2, 3, 26, Dec. 7, 9, Jan. 27, 28, Feb. 6, 8, 9, 11, 13, 20, 21, Mar. 4-6, 9-17, 25, and 29. Ditch probably running nearly to capacity for days given above. Discharge estimated at 25 million gallons per day, which is probably within 15 per cent of actual discharge.

Monthly discharge of Kuna ditch near Hanalei, Kauai, for the year ending June 30, 1918.

| Month. | Discharge. | | | | Total run-off. | |
|----------------|--------------------------|----------|-------|---------------------|------------------|------------|
| | Million gallons per day. | | | Second-foot (mean). | Million gallons. | Acre-feet. |
| | Maximum. | Minimum. | Mean. | | | |
| July..... | 27.0 | 19.8 | 22.2 | 34.3 | 688 | 2,110 |
| August..... | 25.0 | 17.0 | 19.9 | 30.8 | 616 | 1,890 |
| September..... | 25.0 | 14.2 | 17.5 | 27.1 | 525 | 1,610 |
| October..... | 25.0 | 8.0 | 13.4 | 20.7 | 416 | 1,270 |
| November..... | 25.0 | 7.0 | 10.8 | 16.7 | 323 | 994 |
| December..... | 25.0 | 7.5 | 9.38 | 14.5 | 291 | 892 |
| January..... | 25.0 | 5.0 | 9.28 | 14.4 | 288 | 883 |
| February..... | 25.0 | 7.0 | 16.3 | 25.2 | 457 | 1,400 |
| March..... | 25.0 | 11.0 | 20.3 | 31.4 | 630 | 1,930 |
| April..... | 23.7 | 6.0 | 18.1 | 28.0 | 542 | 1,670 |
| May..... | 23.7 | 10.4 | 21.0 | 32.5 | 651 | 2,000 |
| June..... | 23.7 | 14.2 | 20.3 | 31.4 | 608 | 1,870 |
| The year..... | 27.0 | 5.0 | 16.5 | 25.5 | 6,040 | 18,500 |

LUMAHAI RIVER NEAR HANAIEI, KAUAI.

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

RECORDS AVAILABLE.—May 23, 1914, to October 11, 1917, when station was discontinued.

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, 3.27 feet at 1 a. m. October 8 (discharge, 940 million gallons per day or 1,460 second-feet); minimum stage recorded, 0.2 foot August 19-23 (discharge, 33 million gallons per day, or 51 second-feet).

1914-1917: Maximum stage recorded, 9.0 feet at 3 a. m. December 19, 1916 (discharge, computed from extension of rating curve, about 4,600 million gallons per day, or 7,120 second-feet); minimum stage recorded, 0.6 foot April, 1915 (discharge, 20 million gallons per day, or 31 second-feet).

REGULATION.—None.

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

ACCURACY.—Stage-discharge relation practically permanent. Rating curve fairly well defined. Operation of water-stage recorder satisfactory. Records fair.

No discharge measurements made during year.

Daily discharge, in million gallons, of Lumahai River near Hanalei, Kauai, for the year ending June 30, 1918.

| Day. | July. | Aug. | Sept. | Oct. | Day. | July. | Aug. | Sept. | Oct. |
|---------|-------|------|-------|-------|---------|-------|------|-------|-------|
| 1..... | 39 | 43 | 43 | 39 | 16..... | 56 | 47 | 39 | ..... |
| 2..... | 43 | 52 | 43 | 39 | 17..... | 47 | 39 | 39 | ..... |
| 3..... | 113 | 43 | 43 | 39 | 18..... | 39 | 36 | 39 | ..... |
| 4..... | 101 | 47 | 39 | 39 | 19..... | 47 | 33 | 39 | ..... |
| 5..... | 52 | 43 | 39 | 39 | 20..... | 43 | 33 | 39 | ..... |
| 6..... | 47 | 39 | 39 | 43 | 21..... | 43 | 33 | 47 | ..... |
| 7..... | 56 | 39 | 39 | 77 | 22..... | 77 | 33 | 61 | ..... |
| 8..... | 95 | 39 | 39 | 120 | 23..... | 83 | 33 | 61 | ..... |
| 9..... | 156 | 66 | 39 | 43 | 24..... | 56 | 56 | 39 | ..... |
| 10..... | 133 | 61 | 43 | 39 | 25..... | 47 | 39 | 36 | ..... |
| 11..... | 83 | 113 | 39 | 39 | 26..... | 47 | 39 | 36 | ..... |
| 12..... | 56 | 56 | 56 | ..... | 27..... | 43 | 39 | 36 | ..... |
| 13..... | 52 | 66 | 47 | ..... | 28..... | 47 | 39 | 36 | ..... |
| 14..... | 47 | 47 | 66 | ..... | 29..... | 43 | 39 | 39 | ..... |
| 15..... | 61 | 47 | 39 | ..... | 30..... | 52 | 39 | 39 | ..... |
| | | | | | 31..... | 47 | 43 | ..... | ..... |

Monthly discharge of Lumahai River near Hanalei, Kauai, for the year ending June 30, 1918.

| Month. | Discharge. | | | | Total run-off. | |
|-------------------|--------------------------|----------|-------|---------------------|------------------|------------|
| | Million gallons per day. | | | Second-feet (mean). | Million gallons. | Acre-feet. |
| | Maximum. | Minimum. | Mean. | | | |
| July..... | 156 | 39 | 62.9 | 97.3 | 1,950 | 5,980 |
| August..... | 113 | 33 | 45.8 | 70.9 | 1,420 | 4,360 |
| September..... | 66 | 36 | 42.6 | 65.9 | 1,280 | 3,920 |
| October 1-11..... | 120 | 39 | 50.5 | 78.1 | 556 | 1,700 |
| The period..... | | | | | 5,210 | 16,000 |

WAIOLI STREAM NEAR HANAIEI, KAUAI.

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

RECORDS AVAILABLE.—June 30, 1914, to June 30, 1918.

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, 4.60 feet at 1.50 a. m. February 4 (discharge, 550 million gallons per day, or 852 second-feet); minimum stage recorded, 0.9 foot May 1 and 2 (discharge, 5.5 million gallons per day, or 8.5 second-feet).

1914-1918: Maximum stage recorded, 6.15 feet at 6.30 a. m. December 19, 1916 (discharge, computed from extension of rating curve about 1,200 million gallons per day, or 1,860 second-feet); minimum stage recorded, 0.6 foot July 22, 1914 (discharge, 2.0 million gallons per day, or 3.1 second-feet).

DIVERSIONS.—None.

REGULATION.—None.

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

ACCURACY.—Stage-discharge relation not permanent. Rating curves fairly well defined but date of shift somewhat uncertain. Curves applicable July 1 to September 16 and September 17 to June 30. Operation of water-stage recorder satisfactory, except for short periods given in footnote to table of daily discharge. Records poor July to September and fair October to June.

Discharge measurements of Waioli Stream near Hanalei, Kauai, during the year ending June 30, 1918.

[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. 27..... | 1.54 | 26 | 17 | May 22..... | 1.90 | 59 | 38 |
| Dec. 4..... | 1.20 | 13.4 | 8.6 | 22..... | 1.98 | 70 | 45 |
| Feb. 10..... | 1.57 | 29 | 19 | June 13..... | 2.07 | 80 | 51 |
| Mar. 5..... | 2.27 | 107 | 69 | | | | |

Daily discharge, in million gallons, of Waioli Stream near Hanalei, Kauai, for the year ending June 30, 1918.

| Day. | July. | Aug. | Sept. | Oct. | Nov. | Dec. | Jan. | Feb. | Mar. | Apr. | May. | June. |
|---------|-------|------|-------|------|-------|------|------|-------|------|-------|-------|-------|
| 1..... | 16 | 22 | 14 | 9.5 | 8.0 | 8.6 | 6.8 | 10.4 | 18 | 13 | 5.5 | 20 |
| 2..... | 14 | 11 | 8.0 | 8.6 | 42 | 8.6 | 6.8 | 8.6 | 16 | 34 | 5.5 | 16 |
| 3..... | 35 | 16 | 8.0 | 8.6 | 103 | 8.6 | 6.8 | 7.3 | 25 | 73 | 6.3 | 11.7 |
| 4..... | 39 | 11 | 8.0 | 8.0 | 22 | 8.6 | 7.3 | 28 | 42 | 181 | 7.3 | 9.5 |
| 5..... | 28 | 11 | 8.0 | 9.5 | 20 | 8.6 | 6.8 | 8.0 | 132 | 110 | 6.3 | 8.0 |
| 6..... | 16 | 11 | 8.0 | 8.6 | 13 | 20 | 6.8 | 8.0 | 103 | 46 | 6.3 | 8.0 |
| 7..... | 22 | 11 | 8.0 | 8.6 | 8.6 | 50 | 6.8 | 8.0 | 31 | 20 | 6.3 | 8.0 |
| 8..... | 25 | 11 | 8.0 | 8.0 | 8.6 | 14 | 7.3 | 8.6 | 20 | 20 | 6.3 | 10.4 |
| 9..... | 94 | 10 | 8.0 | 7.3 | 8.0 | 22 | 6.8 | 13 | 20 | 18 | 7.3 | 22 |
| 10..... | 43 | 10 | 10 | 7.3 | 10.4 | 13 | 6.8 | 20 | 14 | 22 | 6.8 | 25 |
| 11..... | 11 | 10 | 16 | 7.3 | 8.0 | 13 | 13 | 34 | 172 | 132 | 6.3 | 22 |
| 12..... | 11 | 11 | 28 | 7.3 | 8.0 | 14 | 10.4 | 25 | 164 | 50 | 6.3 | 46 |
| 13..... | 19 | 11 | 19 | 9.5 | 7.3 | 18 | 10.4 | 25 | 63 | 38 | 5.9 | 42 |
| 14..... | 14 | 10 | 14 | 9.5 | 7.3 | 16 | 28 | 14 | 63 | 14 | 6.8 | 25 |
| 15..... | 11 | 28 | 10 | 8.6 | 7.3 | 10.4 | 28 | 10.4 | 96 | 11.7 | 7.3 | 25 |
| 16..... | 11 | 35 | 45 | 46 | 18 | 9.5 | 10.4 | 9.5 | 96 | 11.7 | 9.5 | 25 |
| 17..... | 11 | 19 | ..... | 16 | 16 | 8.6 | 8.6 | 13 | 68 | 10.4 | 8.6 | 16 |
| 18..... | 11 | 14 | ..... | 10.4 | 10.4 | 8.6 | 8.0 | 14 | 22 | 11.7 | 8.0 | 13 |
| 19..... | 11 | 11 | ..... | 8.6 | 11.7 | 8.0 | 11.7 | 14 | 16 | 8.6 | ..... | 16 |
| 20..... | 11 | 11 | ..... | 8.6 | 11.7 | 8.0 | 16 | 22 | 13 | 8.6 | ..... | 22 |
| 21..... | 16 | 11 | ..... | 8.6 | 13 | 11.7 | 10.4 | 63 | 11.7 | 8.6 | ..... | 28 |
| 22..... | 14 | 11 | ..... | 8.0 | 8.6 | 8.0 | 14 | 25 | 10.4 | 8.0 | ..... | 16 |
| 23..... | 11 | 10 | ..... | 9.5 | 8.6 | 8.0 | 14 | 13 | 9.5 | 7.3 | 28 | 14 |
| 24..... | 28 | 16 | ..... | 8.0 | 13 | 7.3 | 10.4 | 10.4 | 10.4 | 7.3 | 25 | 13 |
| 25..... | 28 | 11 | ..... | 8.6 | 9.5 | 7.3 | 10.4 | 10.4 | 63 | 7.3 | 18 | 10.4 |
| 26..... | 39 | 10 | ..... | 10.4 | 8.6 | 7.3 | 28 | 14 | 22 | 6.3 | 22 | 11.7 |
| 27..... | 16 | 10 | 17 | 8.6 | 8.6 | 7.3 | 172 | 11.7 | 18 | 6.3 | 31 | 13 |
| 28..... | 11 | 8.0 | 18 | 8.0 | 8.0 | 7.3 | 31 | 23 | 18 | 6.3 | 38 | 10.4 |
| 29..... | 11 | 8.0 | 18 | 9.5 | 9.5 | 7.3 | 16 | ..... | 31 | 5.9 | 63 | 8.6 |
| 30..... | 14 | 8.0 | 11.7 | 10.4 | 8.0 | 7.3 | 18 | ..... | 63 | 5.9 | 42 | 7.3 |
| 31..... | 11 | 8.0 | ..... | 8.6 | ..... | 7.3 | 13 | ..... | 18 | ..... | 25 | ..... |

NOTE.—No gage height record Sept. 15-27 and May 19-22; discharge estimated from neighboring streams Sept. 15, 16, and 27 as given; Sept. 17-26 and May 19-22 at 20 million gallons per day.

Monthly discharge of Waioli Stream near Hanalei, Kauai, for the year ending June 30, 1918.

| Month. | Discharge. | | | Total run-off. | |
|----------------|--------------------------|----------|-------|---------------------|------------|
| | Million gallons per day. | | | Second-foot (mean). | Acre-feet. |
| | Maximum. | Minimum. | Mean. | | |
| July..... | 94 | 11 | 21.0 | 32.5 | 652 |
| August..... | 35 | 8.0 | 12.7 | 19.6 | 395 |
| September..... | ..... | 8.0 | 16.2 | 25.1 | 485 |
| October..... | 46 | 7.3 | 10.1 | 15.6 | 314 |
| November..... | 103 | 7.3 | 14.8 | 22.9 | 445 |
| December..... | 50 | 7.3 | 11.7 | 18.1 | 362 |
| January..... | 172 | 6.8 | 17.8 | 27.5 | 551 |
| February..... | 63 | 7.3 | 16.7 | 25.8 | 468 |
| March..... | 172 | 9.5 | 47.4 | 73.3 | 1,470 |
| April..... | 181 | 5.9 | 30.1 | 46.6 | 903 |
| May..... | 63 | 5.5 | 16.0 | 24.8 | 495 |
| June..... | 46 | 7.3 | 17.4 | 26.9 | 523 |
| The year..... | 181 | 5.5 | 19.3 | 29.9 | 7,060 |

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, 1918.

| Date. | Stream. | Locality. | Gage height (feet). | Discharge. | |
|----------|---|--|---------------------|--------------|--------------------------|
| | | | | Second-feet. | Million gallons per day. |
| July 5 | Olokele..... | Makaweli..... | 3.04 | 2.0 | 1.3 |
| 12 | Mohihi..... | Waimea..... | 3.92 | 4.2 | 2.7 |
| 12 | Waiahoali..... | do..... | | 3.2 | 2.1 |
| 11 | Kawaikoi..... | do..... | 2.38 | 39 | 25 |
| 13 | do..... | do..... | 1.54 | 9.2 | 5.9 |
| 16 | do..... | do..... | 1.57 | 12.5 | 8.1 |
| Sept. 10 | Rice ditch..... | 15 feet below intake, at Koula, near Eleele. | .83 | .8 | .5 |
| Oct. 1 | do..... | do..... | .63 | .35 | .25 |
| Nov. 13 | do..... | do..... | .70 | .35 | .25 |
| Dec. 30 | do..... | do..... | .62 | .5 | .35 |
| Jan. 23 | do..... | do..... | .44 | .25 | .15 |
| Feb. 19 | do..... | do..... | .71 | .55 | .35 |
| Mar. 4 | do..... | do..... | .88 | .8 | .5 |
| Apr. 9 | do..... | do..... | .88 | .3 | .2 |
| May 25 | do..... | do..... | .92 | 1.1 | .7 |
| Sept. 29 | Old Anahola ditch..... | At intake..... | | 11.7 | 7.6 |
| 29 | do..... | 50 feet below old Weir location..... | | 9.4 | 6.1 |
| 29 | Lower Anahola ditch..... | Station 42 + 45..... | | 7.4 | 4.8 |
| Apr. 8 | McBryde Sugar Co. Pump 3A and 3B ditch..... | Near Weir near Eleele..... | | 31 | 20 |

NOTE.—First six measurements made at former gaging station.

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, 1918.

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 year, 9 feet at 2.15 and 4.30 a. m. April 4 (discharge, 260 million gallons per day, or 403 second-feet); minimum stage recorded, 2.15 feet October 18-20 and 26-27 (discharge, 0.25 million gallons per day, or 0.40 second-foot).

1913-1918: Maximum stage recorded, 12.5 feet at 1 a. m. March 19, 1917 (discharge, about 400 million gallons per day, or 619 second-feet); minimum stage recorded October, 1917.

DIVERSIONS.—None.

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.—Stage-discharge relation not permanent. Rating curve used July 1 to January 29 well defined between 1 and 3 million gallons per day. Poorly defined outside of those limits. Rating curve used January 30 to June 30 well defined between 2 and 30 million gallons per day; fairly well defined outside of those limits. Operation of water-stage recorder satisfactory except no gage height record April 14-28, May 6, 8, and 18-20. Discharge estimated from neighboring streams for these periods. Records fair when water-stage recorder was operating; poor at other times.

Discharge measurements of Kalihi Stream near Honolulu, Oahu, during the year ending June 30, 1918.

| Date. | Made by— | Gage height (feet). | Discharge. | |
|--------------|---------------------|---------------------|--------------|--------------------------|
| | | | Second-feet. | Million gallons per day. |
| Aug. 23..... | R. D. Klise..... | 2.85 | 1.9 | 1.3 |
| Oct. 8..... | do..... | 2.26 | .7 | .45 |
| Nov. 1..... | W. C. Woodward..... | 2.24 | .5 | .3 |
| 1..... | R. D. Klise..... | 2.24 | .5 | .35 |
| Feb. 20..... | do..... | 3.17 | 19.3 | 12 |
| Apr. 19..... | do..... | 3.80 | 37 | 24 |
| 29..... | do..... | 2.80 | 8.0 | 5.2 |
| May 7..... | J. B. Mann..... | 2.72 | 8.2 | 5.3 |
| 7..... | do..... | 2.72 | 8.6 | 5.5 |
| June 25..... | R. D. Klise..... | 2.52 | 4.5 | 2.9 |

Daily discharge, in million gallons, of Kalihi Stream near Honolulu, Oahu, for the year ending June 30, 1918.

| Day. | July. | Aug. | Sept. | Oct. | Nov. | Dec. | Jan. | Feb. | Mar. | Apr. | May. | June. |
|---------|-------|------|-------|------|-------|------|------|-------|------|-------|------|-------|
| 1..... | 1.7 | 1.3 | 0.9 | 0.4 | 0.3 | 1.5 | 0.9 | 6.6 | 4.4 | 3.7 | 5.1 | 4.4 |
| 2..... | 1.7 | 1.3 | .9 | .4 | .3 | 1.2 | .9 | 5.8 | 5.8 | 15 | 4.4 | 3.7 |
| 3..... | 1.7 | 1.3 | .8 | .4 | .5 | 1.2 | .8 | 5.1 | 5.1 | 26 | 13 | 3.7 |
| 4..... | 1.7 | 1.3 | .8 | .4 | .65 | 1.3 | 1.3 | 4.4 | 5.1 | 74 | 5.1 | 3.7 |
| 5..... | 1.5 | 1.2 | .8 | .4 | 2.6 | 1.3 | 1.0 | 9.8 | 15 | 23 | 5.8 | 3.2 |
| 6..... | 1.7 | 1.2 | .8 | .5 | 9.0 | 6.8 | .9 | 6.6 | 12 | 17 | 5.8 | 3.2 |
| 7..... | 1.5 | 1.3 | .9 | .35 | 2.0 | 2.3 | 3.5 | 5.1 | 6.6 | 12 | 5.8 | 3.2 |
| 8..... | 1.7 | 1.2 | .9 | .35 | 1.0 | 1.5 | 1.8 | 12 | 5.1 | 8.2 | 5.1 | 3.2 |
| 9..... | 2.3 | 1.2 | .6 | .35 | .8 | 1.2 | 1.1 | 22 | 17 | 20 | 4.4 | 4.4 |
| 10..... | 2.6 | 1.3 | .65 | .35 | .9 | 6.8 | 1.0 | 8.2 | 38 | 72 | 4.4 | 4.4 |
| 11..... | 1.7 | 1.8 | .6 | .6 | .7 | 2.3 | 1.1 | 6.6 | .68 | 72 | 3.7 | 3.7 |
| 12..... | 1.5 | 1.7 | .8 | .6 | .65 | 1.3 | 1.0 | 5.8 | 27 | 20 | 3.7 | 17 |
| 13..... | 1.5 | 1.5 | 1.5 | .6 | .6 | 1.2 | .9 | 6.6 | 34 | 40 | 3.2 | 5.1 |
| 14..... | 1.5 | 1.3 | .8 | .5 | .6 | 1.1 | .9 | 5.1 | 20 | 28 | 3.2 | 4.4 |
| 15..... | 1.5 | 1.3 | .6 | .4 | .6 | 1.0 | 4.0 | 4.4 | 38 | 9.8 | 3.2 | 18 |
| 16..... | 1.5 | 1.3 | .6 | .35 | .6 | 1.0 | 1.1 | 6.6 | 62 | 9.8 | 19 | 9.0 |
| 17..... | 1.5 | 1.2 | .8 | .35 | .6 | 1.0 | 1.0 | 18 | 20 | 8.2 | 14 | 5.1 |
| 18..... | 1.3 | 1.2 | .6 | .25 | .5 | .9 | 7.5 | 5.8 | 14 | 5.1 | 5.1 | 3.7 |
| 19..... | 1.3 | 1.2 | .5 | .25 | .5 | .9 | 3.5 | 9.0 | 12 | 14 | 4.4 | 3.2 |
| 20..... | 1.5 | 1.2 | .5 | .25 | .5 | .9 | 2.0 | 17 | 9.8 | 9.8 | 4.4 | 5.8 |
| 21..... | 1.3 | 1.2 | .5 | .3 | .8 | .9 | 1.3 | 7.4 | 8.2 | 9.0 | 3.7 | 5.8 |
| 22..... | 1.3 | 1.3 | .4 | .35 | .6 | 1.1 | 1.1 | 6.6 | 7.4 | 9.8 | 8.2 | 7.4 |
| 23..... | 1.3 | 1.5 | .4 | .3 | .5 | .8 | 1.1 | 5.1 | 6.6 | 9.0 | 14 | 3.7 |
| 24..... | 1.3 | 1.3 | .4 | .3 | 1.2 | .8 | 1.3 | 5.1 | 8.2 | 8.2 | 14 | 3.2 |
| 25..... | 1.5 | 1.2 | .4 | .3 | .8 | .8 | 1.3 | 7.4 | 6.6 | 7.4 | 7.4 | 2.8 |
| 26..... | 1.3 | 1.2 | .4 | .25 | 3.5 | 1.0 | 6.0 | 12 | 5.1 | 6.6 | 6.6 | 2.8 |
| 27..... | 1.3 | 1.2 | .4 | .25 | 1.5 | 3.5 | 1.7 | 5.1 | 5.1 | 5.8 | 9 | 2.5 |
| 28..... | 1.3 | 1.2 | .4 | .3 | 1.1 | 1.2 | 1.3 | 6.6 | 4.4 | 5.1 | 11 | 2.5 |
| 29..... | 1.3 | 1.1 | .4 | .3 | 1.1 | 1.5 | 4.5 | ..... | 3.7 | 5.1 | 7.4 | 2.8 |
| 30..... | 1.5 | 1.0 | .4 | .35 | 12 | 1.1 | 22 | ..... | 4.4 | 4.4 | 4.4 | 2.5 |
| 31..... | 1.5 | .9 | ..... | .3 | ..... | 1.0 | 9.0 | ..... | 3.7 | ..... | 5.1 | ..... |

Monthly discharge of Kalihi Stream near Honolulu, Oahu, for the year ending June 30, 1918.

| Month. | Discharge. | | | | Total run-off. | |
|----------------|--------------------------|----------|-------|---------------------|------------------|------------|
| | Million gallons per day. | | | Second-foot (mean). | Million gallons. | Acre-feet. |
| | Maximum. | Minimum. | Mean. | | | |
| July..... | 2.6 | 1.3 | 1.54 | 2.38 | 48 | 147 |
| August..... | 1.8 | .9 | 1.27 | 1.96 | 39 | 121 |
| September..... | 1.5 | .4 | .32 | .50 | 9 | 30 |
| October..... | .6 | .25 | .37 | .57 | 11 | 35 |
| November..... | 12 | .3 | 1.57 | 2.43 | 47 | 145 |
| December..... | 6.8 | .8 | 1.63 | 2.52 | 50 | 155 |
| January..... | 22 | .8 | 2.80 | 4.33 | 87 | 286 |
| February..... | 22 | 4.4 | 8.06 | 12.5 | 226 | 693 |
| March..... | 68 | 3.7 | 15.6 | 24.1 | 482 | 1,480 |
| April..... | 74 | 3.7 | 18.6 | 28.8 | 558 | 1,710 |
| May..... | 19 | 3.2 | 6.89 | 10.7 | 214 | 655 |
| June..... | 18 | 2.5 | 4.94 | 7.64 | 148 | 455 |
| The year..... | 74 | .25 | 5.26 | 8.14 | 1,920 | 5,890 |

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, 1918.

GAGE.—Gurley weekly water-stage recorder installed April 12, 1918, at same location as old inclined staff; datum unchanged.

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

CHANNEL AND CONTROL.—Channel 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 year, 4.95 feet at 5.30 a. m. April 19 (no estimate of discharge possible as entire weir was overflowed); minimum stage recorded, 0.1 foot September 30 to November 2 and November 13–20 (discharge, 0.15 million gallons per day, or 0.25 second-foot).

1913–1918: Maximum stage recorded, 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, September, 1915, July and August, 1916, and during 1917 (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 Laukaha weir. This waste water is used for irrigation of taro and rice.

ACCURACY.—Stage-discharge relation practically permanent. Rating curve well defined below and fairly well defined above 4 million gallons per day. Operation of water-stage recorder satisfactory except April 1–12, May 3, 4, and 18, for which periods there is no record and discharge has been estimated by comparison with Kalihi Stream. Records fair when water-stage recorder was operating and poor when there was no record.

Discharge measurements of Nuuanu Stream below reservoir No. 2 wasteway, near Honolulu, Oahu, during the year ending June 30, 1918.

[Made by R. D. Klise.]

| Date. | Gage height (feet). | Discharge. | |
|--------------|---------------------|--------------|--------------------------|
| | | Second-foot. | Million gallons per day. |
| May 8..... | 1.40 | 22 | 14 |
| June 27..... | 1.16 | 11.7 | 7.5 |

Daily discharge, in million gallons, of Nuuanu Stream below reservoir No. 2 wasteway, near Honolulu, Oahu, for the year ending June 30, 1918.

| Day. | July. | Aug. | Sept. | Oct. | Nov. | Dec. | Jan. | Feb. | Mar. | Apr. | May. | June. |
|---------|-------|------|-------|------|-------|------|------|-------|------|-------|------|-------|
| 1..... | 4.0 | 1.5 | 0.25 | 0.15 | 0.15 | 1.8 | 1.8 | 4.8 | 1.5 | 8.9 | 15 | 10 |
| 2..... | 4.3 | 1.1 | .25 | .15 | .15 | 1.5 | 1.8 | 3.7 | 1.5 | 14 | 13 | 8.9 |
| 3..... | 4.3 | 1.1 | .25 | .15 | 1.3 | 1.5 | 1.8 | 3.4 | 1.8 | 21 | 13 | 8.9 |
| 4..... | 4.8 | 1.1 | .25 | .15 | .9 | 1.3 | 1.5 | 3.4 | 1.5 | 80 | 14 | 8.9 |
| 5..... | 4.3 | 1.1 | .25 | .15 | 4.0 | 2.8 | 1.8 | 3.4 | 10 | 20 | 15 | 8.9 |
| 6..... | 4.3 | 1.1 | .25 | .15 | 4.3 | 1.3 | 4.3 | 2.8 | 8.9 | 16 | 13 | 8.9 |
| 7..... | 4.0 | 1.3 | .25 | .15 | .4 | 1.1 | 3.7 | 3.7 | 4.0 | 14 | 13 | 7.6 |
| 8..... | 3.7 | 1.3 | .25 | .15 | .25 | 1.1 | 2.0 | 2.5 | 4.0 | 10 | 13 | 7.6 |
| 9..... | 4.0 | 1.1 | .25 | .15 | .25 | 1.1 | 2.0 | 6.5 | 16 | 16 | 13 | 7.6 |
| 10..... | 3.4 | 1.1 | .25 | .15 | .25 | 1.1 | 1.8 | 4.3 | 34 | 50 | 13 | 8.9 |
| 11..... | 3.4 | 1.1 | .25 | .15 | .25 | 1.3 | 1.8 | 3.4 | 80 | 50 | 13 | 7.6 |
| 12..... | 2.8 | 1.1 | .25 | .15 | .25 | 1.5 | 1.8 | 2.5 | 45 | 16 | 13 | 10 |
| 13..... | 2.5 | 1.5 | .25 | .15 | .15 | 1.5 | 1.5 | 3.1 | 28 | 26 | 11 | 8.9 |
| 14..... | 2.3 | 1.5 | .25 | .15 | .15 | 1.8 | 1.5 | 3.4 | 15 | 20 | 11 | 8.9 |
| 15..... | 2.0 | 1.5 | .25 | .15 | .15 | 1.5 | 10 | 3.7 | 11 | 18 | 11 | 15 |
| 16..... | 2.0 | 1.5 | .25 | .15 | .15 | 1.1 | 3.4 | 4.0 | 26 | 20 | 16 | 10 |
| 17..... | 3.7 | .4 | .25 | .15 | .15 | 1.1 | 2.5 | 11 | 16 | 18 | 13 | 8.9 |
| 18..... | 2.8 | .25 | .25 | .15 | .15 | 1.3 | 8.9 | 4.0 | 15 | 16 | 12 | 8.9 |
| 19..... | 2.5 | .25 | .25 | .15 | .15 | 1.3 | 3.4 | 10 | 15 | 45 | 11 | 8.9 |
| 20..... | 2.3 | .25 | .25 | .15 | .15 | 1.5 | 3.1 | 5.6 | 15 | 20 | 11 | 8.9 |
| 21..... | 2.0 | .25 | .25 | .15 | .55 | 1.5 | 2.3 | 4.0 | 15 | 18 | 11 | 8.9 |
| 22..... | 1.8 | .25 | .25 | .15 | .25 | 1.5 | 2.3 | 4.3 | 15 | 20 | 13 | 8.9 |
| 23..... | 1.5 | .25 | .25 | .15 | .25 | 1.3 | 2.0 | 4.3 | 13 | 18 | 11 | 8.9 |
| 24..... | 1.5 | .25 | .25 | .15 | .9 | 1.5 | 3.7 | 4.3 | 11 | 18 | 11 | 7.6 |
| 25..... | 1.5 | .25 | .25 | .15 | .55 | 1.8 | 2.8 | 4.3 | 11 | 16 | 11 | 7.6 |
| 26..... | 1.5 | .25 | .25 | .15 | 1.1 | 1.8 | 7.6 | 7.6 | 11 | 16 | 11 | 7.6 |
| 27..... | 1.3 | .25 | .25 | .15 | .75 | 1.8 | 2.8 | 4.0 | 11 | 16 | 11 | 6.5 |
| 28..... | 1.3 | .25 | .25 | .15 | .55 | 2.0 | 2.8 | 3.7 | 11 | 15 | 15 | 6.5 |
| 29..... | 1.3 | .25 | .25 | .15 | 1.3 | 2.0 | 3.7 | ----- | 11 | 15 | 13 | 6.5 |
| 30..... | 1.5 | .25 | .15 | .15 | 3.4 | 1.8 | 3.7 | ----- | 11 | 15 | 10 | 6.5 |
| 31..... | 1.5 | .25 | ----- | .15 | ----- | 1.8 | 3.1 | ----- | 10 | ----- | 10 | ----- |

Monthly discharge of Nuuanu Stream below reservoir No. 2 wasteway, near Honolulu, Oahu, for the year ending June 30, 1918.

| Month. | Discharge. | | | | Total run-off. | |
|----------------|--------------------------|----------|-------|---------------------|------------------|------------|
| | Million gallons per day. | | | Second-foot (mean). | Million gallons. | Acre-feet. |
| | Maximum. | Minimum. | Mean. | | | |
| July..... | 4.8 | 1.3 | 2.71 | 4.19 | 84 | 258 |
| August..... | 1.5 | .25 | .77 | 1.19 | 24 | 73 |
| September..... | .25 | .15 | .25 | .39 | 7 | 23 |
| October..... | .15 | .15 | .15 | .23 | 5 | 14 |
| November..... | 4.3 | .15 | .78 | 1.21 | 23 | 72 |
| December..... | 2.8 | 1.1 | 1.53 | 2.37 | 47 | 146 |
| January..... | 10 | 1.5 | 3.14 | 4.86 | 97 | 299 |
| February..... | 11 | 2.5 | 4.49 | 6.95 | 126 | 385 |
| March..... | 80 | 1.5 | 15.5 | 24.0 | 479 | 1,470 |
| April..... | 80 | 8.9 | 22.2 | 34.3 | 666 | 2,040 |
| May..... | 16 | 10 | 12.4 | 19.2 | 334 | 1,180 |
| June..... | 15 | 6.5 | 8.59 | 13.3 | 268 | 791 |
| The year..... | 80 | .15 | 6.03 | 9.33 | 2,200 | 6,750 |

MAOLE DITCH, MAUKA STATION, NEAR HONOLULU, OAHU.

LOCATION.—In Nuuanu Valley, 200 feet below lower portal of Hillebrand Glen tunnel at the ditch intake, about 6 miles from Honolulu post office.

RECORDS AVAILABLE.—October 6, 1917, to June 30, 1918.

GAGE.—Gurley weekly water-stage recorder.

DISCHARGE MEASUREMENTS.—Made from plank at gage.

CHANNEL AND CONTROL.—Ditch is an earth cut, with bottom lining of concrete. At the gage a section 50 feet long, 4 feet wide, and 2½ feet high was constructed of concrete, with an elliptical concrete control 15 feet below gage.

EXTREMES OF DISCHARGE.—Maximum stage recorded, 2.86 feet at 5.30 a. m., April 19 (discharge, estimated from extension of rating curve, 29 million gallons per day, or 45 second-feet); minimum stage recorded, ditch occasionally dry.

DIVERSIONS.—Ditch diverts water from Maole Stream into Nuuanu Reservoir No. 4.

REGULATION.—By head gates.

UTILIZATION.—City water supply and power development.

ACCURACY.—Stage-discharge relation permanent. Rating curve well defined. Records good for low stages, but may be considerably in error for high and fluctuating stages.

Discharge measurements of Maole ditch, mauka station, near Honolulu, Oahu, during the year ending June 30, 1918.

[Made by R. D. Klise.]

| Date. | Gage height (feet). | Discharge. | | Date. | Gage height (feet). | Discharge. | |
|--------------|---------------------|--------------|--------------------------|------------|---------------------|--------------|--------------------------|
| | | Second-feet. | Million gallons per day. | | | Second-feet. | Million gallons per day. |
| Oct. 14..... | 0.12 | 0.04 | 0.03 | May 3..... | 1.07 | 7.9 | 5.1 |
| Nov. 6..... | .52 | 1.6 | 1.0 | 3..... | .98 | 6.9 | 4.5 |
| 6..... | .52 | 1.7 | 1.1 | 3..... | .84 | 5.1 | 3.2 |
| 7..... | .39 | .75 | .5 | 3..... | .27 | .3 | .2 |
| May 3..... | .86 | 5.6 | 3.6 | 3..... | .76 | 4.1 | 2.6 |
| 3..... | .87 | 5.1 | 3.3 | 3..... | .72 | 3.6 | 2.3 |

Daily discharge, in million gallons, of Maole ditch, mauka station, near Honolulu, Oahu, for the year ending June 30, 1918.

| Day. | Oct. | Nov. | Dec. | Jan. | Feb. | Mar. | Apr. | May. | June. |
|------|------|------|------|------|------|------|------|------|-------|
| 1. | | | 0.15 | 0.10 | 0.67 | 0.13 | 0.23 | 0.23 | 0.12 |
| 2. | | | .12 | .08 | .17 | .15 | 2.04 | .19 | .11 |
| 3. | | 0.03 | .21 | .08 | .12 | .19 | 3.30 | 2.50 | .10 |
| 4. | | .17 | .21 | .31 | .10 | .17 | 4.44 | .71 | .10 |
| 5. | | 1.38 | .15 | .11 | .90 | 2.04 | 2.98 | .90 | .09 |
| 6. | 0.12 | 1.62 | 1.32 | .09 | .34 | 1.26 | 1.50 | .34 | .09 |
| 7. | .01 | .55 | .63 | 1.00 | .52 | .37 | 1.12 | .17 | .09 |
| 8. | .01 | .14 | .19 | .49 | 1.56 | .21 | .80 | .13 | .11 |
| 9. | | .11 | .12 | .11 | 1.88 | 2.50 | 2.74 | .12 | .40 |
| 10. | | .19 | .90 | .08 | .34 | 2.66 | 5.50 | .28 | .55 |
| 11. | .08 | .08 | .31 | .19 | .25 | 1.44 | 2.32 | .21 | .13 |
| 12. | .10 | .04 | .11 | .06 | .37 | 1.08 | 1.88 | .13 | .37 |
| 13. | .13 | .04 | .10 | .08 | .55 | 1.12 | 4.60 | .14 | .63 |
| 14. | .04 | .03 | .10 | .08 | .21 | 1.00 | 2.58 | .10 | .40 |
| 15. | .03 | .03 | .08 | .55 | .13 | .85 | 1.26 | .19 | 1.80 |
| 16. | .03 | .03 | .08 | .09 | .25 | 1.74 | 1.68 | 2.04 | .55 |
| 17. | .12 | .02 | .07 | .06 | 1.26 | .95 | 1.12 | .37 | .21 |
| 18. | .04 | .01 | .07 | .90 | .25 | .52 | .90 | .25 | .17 |
| 19. | .02 | .02 | .07 | .34 | .80 | .52 | 5.50 | .21 | .28 |
| 20. | .02 | .01 | .06 | .25 | 1.08 | .37 | 1.20 | .13 | .71 |
| 21. | .03 | .17 | .09 | .10 | .46 | .31 | .67 | .12 | .80 |
| 22. | .03 | .03 | .34 | .08 | .40 | .28 | 2.20 | .52 | .59 |
| 23. | .03 | .01 | .08 | .07 | .19 | .25 | .59 | .28 | .19 |
| 24. | .01 | .10 | .07 | .12 | .17 | 1.12 | .49 | .21 | .15 |
| 25. | .01 | .19 | .05 | .28 | .34 | .43 | .40 | .34 | .12 |
| 26. | .01 | .25 | .19 | .90 | .75 | .31 | .40 | .13 | .10 |
| 27. | | .25 | 1.00 | .21 | .19 | .25 | .43 | .12 | .11 |
| 28. | | .13 | .28 | .11 | .21 | .23 | .31 | .40 | .12 |
| 29. | | .28 | .49 | 1.00 | | .43 | .52 | .63 | .21 |
| 30. | | 1.68 | .15 | .95 | | .19 | .31 | .75 | .17 |
| 31. | | | .21 | .37 | | .17 | | .21 | |

NOTE.—No gage-height record Nov. 24 and May 7-10; discharge interpolated Nov. 24, estimated from makai station May 7-10. No flow for days when discharge is not given.

Monthly discharge of Maole ditch, mauka station, near Honolulu, Oahu, for the year ending June 30, 1918.

| Month. | Discharge. | | | Total run-off. | |
|-------------------------|--------------------------|----------|-------|---------------------|------------|
| | Million gallons per day. | | | Second-foot (mean). | Acre-feet. |
| | Maximum. | Minimum. | Mean. | | |
| October (19 days)..... | 0.13 | 0.01 | 0.046 | 0.071 | 0.9 |
| November (28 days)..... | 1.68 | .01 | .294 | .455 | 8.2 |
| December..... | 1.32 | .05 | .258 | .399 | 8.0 |
| January..... | 1.00 | .06 | .298 | .461 | 9.2 |
| February..... | 1.88 | .10 | .516 | .798 | 14.5 |
| March..... | 2.66 | .13 | .750 | 1.16 | 23.2 |
| April..... | 5.50 | .23 | 1.80 | 2.78 | 54.0 |
| May..... | 2.50 | .10 | .421 | .651 | 13.0 |
| June..... | 1.80 | .09 | .319 | .494 | 9.6 |
| The period..... | | | | | 141 |
| | | | | | 432 |

MAOLE DITCH, MAKAI STATION, NEAR HONOLULU, OAHU.

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

RECORDS AVAILABLE.—October 5, 1917, to June 30, 1918.

GAGE.—Gurley weekly water-stage recorder.

DISCHARGE MEASUREMENTS.—Made from plank at gage.

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

EXTREMES OF DISCHARGE.—Maximum stage recorded, 3.45 feet at 4 a. m., April 19 (discharge, 32 million gallons per day, or 50 second-feet); minimum stage recorded, ditch occasionally dry.

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

REGULATION.—By head gates.

UTILIZATION.—City water supply and power development.

ACCURACY.—Stage-discharge relation permanent, except during unusually high stages, when the concrete control is not effective on account of large amount of silt carried. A large number of discharge measurements were secured and rating curve is fairly well defined below 14 million gallons per day. Records good for low stages, but subject to considerable error for medium and high stages.

Discharge measurements of Maole ditch, makai station, near Honolulu, Oahu, during the year ending June 30, 1918.

[Made by R. D. Klise.]

| Date. | Gage height (feet). | Discharge. | | Date. | Gage height (feet). | Discharge. | |
|--------------|---------------------|--------------|--------------------------|--------------|---------------------|--------------|--------------------------|
| | | Second-feet. | Million gallons per day. | | | Second-feet. | Million gallons per day. |
| Oct. 14..... | 0.13 | 0.04 | 0.03 | Jan. 18..... | 0.99 | 6.7 | 4.3 |
| Nov. 6..... | .70 | 4.5 | 3.0 | 18..... | .99 | 5.6 | 3.6 |
| 6..... | .62 | 3.3 | 2.1 | 18..... | .87 | 5.3 | 3.5 |
| 6..... | .59 | 2.6 | 1.7 | 18..... | .78 | 4.1 | 2.7 |
| 6..... | .55 | 2.0 | 1.3 | 18..... | .77 | 3.7 | 2.4 |
| 7..... | .40 | .65 | .4 | 18..... | .75 | 4.2 | 2.7 |
| 7..... | .36 | .55 | .35 | 18..... | .77 | 4.2 | 2.7 |
| Dec. 10..... | .99 | 8.6 | 5.6 | Mar. 11..... | 2.89 | 48 | 31 |
| 10..... | .90 | 7.0 | 4.6 | 11..... | 2.75 | 29 | 19 |
| Jan. 18..... | 1.39 | 12.6 | 8.2 | 11..... | 2.47 | 27 | 18 |
| 18..... | 1.11 | 7.2 | 4.7 | 11..... | 2.00 | 22 | 14 |
| 18..... | 1.06 | 7.6 | 4.9 | 11..... | 1.84 | 18 | 12 |
| 18..... | 1.04 | 7.3 | 4.7 | 11..... | 1.64 | 15 | 10 |
| 18..... | 1.03 | 6.9 | 4.5 | 11..... | 1.35 | 10.9 | 7.0 |
| 18..... | 1.04 | 7.0 | 4.5 | | | | |

Daily discharge, in million gallons, of Maole ditch, makai station, near Honolulu, Oahu, for the year ending June 30, 1918.

| Day. | Oct. | Nov. | Dec. | Jan. | Feb. | Mar. | Apr. | May. | June. |
|------|------|------|------|------|------|------|------|------|-------|
| 1. | | | 0.19 | 0.13 | 0.90 | 0.14 | 0.18 | 0.19 | 0.13 |
| 2. | | | .10 | .11 | .18 | .16 | 1.50 | .16 | .13 |
| 3. | | 0.06 | .16 | .11 | .12 | .20 | 2.80 | 1.86 | .10 |
| 4. | | .20 | .14 | .34 | .10 | .22 | 5.84 | .45 | .09 |
| 5. | 0.04 | 1.41 | .14 | .14 | .90 | 2.45 | 2.73 | .58 | .10 |
| 6. | .08 | 1.65 | 1.56 | .09 | .25 | 1.92 | 1.14 | .24 | .10 |
| 7. | .01 | .48 | .50 | .78 | .70 | .32 | .50 | .19 | .09 |
| 8. | .01 | .20 | .32 | .45 | 1.32 | .45 | .35 | .14 | .12 |
| 9. | | .13 | .19 | .14 | 3.04 | 2.10 | 1.68 | .13 | .50 |
| 10. | | .22 | .04 | .06 | .38 | 6.27 | 5.04 | .30 | .50 |
| 11. | .09 | .07 | .40 | .13 | .25 | 5.20 | 1.86 | .22 | .20 |
| 12. | .10 | .04 | .24 | .10 | .25 | 2.17 | 1.20 | .14 | 3.60 |
| 13. | .14 | .02 | .22 | .08 | .48 | 1.86 | 4.24 | .14 | .66 |
| 14. | .08 | .02 | .22 | .10 | .25 | 1.14 | 2.66 | .13 | .38 |
| 15. | .07 | .02 | .20 | .58 | .24 | 3.60 | 1.08 | .13 | 2.17 |
| 16. | .06 | .02 | .18 | .13 | .24 | 5.84 | 1.74 | 2.88 | .38 |
| 17. | .13 | .02 | .18 | .10 | 1.68 | 1.02 | .78 | .32 | .19 |
| 18. | .08 | .02 | .18 | 1.14 | .24 | .50 | .66 | .18 | .13 |
| 19. | .04 | .02 | .18 | .35 | .50 | .42 | 5.84 | .28 | .16 |
| 20. | .02 | .02 | .18 | .24 | .90 | .24 | 1.08 | .14 | .54 |
| 21. | .02 | .25 | .20 | .10 | .35 | .22 | .58 | .13 | .58 |
| 22. | .02 | .06 | .30 | .09 | .25 | .19 | 2.60 | .58 | .74 |
| 23. | .02 | .04 | .10 | .08 | .19 | .19 | .40 | .30 | .22 |
| 24. | .01 | .14 | .08 | .13 | .19 | .66 | .32 | .22 | .14 |
| 25. | | .28 | .08 | .20 | .32 | .38 | .30 | .30 | .14 |
| 26. | | .90 | .14 | 1.02 | .90 | .28 | .32 | .18 | .10 |
| 27. | | .34 | .82 | .14 | .24 | .20 | .32 | .16 | .12 |
| 28. | | .20 | .25 | .08 | .25 | .20 | .24 | .50 | .13 |
| 29. | | .22 | .35 | .70 | | .35 | .40 | .58 | .18 |
| 30. | .01 | 1.62 | .18 | 1.26 | | .19 | .25 | 1.02 | .16 |
| 31. | | | .22 | .25 | | .16 | | .22 | |

NOTE.—No gage-height record Nov. 3-6, 22-24, and Jan. 2, 4; discharge estimated from flow of Mauka station. No flow on days for which discharge is not given.

Monthly discharge of Maole ditch, makai station, near Honolulu, Oahu, for the year ending June 30, 1918.

| Month. | Discharge. | | | | Total run-off. | |
|--------------------|--------------------------|----------|-------|---------------------|------------------|------------|
| | Million gallons per day. | | | Second-feet (mean). | Million gallons. | Acre-feet. |
| | Maximum. | Minimum. | Mean. | | | |
| October (19 days) | 0.14 | 0.01 | 0.054 | 0.084 | 1.0 | 3.1 |
| November (28 days) | 1.65 | .02 | .309 | .478 | 8.6 | 26.6 |
| December | 1.56 | .08 | .295 | .456 | 9.1 | 28.1 |
| January | 1.26 | .06 | .302 | .467 | 9.4 | 28.7 |
| February | 3.04 | .10 | .558 | .863 | 15.6 | 47.9 |
| March | 6.27 | .14 | 1.27 | 1.96 | 39.2 | 121 |
| April | 5.84 | .18 | 1.62 | 2.51 | 48.6 | 149 |
| May | 2.88 | .13 | .419 | .648 | 13.0 | 39.9 |
| June | 3.60 | .09 | .426 | .659 | 12.8 | 39.2 |
| The period | | | | | 157 | 484 |

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, 1918.

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 the 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 during year, 3.50 feet at 4 p. m. April 10 (discharge, 80 million gallons per day, or 124 second-feet) minimum stage recorded, 0.55 foot September 6 (discharge, 0.65 million gallons per day, or 1.0 second-foot).

1909–1918: Maximum stage recorded, 9.0¹ feet from high-water mark of flood of March 19, 1917 (discharge, from extension of rating curve, 850 million gallons per day, or 1,320 second-feet); minimum daily discharge, March, 1914 (0.2 million gallons per day, or 0.3 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.—Stage-discharge relation not permanent. Rating curve used July 1 to November 5 fairly well defined between 2 and 20 million gallons per day; poorly defined outside these limits. Rating curve used November 6 to June 30 poorly defined. Gage read twice daily to tenths. Records fair July to October and poor after October.

Discharge measurements of Manoa Stream at College of Hawaii, near Honolulu, Oahu, during the year ending June 30, 1918.

| Date. | Made by— | Gage height (feet). | Discharge. | |
|--------------|---------------------------------|---------------------|--------------|--------------------------|
| | | | Second-feet. | Million gallons per day. |
| Nov. 22..... | College of Hawaii students..... | 0.87 | 2.9 | 1.9 |
| 22..... | do..... | .86 | 2.8 | 1.8 |
| May 9..... | R. D. Klise..... | 1.09 | 7.4 | 4.8 |
| June 24..... | do..... | 1.39 | 12.7 | 8.2 |

¹ Supersedes maximum published in Water-Supply Paper 465.

Daily discharge, in million gallons, of Manoa Stream at College of Hawaii, near Honolulu, Oahu, for the year ending June 30, 1918.

| Day. | July | Aug. | Sept. | Oct. | Nov. | Dec. | Jan. | Feb. | Mar. | Apr. | May | June. |
|---------|------|------|-------|------|-------|------|------|-------|------|-------|-----|-------|
| 1..... | 0.9 | 0.7 | 0.8 | 0.8 | 0.9 | 5.6 | 3.8 | 7.0 | 8.5 | 8.5 | 4.4 | 5.6 |
| 2..... | .8 | .75 | .75 | .8 | 1.0 | 6.3 | 3.3 | 5.6 | 8.5 | 8.5 | 3.3 | 10 |
| 3..... | .8 | .75 | .75 | .8 | 1.0 | 5.6 | 3.3 | 6.3 | 8.5 | 43 | 3.3 | 7.0 |
| 4..... | .8 | .8 | .75 | .8 | 1.0 | 7.0 | 2.8 | 7.8 | 7.0 | 34 | 5.6 | 2.3 |
| 5..... | .8 | .8 | .7 | .8 | 2.9 | 5.6 | 2.3 | 7.0 | 6.3 | 32 | 5.6 | 2.3 |
| 6..... | .8 | .75 | .65 | .8 | 7.0 | 7.0 | 2.3 | 5.6 | 7.0 | 25 | 7.8 | 2.3 |
| 7..... | .8 | .7 | .75 | .8 | 5.0 | 7.0 | 4.4 | 7.8 | 7.0 | 19 | 7.8 | 2.3 |
| 8..... | .8 | .7 | .7 | .8 | 5.6 | 7.0 | 4.4 | 8.5 | 8.5 | 16 | 7.0 | 2.8 |
| 9..... | .8 | .8 | .75 | .8 | 3.8 | 5.6 | 3.8 | 9.2 | 8.5 | 18 | 5.6 | 2.3 |
| 10..... | .8 | .8 | .8 | .75 | 3.8 | 5.6 | 4.4 | 7.8 | 8.5 | 68 | 5.6 | 2.3 |
| 11..... | .8 | .8 | .8 | .75 | 5.0 | 5.6 | 4.4 | 8.5 | 10 | 51 | 6.3 | 3.3 |
| 12..... | .8 | .8 | .75 | .75 | 5.6 | 4.4 | 3.8 | 7.0 | 8.5 | 37 | 3.8 | 5.0 |
| 13..... | .8 | .8 | .8 | .8 | 2.8 | 5.6 | 4.4 | 5.6 | 11 | 37 | 3.3 | 7.8 |
| 14..... | .8 | .75 | .8 | .8 | 2.3 | 5.6 | 5.0 | 8.5 | 9.2 | 25 | 3.3 | 5.6 |
| 15..... | .9 | .75 | .8 | .8 | 1.5 | 6.3 | 3.8 | 6.3 | 8.5 | 30 | 3.3 | 5.6 |
| 16..... | 1.0 | .8 | .8 | .8 | 1.5 | 5.6 | 6.3 | 5.6 | 8.5 | 41 | 8.5 | 5.6 |
| 17..... | .9 | .8 | .8 | .8 | 1.5 | 7.0 | 5.6 | 5.6 | 8.5 | 22 | 7.0 | 7.0 |
| 18..... | 1.0 | .8 | .8 | .8 | 1.2 | 7.0 | 4.4 | 6.3 | 8.5 | 22 | 7.0 | 5.6 |
| 19..... | 1.0 | .8 | .9 | .8 | 1.2 | 7.0 | 6.3 | 5.6 | 8.5 | 14 | 5.6 | 5.6 |
| 20..... | .75 | .8 | .8 | .8 | 1.5 | 8.5 | 24 | 7.8 | 8.5 | 11 | 5.6 | 6.3 |
| 21..... | .8 | .8 | .8 | .8 | 1.5 | 7.8 | 14 | 7.0 | 8.5 | 10 | 5.6 | 3.8 |
| 22..... | .8 | .8 | .8 | .8 | 1.5 | 6.3 | 11 | 7.0 | 9.2 | 9.2 | 3.3 | 3.3 |
| 23..... | .75 | .8 | .8 | 1.0 | 4.4 | 5.6 | 10 | 5.6 | 8.5 | 8.5 | 2.3 | 2.3 |
| 24..... | .75 | .8 | .75 | 1.0 | 3.8 | 5.6 | 8.5 | 6.3 | 9.2 | 8.5 | 2.3 | 2.3 |
| 25..... | .75 | .8 | .8 | 1.0 | 3.3 | 5.6 | 10 | 5.6 | 9.2 | 7.0 | 2.8 | 2.3 |
| 26..... | .75 | .8 | .8 | 1.0 | 2.3 | 6.3 | 9.2 | 7.0 | 8.5 | 7.0 | 3.3 | 4.4 |
| 27..... | .75 | .75 | .8 | 1.0 | 2.3 | 8.5 | 9.2 | 9.2 | 10 | 4.4 | 3.3 | 3.8 |
| 28..... | .75 | .8 | .8 | 1.0 | 2.3 | 7.8 | 7.8 | 10 | 8.5 | 4.4 | 2.8 | 3.3 |
| 29..... | .75 | .8 | .8 | 1.0 | 5.0 | 7.0 | 7.0 | ----- | 9.2 | 4.4 | 3.8 | 4.4 |
| 30..... | .8 | .8 | .8 | 1.0 | 5.6 | 6.3 | 7.0 | ----- | 8.5 | 4.4 | 5.6 | 4.4 |
| 31..... | .75 | .8 | ----- | 1.0 | ----- | 7.0 | 5.6 | ----- | 8.5 | ----- | 5.0 | ----- |

Monthly discharge of Manoa Stream at College of Hawaii, near Honolulu, Oahu, for year ending June 30, 1918.

| Month. | Discharge. | | | Total run-off. | | |
|----------------|--------------------------|----------|-------|------------------------|---------------------|----------------|
| | Million gallons per day. | | | Second-foot (mean). | Million gallons. | Acre- feet. |
| | Maximum. | Minimum. | Mean. | | | |
| July..... | 1.0 | 0.75 | 0.81 | 1.25 | 25 | 77 |
| August..... | .8 | .7 | .78 | 1.21 | 24 | 74 |
| September..... | .8 | .65 | .78 | 1.21 | 23 | 72 |
| October..... | 1.0 | .75 | .85 | 1.32 | 26 | 81 |
| November..... | 7.0 | .9 | 2.94 | 4.55 | 88 | 271 |
| December..... | 8.5 | 4.4 | 6.41 | 9.92 | 199 | 610 |
| January..... | 24 | 2.3 | 6.52 | 10.1 | 202 | 620 |
| February..... | 10 | 5.6 | 7.04 | 10.9 | 197 | 605 |
| March..... | 11 | 6.3 | 8.57 | 13.3 | 266 | 815 |
| April..... | 68 | 4.4 | 21.0 | 32.5 | 630 | 1,930 |
| May..... | 8.5 | 2.3 | 4.83 | 7.47 | 150 | 460 |
| June..... | 10 | 2.3 | 4.36 | 6.75 | 131 | 401 |
| The year..... | 68 | .65 | 5.37 | 8.31 | 1,960 | 6,020 |

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.

RECORDS AVAILABLE.—May 29, 1913, to June 30, 1918.

GAGE.—Stevens water-stage recorder. Watson water-stage recorder in use June 17 to October 20, 1914; replaced October 20, 1914, by a Friez water-stage recorder; replaced May 9, 1915, by a Stevens 8-day water-stage recorder which was replaced February 28, 1916, by a Stevens continuous water-stage recorder. 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 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 affects the discharge relation slightly. Channel clean and confined in the vicinity of the gage. A short distance upstream the natural slope is steep and channel is filled with boulders.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 4.10 feet at 3 p. m. March 11 (discharge, 400 million gallons per day, or 620 second-feet); minimum stage recorded, 1 foot at various times during August, September, and October (discharge, 0.3 million gallons per day, or 0.45 second-foot.).

1913-1918: Maximum stage recorded, 4.65 feet 12.15 a. m. March 20, 1917 (discharge, 540 million gallons per day, or 837 second-feet; revised); minimum stage recorded, December, 1913, (discharge 0.05 million gallons per day, or 0.08 second-foot.).

DIVERSIONS.—None.

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

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 elevation in Manoa Valley for rice and taro irrigation.

ACCURACY.—Stage-discharge relation practically permanent. Rating curve well defined between 2 and 100 million gallons per day. Operation of water-stage recorder satisfactory, except November 26 to December 2. Discharge estimated for this period from flow of East Branch of Manoa. Records fair.

Discharge measurements of West Branch of Manoa Stream near Honolulu, Oahu, during the year ending June 30, 1918.

| Date. | Made by— | Gage height (feet). | Discharge. | |
|--------------|---------------------|---------------------|--------------|--------------------------|
| | | | Second-feet. | Million gallons per day. |
| July 25..... | R. D. Klise..... | 1.04 | 0.8 | 0.5 |
| Sept. 5..... | do..... | 1.01 | .45 | .3 |
| Oct. 9..... | do..... | 1.02 | .45 | .3 |
| Dec. 17..... | W. C. Woodward..... | 1.06 | 1.3 | .85 |
| Apr. 19..... | R. D. Klise..... | 1.77 | 35 | 22 |
| May 7..... | J. B. Mann..... | 1.14 | 3.0 | 1.9 |

Daily discharge, in million gallons, of West Branch of Manoa Stream near Honolulu, Oahu, for the year ending June 30, 1918.

| Day. | July. | Aug. | Sept. | Oct. | Nov. | Dec. | Jan. | Feb. | Mar. | Apr. | May. | June. |
|---------|-------|------|-------|------|-------|------|------|-------|------|-------|------|-------|
| 1..... | 1.4 | 0.3 | 1.4 | 0.6 | 0.6 | 2.3 | 1.4 | 2.3 | 1.4 | 3.2 | 2.3 | 1.4 |
| 2..... | 1.4 | .3 | .6 | .6 | .6 | 2.3 | 1.4 | 1.4 | 1.4 | 6.7 | 2.3 | 1.4 |
| 3..... | 1.4 | .3 | .6 | .6 | 2.3 | 1.4 | 1.4 | 1.4 | 1.4 | 8.0 | 19 | 1.4 |
| 4..... | .6 | .3 | .6 | .6 | 4.3 | 1.4 | 1.4 | .6 | .6 | 17 | 5.4 | 1.4 |
| 5..... | .6 | .3 | .3 | .6 | 11 | 3.2 | .6 | 2.3 | 5.4 | 5.4 | 5.4 | 1.4 |
| 6..... | .6 | .3 | .3 | 1.4 | 11 | 4.3 | .6 | 1.4 | 4.3 | 5.4 | 3.2 | 1.4 |
| 7..... | .6 | .6 | .6 | .3 | 6.7 | 3.2 | 3.2 | 2.3 | 1.4 | 4.3 | 2.3 | 1.4 |
| 8..... | .6 | .3 | .6 | .3 | 3.2 | 1.4 | 1.4 | 3.2 | 1.4 | 3.2 | 2.3 | 1.4 |
| 9..... | 3.2 | .3 | .6 | .3 | 2.3 | 1.4 | 1.4 | 8.0 | 15 | 6.7 | 2.3 | 1.4 |
| 10..... | 3.2 | .6 | .6 | .3 | 3.2 | 4.3 | .6 | 3.2 | 15 | 19 | 2.3 | 2.3 |
| 11..... | 1.4 | 2.3 | .6 | .6 | 2.3 | 2.3 | 1.4 | 2.3 | 46 | 8.0 | 2.3 | 1.4 |
| 12..... | .6 | 1.4 | .6 | .6 | 1.4 | 1.4 | 1.4 | 1.4 | 15 | 8.0 | 1.4 | 8.0 |
| 13..... | .6 | 1.4 | 1.4 | 1.4 | 1.4 | 1.4 | 1.4 | 1.4 | 11 | 13 | 1.4 | 3.2 |
| 14..... | .6 | 1.4 | .6 | .6 | 1.4 | 1.4 | 1.4 | 1.4 | 5.4 | 11 | 1.4 | 3.2 |
| 15..... | .6 | 2.3 | .6 | .6 | 1.4 | 1.4 | 3.2 | 1.4 | 8.0 | 6.7 | 1.4 | 8.0 |
| 16..... | 1.4 | .6 | 1.4 | 1.4 | 1.4 | .6 | 1.4 | 2.3 | 19 | 10.5 | 13 | 4.3 |
| 17..... | 2.3 | .6 | 2.3 | 3.2 | 1.4 | .6 | 1.4 | 5.4 | 5.4 | 5.4 | 4.3 | 2.3 |
| 18..... | 1.4 | .6 | 1.4 | 1.4 | 1.4 | .6 | 3.2 | 1.4 | 4.3 | 4.3 | 2.3 | 1.4 |
| 19..... | .6 | .3 | .6 | 1.4 | 1.4 | .6 | 2.3 | 4.3 | 3.2 | 21 | 2.3 | 1.4 |
| 20..... | .6 | .3 | .6 | .6 | 1.4 | .6 | 2.3 | 4.3 | 3.2 | 6.7 | 1.4 | 3.2 |
| 21..... | .6 | .3 | .6 | .6 | 1.4 | .6 | 1.4 | 2.3 | 3.2 | 21 | 1.4 | 2.3 |
| 22..... | .6 | .6 | .6 | .6 | 1.4 | 2.3 | 1.4 | 2.3 | 2.3 | 4.3 | 2.3 | 3.2 |
| 23..... | .6 | 1.4 | .3 | .6 | 1.4 | .6 | 1.4 | 1.4 | 2.3 | 3.2 | 1.4 | 2.3 |
| 24..... | .6 | 1.4 | .3 | .6 | 2.3 | .6 | .6 | 1.4 | 6.7 | 3.2 | 1.4 | 2.3 |
| 25..... | .6 | .6 | .3 | .6 | 1.4 | .6 | 1.4 | 1.4 | 3.2 | 3.2 | 2.3 | 1.4 |
| 26..... | .6 | .6 | .6 | .6 | 3.2 | .6 | 4.3 | 2.3 | 2.3 | 3.2 | 1.4 | 1.4 |
| 27..... | .6 | .6 | .6 | .6 | 2.3 | 4.3 | 1.4 | 1.4 | 2.3 | 2.3 | 1.4 | 1.4 |
| 28..... | .6 | .6 | .6 | .6 | 1.4 | 2.3 | 1.4 | 1.4 | 2.3 | 2.3 | 4.3 | 1.4 |
| 29..... | .6 | .6 | .6 | .6 | 2.3 | 5.4 | 3.2 | ..... | 2.3 | 3.2 | 3.2 | 1.4 |
| 30..... | .6 | .6 | .6 | .6 | 4.3 | 2.3 | 4.3 | ..... | 2.3 | 2.3 | 2.3 | 1.4 |
| 31..... | .6 | .6 | ..... | .6 | ..... | 1.4 | 1.4 | ..... | 1.4 | ..... | 1.4 | ..... |

Monthly discharge of West Branch of Manoa Stream near Honolulu, Oahu, for the year ending June 30, 1918.

| Month. | Discharge. | | | | Total run-off. | |
|-----------------|--------------------------|----------|-------|------------------------|---------------------|----------------|
| | Million gallons per day. | | | Second-foot (mean). | Million gallons. | Acre- feet. |
| | Maximum. | Minimum. | Mean. | | | |
| July | 3.2 | 0.6 | 0.98 | 1.52 | 30 | 93 |
| August | 2.3 | .3 | .73 | 1.13 | 23 | 69 |
| September | 2.3 | .3 | .71 | 1.10 | 21 | 65 |
| October | 3.2 | .3 | .77 | 1.19 | 24 | 73 |
| November | 11 | .6 | 2.72 | 4.21 | 82 | 250 |
| December | 5.4 | .6 | 1.84 | 2.85 | 57 | 175 |
| January | 4.3 | .6 | 1.77 | 2.74 | 55 | 168 |
| February | 8.0 | .6 | 2.34 | 3.62 | 66 | 201 |
| March | 46 | .6 | 6.40 | 9.90 | 198 | 609 |
| April | 21 | 2.3 | 7.39 | 11.4 | 222 | 680 |
| May | 19 | 1.4 | 3.25 | 5.03 | 101 | 309 |
| June | 8.0 | 1.4 | 2.33 | 3.60 | 70 | 215 |
| The year | 46 | .3 | 2.60 | 4.02 | 949 | 2,910 |

EAST BRANCH OF MANOA STREAM NEAR HONLOULU, OAHU.

LOCATION.—At highway bridge 400 feet above confluence with West Branch of Manoa Stream, in upper Manoa Valley, 5 miles northeast of Honolulu post office.

RECORDS AVAILABLE.—May 29, 1913, to June 30, 1918.

GAGE.—Stevens water-stage recorder. Watson water-stage recorder from May 5, 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 year, 4.05 feet at 5.30 a. m. April 19 (discharge, 195 million gallons per day, or 302 second-feet); minimum stage recorded, 1.35 feet at various times from October to March (discharge, 0.9 million gallons per day, or 1.4 second-feet).

1913–1918: Maximum stage recorded, 5.2 feet at 4 p. m. March 19, 1917 (discharge, from extension of rating curve, 470 million gallons per day,¹ or 727 second-feet); minimum daily discharge occurred during March, 1914, and in 1917–18.

DIVERSIONS.—East Manoa ditch divert 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.—Stage-discharge relation not permanent. Rating curves well defined below 30 million gallons per day applicable July 1 to April 18 and April 19 to June 30. Operation of water-stage recorder satisfactory except July 12 to August 6, May 21–24, and June 12–20. Discharge for these periods estimated from West Branch of Manoa. Records fair when water-stage recorder was operating, poor at other times.

Discharge measurements of East Branch of Manoa Stream near Honolulu, Oahu, during the year ending June 30, 1918.

| Date. | Made by— | Gage height (feet). | Discharge. | |
|--------------|------------------|---------------------|--------------|--------------------------|
| | | | Second-feet. | Million gallons per day. |
| Sept. 5..... | R. D. Klise..... | 1.40 | 1.65 | 1.1 |
| Oct. 8..... | do..... | 1.37 | 1.65 | 1.1 |
| Apr. 19..... | do..... | 2.09 | 26 | 16 |
| May 2..... | J. B. Mann..... | 1.44 | 3.3 | 2.1 |
| June 21..... | R. D. Klise..... | 1.54 | 5.6 | 3.6 |

¹ Supersedes maximum published in Water-Supply Paper 465.

Daily discharge, in million gallons, of East Branch of Manoa Stream near Honolulu, Oahu, for the year ending June 30, 1918.

| Day. | July. | Aug. | Sept. | Oct. | Nov. | Dec. | Jan. | Feb. | Mar. | Apr. | May. | June. |
|---------|-------|------|-------|------|-------|------|------|-------|------|-------|------|-------|
| 1..... | 1.7 | 1.2 | 1.7 | 1.2 | 0.9 | 1.7 | 0.9 | 1.2 | 1.2 | 2.8 | 2.4 | 3.8 |
| 2..... | 1.7 | 1.2 | 1.2 | 1.2 | 0.9 | 1.7 | .9 | .9 | 1.2 | 8.8 | 2.4 | 3.0 |
| 3..... | 2.2 | 1.2 | 1.2 | 1.2 | 1.7 | 1.2 | .9 | .9 | 1.2 | 16 | 17 | 2.4 |
| 4..... | 2.2 | 1.2 | 1.2 | 2.2 | 2.8 | 1.2 | .9 | .9 | .9 | 18 | 6.2 | 2.4 |
| 5..... | 1.7 | 1.2 | 1.2 | 1.2 | 7.8 | 1.2 | .9 | 2.2 | 4.2 | 5.9 | 7.2 | 3.0 |
| 6..... | 1.7 | 1.2 | 1.7 | 1.7 | 7.8 | 2.8 | .9 | 1.2 | 2.8 | 5.9 | 4.5 | 3.0 |
| 7..... | 1.7 | 1.2 | 1.7 | 1.2 | 2.8 | 2.2 | 1.7 | 1.7 | 1.2 | 3.5 | 3.8 | 2.4 |
| 8..... | 1.7 | 1.2 | 1.2 | 1.2 | 2.2 | 1.7 | 1.2 | 2.8 | 1.2 | 3.5 | 2.4 | 2.4 |
| 9..... | 4.2 | 1.2 | 1.2 | .9 | 1.7 | 1.2 | 1.2 | 5.9 | 5.9 | 6.8 | 2.4 | 3.0 |
| 10..... | 3.5 | 1.2 | 1.2 | .9 | 2.2 | 2.8 | .9 | 1.7 | 7.8 | 16 | 3.8 | 3.8 |
| 11..... | 1.7 | 2.2 | 1.2 | 1.2 | 1.7 | 1.2 | 1.2 | 1.2 | 22 | 6.8 | 3.0 | 3.0 |
| 12..... | 1.7 | 1.7 | 1.2 | 1.7 | 1.7 | 1.2 | 1.2 | 1.2 | 6.8 | 5.9 | 3.0 | 9.4 |
| 13..... | 1.7 | 1.7 | 1.7 | 1.2 | 1.2 | 1.2 | 1.2 | 1.7 | 5.0 | 7.8 | 3.0 | 4.5 |
| 14..... | 1.7 | 1.2 | 1.2 | 1.2 | 1.2 | 1.2 | 1.2 | 1.2 | 4.2 | 6.8 | 2.4 | 4.5 |
| 15..... | 1.7 | 1.7 | 1.2 | 1.2 | 1.2 | .9 | 2.2 | .9 | 8.8 | 5.0 | 3.0 | 9.4 |
| 16..... | 2.2 | 1.2 | 2.2 | 1.7 | 1.2 | .9 | 1.2 | 1.7 | 24 | 6.8 | 15 | 6.2 |
| 17..... | 2.8 | 1.2 | 1.7 | 2.8 | 1.2 | .9 | 1.2 | 4.2 | 9.9 | 5.0 | 3.8 | 3.8 |
| 18..... | 2.2 | 1.2 | 1.2 | 1.2 | 1.2 | .9 | 2.2 | 1.2 | 3.5 | 3.5 | 3.0 | 3.0 |
| 19..... | 1.7 | 1.2 | 1.2 | 1.2 | 1.2 | .9 | 2.2 | 2.2 | 2.8 | 19 | 3.0 | 3.0 |
| 20..... | 1.7 | 1.2 | 1.2 | 1.2 | 1.2 | .9 | 1.7 | 2.8 | 2.8 | 7.2 | 3.0 | 4.5 |
| 21..... | 1.7 | 1.2 | 1.2 | 1.2 | 1.7 | .9 | 1.2 | 1.2 | 2.2 | 5.4 | 3.0 | 5.4 |
| 22..... | 1.7 | 1.7 | 1.2 | 1.2 | 1.2 | 1.7 | 1.2 | 1.2 | 2.2 | 8.2 | 3.8 | 4.5 |
| 23..... | 1.7 | 2.2 | 1.2 | 1.2 | .9 | .9 | .9 | 1.2 | 1.7 | 4.5 | 3.0 | 3.8 |
| 24..... | 1.7 | 1.7 | 1.2 | 1.2 | 2.2 | .9 | .9 | 1.2 | 6.8 | 3.8 | 3.0 | 3.8 |
| 25..... | 1.7 | 1.2 | 1.2 | 1.2 | 1.2 | .9 | .9 | 1.2 | 2.8 | 3.0 | 3.0 | 3.0 |
| 26..... | 1.7 | 1.2 | 1.2 | .9 | 2.8 | .9 | 1.7 | 1.2 | 2.2 | 3.0 | 3.0 | 3.0 |
| 27..... | 1.7 | 1.2 | 1.2 | .9 | 1.7 | 2.8 | .9 | 1.2 | 2.2 | 2.4 | 3.0 | 3.0 |
| 28..... | 1.7 | 1.2 | 1.2 | .9 | 1.2 | 1.2 | .9 | 1.2 | 2.2 | 2.4 | 4.5 | 3.8 |
| 29..... | 1.7 | 1.2 | 1.2 | .9 | 1.7 | 3.5 | 2.2 | ..... | 2.2 | 3.0 | 4.5 | 3.0 |
| 30..... | 1.7 | 1.2 | 1.2 | .9 | 5.0 | 1.2 | 2.2 | ..... | 1.7 | 3.0 | 5.4 | 3.0 |
| 31..... | 1.7 | 1.7 | ..... | .9 | ..... | 1.2 | .9 | ..... | 1.7 | ..... | 3.8 | ..... |

Monthly discharge of East Branch of Manoa Stream near Honolulu, Oahu, for the year ending June 30, 1918.

| Month. | Discharge. | | | Total run-off. | | |
|----------------|--------------------------|----------|-------|------------------------|---------------------|----------------|
| | Million gallons per day. | | | Second-foot (mean). | Million gallons. | Acre- feet. |
| | Maximum. | Minimum. | Mean. | | | |
| July..... | 4.2 | 1.7 | 1.94 | 3.00 | 60 | 185 |
| August..... | 2.2 | 1.2 | 1.36 | 2.10 | 42 | 129 |
| September..... | 2.2 | 1.2 | 1.32 | 2.04 | 40 | 122 |
| October..... | 2.8 | .9 | 1.25 | 1.93 | 39 | 119 |
| November..... | 7.8 | .9 | 2.11 | 3.26 | 63 | 194 |
| December..... | 3.5 | .9 | 1.44 | 2.23 | 44 | 137 |
| January..... | 2.2 | .9 | 1.28 | 1.98 | 40 | 122 |
| February..... | 5.9 | .9 | 1.69 | 2.61 | 47 | 145 |
| March..... | 24 | .9 | 4.69 | 7.26 | 145 | 446 |
| April..... | 19 | 2.4 | 6.66 | 10.3 | 200 | 613 |
| May..... | 17 | 2.4 | 4.33 | 6.70 | 134 | 412 |
| June..... | 9.4 | 2.4 | 3.89 | 6.02 | 117 | 358 |
| The year..... | 24 | .9 | 2.66 | 4.12 | 971 | 2,980 |

EAST MANOA DITCH NEAR HONOLULU, OAHU.

LOCATION.—1,000 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 December 31, 1916; January 26 to June 30, 1918.

GAGE.—Gurley weekly water-stage recorder. Vertical staff May 24, 1915, to December 31, 1916.

DISCHARGE MEASUREMENTS.—Made by a 2.5-foot sharp-crested Cippoletti weir. Old staff gage station rated with current meter.

CHANNEL AND CONTROL.—Weir basin about 6 feet wide, 30 feet long, and 2 feet deep below weir crest. Ditch in earth cut. Wooden weir with metal crest.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 1.53 feet at 9 a. m., April 10 (discharge, not estimated, weir flooded); minimum stage recorded, 0.27 foot, April 23 (discharge, 0.75 million gallons per day, or 1.2 second-feet).

1915-1918: Maximum stage recorded April 10, 1918; minimum stage recorded, 0.75 foot January 22-24, 1916 (discharge, 0.7 million gallons per day, or 1.1 second-feet).

DIVERSIONS.—None.

REGULATION.—None.

UTILIZATION.—For irrigation of rice and taro.

ACCURACY.—Stage-discharge relation practically permanent. Some velocity of approach, probably making published discharge too small. Operation of water-stage recorder satisfactory for record published. Records fair.

Discharge measurements of East Manoa ditch near Honolulu, Oahu, during the year ending June 30, 1918.

[Made by R. D. Klise.]

| Date. | Gage height (feet). | Discharge. | |
|--------------|---------------------|--------------|--------------------------|
| | | Second-feet. | Million gallons per day. |
| Feb. 19..... | 0.40 | 2.1 | 1.4 |
| May 2..... | .43 | 2.3 | 1.5 |

Daily discharge, in million gallons, of East Manoa ditch near Honolulu, Oahu, for the year ending June 30, 1918.

| Day. | Jan. | Feb. | Mar. | Apr. | May. | June. | Day. | Jan. | Feb. | Mar. | Apr. | May. | June. |
|---------|------|------|------|------|------|-------|---------|------|------|------|------|------|-------|
| 1..... | | 0.9 | 0.95 | 1.1 | 1.5 | 1.6 | 16..... | | 1.2 | | | 3.0 | 1.8 |
| 2..... | | .85 | .9 | 1.6 | 1.5 | 1.5 | 17..... | | 1.9 | 1.6 | | 2.0 | 1.5 |
| 3..... | | .8 | 2.2 | 2.4 | 1.5 | 1.8 | 18..... | | 1.1 | 1.3 | | 1.8 | 1.5 |
| 4..... | | .85 | | 2.3 | .9 | 1.5 | 19..... | | 1.6 | 1.2 | | 1.8 | 1.5 |
| 5..... | | 1.6 | | 1.6 | 1.1 | 1.5 | 20..... | | 1.7 | 1.1 | | 1.7 | 2.0 |
| 6..... | | 1.4 | | 1.5 | .8 | 1.5 | 21..... | | 1.2 | 1.1 | 0.9 | 1.7 | 1.9 |
| 7..... | | 1.6 | | 1.3 | 1.3 | 1.5 | 22..... | | 1.1 | 1.0 | 1.1 | 1.7 | 1.7 |
| 8..... | | 1.8 | | 1.1 | 1.9 | 1.5 | 23..... | | 1.0 | .95 | .75 | 1.4 | 1.5 |
| 9..... | | 2.9 | | 1.8 | 1.9 | 1.7 | 24..... | | 1.0 | 1.6 | 1.2 | 1.4 | 1.4 |
| 10..... | | 1.4 | | | 2.2 | 1.8 | 25..... | | .95 | .95 | 1.9 | 1.8 | 1.4 |
| 11..... | | 1.1 | | | 1.8 | 1.5 | 26..... | 1.4 | 1.0 | 1.0 | 1.9 | 1.8 | 1.4 |
| 12..... | | 1.1 | | | 1.8 | 2.3 | 27..... | .85 | .9 | 1.0 | 1.9 | 1.6 | 1.4 |
| 13..... | | 1.3 | | | 1.8 | 1.7 | 28..... | .85 | 1.1 | 1.0 | 1.8 | 1.8 | 1.4 |
| 14..... | | .9 | | | 1.7 | 1.5 | 29..... | 1.2 | | 1.0 | 1.9 | 1.7 | 1.3 |
| 15..... | | .95 | | | 1.8 | 2.4 | 30..... | 1.4 | | .95 | 1.6 | 2.1 | 1.3 |
| | | | | | | | 31..... | .95 | | .9 | | 1.6 | |

Monthly discharge of East Manoa ditch near Honolulu, Oahu, for the year ending June 30, 1918.

| Month. | Discharge. | | | | Total run-off. | |
|--------------------|--------------------------|----------|-------|---------------------|------------------|------------|
| | Million gallons per day. | | | Second-foot (mean). | Million gallons. | Acre-feet. |
| | Maximum. | Minimum. | Mean. | | | |
| January 25-31..... | 1.4 | 0.85 | 1.11 | 1.72 | 7 | 20 |
| February..... | 2.9 | .8 | 1.26 | 1.95 | 35 | 108 |
| May..... | 3.0 | .8 | 1.72 | 2.66 | 53 | 164 |
| June..... | 2.4 | 1.3 | 1.60 | 2.48 | 48 | 147 |

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, 1918.

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 year, 4.36 feet at 12.05 a. m. April 4 and at 6.15 p. m. April 11 (discharge, 180 million gallons per day, or 279 second-feet); minimum stage recorded, 0.7 foot frequently throughout the year (discharge, 2.2 million gallons per day, or 3.4 second-feet).

1914-1918: Maximum stage recorded, 6.5 feet at 1 a. m. March 20, 1917 (estimated discharge, 250 million gallons per day, or 390 second-feet); minimum stage recorded, 0.6 foot July 16, 1916, and February 9-12, 1917 (discharge, 1.4 million gallons per day, or 2.2 second-feet).

DIVERSIONS.—None.

REGULATION.—None.

UTILIZATION.—Low flow diverted below station for domestic supply and for irrigation of taro and rice.

ACCURACY.—Stage-discharge relation practically permanent. Rating curve well defined between 2.5 and 12 million gallons per day. Operation of water-stage recorder satisfactory. Records good.

Discharge measurements of Haiku Stream near Heeia, Oahu, during the year ending June 30, 1918.

| Date. | Made by— | Gage height (feet). | Discharge. | |
|--------------|----------------------|---------------------|--------------|--------------------------|
| | | | Second-foot. | Million gallons per day. |
| July 3..... | H. A. R. Austin..... | 0.75 | 3.9 | 2.5 |
| Oct. 1..... | R. D. Klise..... | .76 | 4.1 | 2.6 |
| Apr. 12..... | do..... | 1.18 | 15.5 | 10 |
| May 1..... | do..... | .73 | 4.1 | 2.6 |

Daily discharge, in million gallons, of Haiku Stream near Heeia, Oahu, for the year ending June 30, 1918.

| Day. | July. | Aug. | Sept. | Oct. | Nov. | Dec. | Jan. | Feb. | Mar. | Apr. | May. | June. |
|---------|-------|------|-------|------|-------|------|------|-------|------|-------|------|-------|
| 1..... | 2.2 | 2.6 | 2.6 | 2.6 | 2.6 | 2.6 | 2.2 | 3.2 | 2.2 | 3.2 | 2.6 | 2.6 |
| 2..... | 2.2 | 2.6 | 2.6 | 2.6 | 2.6 | 2.2 | 2.2 | 2.6 | 2.2 | 5.6 | 2.6 | 2.6 |
| 3..... | 2.6 | 2.6 | 2.6 | 2.6 | 2.6 | 2.6 | 2.2 | 2.6 | 2.2 | 13 | 7.3 | 2.6 |
| 4..... | 2.6 | 2.6 | 2.6 | 2.6 | 2.6 | 3.2 | 2.2 | 2.6 | 2.6 | 32 | 3.2 | 2.6 |
| 5..... | 2.6 | 2.6 | 2.6 | 2.6 | 3.2 | 2.6 | 2.2 | 2.6 | 4.0 | 7.3 | 4.8 | 2.6 |
| 6..... | 2.6 | 2.6 | 2.6 | 2.6 | 4.0 | 4.0 | 2.2 | 2.6 | 4.8 | 5.6 | 3.2 | 2.6 |
| 7..... | 2.6 | 3.2 | 2.6 | 2.6 | 2.6 | 3.2 | 4.8 | 2.6 | 3.2 | 4.0 | 2.6 | 2.6 |
| 8..... | 2.6 | 3.2 | 2.6 | 2.6 | 2.2 | 2.6 | 3.2 | 2.6 | 2.6 | 4.0 | 2.6 | 2.6 |
| 9..... | 2.6 | 3.2 | 2.6 | 2.6 | 2.2 | 2.6 | 2.6 | 3.2 | 2.6 | 4.8 | 2.6 | 3.2 |
| 10..... | 2.6 | 3.2 | 2.6 | 2.6 | 2.2 | 2.6 | 2.6 | 2.6 | 4.8 | 13 | 2.6 | 3.2 |
| 11..... | 2.6 | 3.2 | 2.6 | 2.6 | 2.2 | 2.6 | 2.6 | 2.2 | 4.8 | 16 | 2.6 | 2.6 |
| 12..... | 2.6 | 3.2 | 2.6 | 2.6 | 2.2 | 2.2 | 2.2 | 2.2 | 4.0 | 9.1 | 2.6 | 4.8 |
| 13..... | 2.6 | 3.2 | 3.2 | 2.6 | 2.2 | 2.2 | 2.2 | 2.2 | 16 | 5.6 | 2.2 | 3.2 |
| 14..... | 2.2 | 2.6 | 3.2 | 2.6 | 2.2 | 2.2 | 2.2 | 2.2 | 9.1 | 7.3 | 2.2 | 2.6 |
| 15..... | 2.2 | 2.6 | 2.6 | 2.6 | 2.2 | 2.2 | 4.8 | 2.2 | 10 | 4.0 | 2.6 | 3.2 |
| 16..... | 2.2 | 2.6 | 3.2 | 2.6 | 2.2 | 2.2 | 2.6 | 2.6 | 18 | 5.6 | 4.8 | 3.2 |
| 17..... | 2.2 | 2.6 | 2.6 | 2.6 | 2.2 | 2.2 | 2.6 | 4.8 | 7.3 | 4.0 | 2.6 | 2.6 |
| 18..... | 2.2 | 2.6 | 2.6 | 2.6 | 2.6 | 2.2 | 7.3 | 2.6 | 4.8 | 3.2 | 2.2 | 2.6 |
| 19..... | 2.2 | 2.6 | 2.6 | 2.6 | 2.2 | 2.2 | 4.0 | 3.2 | 6.4 | 15 | 2.2 | 2.6 |
| 20..... | 2.2 | 2.6 | 2.6 | 2.6 | 2.6 | 2.2 | 3.2 | 6.4 | 4.0 | 4.8 | 2.2 | 2.6 |
| 21..... | 2.6 | 2.6 | 2.6 | 2.6 | 2.6 | 2.2 | 2.6 | 3.2 | 3.2 | 4.0 | 2.2 | 2.6 |
| 22..... | 2.6 | 2.6 | 2.6 | 2.6 | 2.6 | 2.6 | 2.6 | 2.6 | 3.2 | 9.1 | 4.8 | 3.2 |
| 23..... | 2.6 | 3.2 | 2.6 | 2.6 | 2.6 | 2.2 | 2.6 | 2.6 | 3.2 | 4.0 | 2.6 | 2.6 |
| 24..... | 2.6 | 2.6 | 2.6 | 2.6 | 2.6 | 2.2 | 2.2 | 2.2 | 3.2 | 3.2 | 3.2 | 2.6 |
| 25..... | 2.6 | 2.6 | 2.6 | 2.6 | 2.2 | 2.2 | 2.6 | 2.2 | 3.2 | 3.2 | 3.2 | 2.6 |
| 26..... | 2.6 | 2.6 | 2.6 | 2.6 | 2.6 | 2.2 | 2.6 | 2.2 | 3.2 | 3.2 | 2.6 | 2.6 |
| 27..... | 2.6 | 2.6 | 2.6 | 2.6 | 2.6 | 4.0 | 2.6 | 2.2 | 2.6 | 2.6 | 2.6 | 2.6 |
| 28..... | 2.6 | 2.6 | 2.6 | 2.6 | 2.6 | 2.6 | 2.6 | 2.2 | 3.2 | 2.6 | 2.6 | 2.6 |
| 29..... | 2.6 | 2.6 | 2.6 | 2.6 | 2.6 | 2.6 | 7.3 | ..... | 4.0 | 3.2 | 4.0 | 2.6 |
| 30..... | 2.6 | 2.6 | 2.6 | 2.6 | 2.6 | 2.6 | 5.6 | ..... | 3.2 | 3.2 | 2.6 | 2.6 |
| 31..... | 2.6 | 2.6 | ..... | 2.6 | ..... | 2.2 | 3.2 | ..... | 2.6 | ..... | 2.6 | ..... |

Monthly discharge of Haiku Stream near Heeia, Oahu, for year ending June 30, 1918.

| Month. | Discharge. | | | | Total run-off. | |
|----------------|--------------------------|----------|-------|---------------------|------------------|------------|
| | Million gallons per day. | | | Second-foot (mean). | Million gallons. | Acre-foot. |
| | Maximum. | Minimum. | Mean. | | | |
| July..... | 2.6 | 2.2 | 2.48 | 3.84 | 77 | 236 |
| August..... | 3.2 | 2.6 | 2.75 | 4.25 | 85 | 262 |
| September..... | 3.2 | 2.6 | 2.66 | 4.12 | 80 | 245 |
| October..... | 2.6 | 2.6 | 2.60 | 4.02 | 81 | 247 |
| November..... | 4.0 | 2.2 | 2.51 | 3.88 | 75 | 231 |
| December..... | 4.0 | 2.2 | 2.52 | 3.90 | 78 | 240 |
| January..... | 7.3 | 2.2 | 3.12 | 4.83 | 97 | 297 |
| February..... | 6.4 | 2.2 | 2.76 | 4.27 | 77 | 237 |
| March..... | 18 | 2.2 | 4.85 | 7.50 | 150 | 461 |
| April..... | 32 | 2.6 | 6.85 | 10.6 | 205 | 631 |
| May..... | 7.3 | 2.2 | 3.01 | 4.66 | 93 | 286 |
| June..... | 4.8 | 2.6 | 2.79 | 4.32 | 84 | 257 |
| The year..... | 32 | 2.2 | 3.24 | 5.01 | 1,180 | 3,630 |

PUNALUU STREAM AT ELEVATION 539 FEET, NEAR PUNALUU, OAHU.

LOCATION.—About a quarter of a mile below confluence of Kalena and Pio branches, and 5 miles by road and foot trail south of Punaluu railroad station.

RECORDS AVAILABLE.—April 27, 1915, to April 11, 1918, when station was discontinued. 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 vertical; both banks fairly clean up to extreme flood stages. Control composed of large boulders; fairly permanent.

EXTREMES OF DISCHARGE.—1915-1918: Maximum stage recorded, 6.6 feet at 9.20 p. m. April 11, 1918 (discharge about 700 million gallons per day, or 1,080 second-feet); minimum stage recorded, 0.67 foot October and November, 1917 (discharge, 1.5 million gallons per day, or 2.3 second-feet).

DIVERSIONS.—None.

REGULATION.—None.

UTILIZATION.—Part of low-water flow is diverted at low elevation for irrigation of sugar cane, rice, and taro. Station was established to determine the feasibility of a project to divert the water of the upper Punaluu Valley to augment the water diverted from the Kahana Valley by the Waiahole Water Co.

ACCURACY.—Stage-discharge relation practically permanent. Rating curve well defined between 2 and 6 million gallons per day. Operation of water-stage recorder satisfactory except January, 16-22, February 13, 16-20, and 23-26, no record; discharge estimated from flow at lower station. Records fair.

Discharge measurements of Punaluu Stream at elevation 539 feet, near Punaluu, Oahu, during the year ending June 30, 1918.

[R. D. Klise.]

| Date. | Gage height (feet). | Discharge. | |
|--------------|---------------------|--------------|--------------------------|
| | | Second-feet. | Million gallons per day. |
| Oct. 17..... | 0.67 | 2.3 | 1.5 |
| Nov. 19..... | .68 | 2.5 | 1.6 |
| Dec. 20..... | .73 | 3.1 | 2.0 |

Daily discharge, in million gallons, of Punaluu Stream at elevation 539 feet, near Punaluu, Oahu, for the year ending June 30, 1918.

| Day. | July. | Aug. | Sept. | Oct. | Nov. | Dec. | Jan. | Feb. | Mar. | Apr. |
|---------|-------|------|-------|------|-------|------|------|-------|------|-------|
| 1..... | 3.8 | 2.5 | 2.0 | 2.0 | 1.5 | 2.0 | 2.5 | 14 | 6.4 | 12 |
| 2..... | 3.8 | 2.5 | 2.0 | 2.0 | 1.6 | 2.0 | 2.5 | 7.4 | 5.5 | 14 |
| 3..... | 3.8 | 2.5 | 2.0 | 2.0 | 3.8 | 3.8 | 2.5 | 6.4 | 5.5 | 28 |
| 4..... | 3.8 | 2.5 | 2.0 | 2.0 | 3.0 | 3.0 | 2.5 | 5.5 | 5.5 | 57 |
| 5..... | 3.8 | 2.5 | 2.0 | 2.0 | 3.0 | 4.6 | 3.8 | 7.4 | 8.5 | 21 |
| 6..... | 3.8 | 2.5 | 2.0 | 2.0 | 3.8 | 7.4 | 3.0 | 6.4 | 7.4 | 16 |
| 7..... | 3.8 | 2.5 | 2.5 | 2.0 | 3.0 | 6.4 | 3.0 | 5.5 | 5.5 | 11 |
| 8..... | 3.8 | 2.5 | 2.5 | 2.0 | 2.5 | 4.6 | 4.6 | 9.8 | 5.5 | 10 |
| 9..... | 3.8 | 2.5 | 2.5 | 2.0 | 2.5 | 3.8 | 3.0 | 11 | 11 | 21 |
| 10..... | 4.6 | 2.5 | 2.5 | 2.0 | 2.5 | 5.5 | 3.0 | 6.4 | 19 | 34 |
| 11..... | 3.8 | 2.5 | 2.5 | 2.0 | 2.0 | 3.8 | 3.0 | 5.5 | 31 | 120 |
| 12..... | 3.0 | 2.5 | 3.0 | 2.0 | 2.0 | 3.8 | 3.0 | 5.5 | 19 | ..... |
| 13..... | 3.0 | 3.0 | 3.0 | 2.0 | 2.0 | 3.8 | 4.6 | 5.5 | 34 | ..... |
| 14..... | 3.0 | 3.0 | 3.8 | 2.5 | 2.0 | 3.8 | 3.8 | 5.5 | 24 | ..... |
| 15..... | 3.0 | 3.0 | 3.0 | 2.0 | 2.0 | 3.0 | 5.5 | 5.5 | 21 | ..... |
| 16..... | 3.8 | 3.0 | 3.8 | 1.8 | 2.0 | 2.5 | 4.6 | 5.5 | 31 | ..... |
| 17..... | 3.0 | 2.5 | 3.8 | 1.5 | 2.0 | 2.5 | 3.8 | 8.5 | 17 | ..... |
| 18..... | 3.0 | 2.5 | 3.0 | 1.5 | 2.0 | 2.5 | 10 | 5.5 | 11 | ..... |
| 19..... | 3.0 | 2.5 | 2.5 | 1.6 | 2.5 | 2.0 | 10 | 6.4 | 9.8 | ..... |
| 20..... | 3.0 | 2.5 | 2.5 | 2.0 | 2.0 | 2.5 | 6.4 | 14 | 8.5 | ..... |
| 21..... | 3.0 | 2.5 | 2.5 | 3.0 | 2.0 | 2.5 | 4.6 | 12 | 7.4 | ..... |
| 22..... | 3.0 | 2.5 | 2.5 | 2.5 | 1.5 | 3.8 | 4.6 | 7.4 | 6.4 | ..... |
| 23..... | 3.0 | 3.0 | 2.0 | 2.0 | 1.5 | 2.5 | 4.6 | 6.4 | 6.4 | ..... |
| 24..... | 3.0 | 3.0 | 2.0 | 1.6 | 1.6 | 2.0 | 5.5 | 7.4 | 7.4 | ..... |
| 25..... | 3.0 | 2.5 | 2.0 | 1.6 | 2.0 | 2.0 | 9.8 | 10 | 6.4 | ..... |
| 26..... | 3.0 | 2.5 | 2.0 | 1.6 | 2.5 | 2.5 | 7.4 | 14 | 5.5 | ..... |
| 27..... | 3.0 | 2.5 | 2.0 | 2.0 | 2.5 | 4.6 | 5.5 | 7.4 | 5.5 | ..... |
| 28..... | 3.0 | 2.5 | 2.0 | 1.8 | 2.0 | 2.5 | 4.6 | 7.4 | 7.4 | ..... |
| 29..... | 3.0 | 2.5 | 2.0 | 1.6 | 2.0 | 2.5 | 14 | ..... | 7.4 | ..... |
| 30..... | 3.0 | 2.5 | 2.0 | 1.5 | 2.0 | 2.5 | 14 | ..... | 6.4 | ..... |
| 31..... | 3.0 | 2.5 | ..... | 1.5 | ..... | 2.5 | 8.5 | ..... | 5.5 | ..... |

Monthly discharge of Punaluu Stream at elevation 539 feet, near Punaluu, Oahu, for the year ending June 30, 1918.

| Month. | Discharge. | | | | Total run-off. | |
|-----------------|--------------------------|----------|-------|---------------------|------------------|------------|
| | Million gallons per day. | | | Second-feet (mean). | Million gallons. | Acre-feet. |
| | Maximum. | Minimum. | Mean. | | | |
| July..... | 4.6 | 3.0 | 3.34 | 5.17 | 103 | 318 |
| August..... | 3.0 | 2.5 | 2.60 | 4.02 | 80 | 247 |
| September..... | 3.8 | 2.0 | 2.46 | 3.81 | 74 | 226 |
| October..... | 3.0 | 1.5 | 1.92 | 2.97 | 60 | 183 |
| November..... | 3.8 | 1.5 | 2.24 | 3.47 | 67 | 206 |
| December..... | 7.4 | 2.0 | 3.33 | 5.15 | 103 | 317 |
| January..... | 14 | 2.5 | 5.43 | 8.40 | 168 | 517 |
| February..... | 14 | 5.5 | 7.83 | 12.1 | 219 | 673 |
| March..... | 34 | 5.5 | 11.5 | 17.8 | 358 | 1,090 |
| April 1-11..... | 120 | 10 | 31.3 | 48.4 | 344 | 1,060 |
| The period..... | | | | | 1,580 | 4,840 |

PUNALUU STREAM AT ELEVATION 250 FEET, NEAR PUNALUU, OAHU.

LOCATION.—About $1\frac{1}{2}$ miles by road and horse trail south of Punaluu railroad station.

RECORDS AVAILABLE.—May 14, 1914, to June 30, 1918, when station was discontinued.

GAGE.—Stevens water-stage recorder.

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. Control composed of large boulders; apparently permanent.

EXTREMES OF DISCHARGE.—1913-1918: Maximum stage recorded, about 8 feet (water-stage recorder not working, staff gage carried away) at 11 p. m. April 11, 1918 (discharge, 1,080 million gallons per day, or 1,670 second-feet); minimum stage recorded, 1 foot March, August, and September, 1915, and September, October, and November, 1917 (discharge, 10 million gallons per day, or 15 second-feet).

DIVERSIONS.—None.

REGULATION.—None.

UTILIZATION.—Part of low-water flow is diverted for irrigation of sugar cane, rice and taro.

ACCURACY.—Stage-discharge relation not permanent. Rating curve used July 1 to April 11 fairly well defined between 10 and 100 million gallons per day. Rating curve used April 12 to June 30 poorly defined. Operation of water-stage recorder satisfactory, except no record April 12-16. Discharge April 12 estimated from flow at Punaluu, at 539 feet elevation; discharge April 13-16 estimated from flow of neighboring streams. Records fair except those for April 13-16, which are poor.

Discharge measurements of Punaluu Stream at elevation 250 feet, near Punaluu, Oahu, during the year ending June 30, 1918.

| Date. | Made by— | Gage height (feet). | Discharge. | |
|---------------|----------------------|---------------------|--------------|--------------------------|
| | | | Second-feet. | Million gallons per day. |
| July 10..... | H. A. R. Austin..... | 1.16 | 27 | 18 |
| Sept. 10..... | R. D. Klise..... | 1.04 | 19.2 | 12 |
| Dec. 20..... | do..... | 1.06 | 17.1 | 11 |
| June 6..... | do..... | .73 | 36 | 24 |

Daily discharge, in million gallons, of Punahuu Stream at elevation 250 feet, near Punahuu, Oahu, for the year ending June 30, 1918.

| Day. | July. | Aug. | Sept. | Oct. | Nov. | Dec. | Jan. | Feb. | Mar. | Apr. | May. | June. |
|------|-------|------|-------|------|-------|------|------|-------|------|-------|------|-------|
| 1. | 16 | 14 | 12 | 10 | 10 | 12 | 12 | 38 | 19 | 50 | 19 | 28 |
| 2. | 16 | 14 | 12 | 10 | 12 | 12 | 12 | 25 | 19 | 50 | 19 | 25 |
| 3. | 16 | 14 | 12 | 10 | 16 | 19 | 12 | 22 | 19 | 79 | 46 | 25 |
| 4. | 16 | 14 | 12 | 10 | 14 | 22 | 12 | 19 | 19 | 146 | 31 | 25 |
| 5. | 16 | 14 | 12 | 10 | 14 | 22 | 19 | 25 | 25 | 55 | 31 | 25 |
| 6. | 16 | 14 | 12 | 10 | 16 | 34 | 16 | 22 | 25 | 42 | 28 | 22 |
| 7. | 16 | 14 | 12 | 10 | 14 | 42 | 16 | 19 | 19 | 31 | 22 | 22 |
| 8. | 16 | 14 | 12 | 10 | 12 | 25 | 19 | 25 | 19 | 28 | 22 | 22 |
| 9. | 16 | 14 | 12 | 10 | 12 | 22 | 16 | 28 | 28 | 46 | 19 | 22 |
| 10. | 22 | 14 | 12 | 10 | 12 | 25 | 14 | 22 | 42 | 64 | 19 | 22 |
| 11. | 16 | 14 | 12 | 10 | 12 | 22 | 16 | 19 | 60 | 150 | 19 | 22 |
| 12. | 14 | 14 | 12 | 10 | 12 | 19 | 14 | 19 | 46 | 200 | 19 | 31 |
| 13. | 14 | 14 | 14 | 12 | 12 | 16 | 16 | 19 | 79 | 50 | 19 | 25 |
| 14. | 14 | 14 | 14 | 12 | 12 | 16 | 16 | 16 | 69 | 70 | 19 | 25 |
| 15. | 14 | 14 | 12 | 12 | 12 | 16 | 31 | 16 | 64 | 40 | 19 | 25 |
| 16. | 16 | 14 | 16 | 12 | 12 | 14 | 19 | 19 | 94 | 50 | 64 | 25 |
| 17. | 14 | 14 | 19 | 10 | 10 | 14 | 16 | 28 | 64 | 46 | 31 | 22 |
| 18. | 14 | 14 | 14 | 10 | 10 | 14 | 31 | 19 | 42 | 34 | 25 | 22 |
| 19. | 14 | 12 | 12 | 10 | 10 | 12 | 31 | 22 | 34 | 64 | 25 | 22 |
| 20. | 14 | 12 | 12 | 12 | 10 | 12 | 22 | 38 | 28 | 38 | 25 | 22 |
| 21. | 14 | 12 | 12 | 14 | 12 | 14 | 19 | 31 | 25 | 31 | 22 | 22 |
| 22. | 14 | 12 | 12 | 14 | 12 | 16 | 19 | 25 | 22 | 34 | 25 | 22 |
| 23. | 14 | 14 | 12 | 12 | 10 | 14 | 19 | 22 | 22 | 28 | 34 | 19 |
| 24. | 14 | 14 | 12 | 12 | 12 | 12 | 22 | 25 | 22 | 25 | 28 | 22 |
| 25. | 14 | 12 | 12 | 12 | 12 | 12 | 28 | 31 | 22 | 25 | 28 | 22 |
| 26. | 14 | 12 | 12 | 12 | 14 | 14 | 28 | 38 | 19 | 25 | 25 | 22 |
| 27. | 14 | 12 | 12 | 12 | 14 | 22 | 22 | 25 | 19 | 25 | 25 | 22 |
| 28. | 14 | 12 | 12 | 12 | 12 | 16 | 19 | 22 | 22 | 22 | 31 | 22 |
| 29. | 14 | 12 | 12 | 12 | 12 | 14 | 55 | ----- | 31 | 22 | 55 | 22 |
| 30. | 14 | 12 | 10 | 12 | 12 | 14 | 55 | ----- | 25 | 19 | 31 | 19 |
| 31. | 14 | 12 | ----- | 12 | ----- | 14 | 31 | ----- | 22 | ----- | 28 | ----- |

Monthly discharge of Punahuu Stream at elevation 250 feet, near Punahuu, Oahu, for the year ending June 30, 1918.

| Month. | Discharge. | | | | Total run-off. | |
|----------------|--------------------------|----------|-------|---------------------|------------------|------------|
| | Million gallons per day. | | | Second-foot (mean). | Million gallons. | Acre-feet. |
| | Maximum. | Minimum. | Mean. | | | |
| July | 22 | 14 | 15.0 | 23.2 | 464 | 1,430 |
| August..... | 14 | 12 | 13.3 | 20.6 | 412 | 1,270 |
| September..... | 19 | 10 | 12.5 | 19.3 | 375 | 1,150 |
| October..... | 14 | 10 | 11.2 | 17.3 | 346 | 1,070 |
| November..... | 16 | 10 | 12.2 | 18.9 | 366 | 1,120 |
| December..... | 42 | 12 | 17.8 | 27.5 | 552 | 1,690 |
| January..... | 55 | 12 | 21.8 | 33.7 | 677 | 2,070 |
| February..... | 38 | 16 | 24.2 | 37.4 | 679 | 2,080 |
| March..... | 94 | 19 | 34.4 | 53.2 | 1,060 | 3,270 |
| April..... | 200 | 19 | 53.0 | 82.0 | 1,590 | 4,880 |
| May..... | 64 | 19 | 27.5 | 42.5 | 853 | 2,620 |
| June..... | 31 | 19 | 23.1 | 35.7 | 693 | 2,130 |
| The year..... | 200 | 10 | 22.1 | 34.2 | 8,070 | 24,800 |

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, 1918.

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. On October 23, 1915, a reinforced concrete control 33 feet long having a low-water notch 16 feet in length was completed.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 4.35 feet at 11 p. m. April 3 (discharge computed by extension of rating curve, about 400 million gallons per day, or 620 second-feet); minimum stage recorded, stream dry at times August to November.

1914-1918: Maximum stage recorded 5.3 feet at 9 a. m. September 25, 1914 (discharge, about 755 million gallons per day, or 1,170 second-feet); minimum discharge, stream dry at times.

DIVERSIONS.—None.

REGULATION.—None.

UTILIZATION.—Stream is not perennial in its lower course. A small part of the flood discharge is diverted at low elevation for irrigation of sugar cane. Station was established to determine whether the total discharge of the stream would justify the construction of a large flood-water storage project in the vicinity.

ACCURACY.—Stage-discharge relation practically permanent. Rating curve fairly well defined between 2 and 10 million gallons per day. Operation of water-stage recorder unsatisfactory at times. Record fair above 2 million gallons per day when water-stage recorder was operating; poor below 2 million gallons per day and when water-stage recorder was not operating.

Discharge measurements of Koloa Stream near Laie, Oahu, during the year ending June 30, 1918.

[Made by R. D. Klise.]

| Date. | Gage height (feet). | Discharge. | | Date. | Gage height (feet). | Discharge. | |
|--------------|---------------------|--------------|--------------------------|--------------|---------------------|--------------|--------------------------|
| | | Second-feet. | Million gallons per day. | | | Second-feet. | Million gallons per day. |
| Jan. 30..... | 1.01 | 10.8 | 6.9 | Apr. 26..... | 0.43 | 2.2 | 1.4 |
| Feb. 27..... | .53 | 2.8 | 1.8 | June 5..... | .22 | 1.8 | 1.1 |

Daily discharge, in million gallons, of Koloa Stream near Laie, Oahu, for the year ending June 30, 1918.

| Day. | July. | Aug. | Sept. | Oct. | Nov. | Dec. | Jan. | Feb. | Mar. | Apr. | May. | June. |
|---------|-------|-------|-------|-------|-------|------|------|-------|------|-------|------|-------|
| 1..... | 0.6 | 0.3 | 0.15 | 0.6 | ..... | 1.0 | 0.4 | 6.8 | 1.5 | 12 | 1.2 | 1.5 |
| 2..... | .6 | .3 | .15 | .3 | ..... | .6 | .4 | 2.6 | 1.2 | 13 | 1.0 | 1.5 |
| 3..... | .6 | .3 | .15 | .15 | ..... | 1.0 | .25 | 1.8 | 1.2 | 19 | 9.5 | 1.5 |
| 4..... | .6 | .15 | .15 | ..... | 2.2 | 2.2 | .25 | 1.8 | 2.6 | 20 | 3.5 | 1.5 |
| 5..... | .6 | .15 | .15 | .3 | 3.1 | 2.2 | 2.6 | 4.5 | 4.0 | 9.5 | 4.5 | 1.5 |
| 6..... | .6 | .15 | .15 | .3 | 3.1 | 13 | 1.5 | 4.5 | 4.5 | 7.4 | 2.2 | .7 |
| 7..... | .6 | .15 | .15 | .3 | 1.0 | 22 | .7 | 2.6 | 1.5 | 5.6 | 1.8 | .7 |
| 8..... | .6 | .15 | .15 | .15 | .6 | 2.6 | 5.0 | 4.0 | 1.2 | 4.5 | 1.5 | .7 |
| 9..... | 3.1 | .15 | .15 | ..... | .3 | 2.2 | 1.0 | 5.6 | 2.6 | 8.8 | 1.5 | 1.5 |
| 10..... | 1.6 | .15 | .15 | ..... | .3 | 3.0 | .55 | 2.2 | 6.8 | 12 | 1.5 | 2.6 |
| 11..... | 1.6 | .15 | .15 | ..... | .3 | 2.2 | .55 | 1.8 | 14 | 18 | 2.6 | 1.5 |
| 12..... | .6 | .15 | .3 | ..... | .3 | 1.5 | .7 | 1.5 | 6.8 | 28 | 1.5 | 6.2 |
| 13..... | .6 | .3 | 1.6 | ..... | .3 | 1.5 | .55 | 1.8 | 12 | 14 | 2.6 | 4.0 |
| 14..... | .6 | .3 | 1.6 | .6 | .15 | 1.2 | 1.0 | 1.5 | 8.8 | 10 | 1.5 | 1.5 |
| 15..... | .6 | .3 | 1.0 | .3 | .15 | .7 | 4.5 | 1.2 | 11 | 6.8 | 1.5 | 5.0 |
| 16..... | .6 | .3 | .6 | 3.1 | .15 | .55 | 1.0 | 1.2 | 19 | 13 | 9.5 | 4.0 |
| 17..... | .6 | .6 | .6 | 1.0 | ..... | .4 | .7 | 6.8 | 10 | 8.1 | 4.0 | 1.5 |
| 18..... | .6 | .3 | .6 | .3 | ..... | .4 | 3.0 | 1.8 | 5.0 | 6.2 | 1.5 | 1.5 |
| 19..... | .3 | .15 | .3 | .15 | ..... | .25 | 3.5 | 1.8 | 4.0 | 12 | 1.5 | 1.5 |
| 20..... | .3 | ..... | .3 | .15 | ..... | .25 | 5.0 | 10 | 3.0 | 4.0 | 1.5 | 2.6 |
| 21..... | .3 | ..... | .3 | .15 | 3.1 | .55 | 1.5 | 8.1 | 2.6 | 4.0 | 1.5 | 1.5 |
| 22..... | .3 | ..... | .15 | ..... | .6 | 1.2 | 1.5 | 4.0 | 2.2 | 7.4 | 1.5 | 1.5 |
| 23..... | .3 | 1.0 | .05 | .05 | .6 | .4 | 1.2 | 2.6 | 1.8 | 2.6 | 4.0 | 1.5 |
| 24..... | .3 | 1.6 | .15 | .15 | .3 | .25 | 4.0 | 2.2 | 3.0 | 1.5 | 7.4 | 1.5 |
| 25..... | .3 | .6 | ..... | ..... | 1.0 | .25 | 6.8 | 4.5 | 3.0 | 1.5 | 5.0 | 1.5 |
| 26..... | .3 | .3 | ..... | ..... | 8.1 | .25 | 5.0 | 5.0 | 1.5 | 1.5 | 5.0 | 1.5 |
| 27..... | .3 | .15 | ..... | ..... | 3.1 | 3.0 | 1.8 | 2.2 | 1.2 | 1.8 | 4.0 | 1.5 |
| 28..... | .3 | .15 | .6 | ..... | 1.6 | 1.0 | 1.2 | 1.5 | 2.2 | 1.5 | 4.0 | 1.5 |
| 29..... | .3 | .15 | 1.0 | ..... | 1.0 | .55 | 5.0 | ..... | 7.4 | 1.5 | 6.2 | 1.5 |
| 30..... | .3 | .15 | .6 | ..... | 1.0 | .4 | 7.4 | ..... | 4.0 | 1.5 | 2.6 | 1.5 |
| 31..... | 3 | .15 | ..... | ..... | ..... | .4 | 3.0 | ..... | 2.2 | ..... | 2.6 | ..... |

NOTE.—No gage-height record Sept. 5-11, Apr. 20-25 and May 9 to June 30; discharge estimated from flow of neighboring streams. No flow for days for which discharge is not given.

Monthly discharge of Koloa Stream near Laie, Oahu, for the year ending June 30, 1918.

| Month. | Discharge. | | | | Total run-off. | |
|----------------|--------------------------|----------|-------|---------------------|------------------|------------|
| | Million gallons per day. | | | Second-feet (mean). | Million gallons. | Acre-feet. |
| | Maximum. | Minimum. | Mean. | | | |
| July..... | 3.1 | 0.3 | 0.57 | 0.88 | 18 | 54 |
| August..... | 1.6 | .0 | .28 | .43 | 9 | 27 |
| September..... | 1.6 | .0 | .38 | .59 | 11 | 35 |
| October..... | 3.1 | .0 | .26 | .40 | 8 | 25 |
| November..... | 8.1 | .0 | 1.08 | 1.67 | 32 | 99 |
| December..... | 22 | .25 | 2.16 | 3.34 | 67 | 205 |
| January..... | 7.4 | .25 | 2.31 | 3.57 | 72 | 220 |
| February..... | 10 | 1.2 | 3.42 | 5.29 | 96 | 294 |
| March..... | 19 | 1.2 | 4.90 | 7.58 | 152 | 466 |
| April..... | 28 | 1.5 | 8.56 | 13.2 | 257 | 788 |
| May..... | 9.5 | 1.0 | 3.22 | 4.98 | 100 | 306 |
| June..... | 6.2 | .7 | 1.93 | 2.98 | 58 | 178 |
| The year..... | 28 | .0 | 2.41 | 3.73 | 880 | 2,700 |

WAILALE STREAM NEAR LAIE, OAHU.

LOCATION.—About 3 miles by horse trail southwest of Laie, about 525 feet above sea level.

RECORDS AVAILABLE.—July 30, 1914, to June 30, 1918.

GAGE.—Stevens water-stage recorder on right bank.

DISCHARGE MEASUREMENTS.—Made by wading or from cable 20 feet above gage.

CHANNEL AND CONTROL.—Channel straight for about 50 feet above gage; right bank sloping and clean; left bank nearly vertical. Control consists of concrete slab 32 feet long with low-water notch 14 feet long.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, over 4.5 feet about 11 p. m. April 11, exact stage not known as pencil did not reverse (discharge, more than 390 million gallons per day, or 605 second-feet); minimum stage recorded, stream dry July 19 to August 13, October 21 to November 4 and November 10–20.

1914–1918: Maximum stage recorded, 4.85 feet at 9 a. m. September 23, 1914 (discharge, about 295 million gallons per day,¹ or 456 second-feet); stream occasionally dry.

DIVERSIONS.—None.

REGULATION.—None.

UTILIZATION.—Stream not perennial. A small part of the flood discharge is diverted at low elevations for sugar-cane irrigation. Station was established to determine whether the total flood discharge of streams at 500 feet above sea level will justify the construction of a large flood-water storage project in the vicinity.

ACCURACY.—Stage-discharge relation practically permanent. Rating curve fairly well defined between 3 and 80 million gallons per day. Operation of water-stage recorder satisfactory except part of April. Records fair above 3 million gallons per day.

Discharge measurements of Waialele Stream near Laie, Oahu, during the year ending June 30, 1918.

[Made by R. D. Klise.]

| Date. | Gage height (feet). | Discharge. | |
|--------------|---------------------|--------------|--------------------------|
| | | Second-feet. | Million gallons per day. |
| Jan. 29..... | 1.30 | 49 | 32 |
| 29..... | 1.60 | 111 | 72 |
| Feb. 27..... | .30 | 1.1 | .75 |

¹ Probably much too low; rating curve very poorly defined at that stage.

Daily discharge, in million gallons, of Waialele Stream near Laie, Oahu, for the year ending June 30, 1918.

| Day. | July. | Aug. | Sept. | Oct. | Nov. | Dec. | Jan. | Feb. | Mar. | Apr. | May. | June. |
|---------|-------|-------|-------|-------|-------|------|------|-------|------|-------|------|-------|
| 1..... | 0.4 | ..... | 0.4 | 0.4 | ..... | 0.4 | 0.4 | 4.4 | 0.8 | 9.3 | 0.8 | 0.8 |
| 2..... | .1 | ..... | .4 | .1 | ..... | .1 | .4 | 2.5 | .8 | 7.4 | .8 | .8 |
| 3..... | .1 | ..... | .4 | .1 | ..... | .4 | .4 | 1.8 | .8 | 23 | 7.4 | .8 |
| 4..... | .1 | ..... | .4 | .1 | 0.8 | .8 | .4 | 1.8 | .8 | 36 | 2.5 | .8 |
| 5..... | .1 | ..... | .1 | .1 | .8 | .8 | 1.8 | 2.5 | 1.8 | 3.4 | 1.8 | .8 |
| 6..... | .1 | ..... | .1 | .1 | 1.2 | 5.8 | 1.2 | 3.4 | 1.8 | 1.8 | 1.2 | .4 |
| 7..... | .1 | ..... | .1 | .1 | .4 | 5.8 | .8 | 2.5 | .8 | 1.2 | 1.2 | .4 |
| 8..... | .1 | ..... | .1 | .1 | .1 | .8 | 4.4 | 3.4 | .4 | .8 | .8 | .4 |
| 9..... | 1.8 | ..... | .1 | .1 | .1 | .8 | 1.2 | 4.4 | .8 | 3.4 | .8 | .8 |
| 10..... | .8 | ..... | .1 | .1 | ..... | 1.2 | .8 | 2.5 | 2.5 | 4.4 | .8 | 1.2 |
| 11..... | .8 | ..... | .1 | .1 | ..... | .8 | .8 | 2.5 | 5.8 | 20 | 1.2 | .8 |
| 12..... | .4 | ..... | .1 | .1 | ..... | .4 | .8 | 2.5 | 2.5 | 29 | .8 | 3.4 |
| 13..... | .4 | ..... | .8 | .1 | ..... | .1 | .4 | 2.5 | 12 | 7.4 | 1.2 | 1.8 |
| 14..... | .4 | 0.4 | .4 | .1 | ..... | .1 | .8 | 2.5 | 5.8 | 4.4 | .8 | .8 |
| 15..... | .4 | .4 | .4 | .1 | ..... | .1 | 3.4 | 2.5 | 5.8 | 2.5 | .8 | 2.5 |
| 16..... | .4 | .4 | .4 | 1.2 | ..... | .1 | .4 | 2.5 | 26 | 7.4 | 9.3 | 1.8 |
| 17..... | .4 | .4 | .4 | .8 | ..... | .1 | .4 | 5.8 | 5.8 | 3.4 | 1.8 | .8 |
| 18..... | .4 | .4 | .4 | .4 | ..... | .1 | 1.8 | 1.8 | 1.8 | 1.8 | .8 | .8 |
| 19..... | ..... | .4 | .4 | .4 | ..... | .1 | 1.2 | 1.8 | 1.2 | 7.4 | .8 | .8 |
| 20..... | ..... | .1 | .1 | .1 | ..... | .1 | 1.8 | 12 | 1.2 | 1.8 | .8 | 1.2 |
| 21..... | ..... | .1 | .1 | ..... | 1.8 | .1 | .4 | 7.4 | .8 | 1.8 | .8 | .8 |
| 22..... | ..... | .1 | .1 | ..... | .4 | .8 | .4 | 3.4 | .8 | 4.4 | .8 | .8 |
| 23..... | ..... | .4 | .1 | ..... | .1 | .4 | .4 | 1.8 | .8 | 1.2 | 1.8 | .8 |
| 24..... | ..... | .8 | .1 | ..... | .1 | .4 | 1.8 | 1.2 | 1.2 | .8 | 4.4 | .8 |
| 25..... | ..... | .4 | .1 | ..... | .1 | .4 | 4.4 | 1.8 | 1.2 | .8 | 2.5 | .8 |
| 26..... | ..... | .1 | .1 | ..... | 2.5 | .4 | 2.5 | 2.5 | .8 | .8 | 2.5 | .8 |
| 27..... | ..... | .1 | .4 | ..... | 1.2 | 1.8 | .8 | .8 | .4 | .8 | 1.8 | .8 |
| 28..... | ..... | .1 | .4 | ..... | .4 | .8 | .8 | .8 | .4 | .8 | 1.8 | .8 |
| 29..... | ..... | .4 | .4 | ..... | .4 | .8 | 5.8 | ..... | 4.4 | .8 | 3.4 | .8 |
| 30..... | ..... | .4 | .4 | ..... | .4 | .4 | 7.4 | ..... | 1.2 | 1.2 | 1.2 | .8 |
| 31..... | ..... | .4 | ..... | ..... | ..... | .4 | 2.5 | ..... | .8 | ..... | 1.2 | ..... |

NOTE.—No gage-height record Apr. 11-25; discharge estimated from East Branch of Kahawainui Stream. No flow on days for which discharge is not given.

Monthly discharge of Waialele Stream near Laie, Oahu, for the year ending June 30, 1918.

| Month. | Discharge. | | | | Total run-off. | |
|----------------|--------------------------|----------|-------|---------------------|------------------|------------|
| | Million gallons per day. | | | Second-foot (mean). | Million gallons. | Acre-feet. |
| | Maximum. | Minimum. | Mean. | | | |
| July..... | 1.8 | 0.0 | 0.24 | 0.37 | 7 | 23 |
| August..... | .8 | .0 | .19 | .29 | 6 | 18 |
| September..... | .8 | .1 | .26 | .40 | 8 | 24 |
| October..... | 1.2 | .0 | .15 | .23 | 5 | 14 |
| November..... | 2.5 | .0 | .36 | .56 | 11 | 33 |
| December..... | 5.8 | .1 | .83 | 1.28 | 26 | 79 |
| January..... | 7.4 | .4 | 1.64 | 2.54 | 51 | 156 |
| February..... | 12 | .8 | 3.05 | 4.72 | 85 | 262 |
| March..... | 26 | .4 | 2.97 | 4.60 | 92 | 283 |
| April..... | 36 | .8 | 6.31 | 9.76 | 189 | 581 |
| May..... | 9.3 | .8 | 1.89 | 2.92 | 59 | 180 |
| June..... | 3.4 | .4 | 1.00 | 1.55 | 30 | 92 |
| The year..... | 36 | .0 | 1.56 | 2.41 | 569 | 1,740 |

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, about 500 feet above sea level.

RECORDS AVAILABLE.—July 29, 1914, to June 30, 1918.

GAUGE.—Stevens water-stage recorder. 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; bed composed of large boulders; free from vegetation; right bank clean and nearly perpendicular; left bank sloping and fairly clean. 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, 4.05 feet at 10 p. m. April 11 (discharge, about 440 million gallons per day, or 682 second-feet); channel frequently dry.

1914-1918: Maximum stage recorded, 5.1 feet at 7 a. m. September 25, 1914 (discharge, about 650 million gallons per day,¹ or 1,010 second-feet); channel frequently dry.

DIVERSIONS.—None.

REGULATION.—None.

UTILIZATION.—Part of the flood discharge is diverted 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.—Stage-discharge relation practically permanent. Rating curve fairly well defined between 3 and 80 million gallons per day. Operation of water-stage recorder unsatisfactory at times. Record poor due to small amount of water.

The following discharge measurement was made by R. D. Klise:

April 24, 1917: Gage height, 0.31 foot; discharge, 1.0 second-foot, or 0.65 million gallons per day.

Daily discharge, in million gallons, of East Branch of Kahawainui Stream near Laie, Oahu, for the year ending June 30, 1918.

| Day. | July. | Oct. | Nov. | Dec. | Jan. | Feb. | Mar. | Apr. | May. | June. |
|------|-------|------|------|------|------|------|------|------|------|-------|
| 1 | | | | 0.2 | | 2.1 | 0.4 | 5.0 | 0.4 | 0.4 |
| 2 | | | | | | .7 | .4 | 4.2 | .2 | .4 |
| 3 | | | | | | .4 | .4 | 11 | 4.2 | .2 |
| 4 | | | 0.4 | .4 | | .4 | .4 | 17 | 2.1 | .1 |
| 5 | | | .4 | .4 | 1.1 | 1.1 | 1.6 | 2.1 | 1.6 | .1 |
| 6 | | | .7 | 2.1 | .7 | 1.1 | 2.1 | 1.1 | 1.1 | .1 |
| 7 | | | .2 | 3.5 | .4 | .7 | .7 | .4 | .7 | .1 |
| 8 | | | | .7 | 2.1 | 1.6 | .4 | .2 | .4 | .1 |
| 9 | 0.2 | | | .4 | .7 | 1.6 | .7 | 1.6 | .4 | .4 |
| 10 | | | | 1.1 | .4 | .7 | 2.1 | 4.2 | .4 | 1.1 |
| 11 | .7 | | | .7 | .4 | .4 | 5.0 | 9.6 | .7 | .4 |
| 12 | | | | .4 | .4 | .4 | 2.8 | 15 | .4 | 2.1 |
| 13 | | | | .4 | .2 | .4 | 7.2 | 4.2 | .4 | 1.1 |
| 14 | | | | .2 | .4 | .4 | 5.0 | 2.8 | .4 | .4 |
| 15 | | | | .2 | 1.6 | .2 | 4.2 | 1.6 | .2 | 1.1 |
| 16 | | | | .2 | .2 | .2 | 17 | 4.2 | 5.0 | 1.6 |
| 17 | | 0.2 | | | .2 | 2.8 | 4.2 | 2.1 | 2.1 | .4 |
| 18 | | | | | 1.1 | .4 | 1.6 | 1.1 | .4 | .2 |
| 19 | | | | | .7 | .4 | 1.1 | 4.2 | .4 | .2 |
| 20 | | | | | 1.1 | 6.0 | 1.1 | 1.1 | .2 | .4 |
| 21 | | | 1.1 | | .2 | 2.8 | .7 | 1.1 | .2 | .2 |
| 22 | | | .2 | | .2 | 1.1 | .7 | 2.8 | .2 | .2 |
| 23 | | | | .2 | .2 | .7 | .7 | .7 | .2 | .2 |
| 24 | | | | | 1.1 | .4 | .7 | .4 | 2.8 | .2 |
| 25 | | | | | 2.1 | .7 | 1.1 | .4 | 3.5 | .2 |
| 26 | | | 2.1 | | 1.1 | 1.1 | .4 | .4 | .7 | .1 |
| 27 | | | 1.1 | .4 | .4 | .7 | .4 | .4 | .7 | .1 |
| 28 | | | .2 | .7 | .4 | .4 | .4 | .4 | 1.1 | .1 |
| 29 | | | .2 | .2 | 2.8 | | 2.8 | .4 | 2.1 | .1 |
| 30 | | | .2 | | 2.8 | | 1.1 | .4 | .7 | .1 |
| 31 | | | | | 1.1 | | .7 | | .4 | |

NOTE.—No gage-height record Nov. 4-21, Jan. 5-29, June 5 and 6; discharge estimated from record of Waiale Stream. No flow on days for which discharge is not given.

Monthly discharge of East Branch of Kahawainui Stream near Laie, Oahu, for the year ending June 30, 1918.

| Month. | Discharge. | | | | Total run-off. | |
|---------------|--------------------------|----------|-------|---------------------|------------------|------------|
| | Million gallons per day. | | | Second-foot (mean). | Million gallons. | Acre-feet. |
| | Maximum. | Minimum. | Mean. | | | |
| July..... | 0.7 | 0.0 | 0.03 | 0.05 | 1 | 3 |
| October..... | .2 | .0 | .01 | .02 | 0 | 1 |
| November..... | 2.1 | .0 | .23 | .36 | 7 | 21 |
| December..... | 3.5 | .0 | .40 | .62 | 12 | 38 |
| January..... | 2.8 | .0 | .78 | 1.21 | 24 | 74 |
| February..... | 6.0 | .2 | 1.07 | 1.66 | 30 | 92 |
| March..... | 17 | .4 | 2.20 | 3.40 | 68 | 209 |
| April..... | 17 | .2 | 3.34 | 5.17 | 100 | 308 |
| May..... | 5.0 | .2 | 1.11 | 1.72 | 34 | 106 |
| June..... | 2.1 | .1 | .41 | .63 | 12 | 38 |
| The year..... | 17 | .0 | .79 | 1.22 | 288 | 890 |

NOTE.—No flow August and September.

EAST BRANCH OF MALAEKAHANA STREAM NEAR KAHUKU, OAHU.

LOCATION.—About three-quarters of a mile above junction with Middle Branch of Malaekahana Stream and $3\frac{1}{2}$ miles, by horse trail, south of Kahuku, about 375 feet above sea level.

RECORDS AVAILABLE.—July 31, 1914, to June 30, 1918.

GAGE.—Stevens water-stage recorder. 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 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; bed composed of loose boulders and gravel; right bank at gage 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 larger boulders, about 6 feet below gage; this control was destroyed by the flood September 24, 1914.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 4.5 feet at 10.15 p. m. April 11 (discharge, 320 million gallons per day, or 496 second-feet); channel dry most of time July to December.

1914-1918: Maximum stage recorded, 5.05 feet at 5 a. m. September 25, 1914 (discharge, about 378 million gallons per day, or 585 second-feet); channel frequently dry.

DIVERSIONS.—None.

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.—Stage-discharge relation practically permanent. Rating curve well defined between 2 and 12 million gallons per day. Operation of water-stage recorder unsatisfactory at times. Records fair.

The following discharge measurement was made by R. D. Klise:

April 25, 1918: Gage height, 0.14 foot; discharge, 1.15 second-feet, or 0.75 million gallons per day.

Daily discharge, in million gallons, of East Branch of Malaekahana Stream near Kahuku, Oahu, for the year ending June 30, 1918.

| Day. | July. | Oct. | Nov. | Dec. | Jan. | Feb. | Mar. | Apr. | May. | June. |
|---------|-------|------|------|------|------|------|------|------|------|-------|
| 1..... | 0.3 | | | | 0.3 | 1.8 | 1.0 | 4.5 | 1.0 | 0.3 |
| 2..... | .3 | | | | .3 | 1.0 | 1.0 | 4.5 | 1.0 | .3 |
| 3..... | .3 | | | | .3 | 1.0 | 1.0 | 12 | 7.5 | .3 |
| 4..... | .3 | | 1.0 | | .3 | 1.0 | 1.0 | 24 | 2.6 | .3 |
| 5..... | .3 | | | | 1.0 | 1.0 | 1.8 | 5.5 | 2.6 | .3 |
| 6..... | | | .3 | 2.6 | 1.0 | 1.8 | 2.6 | 2.6 | 1.8 | .3 |
| 7..... | | | | 3.5 | .3 | 1.0 | 1.8 | 1.8 | 1.0 | .3 |
| 8..... | | | | .3 | 3.5 | 1.8 | 1.0 | 1.8 | 1.0 | .3 |
| 9..... | 1.0 | | | .3 | 1.0 | 2.6 | 1.0 | 4.5 | 1.0 | .3 |
| 10..... | .3 | | | 1.0 | .3 | 1.0 | 2.6 | 6.5 | 1.0 | 1.8 |
| 11..... | | | | 1.0 | .3 | 1.0 | 5.5 | 15 | 1.0 | 1.0 |
| 12..... | | | | .3 | .3 | 1.0 | 3.5 | 17 | 1.0 | 2.6 |
| 13..... | .3 | | | | | 1.0 | 8.6 | 4.5 | 1.0 | 1.8 |
| 14..... | | | | | | 1.0 | 5.5 | 3.5 | 1.0 | 1.0 |
| 15..... | | | | | 3.5 | 1.0 | 7.5 | 2.6 | 1.0 | 3.5 |
| 16..... | | | | | .3 | 1.0 | 17 | 5.5 | 7.5 | 2.6 |
| 17..... | | 0.2 | | | .3 | 4.5 | 6.5 | 3.5 | 2.6 | 1.0 |
| 18..... | | | | | 1.8 | 1.0 | 2.6 | 1.8 | 1.8 | 1.0 |
| 19..... | | | | | 1.8 | 1.8 | 2.6 | 7.0 | 1.0 | 1.0 |
| 20..... | | | | | 2.6 | 7.5 | 1.8 | 4.5 | 1.0 | 1.0 |
| 21..... | | | 1.0 | | 1.0 | 3.5 | 1.8 | 3.5 | 1.0 | 1.0 |
| 22..... | | | .3 | | 1.0 | 1.0 | 1.8 | 4.5 | 1.0 | 1.0 |
| 23..... | | | | | 1.0 | 1.0 | 1.8 | 3.5 | 1.8 | 1.0 |
| 24..... | | | | | 2.6 | 1.0 | 1.8 | 2.6 | 6.5 | 1.0 |
| 25..... | | | | | 6.5 | 1.0 | 1.8 | 1.0 | 3.5 | 1.0 |
| 26..... | | | 1.8 | | 3.5 | 1.8 | 1.0 | 1.0 | 1.8 | 1.0 |
| 27..... | | | 1.0 | | 1.8 | 1.0 | .3 | 1.0 | 1.8 | 1.0 |
| 28..... | | | .3 | 1.0 | 1.0 | 1.0 | .3 | 1.0 | 1.8 | 1.0 |
| 29..... | | | | .3 | 7.5 | | 2.6 | 1.0 | 2.6 | 1.0 |
| 30..... | | | | | 5.5 | | 1.8 | 1.0 | .3 | 1.0 |
| 31..... | | | | | 1.8 | | 1.0 | | .3 | |

NOTE.—No gage height record Jan. 1-4, Apr. 19-24, and June 26-30; discharge estimated from records for neighboring streams. No flow on days for which discharge is not given.

Monthly discharge of East Branch of Malaekahana Stream near Kahuku, Oahu, for the year ending June 30, 1918.

| Month. | Discharge. | | | | Total run-off. | |
|---------------|--------------------------|----------|-------|---------------------|------------------|------------|
| | Million gallons per day. | | | Second-feet (mean). | Million gallons. | Acre-feet. |
| | Maximum. | Minimum. | Mean. | | | |
| July..... | 1.0 | 0.0 | 0.10 | 0.15 | 3 | 10 |
| October..... | .2 | .0 | .01 | .02 | 0 | 1 |
| November..... | 1.8 | .0 | .19 | .29 | 6 | 17 |
| December..... | 3.5 | .0 | .33 | .51 | 10 | 31 |
| January..... | 7.5 | .0 | 1.69 | 2.61 | 52 | 161 |
| February..... | 7.5 | 1.0 | 1.65 | 2.55 | 46 | 142 |
| March..... | 17 | .3 | 2.96 | 4.58 | 92 | 282 |
| April..... | 24 | 1.0 | 5.09 | 7.88 | 153 | 469 |
| May..... | 7.5 | .3 | 1.99 | 3.08 | 62 | 189 |
| June..... | 3.5 | .3 | 1.03 | 1.59 | 31 | 95 |
| The year..... | 24 | .0 | 1.25 | 1.93 | 455 | 1,400 |

NOTE.—No flow August and September.

MIDDLE BRANCH OF MALAEKAHANA STREAM NEAR KAHUKU, OAHU.

LOCATION.—About a mile above junction with East Branch of Malaekahana stream, $3\frac{1}{2}$ miles by horse trail south of Kakuku, and about 440 feet above sea level.

RECORDS AVAILABLE.—July 31, 1914, to June 30, 1918.

GAGE.—Stevens water-stage recorder. Gage datum lowered 1 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. Reinforced concrete control completed November 20, 1915, replacing concrete control washed out September 24, 1914.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 2.65 feet at 11.30 p. m. April 11 (discharge, 180 million gallons per day, or 279 second-feet); channel dry most of year.

1914-1918: Maximum stage recorded, 3.40 feet at 9.30 p. m. January 7, 1916 (discharge, about 200 million gallons per day, or 309 second-feet); channel dry greater part of the time.

DIVERSIONS.—None.

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 Kakuku.

ACCURACY.—Stage-discharge relation assumed permanent. Rating curve fairly well defined for previous year. Operation of water-stage recorder satisfactory. Records poor.

No discharge measurements made during year.

Daily discharge, in million gallons, of Middle Branch of Malaekahana Stream near Kahuku, Oahu, for the year ending June 30, 1918.

| Day. | Jan. | Feb. | Mar. | Apr. | May. | June. | Day. | Jan. | Feb. | Mar. | Apr. | May. | June. |
|---------|------|------|------|------|------|-------|---------|------|------|------|------|------|-------|
| 1..... | | 2.5 | | 1.2 | 0.5 | | 16..... | 0.5 | | 16 | 2.5 | | 2.5 |
| 2..... | | 1.2 | | 1.2 | .5 | | 17..... | | 2.5 | 5.8 | 2.5 | | .5 |
| 3..... | | 1.2 | | 8.0 | 2.5 | | 18..... | | 1.2 | 1.2 | .5 | | |
| 4..... | | 1.2 | | 23 | 1.2 | | 19..... | .5 | .05 | 1.2 | 5.8 | | |
| 5..... | | 1.2 | | 2.5 | 1.2 | | 20..... | 2.5 | 5.8 | .5 | 1.2 | | |
| 6..... | | 1.2 | | .5 | 1.2 | | 21..... | .5 | 1.2 | .5 | .5 | | |
| 7..... | | 1.2 | 0.05 | .05 | .5 | | 22..... | | .5 | .5 | 1.2 | | |
| 8..... | 0.05 | 1.2 | | | .5 | | 23..... | | .5 | .5 | 1.2 | | |
| 9..... | 1.2 | 1.2 | | .05 | .5 | | 24..... | 1.2 | .5 | .5 | 1.2 | | |
| 10..... | | 1.2 | | .5 | .5 | 0.5 | 25..... | 5.8 | .5 | .5 | 1.2 | .05 | |
| 11..... | | 1.2 | 1.2 | 4.0 | .5 | | 26..... | 2.5 | .5 | .5 | .5 | | |
| 12..... | | .05 | 1.2 | 35 | .5 | | 27..... | 1.2 | .5 | .5 | .5 | | |
| 13..... | | | 5.8 | 5.8 | .5 | 1.2 | 28..... | .05 | .05 | .05 | .5 | | |
| 14..... | | | 5.8 | 4.0 | | | 29..... | 5.8 | | .5 | .5 | | |
| 15..... | 1.2 | | 4.0 | 1.2 | | | 30..... | 10 | | .5 | .5 | | |
| | | | | | | | 31..... | 2.5 | | .5 | | | |

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

Monthly discharge of Middle Branch of Malaekahana Stream near Kahuku, Oahu, for year ending June 30, 1918.

| Month. | Discharge. | | | | Total run-off. | |
|---------------|--------------------------|----------|-------|---------------------|------------------|------------|
| | Million gallons per day. | | | Second-foot (mean). | Million gallons. | Acre-feet. |
| | Maximum. | Minimum. | Mean. | | | |
| January..... | 10 | 0.0 | 1.15 | 1.78 | 36 | 109 |
| February..... | 5.8 | .0 | 1.01 | 1.56 | 28 | 87 |
| March..... | 16 | .0 | 1.54 | 2.38 | 48 | 147 |
| April..... | 35 | .0 | 3.58 | 5.54 | 107 | 330 |
| May..... | 2.5 | .0 | .36 | .57 | 11 | 34 |
| June..... | 2.5 | .0 | .16 | .25 | 5 | 15 |
| The year..... | | | | | 235 | 722 |

NOTE.—No flow July to December.

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 confluence of 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, 1918.

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, 5 feet at 8.35 a. m. April 11 (discharge, 280 million gallons per day, or 434 second-feet); mini-stage recorded, 1.35 feet October 9 and 10 (discharge, 0.6 million gallons per day, or 0.9 second-foot).

1913-1918: Maximum stage recorded, 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.

REGULATION.—None.

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

ACCURACY.—Stage-discharge relation not permanent. Drift lodged on control April 11 and was not removed until after June 30. Rating curve used July 1 to April 11 well defined between 2 and 200 million gallons per day. Curve used April 12 to June 30 fairly well defined. Operation of water-stage recorder satisfactory, except January 4-8 and March 29 to April 16, for which periods there are no gage heights. Discharge estimated from flow of Left Branch of North Fork of Kaukonahua January 4-8, March 29 to April 4, and April 10-16; discharge estimated April 5-9. Records fair when water-stage recorder was operating; poor at other times.

Discharge measurements of Right Branch of North Fork of Kaukonahua near Wahiawa, Oahu, during the year ending June 30, 1918.

| Date. | Made by— | Gage height (feet). | Discharge. | |
|--------------|----------------------|---------------------|--------------|--------------------------|
| | | | Second-feet. | Million gallons per day. |
| July 2..... | H. A. R. Austin..... | 1.57 | 2.7 | 1.7 |
| Oct. 2..... | R. D. Klise..... | 1.42 | .95 | .6 |
| Nov. 2..... | do..... | 1.39 | .65 | .4 |
| Mar. 5..... | do..... | 2.27 | 25 | 16 |
| May 14..... | do..... | 1.75 | 3.5 | 2.2 |
| June 20..... | do..... | 2.14 | 15.6 | 10 |

Daily discharge, in million gallons, of Right Branch of North Fork of Kaukonahua Stream near Wahiawa, Oahu, for the year ending June 30, 1918.

| Day. | July. | Aug. | Sept. | Oct. | Nov. | Dec. | Jan. | Feb. | Mar. | Apr. | May. | June. |
|---------|-------|------|-------|------|-------|------|------|-------|------|-------|------|-------|
| 1..... | 2.0 | 0.8 | 1.6 | 0.8 | 0.5 | 1.6 | 1.1 | 16.5 | 5.9 | 4.4 | 3.1 | 7.3 |
| 2..... | 1.6 | .8 | 1.1 | .5 | .5 | 1.1 | .8 | 5.2 | 5.2 | 7.5 | 2.3 | 5.0 |
| 3..... | 3.1 | .8 | .8 | .5 | 9.0 | 1.6 | .8 | 4.4 | 5.2 | 20 | 8.5 | 5.0 |
| 4..... | 3.8 | .8 | .5 | .5 | 4.4 | 2.6 | .8 | 3.8 | 6.8 | 75 | 7.3 | 3.9 |
| 5..... | 2.0 | .8 | .5 | .5 | 10.2 | 3.1 | 1.2 | 7.8 | 14.8 | 30 | 10.2 | 3.9 |
| 6..... | 1.6 | .8 | .5 | .8 | 13.2 | 5.9 | 1.2 | 6.8 | 11.7 | 12 | 7.3 | 3.1 |
| 7..... | 1.6 | 1.6 | .5 | .5 | 3.8 | 4.4 | 2.0 | 7.8 | 6.8 | 4.4 | 3.1 | 1.8 |
| 8..... | 2.6 | .8 | .5 | .5 | 3.1 | 2.0 | 4.0 | 9.0 | 5.2 | 3.8 | 3.1 | 1.3 |
| 9..... | 10.2 | .5 | .5 | .4 | 2.0 | 2.0 | 1.1 | 26 | 36 | 18 | 2.3 | 3.1 |
| 10..... | 13.2 | .5 | .5 | .4 | 3.1 | 5.2 | .8 | 5.9 | 33 | 75 | 2.3 | 6.1 |
| 11..... | 5.9 | 2.6 | .5 | .8 | 1.6 | 2.6 | 3.8 | 5.2 | 102 | 65 | 3.1 | 3.1 |
| 12..... | 3.1 | 3.1 | 1.6 | .5 | 1.6 | 3.8 | 4.4 | 5.2 | 68 | 75 | 2.3 | 18 |
| 13..... | 2.6 | 4.4 | 5.2 | 1.1 | 1.1 | 3.1 | 9.0 | 4.4 | 49 | 45 | 3.1 | 8.5 |
| 14..... | 2.0 | 1.6 | 3.1 | 4.4 | 1.1 | 3.1 | 7.8 | 3.8 | 26 | 38 | 1.8 | 3.9 |
| 15..... | 2.0 | 2.0 | 2.0 | 1.6 | 1.1 | 2.0 | 5.9 | 3.1 | 20 | 16 | 1.8 | 10.2 |
| 16..... | 1.6 | 9.0 | 3.1 | .8 | 1.1 | 1.6 | 2.6 | 3.1 | 33 | 20 | 12 | 8.5 |
| 17..... | 7.8 | 2.0 | 5.2 | .8 | .8 | 1.1 | 2.0 | 14.8 | 14.8 | 18 | 5.0 | 3.9 |
| 18..... | 2.0 | 1.1 | 2.0 | .5 | .8 | 1.1 | 11.7 | 3.8 | 11.7 | 12 | 2.3 | 2.3 |
| 19..... | 1.6 | .8 | 1.1 | .5 | .8 | 1.1 | 9.0 | 3.8 | 16.5 | 26 | 2.3 | 2.3 |
| 20..... | 1.6 | .8 | 1.1 | 3.1 | .8 | 1.1 | 4.4 | 14.8 | 9.0 | 16 | 2.3 | 7.3 |
| 21..... | 1.6 | .8 | 1.1 | 5.9 | .8 | 1.1 | 3.1 | 26 | 7.8 | 8.5 | 1.8 | 5.0 |
| 22..... | 1.6 | .8 | .8 | 5.9 | .8 | 6.8 | 2.6 | 10.2 | 6.8 | 10.2 | 1.8 | 3.9 |
| 23..... | 1.6 | 5.9 | .8 | 5.2 | .8 | 1.6 | 3.8 | 6.8 | 5.9 | 7.3 | 2.3 | 5.0 |
| 24..... | 1.1 | 5.2 | .8 | 1.6 | 2.0 | 1.1 | 5.9 | 10.2 | 11.7 | 7.3 | 1.8 | 7.3 |
| 25..... | 1.6 | 2.0 | .8 | 1.1 | 3.8 | 1.1 | 6.8 | 18.2 | 9.0 | 6.1 | 14 | 3.9 |
| 26..... | 1.1 | 1.1 | 1.1 | 1.1 | 3.8 | 1.1 | 6.8 | 7.8 | 5.9 | 6.1 | 2.3 | 3.1 |
| 27..... | 1.1 | 1.1 | 2.6 | .8 | 6.8 | 6.8 | 3.8 | 7.8 | 5.2 | 6.1 | 8.5 | 3.1 |
| 28..... | .8 | 1.1 | 1.1 | .8 | 2.6 | 2.6 | 3.1 | 5.9 | 5.9 | 5.0 | 28 | 8.5 |
| 29..... | .8 | 1.1 | 1.6 | .8 | 2.0 | 1.6 | 13.2 | ..... | 5.2 | 3.9 | 33 | 3.1 |
| 30..... | 1.6 | 1.6 | 1.1 | .8 | 2.6 | 1.1 | 13.2 | ..... | 4.4 | 3.1 | 18 | 2.3 |
| 31..... | 1.1 | 1.6 | ..... | .8 | ..... | 1.1 | 5.2 | ..... | 3.8 | ..... | 7.3 | ..... |

Monthly discharge of Right Branch of North Fork of Kaukonahua Stream near Wahiawa, Oahu, for the year ending June 30, 1918.

| Month. | Discharge. | | | | Total run-off. | |
|----------------|--------------------------|----------|-------|---------------------|------------------|------------|
| | Million gallons per day. | | | Second-feet (mean). | Million gallons. | Acre-feet. |
| | Maximum. | Minimum. | Mean. | | | |
| July..... | 13.2 | 0.8 | 2.77 | 4.29 | 86 | 264 |
| August..... | 9.0 | .5 | 1.87 | 2.89 | 58 | 178 |
| September..... | 5.2 | .5 | 1.46 | 2.26 | 44 | 134 |
| October..... | 5.9 | .4 | 1.43 | 2.21 | 44 | 136 |
| November..... | 13.2 | .5 | 2.89 | 4.47 | 87 | 266 |
| December..... | 6.8 | 1.1 | 2.45 | 3.79 | 76 | 233 |
| January..... | 13.2 | .8 | 4.58 | 7.09 | 142 | 436 |
| February..... | 26 | 3.1 | 8.86 | 13.7 | 248 | 761 |
| March..... | 102 | 3.8 | 17.8 | 27.5 | 552 | 1,690 |
| April..... | 75 | 3.1 | 21.5 | 33.3 | 645 | 1,980 |
| May..... | 33 | 1.8 | 6.59 | 10.2 | 204 | 627 |
| June..... | 18 | 1.3 | 5.12 | 7.92 | 154 | 471 |
| The year..... | 102 | .4 | 6.41 | 9.92 | 2,340 | 7,180 |

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

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

RECORDS AVAILABLE.—May 25, 1913, to June 30, 1918.

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.—1913-1918: Maximum stage recorded, 8.48 feet at 2.45 p. m. April 12, 1918 (discharge, 1,000 million gallons per day, or 1,550 second-feet); minimum stage recorded, 0.85 foot February 9 and 19, 1915 (discharge, 0.25 million gallons per day, or 0.37 second-foot). Minimum stage recorded during year, 0.9 foot November 2 (discharge, 0.7 million gallons per day, or 1.1 second-foot).

DIVERSIONS.—None.

REGULATION.—None.

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

ACCURACY.—Stage-discharge relation not permanent. Rating curves fairly well defined, applicable July 1 to April 11 and April 12 to June 30. Operation of water-stage recorder satisfactory, except for the following periods which have been estimated from flow of Right Branch of North Fork of Kaukonahua Stream, July 3-5, August 6-9, 11, 12, February 10, 11, and March 14-22. No record April 5-9; discharge estimated. Records fair when water-stage recorder was operating and poor at other times.

Discharge measurements of Left Branch of North Fork of Kaukonahua Stream near Wahiawa, Oahu, during the year ending June 30, 1918.

| Date. | Made by— | Gage height (feet). | Discharge. | |
|--------------|----------------------|---------------------|--------------|--------------------------|
| | | | Second-feet. | Million gallons per day. |
| July 2..... | H. A. R. Austin..... | 1.12 | 4.1 | 2.7 |
| Oct. 2..... | R. D. Klise..... | 1.00 | 1.95 | 1.2 |
| Nov. 2..... | do..... | .91 | 1.1 | .7 |
| Mar. 5..... | do..... | 2.08 | 58 | 37 |
| May 14..... | do..... | 1.28 | 4.9 | 3.2 |
| June 20..... | do..... | 1.84 | 29 | 19 |

Daily discharge, in million gallons, of Left Branch of North Fork of Kaukonahua Stream near Wahiawa, Oahu, for the year ending June 30, 1918.

| Day. | July. | Aug. | Sept. | Oct. | Nov. | Dec. | Jan. | Feb. | Mar. | Apr. | May. | June. |
|---------|-------|------|-------|------|-------|------|------|-------|------|-------|------|-------|
| 1..... | 2.5 | 1.5 | 2.5 | 2.0 | 1.0 | 2.5 | 1.5 | 7.5 | 5.5 | 6.5 | 4.6 | 6.5 |
| 2..... | 2.5 | 1.5 | 1.5 | 1.5 | .7 | 2.0 | 1.5 | 4.6 | 4.6 | 10 | 3.8 | 5.5 |
| 3..... | 5.5 | 1.5 | 1.5 | 1.5 | 17 | 2.5 | 1.5 | 3.8 | 5.5 | 30 | 24 | 4.6 |
| 4..... | 6.5 | 1.5 | 1.5 | 1.5 | 6.5 | 3.8 | 1.5 | 3.8 | 6.5 | 109 | 21 | 3.8 |
| 5..... | 3.8 | 1.5 | 1.5 | 2.5 | 19 | 3.2 | 2.0 | 5.5 | 21 | 40 | 12 | 3.2 |
| 6..... | 3.8 | 1.5 | 1.5 | 4.6 | 17 | 13 | 2.0 | 5.5 | 17 | 17 | 7.5 | 3.8 |
| 7..... | 3.8 | 1.5 | 1.5 | 1.5 | 5.5 | 6.5 | 3.2 | 4.6 | 7.5 | 6.5 | 4.6 | 3.2 |
| 8..... | 3.8 | 1.5 | 1.5 | 1.0 | 4.6 | 3.8 | 6.5 | 10 | 5.5 | 5.5 | 3.8 | 3.2 |
| 9..... | 19 | 1.5 | 1.5 | 1.0 | 3.8 | 3.8 | 2.0 | 48 | 24 | 27 | 4.6 | 3.8 |
| 10..... | 27 | 1.5 | 1.5 | 1.0 | 4.6 | 8.8 | 1.5 | 7.5 | 48 | 109 | 6.5 | 5.5 |
| 11..... | 8.8 | 3.8 | 1.5 | 2.0 | 2.5 | 5.5 | 1.5 | 6.5 | 217 | 99 | 7.5 | 3.2 |
| 12..... | 5.5 | 5.5 | 3.2 | 1.5 | 2.5 | 7.5 | 3.2 | 6.5 | 136 | 109 | 5.5 | 40 |
| 13..... | 4.6 | 10 | 24 | 2.5 | 2.5 | 10 | 3.2 | 5.5 | 70 | 70 | 6.5 | 12 |
| 14..... | 3.8 | 3.2 | 6.5 | 6.5 | 2.5 | 6.5 | 4.6 | 4.6 | 33 | 56 | 3.8 | 5.5 |
| 15..... | 3.8 | 15 | 3.8 | 2.5 | 2.0 | 5.5 | 3.8 | 3.8 | 24 | 21 | 3.8 | 17 |
| 16..... | 5.5 | 13 | 5.5 | 2.0 | 2.0 | 4.6 | 2.5 | 3.8 | 48 | 24 | 30 | 10 |
| 17..... | 6.5 | 3.8 | 6.5 | 1.5 | 2.0 | 3.8 | 2.0 | 19 | 17 | 19 | 10 | 5.5 |
| 18..... | 3.8 | 2.0 | 3.2 | 1.5 | 1.5 | 3.8 | 4.6 | 4.6 | 13 | 12 | 5.5 | 5.5 |
| 19..... | 3.2 | 2.0 | 2.0 | 1.5 | 2.0 | 3.8 | 4.6 | 3.8 | 19 | 36 | 5.5 | 4.6 |
| 20..... | 2.5 | 2.0 | 2.0 | 3.8 | 2.0 | 3.2 | 2.5 | 17 | 10 | 15 | 5.5 | 12 |
| 21..... | 2.5 | 1.5 | 2.0 | 6.5 | 2.0 | 3.2 | 2.0 | 21 | 8.8 | 10 | 4.6 | 10 |
| 22..... | 2.5 | 3.2 | 1.5 | 7.5 | 2.0 | 10 | 2.0 | 8.8 | 7.5 | 12 | 4.6 | 10 |
| 23..... | 2.5 | 8.8 | 1.5 | 6.5 | 2.0 | 3.2 | 2.5 | 6.5 | 7.5 | 8.8 | 5.5 | 10 |
| 24..... | 2.5 | 4.6 | 2.0 | 3.2 | 4.6 | 2.5 | 3.8 | 6.5 | 13 | 7.5 | 5.5 | 10 |
| 25..... | 3.2 | 2.0 | 2.0 | 2.5 | 5.5 | 2.5 | 3.8 | 13 | 17 | 6.5 | 24 | 5.5 |
| 26..... | 2.0 | 1.5 | 3.8 | 2.0 | 6.5 | 2.0 | 4.6 | 40 | 10 | 6.5 | 7.5 | 4.6 |
| 27..... | 2.0 | 1.5 | 5.5 | 2.0 | 8.8 | 7.5 | 3.2 | 7.5 | 7.5 | 7.5 | 21 | 4.6 |
| 28..... | 2.0 | 1.5 | 2.5 | 2.0 | 4.6 | 3.8 | 2.5 | 6.5 | 7.5 | 6.5 | 27 | 21 |
| 29..... | 1.5 | 1.5 | 3.8 | 2.0 | 4.6 | 2.5 | 12 | 7.5 | 7.5 | 4.6 | 36 | 8.8 |
| 30..... | 3.2 | 2.5 | 2.5 | 2.0 | 5.5 | 2.0 | 7.5 | 6.5 | 4.6 | 15 | 7.5 | 7.5 |
| 31..... | 2.0 | 2.5 | ..... | 2.0 | ..... | 1.5 | 4.6 | ..... | 5.5 | ..... | 7.5 | ..... |

Monthly discharge of Left Branch of North Fork of Kaukonahua Stream near Wahiawa, Oahu, for the year ending June 30, 1918.

| Month. | Discharge. | | | | Total run-off. | |
|----------------|--------------------------|----------|-------|---------------------|------------------|------------|
| | Million gallons per day. | | | Second-foot (mean). | Million gallons. | Acre-feet. |
| | Maximum. | Minimum. | Mean. | | | |
| July..... | 27 | 1.5 | 4.91 | 7.60 | 152 | 467 |
| August..... | 15 | 1.5 | 3.43 | 5.31 | 106 | 326 |
| September..... | 24 | 1.5 | 3.38 | 5.23 | 101 | 311 |
| October..... | 7.5 | 1.0 | 2.63 | 4.07 | 82 | 250 |
| November..... | 19 | .7 | 4.91 | 7.60 | 147 | 452 |
| December..... | 13 | 1.5 | 4.67 | 7.23 | 145 | 444 |
| January..... | 12 | 1.5 | 3.36 | 5.20 | 104 | 320 |
| February..... | 48 | 3.8 | 10.2 | 15.8 | 286 | 876 |
| March..... | 217 | 4.6 | 26.8 | 41.5 | 830 | 2,550 |
| April..... | 109 | 4.6 | 29.9 | 46.3 | 896 | 2,750 |
| May..... | 36 | 3.8 | 10.8 | 16.7 | 334 | 1,030 |
| June..... | 40 | 3.2 | 8.35 | 12.9 | 250 | 769 |
| The year..... | 217 | .7 | 9.41 | 14.6 | 3,430 | 10,500 |

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 during the year ending June 30, 1918.

| Date. | Stream. | Locality. | Gage height (feet). | Discharge. | |
|---------|----------------------------|---|---------------------|--------------|--------------------------|
| | | | | Second-feet. | Million gallons per day. |
| July 9 | Kahana..... | Near Kahana..... | 0.91 | 24 | 16 |
| Aug. 10 | Kalanui..... | At elevation 1,900 feet, near Hauula. | 1.37 | 3.9 | 2.5 |
| Aug. 24 | Maole..... | Hillebrand Glen, 200 feet below diversion dam. | | .06 | .04 |
| Apr. 22 | South Fork of Kaukonahua.. | Below United States Army Reservoir near Wahiawa.. | 1.34 | 34 | 22 |
| May 22 |do..... |do..... | .46 | 3.0 | 1.9 |
| Aug. 9 | Wahoi..... | Near Hauula..... | .77 | 5.9 | 3.8 |
| Dec. 20 |do..... |do..... | .62 | 4.0 | 2.6 |
| Feb. 27 |do..... |do..... | .72 | 4.2 | 2.7 |
| June 6 |do..... |do..... | .82 | 8.7 | 5.6 |

NOTE.—Measurements made at former gaging stations, except Maole.

ISLAND OF MAUI.

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, 1918.

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 and 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 year, 6.50 feet at 6.30 a. m. April 3 (discharge, about 1,100 million gallons per day, or 1,700 second-feet); minimum stage recorded, 1.4 feet December 11-13, 17 and 18 (discharge, 6.0 million gallons per day, or 9.3 second-feet).

1913-1918: Maximum stage recorded, 8.25 feet at 7.30 a. m. January 18, 1916 (discharge, computed from extension of rating curve, about 1,900 million gallons per day, or 2,940 second-feet); minimum stage recorded (see preceding paragraph).

DIVERSIONS.—None.

REGULATION.—None.

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

ACCURACY.—Stage-discharge relation not permanent. Rating curve used July 1 to March 10 well defined between 6 and 60 million gallons per day; curve used March 11 to June 30 poorly defined. Operation of water-stage recorder satisfactory except no record, or only part record July 17-19, 23-27, August 10, 11, 14-24, and April 11-13; discharge estimated from flow of neighboring streams. Records fair when water-stage was operating properly July 1 to March 10; poor for other periods.

Discharge measurements of Honokahau Stream near Honokahau, Maui, during the year ending June 30, 1918.

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

| Date. | Gage height (feet). | Discharge. | | Date. | Gage height (feet). | Discharge. | |
|--------------|---------------------|--------------|--------------------------|-------------|---------------------|--------------|--------------------------|
| | | Second-foot. | Million gallons per day. | | | Second-foot. | Million gallons per day. |
| Aug. 31..... | 1.57 | 16.0 | 10 | Feb. 8..... | 1.43 | 10.2 | 6.5 |
| Nov. 11..... | 1.51 | 13.5 | 8.7 | May 10..... | 2.58 | 125 | 81 |

Daily discharge, in million gallons, of Honokahau Stream near Honokahau, Maui, for the year ending June 30, 1918.

| Day. | July. | Aug. | Sept. | Oct. | Nov. | Dec. | Jan. | Feb. | Mar. | Apr. | May. | June. |
|---------|-------|------|-------|------|-------|------|------|-------|------|-------|------|-------|
| 1..... | 14 | 17 | 9.7 | 11 | 8.4 | 12 | 7.2 | 16 | 16 | 33 | 23 | 25 |
| 2..... | 14 | 19 | 9.7 | 8.4 | 8.4 | 9.7 | 7.2 | 7.2 | 33 | 112 | 21 | 21 |
| 3..... | 12 | 14 | 9.7 | 8.4 | 8.4 | 8.4 | 7.2 | 7.2 | 40 | 196 | 25 | 19 |
| 4..... | 17 | 14 | 9.7 | 8.4 | 16 | 8.4 | 8.4 | 7.2 | 54 | 33 | 112 | 19 |
| 5..... | 21 | 14 | 9.7 | 9.7 | 17 | 7.2 | 8.4 | 7.2 | 30 | 80 | 36 | 19 |
| 6..... | 14 | 14 | 9.7 | 14 | 17 | 7.2 | 8.4 | 7.2 | 14 | 107 | 23 | 19 |
| 7..... | 12 | 19 | 9.7 | 9.7 | 36 | 7.2 | 7.2 | 7.2 | 21 | 33 | 23 | 19 |
| 8..... | 12 | 14 | 9.7 | 8.4 | 14 | 7.2 | 16 | 8.4 | 21 | 58 | 23 | 19 |
| 9..... | 23 | 14 | 9.7 | 8.4 | 12 | 7.2 | 11 | 155 | 25 | 170 | 19 | 19 |
| 10..... | 25 | 12 | 9.7 | 8.4 | 14 | 7.2 | 8.4 | 43 | 54 | 232 | 43 | 36 |
| 11..... | 14 | 23 | 8.4 | 8.4 | 8.4 | 6.0 | 40 | 40 | 232 | 40 | 23 | 36 |
| 12..... | 11 | 14 | 9.7 | 8.4 | 8.4 | 6.0 | 11 | 33 | 170 | 21 | 66 | 98 |
| 13..... | 11 | 21 | 36 | 8.4 | 8.4 | 6.0 | 8.4 | 14 | 33 | 21 | 43 | 28 |
| 14..... | 11 | 19 | 12 | 8.4 | 7.2 | 9.7 | 9.7 | 11 | 19 | 62 | 23 | 19 |
| 15..... | 11 | 17 | 9.7 | 8.4 | 7.2 | 11 | 7.2 | 9.7 | 17 | 62 | 25 | 98 |
| 16..... | 14 | 16 | 9.7 | 8.4 | 7.2 | 7.2 | 12 | 36 | 66 | 28 | 33 | 40 |
| 17..... | 14 | 14 | 8.4 | 8.4 | 7.2 | 6.0 | 7.2 | 88 | 30 | 23 | 25 | 21 |
| 18..... | 11 | 14 | 8.4 | 8.4 | 7.2 | 6.0 | 12 | 28 | 16 | 21 | 19 | 17 |
| 19..... | 11 | 12 | 9.7 | 8.4 | 7.2 | 7.2 | 8.4 | 43 | 14 | 21 | 19 | 17 |
| 20..... | 11 | 12 | 9.7 | 8.4 | 7.2 | 8.4 | 14 | 43 | 14 | 23 | 19 | 40 |
| 21..... | 11 | 11 | 9.7 | 8.4 | 7.2 | 25 | 7.2 | 43 | 14 | 33 | 28 | 33 |
| 22..... | 11 | 19 | 9.7 | 8.4 | 14 | 43 | 8.4 | 16 | 14 | 28 | 21 | 40 |
| 23..... | 11 | 14 | 9.7 | 8.4 | 17 | 14 | 11 | 12 | 14 | 21 | 19 | 40 |
| 24..... | 11 | 11 | 9.7 | 8.4 | 17 | 8.4 | 8.4 | 11 | 50 | 19 | 17 | 23 |
| 25..... | 11 | 11 | 9.7 | 8.4 | 8.4 | 14 | 7.2 | 11 | 162 | 21 | 33 | 23 |
| 26..... | 11 | 11 | 11 | 7.2 | 46 | 9.7 | 7.2 | 9.7 | 28 | 21 | 28 | 23 |
| 27..... | 11 | 11 | 9.7 | 7.2 | 14 | 8.4 | 7.2 | 14 | 21 | 33 | 36 | 28 |
| 28..... | 11 | 11 | 9.7 | 11 | 8.4 | 11 | 7.2 | 46 | 17 | 23 | 98 | 28 |
| 29..... | 11 | 11 | 11 | 12 | 17 | 8.4 | 7.2 | ..... | 16 | 40 | 25 | 25 |
| 30..... | 14 | 11 | 11 | 12 | 58 | 8.4 | 30 | ..... | 19 | 54 | 36 | 33 |
| 31..... | 14 | 9.7 | ..... | 8.4 | ..... | 7.2 | 17 | ..... | 21 | ..... | 21 | ..... |

Monthly discharge of Honokahau Stream near Honokahau, Maui, for the year ending June 30, 1918.

| Month. | Discharge. | | | Total run-off. | | |
|----------------|--------------------------|----------|-------|------------------------|---------------------|----------------|
| | Million gallons per day. | | | Second-feet (mean). | Million gallons. | Acre- feet. |
| | Maximum. | Minimum. | Mean. | | | |
| July..... | 25 | 11 | 13.2 | 20.4 | 410 | 1,260 |
| August..... | 23 | 9.7 | 14.3 | 22.1 | 444 | 1,360 |
| September..... | 36 | 8.4 | 10.7 | 16.6 | 320 | 985 |
| October..... | 14 | 7.2 | 8.99 | 13.9 | 279 | 855 |
| November..... | 58 | 7.2 | 14.5 | 22.4 | 434 | 1,340 |
| December..... | 43 | 6.0 | 10.1 | 15.6 | 313 | 961 |
| January..... | 40 | 7.2 | 10.9 | 16.9 | 337 | 1,040 |
| February..... | 155 | 7.2 | 27.6 | 42.7 | 774 | 2,370 |
| March..... | 232 | 14 | 41.8 | 64.7 | 1,300 | 3,980 |
| April..... | 232 | 19 | 55.6 | 86.0 | 1,670 | 5,120 |
| May..... | 112 | 17 | 32.4 | 50.1 | 1,000 | 3,080 |
| June..... | 98 | 17 | 30.8 | 47.7 | 925 | 2,840 |
| The year..... | 232 | 6.0 | 22.5 | 34.8 | 8,210 | 25,200 |

HONOKAWAI DITCH NEAR LAHAÏNA, 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 December 31, 1917, when station was discontinued.

GAGE.—A graduated rod placed in center of flume at each visit; read by Wamura.

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 clean and uniform in section and grade. Stage-discharge relation stable.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 1.35 feet at 3 p. m. September 13 (discharge, 7.8 million gallons per day, or 12 second-feet); minimum stage recorded, 0.85 foot November 19–22 and frequently in December (discharge, 2.8 million gallons per day, or 4.3 second-feet).

1912–1917: Maximum stage recorded, 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).

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.—Stage-discharge relation practically permanent. Rating curve fairly well defined. Gage read to hundredths twice daily. Results fair.

No discharge measurements made during year.

Daily discharge, in million gallons, of Honokawai ditch near Lahaina, Maui, for the year ending June 30, 1918.

| Day. | July. | Aug. | Sept. | Oct. | Nov. | Dec. | Day. | July. | Aug. | Sept. | Oct. | Nov. | Dec. |
|---------|-------|------|-------|------|------|------|---------|-------|------|-------|------|-------|------|
| 1..... | 4.0 | 4.5 | 3.2 | 3.2 | 3.2 | 4.0 | 16..... | 4.0 | 3.6 | 3.2 | 3.2 | 3.2 | 2.8 |
| 2..... | 4.0 | 6.0 | 3.2 | 3.2 | 3.2 | 3.2 | 17..... | 4.0 | 3.6 | 3.2 | 3.2 | 3.2 | 2.8 |
| 3..... | 4.0 | 4.0 | 3.2 | 3.2 | 3.2 | 2.8 | 18..... | 4.0 | 3.6 | 3.2 | 3.2 | 3.2 | 2.8 |
| 4..... | 4.0 | 3.6 | 3.2 | 3.2 | 4.0 | 2.8 | 19..... | 4.0 | 3.6 | 3.2 | 3.2 | 2.8 | 2.8 |
| 5..... | 5.5 | 3.6 | 3.2 | 3.2 | 5.5 | 2.8 | 20..... | 3.6 | 3.2 | 3.2 | 3.2 | 2.8 | 2.8 |
| 6..... | 4.0 | 3.6 | 3.2 | 3.2 | 4.0 | 2.8 | 21..... | 3.6 | 3.2 | 3.2 | 3.2 | 2.8 | 4.0 |
| 7..... | 3.6 | 5.0 | 3.2 | 3.2 | 7.2 | 2.8 | 22..... | 3.6 | 4.0 | 3.2 | 3.2 | 2.8 | 5.0 |
| 8..... | 3.6 | 4.0 | 3.2 | 3.2 | 4.0 | 2.8 | 23..... | 3.6 | 4.0 | 3.2 | 3.2 | 4.0 | 3.2 |
| 9..... | 6.0 | 4.0 | 3.2 | 3.2 | 3.6 | 2.8 | 24..... | 3.6 | 3.6 | 3.2 | 3.2 | 4.0 | 2.8 |
| 10..... | 5.5 | 3.6 | 3.2 | 3.2 | 4.0 | 2.8 | 25..... | 3.6 | 3.6 | 3.2 | 3.2 | 3.2 | 4.0 |
| 11..... | 4.0 | 5.0 | 3.2 | 3.2 | 3.2 | 2.8 | 26..... | 3.6 | 3.6 | 3.2 | 3.2 | 6.0 | 3.2 |
| 12..... | 3.6 | 6.0 | 3.2 | 3.2 | 3.2 | 2.8 | 27..... | 3.6 | 3.6 | 3.2 | 3.2 | 4.0 | 2.8 |
| 13..... | 3.6 | 6.6 | 3.2 | 3.2 | 3.2 | 2.8 | 28..... | 3.6 | 3.6 | 3.2 | 3.2 | 3.2 | 3.2 |
| 14..... | 3.6 | 4.0 | 3.2 | 3.2 | 3.2 | 2.8 | 29..... | 3.6 | 3.2 | 3.2 | 3.2 | 6.0 | 2.8 |
| 15..... | 3.6 | 3.6 | 3.2 | 3.2 | 3.2 | 5.0 | 30..... | 3.6 | 3.2 | 3.2 | 3.6 | 7.2 | 2.8 |
| | | | | | | | 31..... | 3.6 | 3.2 | ..... | 3.2 | ..... | 2.8 |

Monthly discharge of Honokawai ditch near Lahaina, Maui, for the year ending June 30, 1918.

| Month. | Discharge. | | | | Total run-off. | |
|------------------|--------------------------|----------|-------|------------------------|---------------------|------------|
| | Million gallons per day. | | | Second-feet (mean). | Million gallons. | Acre-feet. |
| | Maximum. | Minimum. | Mean. | | | |
| July | 6.0 | 3.6 | 3.93 | 6.08 | 122 | 374 |
| August | 6.6 | 3.2 | 3.98 | 6.16 | 124 | 379 |
| September | 3.2 | 3.2 | 3.20 | 4.95 | 96 | 295 |
| October | 3.6 | 3.2 | 3.21 | 4.97 | 100 | 305 |
| November | 7.2 | 2.8 | 3.88 | 6.00 | 116 | 357 |
| December | 5.0 | 2.8 | 3.11 | 4.81 | 96 | 296 |
| The period | | | | | 654 | 2,010 |

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

LOCATION.—200 feet above intake of pipe line supplying Lahaina and Lahainaluna school, about $2\frac{1}{2}$ miles northeast of Lahaina.

RECORDS AVAILABLE.—February 29, 1916, to June 30, 1918.

GAGE.—Gurley printing water-stage recorder.

DISCHARGE MEASUREMENTS.—Made by wading.

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

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 3.43 feet at 2.30 a. m. February 17 (discharge, about 340 million gallons per day, or 527 second-feet); minimum stage recorded, 1.00 foot February 4-8 and June 6-11 and 29 (discharge 2.5 million gallons per day, or 3.8 second-feet).

1916-1918: Maximum stage recorded, 3.3 feet at 11.30 p. m. December 21, 1916 (discharge, about 300 million gallons per day, or 464 second-feet); minimum stage recorded February and June, 1918.

DIVERSIONS.—None.

REGULATION.—None.

UTILIZATION.—Domestic supply, power development, and irrigation of sugar cane.

ACCURACY.—Stage-discharge relation not permanent. Rating curves fairly well defined below 15 million gallons per day. No gage height recorded September 3 to October 6 and June 6-30; intake pipe plugged March 4-29. Discharge interpolated September 3 to October 6. Discharge estimated from records for Ukumehame stream for periods in March and June. Records fair when water-stage recorder was operating satisfactorily; poor at other times.

Discharge measurements of Lahainaluna Stream above pipe-line intake, near Lahaina, Maui, during the year ending June 30, 1918.

[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 27..... | 1.09 | 5.0 | 3.2 | Feb. 7..... | 1.00 | 3.8 | 2.5 |
| Aug. 30..... | 1.07 | 4.2 | 2.7 | May 11..... | 1.08 | 4.7 | 3.1 |
| Dec. 9..... | 1.03 | 3.7 | 2.4 | | | | |

Daily discharge, in million gallons, of Lahainaluna Stream above pipe-line intake, near Lahaina, Maui, for the year ending June 30, 1918.

| Day. | July. | Aug. | Sept. | Oct. | Nov. | Dec. | Jan. | Feb. | Mar. | Apr. | May. | June. |
|---------|-------|------|-------|------|-------|------|------|-------|------|-------|------|-------|
| 1..... | 4.6 | 3.7 | 2.8 | 2.8 | 2.8 | 4.2 | 2.8 | 3.2 | 5.0 | 2.8 | 3.2 | 2.8 |
| 2..... | 4.2 | 5.0 | 2.8 | 2.8 | 2.8 | 3.2 | 2.8 | 2.8 | 5.0 | 5.8 | 3.2 | 2.8 |
| 3..... | 4.2 | 3.2 | 2.8 | 2.8 | 2.8 | 3.2 | 2.8 | 2.8 | 5.0 | 31 | 2.8 | 2.8 |
| 4..... | 4.6 | 3.2 | 2.8 | 2.8 | 13 | 2.8 | 2.8 | 2.5 | 5.8 | 3.7 | 5.8 | 2.8 |
| 5..... | 5.0 | 3.2 | 2.8 | 2.8 | 11 | 2.8 | 2.8 | 2.5 | 4.2 | 7.2 | 3.7 | 2.8 |
| 6..... | 3.2 | 3.2 | 2.8 | 2.8 | 5.8 | 2.8 | 2.8 | 2.5 | 4.2 | 8.6 | 3.2 | 2.5 |
| 7..... | 3.2 | 3.2 | 2.8 | 2.8 | 26 | 2.8 | 2.8 | 2.5 | 3.2 | 3.2 | 3.2 | 2.5 |
| 8..... | 3.2 | 3.2 | 2.8 | 2.8 | 5.0 | 2.8 | 5.0 | 2.5 | 3.2 | 3.7 | 3.2 | 2.5 |
| 9..... | 5.0 | 3.2 | 2.8 | 2.8 | 3.7 | 2.8 | 2.8 | 4.2 | 3.2 | 37 | 2.8 | 2.5 |
| 10..... | 4.2 | 3.2 | 2.8 | 2.8 | 3.7 | 2.8 | 2.8 | 5.8 | 3.7 | 77 | 5.0 | 2.5 |
| 11..... | 3.2 | 5.0 | 2.8 | 2.8 | 3.2 | 2.8 | 13 | 17 | 31 | 4.2 | 2.8 | 2.5 |
| 12..... | 3.2 | 3.7 | 2.8 | 2.8 | 2.8 | 2.8 | 3.2 | 8.6 | 21 | 3.2 | 3.7 | 3.2 |
| 13..... | 3.2 | 5.8 | 2.8 | 2.8 | 2.8 | 3.2 | 2.8 | 3.2 | 7.2 | 3.2 | 3.2 | 2.8 |
| 14..... | 3.2 | 3.7 | 2.8 | 2.8 | 2.8 | 3.2 | 2.8 | 2.8 | 5.8 | 143 | 2.8 | 2.8 |
| 15..... | 3.2 | 3.2 | 2.8 | 2.8 | 2.8 | 2.8 | 2.8 | 2.8 | 4.2 | 5.8 | 2.8 | 4.2 |
| 16..... | 4.2 | 3.2 | 2.8 | 2.8 | 2.8 | 2.8 | 2.8 | 8.6 | 4.2 | 3.7 | 2.8 | 3.2 |
| 17..... | 3.7 | 3.2 | 2.8 | 2.8 | 2.8 | 2.8 | 2.8 | 56 | 5.0 | 3.2 | 2.8 | 2.8 |
| 18..... | 3.2 | 3.2 | 2.8 | 2.8 | 2.8 | 2.8 | 3.7 | 8.6 | 5.8 | 3.2 | 2.8 | 2.8 |
| 19..... | 3.2 | 3.2 | 2.8 | 2.8 | 2.8 | 2.8 | 3.2 | 17 | 4.2 | 3.2 | 2.8 | 2.8 |
| 20..... | 3.2 | 3.2 | 2.8 | 2.8 | 2.8 | 2.8 | 4.2 | 7.2 | 3.7 | 3.2 | 2.8 | 3.2 |
| 21..... | 3.2 | 3.2 | 2.8 | 2.8 | 2.8 | 2.8 | 2.8 | 5.8 | 3.7 | 3.2 | 2.8 | 3.2 |
| 22..... | 3.2 | 5.0 | 2.8 | 2.8 | 5.8 | 3.2 | 2.8 | 3.2 | 3.7 | 3.2 | 2.8 | 3.2 |
| 23..... | 3.2 | 3.7 | 2.8 | 2.8 | 5.0 | 2.8 | 2.8 | 2.8 | 3.7 | 3.2 | 2.8 | 2.8 |
| 24..... | 3.2 | 3.2 | 2.8 | 2.8 | 4.2 | 2.8 | 2.8 | 3.7 | 4.2 | 3.2 | 2.8 | 2.8 |
| 25..... | 3.2 | 3.2 | 2.8 | 2.8 | 2.8 | 5.0 | 2.8 | 2.8 | 13 | 3.2 | 2.8 | 2.8 |
| 26..... | 3.2 | 3.2 | 2.8 | 2.8 | 7.2 | 2.8 | 2.8 | 2.8 | 5.8 | 3.2 | 3.2 | 2.8 |
| 27..... | 3.2 | 3.2 | 2.8 | 2.8 | 3.2 | 2.8 | 2.8 | 8.6 | 4.2 | 3.2 | 7.2 | 2.8 |
| 28..... | 3.2 | 2.8 | 2.8 | 2.8 | 3.2 | 5.0 | 2.8 | 43 | 4.2 | 2.8 | 7.2 | 2.8 |
| 29..... | 3.2 | 2.8 | 2.8 | 4.2 | 11 | 2.8 | 2.8 | ----- | 3.7 | 3.7 | 3.2 | 2.5 |
| 30..... | 3.2 | 2.8 | 2.8 | 3.2 | 43 | 2.8 | 5.0 | ----- | 2.8 | 5.8 | 2.8 | 2.8 |
| 31..... | 3.2 | 3.2 | ----- | 2.8 | ----- | 2.8 | 5.0 | ----- | 2.8 | ----- | 2.8 | ----- |

Monthly discharge of Lahainaluna Stream above pipe-line intake, near Lahaina, Maui, for the year ending June 30, 1918.

| Month. | Discharge. | | | | Total run-off. | |
|----------------|--------------------------|----------|-------|--------------------|------------------|------------|
| | Million gallons per day. | | | Second-foot mean). | Million gallons. | Acre-feet. |
| | Maximum. | Minimum. | Mean. | | | |
| July..... | 5.0 | 3.2 | 3.55 | 5.49 | 110 | 338 |
| August..... | 5.8 | 2.8 | 3.48 | 5.38 | 108 | 331 |
| September..... | 2.8 | 2.8 | 2.80 | 4.33 | 84 | 258 |
| October..... | 4.2 | 2.8 | 2.86 | 4.43 | 89 | 272 |
| November..... | 43 | 2.8 | 6.44 | 9.96 | 193 | 593 |
| December..... | 5.0 | 2.8 | 3.05 | 4.72 | 95 | 290 |
| January..... | 13 | 2.8 | 3.44 | 5.32 | 107 | 327 |
| February..... | 56 | 2.5 | 8.42 | 13.0 | 236 | 724 |
| March..... | 31 | 2.8 | 6.01 | 9.3 | 186 | 572 |
| April..... | 143 | 2.8 | 13.0 | 20.1 | 391 | 1,200 |
| May..... | 7.2 | 2.8 | 3.41 | 5.28 | 106 | 324 |
| June..... | 4.2 | 2.5 | 2.84 | 4.39 | 85 | 261 |
| The year..... | 143 | 2.5 | 4.90 | 7.58 | 1,790 | 5,490 |

OLOWALU DITCH NEAR OLOWALU, MAUI.

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

RECORDS AVAILABLE.—July 28, 1916, to June 30, 1918. August 12, 1911, to June 30, 1916, for old station, in tailrace of power house.

GAGE.—Vertical staff; read by power-house tender.

DISCHARGE MEASUREMENTS.—Made by wading.

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

EXTREMES OF DISCHARGE.—1916-1918: Maximum stage recorded, 1.20 feet at 5.30 a. m. December 26, 1917 (discharge, 9 million gallons per day, or 14 second-feet); minimum stage recorded, 0.2 foot March 5-8, 1918 (discharge, 1.9 million gallons per day, or 2.9 second-feet).

DIVERSIONS.—None.

REGULATION.—None.

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

ACCURACY.—Stage-discharge relation not permanent. Rating curve used July 1 to March 8 well defined between 2 and 6 million gallons per day, excepting for last part of September and for October; observer removed grass from channel on September 24; curve used March 9 to June 30 fairly well defined. Operation of water-stage recorder satisfactory. Records fair, July, August, September, and November to February; poor for October and March to June.

Discharge measurements of Olowalu ditch near Olowalu, Maui, during the year ending June 30, 1918.

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

| Date. | Gage height (feet). | Discharge. | |
|--------------|---------------------|--------------|--------------------------|
| | | Second-feet. | Million gallons per day. |
| July 28..... | 0.47 | 5.4 | 3.5 |
| Feb. 6..... | .33 | 4.1 | 2.6 |
| May 21..... | .76 | 7.3 | 4.7 |

Daily discharge, in million gallons, of Olowalu ditch near Olowalu, Maui, for the year ending June 30, 1913.

| Day. | July. | Aug. | Sept. | Oct. | Nov. | Dec. | Jan. | Feb. | Mar. | Apr. | May. | June. |
|---------|-------|------|-------|------|-------|------|------|-------|------|-------|------|-------|
| 1..... | 3.7 | 4.0 | 3.0 | 2.2 | 2.2 | 5.1 | 3.7 | 4.0 | 6.6 | 6.2 | 6.2 | 4.8 |
| 2..... | 3.7 | 4.0 | 3.0 | 2.2 | 2.2 | 4.4 | 3.7 | 3.7 | 7.0 | 6.2 | 5.8 | 4.8 |
| 3..... | 3.7 | 3.7 | 3.0 | 2.4 | 2.2 | 3.7 | 3.0 | 3.7 | 7.0 | 6.6 | 5.8 | 4.8 |
| 4..... | 3.0 | 3.7 | 3.0 | 2.2 | 3.0 | 3.0 | 3.0 | 3.4 | 4.4 | 6.2 | 6.2 | 4.8 |
| 5..... | 3.0 | 3.7 | 3.0 | 2.2 | 2.7 | 3.0 | 3.0 | 3.4 | 1.9 | 6.2 | 6.2 | 4.8 |
| 6..... | 4.0 | 3.4 | 3.0 | 2.4 | 2.7 | 3.0 | 3.0 | 3.0 | 1.9 | 6.6 | 6.2 | 4.8 |
| 7..... | 4.0 | 3.4 | 3.0 | 2.4 | 6.2 | 5.1 | 2.7 | 2.7 | 1.9 | 6.6 | 5.8 | 4.4 |
| 8..... | 3.7 | 3.0 | 3.0 | 2.2 | 3.7 | 4.8 | 6.6 | 3.0 | 1.9 | 6.6 | 5.8 | 4.0 |
| 9..... | 3.7 | 3.7 | 3.0 | 2.2 | 3.4 | 3.0 | 6.2 | 6.2 | 4.0 | 6.6 | 5.4 | 3.7 |
| 10..... | 3.4 | 3.7 | 3.0 | 2.2 | 2.4 | 3.0 | 5.4 | 6.6 | 4.4 | 6.6 | 5.4 | 3.7 |
| 11..... | 3.4 | 4.4 | 3.0 | 2.2 | 2.4 | 3.0 | 5.8 | 7.0 | 5.8 | 6.6 | 5.4 | 3.7 |
| 12..... | 3.7 | 4.8 | 3.0 | 2.7 | 2.4 | 2.7 | 5.8 | 7.4 | 6.6 | 6.2 | 5.4 | 5.8 |
| 13..... | 3.7 | 4.4 | 3.0 | 2.4 | 2.2 | 2.7 | 5.4 | 7.0 | 5.8 | 5.8 | 5.4 | 6.2 |
| 14..... | 3.7 | 3.7 | 3.7 | 2.2 | 2.2 | 2.7 | 4.8 | 6.2 | 5.1 | 5.4 | 5.1 | 5.8 |
| 15..... | 3.7 | 3.7 | 3.4 | 2.2 | 2.2 | 2.7 | 4.8 | 6.2 | 4.4 | 4.8 | 4.8 | 6.2 |
| 16..... | 4.0 | 3.7 | 3.7 | 2.4 | 2.2 | 2.7 | 4.0 | 7.0 | 4.4 | 4.8 | 5.1 | 6.2 |
| 17..... | 4.0 | 3.7 | 3.4 | 2.4 | 2.4 | 2.7 | 4.0 | 7.0 | 3.7 | 5.4 | 5.1 | 5.8 |
| 18..... | 4.0 | 3.4 | 3.0 | 2.2 | 2.4 | 2.7 | 5.4 | 6.2 | 2.7 | 6.2 | 5.1 | 5.8 |
| 19..... | 4.0 | 3.4 | 3.0 | 2.2 | 2.2 | 2.4 | 6.6 | 7.0 | 2.4 | 6.6 | 5.1 | 5.1 |
| 20..... | 4.0 | 3.4 | 3.0 | 2.2 | 2.4 | 2.7 | 6.2 | 7.0 | 2.4 | 6.2 | 4.8 | 4.8 |
| 21..... | 3.7 | 3.7 | 3.0 | 2.2 | 2.2 | 2.7 | 5.4 | 3.0 | 3.4 | 6.2 | 4.8 | 5.1 |
| 22..... | 3.7 | 4.4 | 3.0 | 2.2 | 2.7 | 2.7 | 4.8 | 4.4 | 5.1 | 6.2 | 5.1 | 4.8 |
| 23..... | 3.7 | 4.8 | 2.7 | 2.2 | 3.0 | 2.7 | 4.8 | 4.4 | 5.8 | 5.8 | 5.1 | 4.4 |
| 24..... | 3.4 | 4.0 | 2.7 | 2.2 | 3.4 | 2.7 | 4.4 | 4.0 | 6.2 | 5.4 | 4.8 | 4.4 |
| 25..... | 3.4 | 3.4 | 2.4 | 2.2 | 2.4 | 9.0 | 4.0 | 4.0 | 6.6 | 5.4 | 4.8 | 4.0 |
| 26..... | 3.4 | 3.7 | 2.4 | 2.2 | 4.4 | 9.0 | 4.0 | 4.0 | 6.6 | 5.1 | 5.1 | 5.1 |
| 27..... | 3.4 | 3.7 | 2.4 | 2.2 | 5.1 | 8.6 | 4.0 | 4.0 | 6.6 | 4.8 | 5.1 | 5.1 |
| 28..... | 3.4 | 3.4 | 2.4 | 2.2 | 3.7 | 8.6 | 4.0 | 5.4 | 6.6 | 4.8 | 5.1 | 5.1 |
| 29..... | 3.4 | 3.4 | 2.2 | 2.4 | 5.1 | 7.0 | 3.7 | ..... | 6.2 | 5.4 | 5.1 | 5.1 |
| 30..... | 3.7 | 3.0 | 2.2 | 2.2 | 5.8 | 3.7 | 4.4 | ..... | 6.2 | 6.2 | 4.8 | 5.4 |
| 31..... | 3.4 | 3.4 | ..... | 2.2 | ..... | 5.8 | 4.0 | ..... | 6.2 | ..... | 4.8 | ..... |

Monthly discharge of Olowalu ditch near Olowalu, Maui, for the year ending June 30, 1918.

| Month. | Discharge. | | | | Total run-off. | |
|----------------|--------------------------|----------|-------|---------------------|------------------|------------|
| | Million gallons per day. | | | Second feet (mean). | Million gallons. | Acre-feet. |
| | Maximum. | Minimum. | Mean. | | | |
| July..... | 4.0 | 3.0 | 3.64 | 5.63 | 113 | 346 |
| August..... | 4.8 | 3.0 | 3.74 | 5.79 | 116 | 356 |
| September..... | 3.7 | 2.2 | 2.92 | 4.52 | 88 | 269 |
| October..... | 2.4 | 2.2 | 2.26 | 3.50 | 70 | 215 |
| November..... | 6.2 | 2.2 | 3.05 | 4.72 | 92 | 281 |
| December..... | 9.0 | 2.4 | 4.12 | 6.37 | 128 | 392 |
| January..... | 6.6 | 2.7 | 4.54 | 7.02 | 141 | 432 |
| February..... | 7.4 | 2.7 | 5.03 | 7.78 | 141 | 432 |
| March..... | 7.0 | 1.9 | 4.83 | 7.47 | 150 | 460 |
| April..... | 6.6 | 4.8 | 5.92 | 9.16 | 178 | 545 |
| May..... | 6.2 | 4.8 | 5.31 | 8.22 | 165 | 505 |
| June..... | 6.2 | 3.7 | 4.95 | 7.66 | 148 | 456 |
| The year..... | 9.0 | 1.9 | 4.18 | 6.47 | 1,530 | 4,690 |

UKUMEHAME STREAM NEAR OLOWALU, MAUI.

LOCATION.—Half a mile above upper ditch intake, 2 miles above Government road at 14-mile post, and 4 miles by road and trail east of Olowalu.

RECORDS AVAILABLE.—August 14, 1911, to June 30, 1918.

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 is steep and high; left bank slopes gradually; very rough stream bed composed of boulders and gravel. Control somewhat shifting.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 2.44 feet at 10.30 a. m. April 3 (discharge, 120 million gallons per day, or 186 second-feet); minimum stage recorded, 0.45 foot frequently in July to February (discharge, 3.2 million gallons per day, or 5.0 second-feet).

1911-1918: Maximum stage recorded, 9.0 feet estimated gage height of flood of January 18, 1916; discharge not estimated; minimum stage recorded, 0.60 foot October 4 and 5, 1913 (discharge, 2.3 million gallons per day, or 3.6 second-feet).

DIVERSIONS.—None.

REGULATION.—None.

UTILIZATION.—Irrigation of sugar cane.

ACCURACY.—Stage-discharge relation not permanent. Rating curve used July 1 to March 10 fairly well defined. Rating curves used March 11 to April 9 and April 10 to June 30 poorly defined. Operation of water-stage recorder satisfactory. Records fair July 1 to March 10; poor March 11 to June 30.

Discharge measurements of Ukumehame Stream near Olowalu, Maui, during the year ending June 30, 1918.

[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 27..... | 0.47 | 5.7 | 3.7 | Mar. 30..... | 0.49 | 13.3 | 8.6 |
| Aug. 30..... | .47 | 5.1 | 3.3 | May 9..... | .48 | 10.6 | 6.9 |
| Oct. 7..... | .45 | 4.8 | 3.1 | June 8..... | .41 | 7.6 | 4.9 |
| Feb. 9..... | .92 | 23 | 15 | | | | |

Daily discharge, in million gallons, of Ukumehame Stream near Olowalu, Maui, for the year ending June 30, 1918.

| Day. | July. | Aug. | Sept. | Oct. | Nov. | Dec. | Jan. | Feb. | Mar. | Apr. | May. | June. |
|---------|-------|------|-------|------|-------|------|------|-------|------|-------|------|-------|
| 1..... | 3.9 | 3.9 | 3.2 | 3.2 | 3.2 | 4.9 | 3.9 | 3.9 | 11 | 7.6 | 7.5 | 6.0 |
| 2..... | 3.9 | 3.9 | 3.2 | 3.2 | 3.2 | 3.9 | 3.9 | 3.9 | 11 | 10 | 7.5 | 6.0 |
| 3..... | 3.9 | 3.2 | 3.2 | 3.2 | 3.2 | 3.9 | 3.9 | 3.9 | 9.5 | 44 | 6.0 | 4.8 |
| 4..... | 3.9 | 3.2 | 3.2 | 3.2 | 3.2 | 3.2 | 3.9 | 3.9 | 12 | 20 | 14 | 4.8 |
| 5..... | 3.9 | 3.2 | 3.2 | 3.2 | 3.2 | 3.2 | 3.9 | 3.9 | 9.5 | 20 | 12 | 4.8 |
| 6..... | 3.9 | 3.2 | 3.2 | 3.2 | 3.2 | 3.2 | 3.9 | 3.9 | 8.2 | 34 | 9.1 | 4.8 |
| 7..... | 3.9 | 3.2 | 3.2 | 3.2 | 7.0 | 4.9 | 3.2 | 3.2 | 5.8 | 16 | 7.5 | 4.8 |
| 8..... | 3.9 | 3.2 | 3.2 | 3.2 | 3.9 | 3.9 | 11 | 3.2 | 4.9 | 16 | 7.5 | 4.8 |
| 9..... | 3.9 | 3.2 | 3.2 | 3.2 | 3.2 | 3.2 | 5.8 | 12 | 4.9 | 32 | 7.5 | 4.8 |
| 10..... | 3.9 | 3.2 | 3.2 | 3.2 | 3.2 | 3.2 | 4.9 | 11 | 7.0 | 44 | 9.1 | 4.8 |
| 11..... | 3.9 | 3.9 | 3.2 | 3.2 | 3.2 | 3.2 | 8.2 | 29 | 27 | 27 | 7.5 | 4.8 |
| 12..... | 3.2 | 3.9 | 3.2 | 3.2 | 3.2 | 3.2 | 5.8 | 19 | 34 | 18 | 9.1 | 11 |
| 13..... | 3.2 | 3.9 | 3.9 | 3.2 | 3.2 | 3.2 | 5.8 | 9.5 | 16 | 14 | 9.1 | 7.5 |
| 14..... | 3.2 | 3.2 | 3.9 | 3.2 | 3.2 | 3.2 | 4.9 | 7.0 | 12 | 16 | 7.5 | 6.0 |
| 15..... | 3.2 | 3.2 | 3.2 | 3.2 | 3.2 | 3.2 | 4.9 | 5.8 | 10 | 18 | 7.5 | 14 |
| 16..... | 3.2 | 3.2 | 3.2 | 3.2 | 3.2 | 3.2 | 3.9 | 27 | 10 | 12 | 7.5 | 11 |
| 17..... | 3.2 | 3.2 | 3.2 | 3.2 | 3.2 | 3.2 | 3.9 | 34 | 11 | 11 | 6.0 | 7.5 |
| 18..... | 3.2 | 3.2 | 3.2 | 3.2 | 3.2 | 3.2 | 7.0 | 21 | 12 | 11 | 6.0 | 6.0 |
| 19..... | 3.2 | 3.2 | 3.2 | 3.2 | 3.2 | 3.2 | 5.8 | 27 | 8.9 | 9.1 | 6.0 | 6.0 |
| 20..... | 3.2 | 3.2 | 3.2 | 3.2 | 3.2 | 3.2 | 8.2 | 16 | 7.6 | 9.1 | 6.0 | 11 |
| 21..... | 3.2 | 3.2 | 3.2 | 3.2 | 3.2 | 3.2 | 5.8 | 12 | 7.6 | 9.1 | 6.0 | 11 |
| 22..... | 3.2 | 4.9 | 3.2 | 3.2 | 3.9 | 3.2 | 4.9 | 8.2 | 7.6 | 7.5 | 6.0 | 9.1 |
| 23..... | 3.2 | 3.9 | 3.2 | 3.2 | 3.9 | 3.2 | 4.9 | 7.0 | 7.6 | 7.5 | 6.0 | 7.5 |
| 24..... | 3.2 | 3.9 | 3.2 | 3.2 | 3.9 | 3.9 | 3.9 | 5.8 | 8.9 | 7.5 | 6.0 | 6.0 |
| 25..... | 3.2 | 3.2 | 3.2 | 3.2 | 3.2 | 8.2 | 3.9 | 4.9 | 30 | 7.5 | 6.0 | 6.0 |
| 26..... | 3.2 | 3.2 | 3.2 | 3.2 | 5.8 | 7.0 | 4.9 | 4.9 | 14 | 7.5 | 6.0 | 6.0 |
| 27..... | 3.2 | 3.2 | 3.2 | 3.2 | 4.9 | 5.8 | 3.9 | 4.9 | 10 | 6.0 | 6.0 | 6.0 |
| 28..... | 3.2 | 3.2 | 3.2 | 3.2 | 3.9 | 11 | 3.9 | 11 | 8.9 | 6.0 | 7.5 | 6.0 |
| 29..... | 3.2 | 3.2 | 3.2 | 3.2 | 3.9 | 7.0 | 3.9 | ..... | 7.6 | 9.1 | 6.0 | 4.8 |
| 30..... | 3.2 | 3.2 | 3.2 | 3.2 | 5.8 | 5.8 | 7.0 | ..... | 7.6 | 12 | 6.0 | 7.5 |
| 31..... | 3.2 | 3.2 | ..... | 3.2 | ..... | 4.9 | 4.9 | ..... | 7.6 | ..... | 6.0 | ..... |

Monthly discharge of Ukumehame Stream near Olowalu, Maui, for the year ending June 30, 1918.

| Month. | Discharge. | | | | Total run-off. | |
|----------------|--------------------------|----------|-------|---------------------|------------------|------------|
| | Million gallons per day. | | | Second-foot (mean). | Million gallons. | Acre-feet. |
| | Maximum. | Minimum. | Mean. | | | |
| July..... | 3.9 | 3.2 | 3.45 | 5.34 | 107 | 328 |
| August..... | 4.9 | 3.2 | 3.41 | 5.28 | 106 | 324 |
| September..... | 3.9 | 3.2 | 3.25 | 5.03 | 97 | 289 |
| October..... | 3.2 | 3.2 | 3.20 | 4.95 | 99 | 304 |
| November..... | 7.0 | 3.2 | 3.70 | 5.72 | 111 | 341 |
| December..... | 11 | 3.2 | 4.28 | 6.62 | 133 | 407 |
| January..... | 11 | 3.2 | 5.12 | 7.92 | 159 | 487 |
| February..... | 34 | 3.2 | 11.0 | 17.0 | 307 | 945 |
| March..... | 34 | 4.9 | 11.3 | 17.5 | 350 | 1,080 |
| April..... | 44 | 6.0 | 15.6 | 24.1 | 468 | 1,440 |
| May..... | 14 | 6.0 | 7.34 | 11.4 | 227 | 688 |
| June..... | 14 | 4.8 | 6.84 | 10.6 | 205 | 630 |
| The year..... | 44 | 3.2 | 6.49 | 10.0 | 2,370 | 7,270 |

WEST KOPILIULA STREAM NEAR KEANAE, MAUI.

LOCATION.—600 feet above Koolau ditch crossing and highway bridge, $4\frac{1}{2}$ miles by trail east of Upper Keanae, and 6 miles east of Keanae post office.

RECORDS AVAILABLE.—January 3, 1914, to September 17, 1917, when station was discontinued.

• GAGE.—Friez water-stage recorder.

DICHARGE 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 year, 1.95 feet at 6 p. m. August 22 (discharge, about 29 million gallons per day, or 45 second-feet); minimum stage recorded, 0.6 foot September 15–17 (discharge, 0.6 million gallons per day, or 0.9 second-foot).

1914–1918: Maximum stage recorded, 9.25 feet at 5.30 a. m. January 18, 1916 (discharge, computed from extension of rating curve, about 2,000 million gallons per day, or 3,090 second-feet); minimum stage recorded, September 15–17, 1917.

DIVERSIONS.—None.

REGULATION.—None.

UTILIZATION.—Ordinary flow is diverted into Koolau ditch for irrigation of sugar cane.

ACCURACY.—Stage-discharge relation practically permanent. Rating curve well defined between 2 and 500 million gallons per day. Operation of water-stage recorder satisfactory. Records fair.

The following discharge measurement was made by H. A. R. Austin:

September 7, 1917: Gage height, 0.72 foot; discharge, 1.55 second-feet, or 1.0 million gallons per day.

Daily discharge, in million gallons, of West Kopiliula Stream near Keanae, Maui, for the year ending June 30, 1918.

| Day. | July. | Aug. | Sept. | Day. | July. | Aug. | Sept. | Day. | July. | Aug. | Sept. |
|---------|-------|------|-------|---------|-------|------|-------|---------|-------|------|-------|
| 1..... | 3.3 | 1.8 | 1.0 | 11..... | 2.8 | 2.3 | 1.0 | 21..... | 1.8 | 1.8 | ..... |
| 2..... | 2.8 | 2.3 | 1.0 | 12..... | 2.3 | 2.3 | 1.4 | 22..... | 2.8 | 9.0 | ..... |
| 3..... | 3.3 | 1.8 | 1.0 | 13..... | 2.3 | 2.8 | 1.8 | 23..... | 3.3 | 1.2 | ..... |
| 4..... | 3.8 | 1.8 | 1.0 | 14..... | 2.3 | 2.3 | 1.0 | 24..... | 2.8 | 3.8 | ..... |
| 5..... | 5.0 | 1.4 | 1.0 | 15..... | 2.3 | 1.8 | .6 | 25..... | 2.3 | 1.4 | ..... |
| 6..... | 3.3 | 1.4 | 1.0 | 16..... | 2.3 | 1.8 | .6 | 26..... | 2.3 | 1.4 | ..... |
| 7..... | 2.8 | 1.4 | 1.0 | 17..... | 2.3 | 1.4 | .6 | 27..... | 1.8 | 1.0 | ..... |
| 8..... | 2.8 | 1.4 | 1.0 | 18..... | 1.8 | 1.4 | ..... | 28..... | 1.8 | 1.0 | ..... |
| 9..... | 3.8 | 1.8 | 1.0 | 19..... | 1.8 | 1.4 | ..... | 29..... | 1.8 | 1.0 | ..... |
| 10..... | 3.8 | 1.8 | 1.0 | 20..... | 1.8 | 1.4 | ..... | 30..... | 2.3 | 1.0 | ..... |
| | | | | | | | | 31..... | 1.8 | 1.0 | ..... |

Monthly discharge of West Kopiliula Stream near Keanae, Maui, for the year ending June 30, 1918.

| Month. | Discharge. | | | | Total run-off. | |
|---------------------|--------------------------|----------|-------|---------------------|------------------|------------|
| | Million gallons per day. | | | Second-feet (mean). | Million gallons. | Acre-feet. |
| | Maximum. | Minimum. | Mean. | | | |
| July..... | 5.0 | 1.8 | 2.63 | 4.07 | 82 | 250 |
| August..... | 12 | 1.0 | 2.26 | 3.50 | 70 | 215 |
| September 1–17..... | 1.8 | .6 | 1.0 | 1.55 | 17 | 52 |
| The period..... | | | | | 169 | 517 |

EAST WAILUAIKI STREAM NEAR KEANAE, MAUI.

LOCATION.—1,000 feet above Koolau ditch crossing and trail, $3\frac{1}{4}$ miles east of Upper Keanae, and about $6\frac{1}{4}$ miles east of Keanae post office.

RECORDS AVAILABLE.—December 21, 1913, to October 23, 1917, when station was discontinued.

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 are nearly vertical walls of rock. Control composed of large boulders and rock ledge; fairly permanent.

EXTREME OF DISCHARGE.—Maximum stage recorded during year, 1.35 feet at 4 p. m. July 5 (discharge, about 17 million gallons per day, or 26 second-feet); minimum stage recorded, 0.5 foot October 22 and 23 (discharge, 1.0 million gallons per day, or 1.55 second-feet).

1913-1917: Maximum stage recorded, 8.35 feet at 8 a. m. January 18, 1916 (discharge, computed from extension of rating curve, about 1,900 million gallons per day, or 2.940 second-feet); minimum stage recorded (see preceding paragraph).

DIVERSIONS.—None.

REGULATION.—None.

UTILIZATION.—Ordinary flow is diverted into Koolau ditch for irrigation of sugar cane.

ACCURACY.—Stage-discharge relation practically permanent. Rating curve well defined between 2 and 15 million gallons per day. Operation of water-stage recorder unsatisfactory August 5 to September 7; no gage height record August 6-23 and August 26 to September 6, only part record August 5, 24, 25, and September 7; discharge estimated from records of flow of nearby streams and from gage heights for parts of days. Records fair.

The following discharge measurement was made by H. A. R. Austin:

September 7, 1917: Gage height, 0.68 foot; discharge, 2.9 second-feet, or 1.9 million gallons per day.

Daily discharge, in million gallons, of East Wailuaiki Stream near Keanae, Maui, for the year ending June 30, 1918.

| Day. | July. | Aug. | Sept. | Oct. | Day. | July. | Aug. | Sept. | Oct. |
|---------|-------|------|-------|------|---------|-------|------|-------|-------|
| 1..... | 5.0 | 3.2 | 2.6 | 1.4 | 16..... | 4.1 | 2.6 | 1.4 | 1.2 |
| 2..... | 5.0 | 4.1 | 2.0 | 1.2 | 17..... | 3.2 | 2.0 | 1.4 | 1.2 |
| 3..... | 6.0 | 3.2 | 2.0 | 1.2 | 18..... | 3.2 | 2.0 | 1.4 | 1.2 |
| 4..... | 8.2 | 3.2 | 2.0 | 1.2 | 19..... | 2.6 | 2.0 | 1.4 | 1.2 |
| 5..... | 11.0 | 2.6 | 2.0 | 1.2 | 20..... | 2.6 | 2.6 | 1.2 | 1.2 |
| 6..... | 7.0 | 2.6 | 2.0 | 1.2 | 21..... | 2.6 | 2.6 | 1.2 | 1.2 |
| 7..... | 6.0 | 2.6 | 2.0 | 1.2 | 22..... | 5.0 | 3.0 | 1.2 | 1.0 |
| 8..... | 6.0 | 2.6 | 2.0 | 1.0 | 23..... | 5.0 | 9.4 | 1.2 | 1.0 |
| 9..... | 7.0 | 3.2 | 1.7 | 1.0 | 24..... | 3.2 | 3.2 | 1.2 | ..... |
| 10..... | 8.2 | 3.2 | 1.7 | 1.2 | 25..... | 3.2 | 3.2 | 1.4 | ..... |
| 11..... | 6.0 | 3.2 | 1.4 | 1.2 | 26..... | 4.1 | 3.2 | 1.7 | ..... |
| 12..... | 5.0 | 3.2 | 2.0 | 1.2 | 27..... | 3.2 | 3.2 | 1.7 | ..... |
| 13..... | 5.0 | 4.1 | 2.0 | 1.2 | 28..... | 3.2 | 2.6 | 1.7 | ..... |
| 14..... | 4.1 | 4.1 | 1.4 | 1.2 | 29..... | 3.2 | 2.6 | 1.7 | ..... |
| 15..... | 4.1 | 2.6 | 1.4 | 1.2 | 30..... | 4.1 | 2.6 | 1.7 | ..... |
| | | | | | 31..... | 4.1 | 2.6 | ..... | ..... |

Monthly discharge of East Wailuaiki Stream near Keanae, Maui, for the year ending June 30, 1918.

| Month. | Discharge. | | | | Total run-off. | |
|-------------------|--------------------------|----------|-------|---------------------|------------------|------------|
| | Million gallons per day. | | | Second feet (mean). | Million gallons. | Acre-feet. |
| | Maximum. | Minimum. | Mean. | | | |
| July..... | 11 | 2.6 | 4.85 | 7.50 | 150 | 461 |
| August..... | 30 | 2.0 | 4.00 | 6.19 | 124 | 381 |
| September..... | 2.6 | 1.2 | 1.66 | 2.57 | 50 | 153 |
| October 1-23..... | 1.4 | 1.0 | 1.17 | 1.81 | 27 | 83 |
| The period..... | | | | | 351 | 1,080 |

WEST WAILUAIKI STREAM NEAR KEANAE, MAUI.

LOCATION.—500 feet above Koolau ditch crossing and trail bridge, 3 miles east of Upper Kanae, and $5\frac{1}{2}$ miles east of Kanae post office.

RECORDS AVAILABLE.—January 1, 1914, to October 22, 1917, when station was discontinued.

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.—Maximum stage recorded during year, 2.35 feet at 4.30 p. m. August 22 (discharge, about 49 million gallons per day, or 76 second-feet); minimum stage recorded, 0.6 foot October 8–12 and 18–22 (discharge, 0.4 million gallons per day, or 0.6 second-foot).

1913–1917: 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 in October, 1917.

DIVERSIONS.—None.

REGULATION.—None.

UTILIZATION.—Ordinary flow is diverted into Koolau ditch for irrigation of sugar cane. ACCURACY.—Stage-discharge relation practically permanent. Rating curve well defined between 2 and 600 million gallons per day. Operation of water-stage recorder satisfactory. Records fair.

The following discharge measurement was made by H. A. R. Austin:

July 24, 1917: Gage height, 0.99 foot; discharge, 5.9 second-feet, or 3.8 million gallons per day.

Daily discharge, in million gallons, of West Wailuaiki Stream near Kanae, Maui, for the year ending June 30, 1918.

| Day. | July. | Aug. | Sept. | Oct. | Day. | July. | Aug. | Sept. | Oct. |
|---------|-------|------|-------|------|---------|-------|------|-------|-------|
| 1..... | 4.2 | 2.5 | 1.6 | 1.2 | 16..... | 3.0 | 2.0 | 0.8 | 0.8 |
| 2..... | 4.2 | 3.0 | 1.6 | .8 | 17..... | 2.5 | 1.6 | .6 | .6 |
| 3..... | 5.0 | 2.5 | 1.2 | .6 | 18..... | 2.5 | 1.6 | .6 | .4 |
| 4..... | 6.5 | 2.0 | 1.2 | .6 | 19..... | 2.0 | 1.6 | .6 | .4 |
| 5..... | 8.5 | 2.0 | 1.2 | .6 | 20..... | 2.5 | 2.0 | .6 | .4 |
| 6..... | 5.0 | 2.0 | 1.2 | .8 | 21..... | 2.5 | 2.0 | .6 | .4 |
| 7..... | 4.2 | 2.0 | 1.2 | .6 | 22..... | 5.8 | 2.3 | .6 | .4 |
| 8..... | 3.5 | 2.0 | 1.2 | .4 | 23..... | 7.5 | 7.5 | .6 | ..... |
| 9..... | 5.8 | 2.5 | .8 | .4 | 24..... | 4.2 | 3.5 | .6 | ..... |
| 10..... | 6.5 | 2.5 | .8 | .4 | 25..... | 3.5 | 3.0 | 1.2 | ..... |
| 11..... | 4.2 | 2.5 | .8 | .4 | 26..... | 3.5 | 2.5 | 2.0 | ..... |
| 12..... | 3.5 | 2.5 | 2.0 | .4 | 27..... | 2.5 | 2.0 | 1.6 | ..... |
| 13..... | 3.0 | 3.0 | 2.0 | .6 | 28..... | 2.0 | 2.0 | 2.0 | ..... |
| 14..... | 3.0 | 3.0 | 1.2 | .6 | 29..... | 2.0 | 2.0 | 2.5 | ..... |
| 15..... | 3.0 | 2.0 | .8 | .6 | 30..... | 2.5 | 1.6 | 2.0 | ..... |
| | | | | | 31..... | 2.5 | 1.6 | ..... | ..... |

Monthly discharge of West Wailuaiki Stream near Keanae, Maui, for the year ending June 30, 1918.

| Month. | Discharge. | | | | Total run-off. | |
|-------------------|--------------------------|----------|-------|---------------------|------------------|------------|
| | Million gallons per day. | | | Second-foot (mean). | Million gallons. | Acre-feet. |
| | Maximum. | Minimum. | Mean. | | | |
| July..... | 8.5 | 2.0 | 3.91 | 6.05 | 121 | 372 |
| August..... | 23 | 1.6 | 3.08 | 4.77 | 96 | 293 |
| September..... | 2.5 | .6 | 1.19 | 1.84 | 36 | 110 |
| October 1-22..... | 1.2 | .4 | .56 | .87 | 12 | 38 |
| The period..... | | | | | 265 | 813 |

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 October 23, 1917, when station was discontinued.

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 is ledge of rock; probably permanent.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 1.83 feet at 1 p. m. August 22 (discharge, 16 million gallons per day, or 25 second-feet); minimum stage recorded, 0.7 foot October 14 (discharge, 0.2 million gallons per day, or 0.3 second-foot).

1914-1917: Maximum stage recorded, 5.1 feet at 5.45 a. m. December 23, 1916 (discharge, computed from extension of rating curve, about 430 million gallons per day, or 665 second-feet); minimum stage recorded October 14, 1917.

DIVERSIONS.—None.

REGULATION.—None.

UTILIZATION.—Ordinary flow is diverted into Koolau ditch for irrigation of sugar cane.

ACCURACY.—Stage-discharge relation practically permanent. Rating curve well defined between 2 and 100 million gallons per day. Operation of water-stage recorder satisfactory. Records fair.

The following discharge measurement was made by H. A. R. Austin:

September 7, 1917: Gage height, 0.89 foot; discharge, 0.95 second-foot, or 0.6 million gallons per day.

Daily discharge, in million gallons, of East Wailuanui Stream near Keanae, Maui, for the year ending June 30, 1918.

| Day. | July. | Aug. | Sept. | Oct. | Day. | July. | Aug. | Sept. | Oct. |
|---------|-------|------|-------|------|---------|-------|------|-------|-------|
| 1..... | 1.6 | 1.0 | 0.7 | 0.3 | 16..... | 1.3 | 0.7 | 0.5 | 0.25 |
| 2..... | 1.3 | 1.3 | .7 | .25 | 17..... | 1.3 | .7 | .5 | .25 |
| 3..... | 2.0 | 1.0 | .7 | .25 | 18..... | 1.0 | .7 | .3 | .25 |
| 4..... | 2.5 | .7 | .7 | .25 | 19..... | 1.0 | .7 | .3 | .25 |
| 5..... | 3.7 | .7 | .7 | .25 | 20..... | 1.0 | .7 | .3 | .25 |
| 6..... | 2.0 | .7 | .7 | .25 | 21..... | 1.0 | .7 | .3 | .25 |
| 7..... | 1.6 | .7 | .7 | .25 | 22..... | 1.6 | 8.0 | .3 | .25 |
| 8..... | 1.6 | .7 | .7 | .25 | 23..... | 1.6 | 1.6 | .3 | .3 |
| 9..... | 2.0 | .7 | .7 | .25 | 24..... | 1.0 | 1.3 | .3 | ..... |
| 10..... | 2.0 | .7 | .7 | .25 | 25..... | 1.3 | 1.3 | .5 | ..... |
| 11..... | 1.6 | 1.0 | .5 | .25 | 26..... | 1.6 | 1.3 | .3 | ..... |
| 12..... | 1.3 | 1.3 | .7 | .25 | 27..... | 1.0 | 1.3 | .3 | ..... |
| 13..... | 1.3 | 1.6 | .7 | .25 | 28..... | 1.0 | 1.0 | .3 | ..... |
| 14..... | 1.3 | 1.3 | .5 | .2 | 29..... | 1.0 | 1.0 | .3 | ..... |
| 15..... | 1.3 | 1.0 | .5 | .25 | 30..... | 1.0 | 1.0 | .3 | ..... |
| | | | | | 31..... | 1.0 | .7 | ..... | ..... |

Monthly discharge of East Wailuanui Stream near Keanae, Maui, for the year ending June 30, 1918.

| Month. | Discharge. | | | | Total run-off. | |
|-------------------|--------------------------|----------|-------|---------------------|------------------|------------|
| | Million gallons per day. | | | Second feet (mean). | Million gallons. | Acre-feet. |
| | Maximum. | Minimum. | Mean. | | | |
| July..... | 3.7 | 1.0 | 1.48 | 2.29 | 46 | 141 |
| August..... | 8.0 | .7 | 1.20 | 1.86 | 37 | 114 |
| September..... | .7 | .3 | .50 | .77 | 15 | 46 |
| October 1-23..... | .3 | .2 | .25 | .39 | 6 | 18 |
| The period..... | | | | | 104 | 319 |

KOOLAU DITCH NEAR KEANAE, MAUI.

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

RECORDS AVAILABLE.—November 2, 1917, to June 30, 1918. Discharge January 1, 1910, to December 31, 1912, computed from gage heights obtained by East Maui Irrigation Co.

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

DISCHARGE MEASUREMENTS.—Made from plank at gage.

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

EXTREMES OF DISCHARGE.—1910-1912 and 1917-1918: Maximum stage recorded, 6.06 feet at 6 a. m. November 30, 1917 (discharge, 142 million gallons per day, or 220 second-feet); minimum stage recorded, water occasionally shut off.

DIVERSIONS.—Ditch diverts water from all streams from Makapipi to Keanae, inclusive, but all available water was not taken part of the time on account of lining operations.

REGULATION.—By gates at intervals.

UTILIZATION.—For irrigation of sugar cane.

ACCURACY.—Stage-discharge relation permanent for published record. Rating curve well defined between 8 and 50 million gallons per day. Operation of water-stage recorder satisfactory, except that for short periods when intake pipe became partly clogged and December 7-9 no record, discharge interpolated. Records fair.

Discharge measurements of Koolau ditch near Keanae, Maui, during the year ending June 30, 1918.

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

| Date. | Gage height (feet). | Discharge. | |
|--------------|---------------------|--------------|--------------------------|
| | | Second-feet. | Million gallons per day. |
| Dec. 8..... | 2.12 | 55 | 35 |
| Jan. 31..... | .90 | 12.8 | 8.3 |
| May 15..... | 1.66 | 38 | 25 |

Daily discharge, in million gallons, of Koolau ditch near Keanae, Maui, for the year ending June 30, 1918.

| Day. | Nov. | Dec. | Jan. | Feb. | Apr. | May. | June. |
|------|------|------|------|------|------|------|-------|
| 1 | | 68 | 24 | 10 | | 22 | 12 |
| 2 | | 78 | 20 | 6.6 | | 16 | 10 |
| 3 | | 65 | 22 | 5.8 | | 21 | 9.2 |
| 4 | 41 | 54 | 22 | 5.0 | | 27 | 8.4 |
| 5 | 21 | 47 | 8.4 | 5.0 | | 21 | 7.5 |
| 6 | 32 | 45 | 2.6 | | | 15 | 6.6 |
| 7 | 40 | 41 | 2.2 | | | 14 | 5.8 |
| 8 | 65 | 38 | 7.5 | | | 12 | 5.8 |
| 9 | 34 | 35 | 5.8 | | | 11 | 3.2 |
| 10 | 28 | 32 | 7.5 | | | 16 | 2.6 |
| 11 | 21 | 30 | 5.0 | | | 12 | 9.2 |
| 12 | 16 | 48 | 1.2 | | | 20 | 37 |
| 13 | 15 | 58 | 1.0 | | | 20 | 21 |
| 14 | 14 | 66 | 2.2 | | | 19 | 22 |
| 15 | 13 | 52 | 3.2 | | | 24 | 37 |
| 16 | 13 | 37 | 13 | | | 22 | 44 |
| 17 | 12 | 33 | 3.8 | | | 19 | 36 |
| 18 | 18 | 30 | 4.4 | | | 15 | 26 |
| 19 | 33 | 27 | 4.4 | | | 12 | 20 |
| 20 | 37 | 33 | 4.4 | | | 9.2 | 21 |
| 21 | 30 | 49 | 4.4 | | | 10 | 18 |
| 22 | 71 | 56 | 12 | | | 11 | 35 |
| 23 | 99 | 33 | 5.8 | | | 12 | 22 |
| 24 | 75 | 25 | 12 | | | 14 | 19 |
| 25 | 78 | 20 | 12 | | | 12 | 21 |
| 26 | 74 | 30 | 6.6 | | | 13 | 20 |
| 27 | 59 | 27 | 6.6 | | 12 | 19 | 22 |
| 28 | 60 | 25 | 5.0 | | 19 | 16 | 19 |
| 29 | 104 | 22 | 6.6 | | 19 | 6.6 | 14 |
| 30 | 71 | 21 | 20 | | 24 | 8.4 | 12 |
| 31 | | 20 | 12 | | | 14 | |

Monthly discharge of Koolau ditch near Keanae, Maui, for the year ending June 30, 1918.

| Month. | Discharge. | | | | Total run-off. | |
|---------------|--------------------------|----------|-------|---------------------|------------------|------------|
| | Million gallons per day. | | | Second-foot (mean). | Million gallons. | Acre-feet. |
| | Maximum. | Minimum. | Mean. | | | |
| November 4-30 | 104 | 12 | 43.5 | 67.3 | 1,170 | 3,600 |
| December | 78 | 20 | 40.2 | 62.2 | 1,240 | 3,820 |
| January | 24 | 1.0 | 8.63 | 13.4 | 268 | 821 |
| February 1-5 | 10 | 5.0 | 6.48 | 10.0 | 32 | 99 |
| May | 27 | 6.6 | 15.6 | 24.1 | 483 | 1,480 |
| June | 44 | 2.6 | 18.2 | 28.2 | 546 | 1,680 |

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, 1918.

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 year, 9.62 feet at 6.30 p. m., April 2 (discharge, about 1,120 million gallons per day, or 1,740 second-foot); minimum stage recorded, 1.9 feet September 18-24 and October 4, 5, and 25-27 (discharge, 0.4 million gallons per day, or 0.6 second-foot).

1913-1918: Maximum stage recorded, 9.9 feet at 9 p. m. May 1, 1916 (discharge computed from extension of rating curve, about 1,200 million gallons per day, or 1,860 second-foot); minimum stage recorded, 2.20 feet April 7 and 8, 1915 (discharge, 0.25 million gallons per day, or 0.4 second-foot).

DIVERSIONS.—None.

REGULATION.—None.

UTILIZATION.—Ordinary flow is diverted by Spreckels ditch for irrigation of sugar cane.

ACCURACY.—Stage-discharge relation not permanent. Rating curves fairly well defined between 2 and 20 million gallons per day applicable July 1 to November 29, November 30 to April 2, and April 3 to June 30. Operation of water-stage recorder satisfactory. Records poor.

Discharge measurements of Honomanu Stream near Keanae, Maui, during the year ending June 30, 1918.

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

| Date. | Gage height (feet). | Discharge. | | Date. | Gage height (feet). | Discharge. | |
|--------------|---------------------|--------------|--------------------------|-------------|---------------------|--------------|--------------------------|
| | | Second-foot. | Million gallons per day. | | | Second-foot. | Million gallons per day. |
| Sept. 6..... | 1.95 | 0.85 | 0.55 | Mar. 5..... | 3.22 | 31 | 20 |
| Dec. 7..... | 2.27 | 4.0 | 2.6 | May 14..... | 2.83 | 16.9 | 11 |
| Jan. 31..... | 2.84 | 16.9 | 11 | | | | |

Daily discharge, in million gallons, of Honomanu Stream near Keanae, Maui, for the year ending June 30, 1918.

| Day. | July. | Aug. | Sept. | Oct. | Nov. | Dec. | Jan. | Feb. | Mar. | Apr. | May. | June. |
|---------|-------|------|-------|------|-------|------|------|-------|------|-------|------|-------|
| 1..... | 3.3 | 1.7 | 0.9 | 0.9 | 2.5 | 18 | 1.7 | 9.7 | 41 | 25 | 12 | 9.7 |
| 2..... | 2.9 | 5.7 | .7 | .7 | 9.7 | 7.1 | 1.4 | 5.0 | 134 | 271 | 8.7 | 8.7 |
| 3..... | 2.9 | 2.5 | .7 | .55 | 3.3 | 7.1 | 1.4 | 3.8 | 195 | 425 | 18 | 6.4 |
| 4..... | 4.3 | 1.7 | .7 | .4 | 14 | 7.1 | 2.1 | 3.3 | 83 | 59 | 28 | 5.0 |
| 5..... | 7.9 | 1.4 | .55 | .4 | 5.7 | 3.8 | 2.5 | 2.9 | 28 | 51 | 12 | 4.3 |
| 6..... | 3.3 | 1.4 | .55 | 2.9 | 3.8 | 3.3 | 2.5 | 2.9 | 13 | 179 | 7.1 | 4.3 |
| 7..... | 2.5 | 1.4 | .55 | 1.1 | 35 | 2.5 | 1.4 | 2.9 | 35 | 51 | 6.4 | 3.8 |
| 8..... | 2.1 | 1.4 | .55 | .55 | 23 | 2.9 | 6.4 | 7.9 | 20 | 51 | 5.7 | 3.8 |
| 9..... | 2.9 | 2.9 | .55 | .55 | 9.7 | 2.9 | 18 | 307 | 16 | 435 | 6.4 | 4.3 |
| 10..... | 4.3 | 2.5 | .55 | 1.1 | 3.3 | 2.1 | 3.8 | 114 | 47 | 375 | 21 | 15 |
| 11..... | 2.5 | 2.5 | .55 | 2.5 | 2.5 | 2.1 | 89 | 68 | 227 | 78 | 8.7 | 30 |
| 12..... | 2.1 | 3.3 | .7 | .9 | 2.1 | 2.9 | 7.9 | 89 | 78 | 21 | 25 | 55 |
| 13..... | 1.7 | 5.7 | 1.7 | .7 | 1.7 | 6.4 | 3.8 | 13 | 25 | 15 | 51 | 12 |
| 14..... | 1.7 | 3.3 | 1.1 | .7 | 1.7 | 5.0 | 2.9 | 7.1 | 28 | 51 | 14 | 7.9 |
| 15..... | 1.7 | 2.5 | .7 | .7 | 1.4 | 9.7 | 3.3 | 5.0 | 14 | 18 | 16 | 95 |
| 16..... | 1.7 | 2.1 | .7 | 3.8 | 1.4 | 3.8 | 15 | 4.3 | 47 | 11 | 32 | 47 |
| 17..... | 1.7 | 1.7 | .55 | 1.7 | 1.1 | 2.9 | 4.3 | 44 | 30 | 7.9 | 14 | 30 |
| 18..... | 1.4 | 1.4 | .4 | .9 | 1.1 | 2.5 | 4.3 | 7.9 | 11 | 7.1 | 7.1 | 8.7 |
| 19..... | 1.4 | 1.4 | .4 | .7 | 1.4 | 2.5 | 4.3 | 30 | 7.1 | 6.4 | 6.4 | 6.4 |
| 20..... | 1.4 | 1.7 | .4 | .7 | 2.1 | 5.7 | 4.3 | 289 | 5.7 | 9.7 | 5.7 | 7.1 |
| 21..... | 1.4 | 2.1 | .4 | .55 | 1.4 | 3.3 | 3.8 | 59 | 4.3 | 11 | 6.4 | 8.7 |
| 22..... | 3.8 | 32 | .4 | .55 | 15 | 13 | 13 | 14 | 3.8 | 11 | 7.1 | 18 |
| 23..... | 7.9 | 5.7 | .4 | .55 | 18 | 6.4 | 6.4 | 9.7 | 3.8 | 6.4 | 7.1 | 8.7 |
| 24..... | 2.9 | 2.5 | .4 | .55 | 30 | 3.3 | 7.1 | 6.4 | 7.9 | 5.7 | 41 | 7.1 |
| 25..... | 2.1 | 1.7 | .7 | .4 | 12 | 2.5 | 6.4 | 5.0 | 253 | 5.7 | 38 | 7.1 |
| 26..... | 1.7 | 1.7 | 1.4 | .4 | 7.1 | 2.1 | 3.8 | 4.3 | 35 | 6.4 | 13 | 7.1 |
| 27..... | 7.1 | 1.4 | 1.4 | .4 | 5.0 | 2.1 | 4.3 | 6.4 | 12 | 14 | 35 | 7.9 |
| 28..... | 4.3 | 1.4 | 1.1 | .7 | 5.0 | 1.7 | 2.9 | 68 | 9.7 | 12 | 89 | 7.9 |
| 29..... | 1.7 | 1.1 | 1.7 | 2.5 | 51 | 1.7 | 2.9 | ..... | 6.4 | 20 | 89 | 9.7 |
| 30..... | 1.7 | 1.1 | 1.7 | 3.8 | 187 | 1.7 | 44 | ..... | 8.7 | 32 | 12 | 9.7 |
| 31..... | 1.7 | 1.1 | ..... | 1.7 | ..... | 1.4 | 14 | ..... | 16 | ..... | 8.7 | ..... |

Monthly discharge of Honomanu Stream near Keanae, Maui, for the year ending June 30, 1918.

| Month. | Discharge. | | | | Total run-off. | |
|----------------|--------------------------|----------|-------|---------------------|------------------|------------|
| | Million gallons per day. | | | Second feet (mean). | Million gallons. | Acre-feet. |
| | Maximum. | Minimum. | Mean. | | | |
| July..... | 7.9 | 1.4 | 2.90 | 4.49 | 90 | 276 |
| August..... | 32 | 1.1 | 3.23 | 5.00 | 100 | 307 |
| September..... | 1.7 | .4 | .77 | 1.19 | 23 | 71 |
| October..... | 3.8 | .4 | 1.11 | 1.72 | 35 | 106 |
| November..... | 187 | 1.1 | 15.3 | 23.7 | 458 | 1,410 |
| December..... | 18 | 1.4 | 4.50 | 6.96 | 140 | 428 |
| January..... | 89 | 1.4 | 9.32 | 14.4 | 289 | 887 |
| February..... | 307 | 2.9 | 42.5 | 65.8 | 1,190 | 3,650 |
| March..... | 253 | 3.8 | 46.6 | 72.1 | 1,450 | 4,430 |
| April..... | 435 | 5.7 | 75.7 | 117 | 2,270 | 6,970 |
| May..... | 89 | 5.7 | 21.0 | 32.5 | 652 | 2,000 |
| June..... | 95 | 3.8 | 15.2 | 23.6 | 456 | 1,400 |
| The year..... | 435 | .4 | 19.6 | 30.3 | 7,150 | 21,900 |

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, 1918; also records of combined flow of stream and Spreckels ditch at staff-gage station 600 feet below present site December 18, 1910, to September 30, 1913.

GAGE.—Stevens 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.—1913-1918: Maximum stage recorded, 5.92 feet at 3.15 a. m. April 3, 1918 (discharge, computed from extension of rating curve, 430 million gallons per day, or 666 second-feet); minimum stage recorded, 0.1 foot October 26, 1917 (discharge, 0.7 million gallons per day, or 1.1 second-feet).

DIVERSIONS.—None.

REGULATION.—None.

UTILIZATION.—Ordinary flow diverted by ditches of East Maui Irrigation Co. for irrigation of sugar cane.

ACCURACY.—Stage-discharge relation not permanent. Rating curves fairly well defined between 2 million and 150 million gallons per day applicable July 1, July 26 to November 29, and February 9 to June 30, November 30 to February 8. Operation of water-stage recorder unsatisfactory; no gage height record July 2-25, November 3, 4, January 30 to February 26, and May 6-15; discharge estimated from flow of Puohakamoa Stream, except November 3 and 4, which was interpolated. Records fair when water-stage recorder was operating; poor for other periods.

Discharge measurements of Haipuaena Stream near Huelo, Maui, during the year ending June 30, 1918.

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

| Date. | Gage height (feet). | Discharge. | |
|--------------|---------------------|--------------|--------------------------|
| | | Second-feet. | Million gallons per day. |
| July 25..... | 0.48 | 2.8 | 1.8 |
| Dec. 7..... | .59 | 3.2 | 2.1 |
| Mar. 6..... | .96 | 12.4 | 8.0 |

Daily discharge, in million gallons, of Haipuaena Stream near Huelo, Maui, for the year ending June 30, 1918.

| Day. | July. | Aug. | Sept. | Oct. | Nov. | Dec. | Jan. | Feb. | Mar. | Apr. | May. | June. |
|---------|-------|------|-------|------|-------|------|------|-------|------|-------|------|-------|
| 1..... | 4.0 | 2.2 | 1.6 | 1.3 | 1.0 | 7.6 | 2.2 | 8.6 | 15 | 20 | 9.5 | 4.5 |
| 2..... | 3.0 | 4.0 | 1.3 | 1.0 | 5.2 | 4.0 | 1.6 | 3.4 | 49 | 123 | 6.8 | 4.5 |
| 3..... | 3.0 | 2.2 | 1.3 | 1.0 | 4.8 | 4.0 | 2.2 | 3.0 | 62 | 230 | 12 | 4.0 |
| 4..... | 5.2 | 1.8 | 1.3 | 1.0 | 4.4 | 3.4 | 2.5 | 2.5 | 35 | 22 | 24 | 3.4 |
| 5..... | 9.5 | 1.6 | 1.3 | 1.0 | 4.0 | 2.5 | 2.2 | 2.2 | 16 | 26 | 11 | 3.4 |
| 6..... | 4.5 | 1.6 | 1.2 | 1.8 | 3.4 | 2.2 | 1.8 | 2.2 | 8.6 | 81 | 9.5 | 3.0 |
| 7..... | 3.4 | 1.8 | 1.2 | 1.2 | 20 | 2.2 | 1.6 | 2.2 | 15 | 26 | 8.6 | 3.0 |
| 8..... | 3.0 | 1.8 | 1.2 | 1.0 | 11 | 2.2 | 5.2 | 3.0 | 11 | 30 | 7.6 | 3.0 |
| 9..... | 3.4 | 2.5 | 1.2 | .9 | 6.8 | 1.8 | 9.5 | 136 | 12 | 110 | 5.9 | 3.4 |
| 10..... | 4.5 | 2.2 | 1.3 | 1.2 | 3.4 | 1.8 | 3.0 | 46 | 26 | 170 | 13 | 9.5 |
| 11..... | 3.0 | 2.2 | 1.0 | 1.8 | 2.5 | 1.8 | 40 | 35 | 101 | 43 | 7.6 | 16 |
| 12..... | 2.5 | 2.5 | 1.3 | 1.2 | 2.5 | 2.2 | 5.2 | 40 | 46 | 15 | 13 | 38 |
| 13..... | 2.2 | 4.0 | 1.8 | 1.0 | 2.2 | 3.4 | 3.4 | 13 | 15 | 11 | 38 | 9.5 |
| 14..... | 2.2 | 3.0 | 1.6 | .9 | 1.8 | 4.5 | 3.0 | 8.6 | 13 | 28 | 9.5 | 6.8 |
| 15..... | 2.2 | 2.2 | 1.2 | 1.0 | 1.8 | 4.0 | 4.0 | 6.8 | 8.6 | 20 | 13 | 43 |
| 16..... | 2.2 | 1.8 | 1.0 | 2.2 | 1.8 | 2.5 | 9.5 | 5.2 | 30 | 9.5 | 20 | 24 |
| 17..... | 2.2 | 1.8 | 1.0 | 1.3 | 1.6 | 1.8 | 3.4 | 13 | 22 | 7.6 | 11 | 16 |
| 18..... | 1.8 | 1.6 | 1.0 | 1.0 | 1.6 | 1.8 | 3.0 | 5.9 | 8.6 | 6.8 | 6.8 | 7.6 |
| 19..... | 1.8 | 1.6 | 1.0 | .9 | 1.8 | 1.8 | 3.0 | 12 | 5.9 | 5.9 | 5.2 | 5.9 |
| 20..... | 1.8 | 1.8 | 1.0 | .9 | 1.8 | 4.5 | 3.4 | 85 | 5.2 | 6.8 | 4.5 | 5.9 |
| 21..... | 1.8 | 1.8 | 1.0 | .8 | 1.6 | 5.2 | 2.5 | 32 | 4.5 | 8.6 | 4.0 | 5.9 |
| 22..... | 3.0 | 16 | 1.0 | .8 | 9.5 | 9.6 | 6.8 | 13 | 4.0 | 11 | 4.5 | 12 |
| 23..... | 5.9 | 4.5 | 1.0 | .9 | 14 | 4.0 | 4.0 | 9.5 | 4.0 | 5.9 | 5.2 | 7.6 |
| 24..... | 2.5 | 2.5 | 1.0 | .9 | 14 | 3.0 | 4.5 | 9.5 | 5.2 | 5.2 | 16 | 6.8 |
| 25..... | 2.2 | 2.2 | 1.6 | .8 | 6.8 | 2.2 | 4.5 | 7.6 | 101 | 4.5 | 16 | 6.8 |
| 26..... | 2.2 | 2.2 | 4.5 | .7 | 5.2 | 2.2 | 3.4 | 5.2 | 22 | 5.2 | 5.2 | 5.9 |
| 27..... | 3.4 | 1.8 | 5.9 | .8 | 3.4 | 1.8 | 3.4 | 5.2 | 8.6 | 8.6 | 16 | 7.6 |
| 28..... | 3.0 | 1.8 | 1.3 | 1.0 | 4.0 | 1.8 | 2.5 | 30 | 7.6 | 8.6 | 38 | 6.8 |
| 29..... | 1.8 | 1.6 | 1.8 | 1.6 | 30 | 1.6 | 3.0 | ..... | 5.9 | 11 | 9.5 | 6.8 |
| 30..... | 1.8 | 1.6 | 1.8 | 2.5 | 52 | 1.6 | 13 | ..... | 7.6 | 20 | 5.9 | 7.6 |
| 31..... | 1.8 | 1.6 | ..... | 1.2 | ..... | 1.6 | 7.6 | ..... | 12 | ..... | 5.2 | ..... |

Monthly discharge of Haipuaena Stream near Huelo, Maui, for the year ending June 30, 1918.

| Month. | Discharge. | | | | Total run-off. | |
|----------------|--------------------------|----------|-------|---------------------|------------------|------------|
| | Million gallons per day. | | | Second-foot (mean). | Million gallons. | Acre-feet. |
| | Maximum. | Minimum. | Mean. | | | |
| July..... | 9.5 | 1.8 | 3.06 | 4.73 | 95 | 291 |
| August..... | 16 | 1.6 | 2.64 | 4.08 | 82 | 251 |
| September..... | 5.9 | 1.0 | 1.52 | 2.35 | 46 | 140 |
| October..... | 2.5 | .7 | 1.15 | 1.78 | 36 | 109 |
| November..... | 52 | 1.0 | 7.46 | 11.5 | 224 | 687 |
| December..... | 9.6 | 1.6 | 3.05 | 4.72 | 95 | 290 |
| January..... | 40 | 1.6 | 5.32 | 8.23 | 165 | 506 |
| February..... | 136 | 2.2 | 19.5 | 30.2 | 546 | 1,680 |
| March..... | 101 | 4.0 | 22.2 | 34.3 | 687 | 2,110 |
| April..... | 230 | 4.5 | 36.0 | 55.7 | 1,080 | 3,310 |
| May..... | 38 | 4.0 | 11.7 | 18.1 | 362 | 1,110 |
| June..... | 43 | 3.0 | 9.61 | 14.9 | 288 | 885 |
| The year..... | 230 | .7 | 10.2 | 15.8 | 3,710 | 11,400 |

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, 1918 (new station); December 18, 1910, to June 18, 1913 (old station).

GAGE.—Stevens water-stage recorder installed November 23, 1917, replacing 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 must be deducted from measurements made at footbridge.

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

EXTREMES OF DISCHARGE.—1910-1918: Maximum stage recorded, 7.63 feet at 7 p. m. April 2, 1918 (discharge, computed from extension of rating curve, 900 million gallons per day, or 1,400 second-feet); minimum stage recorded, 0.25 foot October 26, 1917 (discharge, 0.4 million gallons per day, or 0.6 second-foot).

DIVERSIONS.—Kula pipe line diverts small amount of water above station at elevation 4,300 feet.

REGULATION.—None.

UTILIZATION.—Ordinary flow of stream is diverted by East Maui Irrigation Co.'s ditches for irrigation of sugar cane.

ACCURACY.—Stage-discharge relation practically permanent. Rating curve well defined between 2 and 100 million gallons per day. Operation of water-stage recorder satisfactory except August 29 to December 7, during which time water was below intake, station being reconstructed or water-stage recorder not operating; discharge estimated for this period from flow of Haipuaena Stream. Record fair between 2 and 100 million gallons per day when water-stage recorder was operating properly; poor at other times.

Discharge measurements of Puohakamoa Stream near Huelo, Maui, during the year ending June 30, 1918.

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

| Date. | Gage height (feet). | Discharge. | | Date. | Gage height (feet). | Discharge. | |
|--------------|---------------------|--------------|--------------------------|--------------|---------------------|--------------|--------------------------|
| | | Second-foot. | Million gallons per day. | | | Second-foot. | Million gallons per day. |
| July 25..... | 1.02 | 3.9 | 2.5 | Jan. 30..... | 1.96 | 17.2 | 11 |
| Sept. 6..... | .67 | 1.6 | 1.0 | May 16..... | 2.57 | 41 | 27 |
| Dec. 7..... | 1.27 | 6.2 | 4.0 | 16..... | 3.02 | 93 | 60 |

Daily discharge, in million gallons, of Puohakamoa Stream near Huelo, Maui, for the year ending June 30, 1918.

| Day. | July. | Aug. | Sept. | Oct. | Nov. | Dec. | Jan. | Feb. | Mar. | Apr. | May. | June. |
|---------|-------|------|-------|------|-------|------|------|-------|------|-------|------|-------|
| 1..... | 4.4 | 3.0 | 1.2 | 1.2 | 0.7 | 13 | 4.0 | 12 | 26 | 46 | 19 | 12 |
| 2..... | 4.0 | 6.0 | 1.2 | .7 | 7.8 | 7.8 | 3.0 | 6.8 | 87 | 236 | 13 | 12 |
| 3..... | 4.4 | 3.4 | 1.2 | .7 | 7.2 | 7.8 | 3.7 | 5.6 | 132 | 436 | 20 | 10 |
| 4..... | 7.3 | 2.4 | 1.2 | .7 | 6.6 | 6.8 | 5.2 | 4.8 | 80 | 63 | 54 | 7.8 |
| 5..... | 13 | 2.4 | 1.2 | .7 | 6.0 | 5.2 | 4.4 | 4.4 | 42 | 63 | 29 | 7.3 |
| 6..... | 6.8 | 2.4 | 1.0 | 2.4 | 5.2 | 4.4 | 3.0 | 4.4 | 18 | 220 | 14 | 6.8 |
| 7..... | 4.8 | 2.4 | 1.0 | 1.0 | 35 | 4.4 | 2.4 | 4.0 | 29 | 74 | 12 | 6.0 |
| 8..... | 4.4 | 2.4 | 1.0 | .7 | 15 | 3.7 | 6.8 | 6.0 | 24 | 80 | 11 | 5.6 |
| 9..... | 5.2 | 3.7 | 1.0 | .55 | 10 | 3.7 | 19 | 336 | 22 | 272 | 8.8 | 6.8 |
| 10..... | 6.8 | 2.7 | 1.2 | 1.0 | 5.2 | 3.4 | 5.6 | 108 | 50 | 436 | 32 | 14 |
| 11..... | 4.0 | 3.0 | .7 | 2.4 | 3.7 | 3.0 | 80 | 74 | 263 | 116 | 15 | 24 |
| 12..... | 3.4 | 4.0 | 1.2 | 1.0 | 3.7 | 4.0 | 11 | 94 | 108 | 42 | 32 | 80 |
| 13..... | 3.0 | 6.8 | 2.4 | .7 | 3.0 | 7.3 | 6.4 | 19 | 35 | 29 | 94 | 26 |
| 14..... | 3.0 | 4.4 | 1.9 | .55 | 2.4 | 8.8 | 5.2 | 12 | 29 | 63 | 24 | 13 |
| 15..... | 3.0 | 2.4 | 1.0 | .7 | 2.4 | 7.3 | 5.6 | 9.4 | 19 | 54 | 29 | 68 |
| 16..... | 3.0 | 2.4 | .7 | 3.0 | 2.4 | 4.4 | 19 | 7.8 | 68 | 24 | 46 | 50 |
| 17..... | 2.7 | 2.4 | .7 | 1.2 | 1.9 | 3.7 | 6.4 | 20 | 50 | 19 | 22 | 42 |
| 18..... | 2.4 | 2.2 | .7 | .7 | 1.9 | 3.4 | 5.6 | 8.8 | 18 | 15 | 14 | 15 |
| 19..... | 2.4 | 2.2 | .7 | .55 | 2.4 | 3.0 | 5.6 | 18 | 12 | 13 | 12 | 12 |
| 20..... | 2.4 | 2.2 | .7 | .55 | 2.4 | 8.8 | 6.4 | 220 | 10 | 15 | 9.4 | 10 |
| 21..... | 2.4 | 2.4 | .7 | .45 | 1.9 | 7.8 | 4.8 | 68 | 8.8 | 18 | 8.8 | 12 |
| 22..... | 4.4 | 26 | .7 | .45 | 13 | 20 | 8.8 | 19 | 7.8 | 22 | 10 | 18 |
| 23..... | 8.8 | 6.0 | .7 | .55 | 20 | 8.8 | 6.8 | 14 | 7.3 | 13 | 11 | 15 |
| 24..... | 3.7 | 3.0 | .7 | .55 | 20 | 6.0 | 6.8 | 14 | 8.8 | 11 | 19 | 12 |
| 25..... | 2.7 | 3.0 | 1.9 | .45 | 10 | 4.8 | 7.8 | 11 | 245 | 9.4 | 38 | 12 |
| 26..... | 2.4 | 2.4 | 6.8 | .4 | 7.8 | 4.0 | 5.2 | 8.3 | 50 | 9.4 | 13 | 12 |
| 27..... | 3.7 | 2.4 | 6.8 | .45 | 7.2 | 3.7 | 5.2 | 9.4 | 20 | 16 | 38 | 12 |
| 28..... | 4.4 | 2.4 | 1.2 | .7 | 6.0 | 3.0 | 4.4 | 58 | 15 | 16 | 87 | 11 |
| 29..... | 2.2 | 1.9 | 2.4 | 1.9 | 58 | 3.0 | 4.0 | ..... | 12 | 19 | 26 | 12 |
| 30..... | 2.4 | 1.9 | 2.4 | 3.7 | 156 | 2.7 | 26 | ..... | 13 | 46 | 16 | 13 |
| 31..... | 2.4 | 1.9 | ..... | 1.0 | ..... | 2.4 | 14 | ..... | 24 | ..... | 13 | ..... |

Monthly discharge of Puohokamoa Stream near Huelo, Maui, for the year ending June 30, 1918.

| Month. | Discharge. | | | | Total run-off. | |
|----------------|--------------------------|----------|-------|------------------------|---------------------|------------|
| | Million gallons per day. | | | Second-foot (mean). | Million gallons. | Acre-feet. |
| | Maximum. | Minimum. | Mean. | | | |
| July..... | 13 | 2.2 | 4.19 | 6.48 | 130 | 399 |
| August..... | 26 | 1.9 | 3.75 | 5.80 | 116 | 357 |
| September..... | 8.8 | .7 | 1.61 | 2.49 | 48 | 148 |
| October..... | 3.7 | .4 | 1.02 | 1.58 | 32 | 97 |
| November..... | 156 | .7 | 14.1 | 21.8 | 423 | 1,300 |
| December..... | 20 | 2.4 | 3.81 | 8.99 | 180 | 553 |
| January..... | 80 | 2.4 | 9.75 | 15.1 | 302 | 928 |
| February..... | 336 | 4.0 | 42.0 | 65.0 | 1,180 | 3,610 |
| March..... | 263 | 7.3 | 49.5 | 76.6 | 1,530 | 4,710 |
| April..... | 436 | 9.4 | 83.2 | 129 | 2,500 | 7,660 |
| May..... | 94 | 8.8 | 25.5 | 39.5 | 790 | 2,430 |
| June..... | 80 | 5.6 | 18.6 | 28.8 | 557 | 1,710 |
| The year..... | 436 | .4 | 21.3 | 33.0 | 7,790 | 23,900 |

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, 1918.

GAGE.—Friez water-stage recorder installed June 18, 1914. Prior to June 18, 1914, vertical staff at trail bridge 300 feet downstream from present site.

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

CHANNEL AND CONTROL.—Channel at gage 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 year, 3.91 feet at 6.30 a. m. April 3 (discharge, about 490 million gallons per day, or 760 second-feet); minimum stage recorded, 0.35 foot September 24 and frequently in October (discharge, 0.3 million gallons per day, or 0.5 second-foot).

1910-1918: Maximum stage recorded, 4.35 feet at 7 p. m. December 9, 1916 (discharge, computed from extension of rating curve, approximately 550 million gallons per day, or 850 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).

DIVERSIONS.—None.

REGULATION.—None.

UTILIZATION.—Ordinary flow diverted by ditches of East Maui Irrigation Co. for irrigation of sugar cane.

ACCURACY.—Stage-discharge relation practically permanent. Rating curve well defined between 2 and 50 million gallons per day. Operation of water-stage recorder satisfactory except December 20-26; discharge estimated from records of flow of neighboring stations. Record fair between 2 and 50 million gallons per day when water-stage recorder was operating; poor at other times.

Discharge measurements of Alo Stream near Huelo, Maui, during the year ending June 30, 1918.

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

| Date. | Gage height (feet). | Discharge. | | Date. | Gage height (feet). | Discharge. | |
|--------------|---------------------|--------------|--------------------------|-------------|---------------------|--------------|--------------------------|
| | | Second-foot. | Million gallons per day. | | | Second-foot. | Million gallons per day. |
| Sept. 5..... | 0.41 | 0.65 | 0.4 | Mar. 6..... | 0.83 | 6.3 | 4.1 |
| Dec. 6..... | .61 | 2.0 | 1.3 | Apr. 7..... | 1.10 | 12.7 | 8.2 |

Daily discharge, in million gallons, of Alo Stream near Huelo, Maui, for the year ending June 30, 1918.

| Day. | July. | Aug. | Sept. | Oct. | Nov. | Dec. | Jan. | Feb. | Mar. | Apr. | May. | June. |
|---------|-------|------|-------|------|-------|------|------|-------|------|-------|------|-------|
| 1..... | 1.1 | 1.1 | 0.6 | 0.4 | 0.4 | 3.5 | 2.3 | 3.5 | 1.8 | 18 | 3.5 | 2.9 |
| 2..... | .8 | .6 | .6 | .4 | 1.4 | 2.3 | 1.1 | 2.3 | 7.6 | 134 | 2.9 | 2.3 |
| 3..... | 1.1 | .6 | .6 | .4 | .6 | 2.3 | 2.9 | 1.8 | 5.7 | 95 | 5.7 | 1.8 |
| 4..... | 1.8 | .6 | .4 | .3 | 1.4 | 1.8 | 3.5 | 1.4 | 16 | 10 | 21 | 1.8 |
| 5..... | 3.5 | .6 | .4 | .3 | .8 | 1.4 | 1.8 | 1.4 | 8.7 | 21 | 4.9 | 1.4 |
| 6..... | 1.4 | .6 | .4 | .4 | .6 | 1.4 | 1.4 | 1.4 | 4.2 | 47 | 2.9 | 1.4 |
| 7..... | 1.1 | .8 | .4 | .3 | 2.3 | 1.1 | 1.1 | 1.4 | 4.9 | 12 | 2.3 | 1.1 |
| 8..... | 1.1 | .6 | .6 | .3 | 1.4 | 1.1 | 4.2 | 2.3 | 4.9 | 12 | 1.8 | 1.4 |
| 9..... | 1.4 | 1.1 | .6 | .3 | 1.1 | 1.1 | 3.5 | 126 | 8.7 | 88 | 1.8 | 1.8 |
| 10..... | 1.1 | .6 | .6 | .3 | .8 | .8 | 2.3 | 12 | 18 | 118 | 4.9 | 7.6 |
| 11..... | .8 | 1.1 | .4 | .3 | .8 | .8 | 14 | 12 | 95 | 12 | 2.3 | 5.7 |
| 12..... | .8 | 1.1 | .8 | .3 | .6 | 1.1 | 3.5 | 7.6 | 47 | 6.5 | 5.7 | 38 |
| 13..... | .8 | 1.8 | .8 | .3 | .6 | 1.4 | 2.3 | 3.5 | 8.7 | 6.5 | 16 | 5.7 |
| 14..... | .8 | .8 | .6 | .3 | .6 | 2.9 | 1.8 | 2.9 | 6.5 | 18 | 4.9 | 3.5 |
| 15..... | .8 | .6 | .4 | .8 | .6 | 1.1 | 3.5 | 2.3 | 6.5 | 7.6 | 10 | 18 |
| 16..... | .8 | .6 | .4 | .6 | .6 | .8 | 4.2 | 1.8 | 34 | 4.9 | 7.6 | 7.6 |
| 17..... | .8 | .6 | .4 | .4 | .4 | .8 | 1.8 | 4.2 | 7.6 | 4.2 | 4.9 | 5.7 |
| 18..... | .6 | .6 | .4 | .3 | .6 | .8 | 1.8 | 1.8 | 3.5 | 2.9 | 3.5 | 3.5 |
| 19..... | .6 | .6 | .4 | .3 | .6 | .8 | 1.4 | 6.5 | 2.3 | 2.3 | 2.9 | 2.9 |
| 20..... | .6 | .6 | .4 | .3 | .6 | 6.5 | 2.3 | 57 | 1.8 | 4.2 | 2.3 | 2.9 |
| 21..... | .6 | .6 | .4 | .4 | .6 | 1.8 | 1.4 | 10 | 1.4 | 4.2 | 2.3 | 2.9 |
| 22..... | .8 | 6.5 | .3 | .3 | .8 | 4.2 | 2.9 | 2.9 | 1.4 | 5.7 | 2.3 | 4.9 |
| 23..... | 1.4 | 1.4 | .4 | .4 | 2.9 | 2.9 | 1.4 | 1.8 | 1.4 | 2.9 | 4.2 | 4.2 |
| 24..... | .6 | 1.1 | .3 | .3 | 2.9 | 2.3 | 4.2 | 1.4 | 5.7 | 2.3 | 2.3 | 2.9 |
| 25..... | .6 | .8 | .4 | .3 | 1.1 | 1.8 | 3.5 | 1.1 | 62 | 1.8 | 2.9 | 2.9 |
| 26..... | .6 | .8 | .4 | .3 | 2.9 | 1.4 | 2.3 | 1.4 | 7.6 | 1.8 | 2.3 | 1.8 |
| 27..... | .6 | .8 | .6 | .3 | 1.4 | 1.4 | 1.8 | 1.4 | 4.2 | 4.9 | 4.9 | 2.3 |
| 28..... | .4 | .8 | .6 | .4 | 1.4 | 1.1 | 1.4 | 3.5 | 2.9 | 4.2 | 27 | 2.9 |
| 29..... | .6 | .6 | .8 | .6 | 5.7 | 1.1 | 1.8 | ..... | 2.3 | 4.9 | 4.2 | 1.8 |
| 30..... | .6 | .6 | .8 | 1.1 | 14 | 1.1 | 4.9 | ..... | 5.7 | 10 | 3.5 | 3.5 |
| 31..... | .6 | .6 | ..... | .4 | ..... | .8 | 3.5 | ..... | 10 | ..... | 2.9 | ..... |

Monthly discharge of Alo Stream near Huelo, Maui, for the year ending June 30, 1918.

| Month. | Discharge. | | | | Total run-off. | |
|----------------|--------------------------|----------|-------|---------------------|------------------|------------|
| | Million gallons per day. | | | Second foot (mean). | Million gallons. | Acre-feet. |
| | Maximum. | Minimum. | Mean. | | | |
| July..... | 3.5 | 0.4 | 0.94 | 1.45 | 29 | 89 |
| August..... | 6.5 | .6 | .97 | 1.50 | 30 | 92 |
| September..... | .8 | .3 | .51 | .79 | 15 | 47 |
| October..... | 1.1 | .3 | .39 | .60 | 12 | 37 |
| November..... | 14 | .4 | 1.68 | 2.60 | 50 | 155 |
| December..... | 6.5 | .8 | 1.73 | 2.68 | 54 | 165 |
| January..... | 14 | 1.1 | 2.90 | 4.49 | 90 | 276 |
| February..... | 126 | 1.1 | 9.88 | 15.3 | 277 | 849 |
| March..... | 95 | 1.4 | 12.8 | 19.8 | 398 | 1,220 |
| April..... | 134 | 1.8 | 22.2 | 34.3 | 667 | 2,040 |
| May..... | 27 | 1.8 | 5.50 | 8.51 | 171 | 523 |
| June..... | 38 | 1.1 | 4.90 | 7.58 | 147 | 451 |
| The year..... | 134 | .3 | 5.31 | 8.22 | 1,940 | 5,940 |

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, 1918.

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 rock ledge and boulders and fairly permanent.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 4.80 feet at 2.45 p. m., April 2 (discharge, about 800 million gallons per day, or 1,240 second-foot); minimum stage recorded, -0.15 foot September 23 and 24 (discharge, 0.4 million gallons per day, or 0.6 second-foot).

1910-1918: Maximum stage recorded, 7.57 feet at 5 a. m., January 18, 1916 (discharge, computed from extension of rating curve, about 1,800 million gallons per day, or 2,780 second-foot); minimum stage recorded, 1.08 feet September 28, 1912 (discharge, 0.3 million gallons per day, or 0.5 second-foot).

DIVERSIONS.—A small amount of water is diverted by Kula pipe line above station at elevation 4,300 feet.

REGULATION.—None.

UTILIZATION.—Low water is all diverted by ditches of East Maui Irrigation Co. for irrigation of sugar cane.

ACCURACY.—Stage-discharge relation not permanent. Rating curves fairly well defined between 2 and 100 million gallons per day, applicable July 1 to November 29, November 30 to April 3, and April 4 to June 30. Operation of water-stage recorder satisfactory except December 21-26, for which period discharge was interpolated. Records fair.

Discharge measurements of Waikamoi Stream near Huelo, Maui, during the year ending June 30, 1918.

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

| Date. | Gage height (feet). | Discharge. | | Date. | Gage height (feet). | Discharge. | |
|---------------|---------------------|--------------|--------------------------|---------------|---------------------|--------------|--------------------------|
| | | Second-foot. | Million gallons per day. | | | Second-foot. | Million gallons per day. |
| Aug. 23 | 0.66 | 11.8 | 7.7 | Jan. 29 | 0.49 | 5.0 | 3.2 |
| Sept. 5 | .06 | 1.2 | .8 | May 16 | .90 | 20 | 13 |
| Nov. 7 | 1.93 | 145 | 94 | | | | |

Daily discharge, in million gallons, of Waikamoi Stream near Huelo, Maui, for the year ending June 30, 1918.

| Day. | July. | Aug. | Sept. | Oct. | Nov. | Dec. | Jan. | Feb. | Mar. | Apr. | May. | June. |
|---------|-------|------|-------|------|-------|------|------|-------|------|-------|------|-------|
| 1..... | 4.7 | 3.5 | 1.6 | 1.9 | 2.2 | 18 | 3.0 | 8.7 | 25 | 18 | 12 | 8.7 |
| 2..... | 4.0 | 4.7 | 1.4 | .8 | 7.4 | 10 | 2.2 | 5.4 | 119 | 172 | 7.4 | 10 |
| 3..... | 4.0 | 4.7 | 1.4 | .4 | 5.4 | 7.4 | 3.5 | 4.0 | 148 | 229 | 12 | 7.4 |
| 4..... | 6.4 | 3.0 | 1.2 | .4 | 16 | 6.4 | 4.0 | 3.5 | 77 | 28 | 28 | 5.4 |
| 5..... | 12.0 | 1.9 | 1.2 | .4 | 10 | 4.7 | 3.0 | 3.0 | 20 | 45 | 12 | 5.4 |
| 6..... | 6.4 | 1.9 | 1.0 | .4 | 6.4 | 4.0 | 2.6 | 3.0 | 10 | 99 | 6.4 | 4.7 |
| 7..... | 4.7 | 2.2 | 1.0 | .8 | 34 | 3.5 | 2.2 | 3.0 | 13 | 34 | 5.4 | 4.7 |
| 8..... | 4.0 | 2.2 | 1.0 | .8 | 22 | 3.5 | 6.4 | 4.7 | 14 | 42 | 4.7 | 4.0 |
| 9..... | 4.7 | 3.5 | .8 | .4 | 20 | 3.5 | 14 | 172 | 14 | 189 | 4.7 | 5.4 |
| 10..... | 6.4 | 3.0 | 1.0 | .6 | 6.4 | 3.0 | 4.7 | 72 | 16 | 360 | 45 | 13 |
| 11..... | 4.0 | 3.5 | .6 | 3.0 | 4.7 | 3.0 | 67 | 53 | 93 | 45 | 8.7 | 22 |
| 12..... | 3.5 | 4.0 | 1.2 | 1.2 | 4.0 | 3.5 | 10 | 58 | 28 | 22 | 22 | 62 |
| 13..... | 3.0 | 6.4 | 2.2 | .6 | 3.0 | 6.4 | 5.4 | 14 | 6.4 | 14 | 49 | 14 |
| 14..... | 3.0 | 4.7 | 1.6 | 1.6 | 2.6 | 5.4 | 4.0 | 8.7 | 6.4 | 31 | 13 | 10 |
| 15..... | 3.0 | 3.0 | 1.0 | 6.4 | 2.6 | 3.5 | 4.7 | 5.4 | 3.0 | 25 | 16 | 67 |
| 16..... | 3.0 | 2.2 | .6 | 4.7 | 2.2 | 3.0 | 16 | 4.7 | 25 | 12 | 20 | 38 |
| 17..... | 2.6 | 1.9 | .4 | 2.6 | 1.9 | 2.6 | 5.4 | 49 | 20 | 8.7 | 13 | 28 |
| 18..... | 2.2 | 1.6 | .4 | 1.2 | 1.9 | 2.6 | 4.7 | 7.4 | 7.4 | 7.4 | 8.7 | 10 |
| 19..... | 1.9 | 1.6 | .4 | 1.0 | 2.2 | 3.5 | 53 | 31 | 5.4 | 6.4 | 6.4 | 7.4 |
| 20..... | 1.9 | 2.2 | .4 | .8 | 1.9 | 3.5 | 7.4 | 218 | 5.4 | 7.4 | 5.4 | 7.4 |
| 21..... | 2.2 | 2.2 | .4 | .8 | 1.6 | 3.5 | 53 | 45 | 4.7 | 10 | 5.4 | 8.7 |
| 22..... | 4.7 | 25 | .4 | .8 | 13 | 3.5 | 12 | 13 | 4.7 | 13 | 6.4 | 12 |
| 23..... | 10 | 10 | .4 | .8 | 25 | 3.5 | 6.4 | 8.7 | 4.0 | 7.4 | 7.4 | 8.7 |
| 24..... | 4.7 | 4.7 | .4 | .8 | 25 | 3.5 | 7.4 | 6.4 | 10 | 6.4 | 25 | 7.4 |
| 25..... | 3.0 | 3.5 | .6 | .8 | 14 | 3.5 | 7.4 | 5.4 | 133 | 5.4 | 31 | 8.7 |
| 26..... | 2.6 | 3.0 | 2.2 | .8 | 12 | 3.5 | 4.7 | 4.7 | 25 | 5.4 | 8.7 | 7.4 |
| 27..... | 2.6 | 2.6 | 2.2 | .8 | 7.4 | 3.0 | 4.7 | 6.4 | 12 | 10 | 25 | 8.7 |
| 28..... | 7.4 | 2.2 | 1.9 | .8 | 8.7 | 3.0 | 4.0 | 42 | 7.4 | 10 | 67 | 7.4 |
| 29..... | 3.5 | 1.9 | 2.6 | 1.6 | 62 | 2.6 | 4.0 | ----- | 6.4 | 14 | 18 | 7.4 |
| 30..... | 3.0 | 1.9 | 3.5 | 4.7 | 93 | 2.2 | 25 | ----- | 7.4 | 38 | 12 | 8.7 |
| 31..... | 3.0 | 1.9 | ----- | 2.6 | ----- | 2.2 | 12 | ----- | 14 | ----- | 8.7 | ----- |

Monthly discharge of Waikamoi Stream near Huelo, Maui, for year ending June 30, 1918.

| Month. | Discharge. | | | | Total run-off. | |
|----------------|--------------------------|----------|-------|---------------------|------------------|------------|
| | Million gallons per day. | | | Second-foot (mean). | Million gallons. | Acre-feet. |
| | Maximum. | Minimum. | Mean. | | | |
| July..... | 12 | 1.9 | 4.26 | 6.59 | 132 | 405 |
| August..... | 25 | 1.6 | 3.89 | 6.02 | 121 | 370 |
| September..... | 3.5 | .4 | 1.17 | 1.81 | 35 | 108 |
| October..... | 6.4 | .4 | 1.46 | 2.26 | 45 | 139 |
| November..... | 93 | 1.6 | 14.0 | 21.7 | 418 | 1,290 |
| December..... | 18 | 2.2 | 4.35 | 6.73 | 135 | 414 |
| January..... | 67 | 2.2 | 11.7 | 18.1 | 364 | 1,110 |
| February..... | 218 | 3.0 | 30.7 | 47.5 | 860 | 2,640 |
| March..... | 148 | 3.0 | 28.5 | 44.1 | 885 | 2,710 |
| April..... | 360 | 5.4 | 50.5 | 78.1 | 1,510 | 4,650 |
| May..... | 67 | 4.7 | 16.6 | 25.7 | 514 | 1,580 |
| June..... | 67 | 4.0 | 14.0 | 21.7 | 420 | 1,290 |
| The year..... | 360 | .4 | 14.9 | 23.1 | 5,440 | 16,700 |

SPRECKELS DITCH BELOW KAAIEA GULCH, NEAR HUELO, MAUI.

LOCATION.—1,000 feet below intake in Kaaiea Stream and 2½ miles by trail southeast of ditch superintendent's house at Huelo.

RECORDS AVAILABLE.—December 15, 1917, to June 30, 1918.

GAGE.—Stevens water-stage recorder.

DISCHARGE MEASUREMENTS.—Made from plank at gage.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 4.63 feet at 3 p. m. April 2 (discharge, computed from extension of rating curve, approximately 96 million gallons per day, or 149 second-feet); minimum stage recorded, water occasionally shut off.

DIVERSIONS.—Ditch diverts water from a dozen or more streams east of Nailiilihaele.

REGULATION.—By gates at frequent intervals.

UTILIZATION.—For irrigation of sugar cane.

ACCURACY.—Stage-discharge relation practically permanent until April 2 when a slide in the ditch below gage caused backwater. Rating curve used December 15 to April 2 well defined between 6 and 50 million gallons per day. Rating curve used after April 2 fairly well defined. Operation of water-stage recorder satisfactory except April 3 to May 13 (no record). Records prior to April 2, good; after that date, fair.

Discharge measurements of Spreckels ditch below Kaaiea Gulch, near Huelo, Maui, during the year ending June 30, 1918.

[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..... | 0.87 | 9.3 | 6.0 | Jan. 31..... | 2.24 | 46 | 30 |
| Jan. 28..... | 1.30 | 19.2 | 12 | Mar. 6..... | 1.96 | 37 | 24 |
| 29..... | 1.19 | 15.7 | 10 | May 14..... | .80 | 4.2 | 2.7 |

Daily discharge, in million gallons, of Spreckels ditch below Kaaiea Gulch, near Huelo, Maui, for the year ending June 30, 1918.

| Day. | Dec. | Jan. | Feb. | Mar. | May. | June. | Day. | Dec. | Jan. | Feb. | Mar. | May. | June. |
|---------|------|------|------|------|-------|-------|---------|------|------|-------|------|------|-------|
| 1..... | | 16 | 28 | 27 | ----- | 2.8 | 16..... | 2.5 | 30 | 12 | 39 | 2.8 | 17 |
| 2..... | | 9.8 | 17 | 32 | ----- | 2.5 | 17..... | 2.2 | 14 | 25 | 29 | 2.8 | 13 |
| 3..... | | 17 | 14 | 34 | ----- | 2.2 | 18..... | 2.2 | 14 | 17 | 28 | 1.0 | 4.0 |
| 4..... | | 23 | 11 | 35 | ----- | 1.8 | 19..... | 2.2 | 15 | 25 | 25 | .2 | 2.5 |
| 5..... | | 13 | 9.8 | 34 | ----- | 1.6 | 20..... | 9.0 | 20 | 48 | 20 | .2 | 2.5 |
| 6..... | | 7.6 | 8.3 | 25 | ----- | 1.6 | 21..... | 6.9 | 14 | 34 | 15 | .2 | 2.8 |
| 7..... | | 6.2 | 8.3 | 26 | ----- | 1.6 | 22..... | 17 | 24 | 27 | 14 | .2 | 28 |
| 8..... | | 16 | 10 | 27 | ----- | 1.6 | 23..... | 9.8 | 20 | 22 | 13 | .8 | 25 |
| 9..... | | 32 | 42 | 30 | ----- | 1.8 | 24..... | 3.6 | 24 | 17 | 18 | .2 | 15 |
| 10..... | | 13 | 36 | 32 | ----- | 1.4 | 25..... | 3.2 | 27 | 14 | 47 | 1.3 | 22 |
| 11..... | | 36 | 35 | 46 | ----- | 1.4 | 26..... | 2.8 | 16 | 16 | 39 | 2.8 | 17 |
| 12..... | | 27 | 34 | 38 | ----- | 2.8 | 27..... | 7.6 | 16 | 15 | 32 | 12 | 12 |
| 13..... | | 15 | 26 | 28 | ----- | 9.0 | 28..... | 11 | 13 | 26 | 26 | 14 | 3.6 |
| 14..... | | 12 | 18 | 27 | 2.5 | 3.2 | 29..... | 9.8 | 11 | ----- | 20 | 9.0 | 3.2 |
| 15..... | 5.6 | 12 | 14 | 28 | 2.5 | 21 | 30..... | 9.8 | 32 | ----- | 27 | 4.0 | 14 |
| | | | | | | | 31..... | 9.0 | 30 | ----- | 38 | 2.8 | ----- |

Monthly discharge of Spreckels ditch below Kaaiea Gulch, near Huelo, Maui, for the year ending June 30, 1918.

| Month. | Discharge. | | | | Total run-off. | |
|---------------------|--------------------------|----------|-------|---------------------|------------------|------------|
| | Million gallons per day. | | | Second feet (mean). | Million gallons. | Acre-feet. |
| | Maximum. | Minimum. | Mean. | | | |
| December 15-31..... | 17 | 2.2 | 6.72 | 10.4 | 114 | 351 |
| January..... | 36 | 6.2 | 18.6 | 28.8 | 576 | 1,770 |
| February..... | 48 | 8.3 | 21.8 | 33.7 | 609 | 1,870 |
| March..... | 47 | 13 | 29.0 | 44.9 | 899 | 2,760 |
| May 14-31..... | 14 | .2 | 3.29 | 5.09 | 59 | 182 |
| June..... | 28 | 1.6 | 9.61 | 14.9 | 288 | 885 |

MANUEL LUIS DITCH AT PUOHAKAMOA GULCH, NEAR HUELO, MAUI.

LOCATION.—In Puohakamoa Gulch at lower portal of tunnel between Haipuaena and Puohakamoa stations, 6 miles east of Huelo.

RECORDS AVAILABLE.—December 15, 1917, to June 30, 1918.

GAGE.—Stevens water-stage recorder.

DISCHARGE MEASUREMENTS.—Made by rectangular sharp-crested weir 4.5 feet long with end contractions; set in concrete.

CHANNEL AND CONTROL.—Weir basin 25 feet long, 8 feet wide, and 2 feet deep below crest of weir; made by enlarging tunnel.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 3.96 feet April 2, 3, and 9 (weir flooded, discharge estimated at 82 million gallons per day, or 127 second-feet); minimum stage recorded, 0.15 foot December 16–19 (discharge, 0.55 million gallons per day, or 0.85 second-foot).

DIVERSIONS.—Ditch is an extension of Center ditch and picks up water not diverted by Spreckles ditch which is at higher elevation.

REGULATION.—By gates at frequent intervals.

UTILIZATION.—For irrigation of sugar cane.

ACCURACY.—For discharges above 5 million gallons per day, there is an unmeasured velocity of approach at weir which increases with the stage. Records below 5 million gallons per day, excellent; from 5 to 20 million gallons per day, fair; above 20 million gallons per day, poor.

Daily discharge, in million gallons, of Manuel Luis ditch at Puohakamoa Gulch, near Huelo, Maui, for the year ending June 30, 1918.

| Day. | Dec. | Jan. | Feb. | Mar. | Apr. | May. | June. |
|------|------|------|-------|------|-------|------|-------|
| 1. | | 2.5 | 2.4 | 10.6 | 28 | 3.0 | 1.8 |
| 2. | | 1.1 | 2.0 | 31 | 56 | 2.3 | 1.4 |
| 3. | | 2.0 | 1.5 | 43 | 57 | 3.4 | 1.3 |
| 4. | | 2.6 | 1.4 | 34 | 28 | 18.0 | 1.1 |
| 5. | | 1.6 | 1.3 | 17.3 | 28 | 15.8 | 1.1 |
| 6. | | 1.4 | 3.5 | 3.8 | 49 | 8.1 | .9 |
| 7. | | 1.2 | 3.4 | 12.0 | 32 | 5.6 | .9 |
| 8. | | 2.7 | 3.4 | 8.4 | 35 | 4.3 | .9 |
| 9. | | 6.9 | 59 | 17.3 | 56 | 2.6 | .9 |
| 10. | | 1.6 | 35 | 28 | 67 | 15.8 | 7.6 |
| 11. | | 24 | 28 | 54 | 39 | 5.3 | 7.4 |
| 12. | | 2.9 | 31 | 40 | 21 | 5.3 | 27 |
| 13. | | 2.1 | 9.9 | 15.8 | 17.3 | 18.0 | 6.4 |
| 14. | | 1.6 | 9.2 | 12.0 | 26 | 3.3 | 3 |
| 15. | 2.4 | 2.3 | 9.9 | 6.9 | 26 | 9.0 | 22 |
| 16. | .55 | 6.9 | 8.3 | 39 | 12.8 | 6.6 | 14.2 |
| 17. | .55 | 2.1 | 17.3 | 23 | 9.0 | 3.4 | 9.9 |
| 18. | .55 | 1.7 | 9.2 | 5.4 | 6.4 | 2.2 | 3.0 |
| 19. | .55 | 1.6 | 19 | 3.0 | 5.4 | 1.9 | 2.1 |
| 20. | 5.5 | 1.9 | 53 | 2.2 | 8.7 | 1.6 | 1.8 |
| 21. | 4.2 | 1.4 | 30 | 2.3 | 13.5 | 1.7 | 1.9 |
| 22. | 11.3 | 3.8 | 8.8 | 1.6 | 16.6 | 2.1 | 3.5 |
| 23. | 2.9 | 2.2 | 5.5 | 1.4 | 6.0 | 4.0 | 2.2 |
| 24. | 1.7 | 3.4 | 3.7 | 5.3 | 2.2 | 6.7 | 1.5 |
| 25. | 1.2 | 4.6 | 2.6 | 52 | 1.1 | 5.0 | 1.9 |
| 26. | 1.0 | 2.6 | 2.6 | 17.3 | 1.3 | 1.8 | 1.8 |
| 27. | .8 | 2.3 | 2.4 | 4.4 | 2.3 | 6.3 | 1.9 |
| 28. | .9 | 1.9 | 21 | 2.7 | 2.7 | 20 | 1.3 |
| 29. | 1.0 | 1.9 | ----- | 1.8 | 3.0 | 4.0 | 1.6 |
| 30. | .9 | 8.2 | ----- | 5.8 | 7.3 | 2.5 | 2.1 |
| 31. | .9 | 2.8 | ----- | 12.8 | ----- | 1.9 | ----- |

Monthly discharge of Manuel Luis ditch at Puohakamoa Gulch, near Huelo, Maui, for year ending June 30, 1918.

| Month. | Discharge. | | | | Total run-off. | |
|----------------------|--------------------------|----------|-------|---------------------|------------------|------------|
| | Million gallons per day. | | | Second-foot (mean). | Million gallons. | Acre-feet. |
| | Maximum. | Minimum. | Mean. | | | |
| December 15-31 | 11.3 | 0.55 | 2.17 | 3.36 | 37 | 113 |
| January | 24 | 1.1 | 3.41 | 5.28 | 106 | 324 |
| February | 59 | 1.3 | 13.7 | 21.2 | 384 | 1,180 |
| March | 54 | 1.4 | 16.6 | 25.7 | 514 | 1,580 |
| April | 67 | 1.1 | 22.1 | 34.2 | 664 | 2,030 |
| May | 20 | 1.6 | 6.18 | 9.56 | 192 | 588 |
| June | 27 | .9 | 4.48 | 6.93 | 134 | 412 |
| The period | | | | | 2,030 | 6,230 |

CENTER DITCH AT WAIKAMOI, NEAR HUELO, MAUI.

LOCATION.—250 feet below intake in Waikamoi Stream, 4 miles by trail east of Huelo.

RECORDS AVAILABLE.—March 6 to June 30, 1918.

GAGE.—Stevens water-stage recorder.

DISCHARGE MEASUREMENTS.—Made from plank at gage.

CHANNEL AND CONTROL.—Sections of ditch trapezoidal; sides and bottom of hardpan and rock; straight for 30 feet above and 10 feet below gage. Control is plank set on edge in bottom of ditch 5 feet below gage.

EXTREME OF DISCHARGE.—Maximum stage recorded during year, 2.70 feet at 2 p. m., April 2 (discharge, 60 million gallons per day, or 93 second-feet); minimum stage recorded, 0.35 foot May 9 (discharge, 1.5 million gallons per day, or 2.3 second-feet).

DIVERSIONS.—Ditch diverts water that arises below or passes Spreckels ditch.

REGULATION.—By gates.

UTILIZATION.—For irrigation of sugar cane.

ACCURACY.—Stage-discharge relation practically permanent. Rating curve well defined. Operation of water-stage recorder satisfactory except March 12-14, April 7, 8, May 15 and 16; discharge for these periods estimated. Records good.

Discharge measurements of Center ditch at Waikamoi, near Huelo, Maui, during the year ending June 30, 1918.

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

| Date. | Gage height (feet). | Discharge. | |
|---------------|---------------------|--------------|--------------------------|
| | | Second-feet. | Million gallons per day. |
| Jan. 28 | 0.51 | 5.8 | 3.8 |
| Mar. 5 | 2.19 | 64 | 41 |
| May 14 | .84 | 11.1 | 7.2 |

Daily discharge, in million gallons, of Center ditch at Waikamoi, near Huelo, Maui, for the year ending June 30, 1918.

| Day. | Mar. | Apr. | Apr. | June. | Day. | Mar. | Apr. | May. | June. |
|---------|------|------|------|-------|---------|------|-------|------|-------|
| 1..... | | 36 | 3.9 | 19 | 16..... | 36 | 3.4 | 4.4 | 38 |
| 2..... | | 43 | 2.9 | 15 | 17..... | 28 | 2.9 | 3.4 | 34 |
| 3..... | | 36 | 4.5 | 11 | 18..... | 11 | 2.9 | 2.9 | 23 |
| 4..... | | 26 | 18 | 9.7 | 19..... | 7.5 | 2.4 | 2.9 | 17 |
| 5..... | | 24 | 4.5 | 8.1 | 20..... | 6.1 | 2.4 | 2.4 | 19 |
| 6..... | 21 | 29 | 2.9 | 6.6 | 21..... | 5.5 | 3.9 | 2.9 | 18 |
| 7..... | 27 | 24 | 2.4 | 6.6 | 22..... | 4.3 | 3.4 | 11 | 5.8 |
| 8..... | 30 | 20 | 2.0 | 8.9 | 23..... | 3.7 | 2.9 | 20 | 3.4 |
| 9..... | 52 | 15 | 1.5 | 18 | 24..... | 13 | 2.4 | 35 | 3.4 |
| 10..... | 45 | 34 | 8.1 | 35 | 25..... | 41 | 2.0 | 17 | 3.4 |
| 11..... | 35 | 20 | 1.5 | 49 | 26..... | 28 | 2.0 | 30 | 2.9 |
| 12..... | 32 | 8.1 | 7.3 | 36 | 27..... | 9.1 | 2.9 | 34 | 9.7 |
| 13..... | 28 | 4.5 | 36 | 24 | 28..... | 6.1 | 2.9 | 30 | 9.7 |
| 14..... | 24 | 8.9 | 6.6 | 26 | 29..... | 4.8 | 5.8 | 26 | 18 |
| 15..... | 21 | 4.5 | 5.5 | 38 | 30..... | 13 | 13 | 22 | 9.7 |
| | | | | | 31..... | 22 | ----- | 18 | ----- |

Monthly discharge of Center ditch at Waikamoi, near Huelo, Maui, for year ending June 30, 1918.

| Month. | Discharge. | | | | Total run-off. | |
|----------------------|--------------------------|----------|-------|---------------------|------------------|------------|
| | Million gallons per day. | | | Second-foot (mean). | Million gallons. | Acre-feet. |
| | Maximum. | Minimum. | Mean. | | | |
| March (26 days)..... | 52 | 3.7 | 21.3 | 33.0 | 554 | 1,700 |
| April..... | 43 | 2.0 | 12.9 | 20.0 | 388 | 1,190 |
| May..... | 36 | 1.5 | 11.9 | 18.4 | 370 | 1,130 |
| June..... | 49 | 3.4 | 17.5 | 27.1 | 526 | 1,610 |
| The period..... | | | | | 1,840 | 5,630 |

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, 1918, when station was discontinued. Also at old staff-gage station below New Hamakua ditch from December 9, 1910, to December 31, 1912.

GAGE.—Stevens water-stage recorder installed December 13, 1917, replacing original Barrett & Lawrence water-stage recorder.

DISCHARGE MEASUREMENTS.—Made by wading or from footbridge 150 feet below gage.

CHANNEL AND CONTROL.—One channel at all stages; straight for 100 feet above and below gage; stream bed very rough and steep; banks steep and high and covered with dense vegetation. Control composed of large boulders; fairly permanent.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 4.97 feet at 10.15 a. m. April 3 (discharge, about 900 million gallons per day, or 1,400 second feet); minimum stage recorded, 0.2 foot September 11–23 and October 24–31 (discharge, 2.0 million gallons per day, or 3.1 second-feet).

1913–1918: Maximum stage recorded, 6.3 feet at 6.30 p. m. May 1, 1916 (discharge, computed from extension of rating curve, about 1,800 million gallons per day, or 2,780 second-feet); minimum stage in September and October, 1917.

DIVERSIONS.—Low flow of left branch of stream diverted above station by Old Hamakua ditch since about March 1, 1918.

REGULATION.—None.

UTILIZATION.—Ordinary flow is diverted by ditches of East Maui Irrigation Co. for irrigation of sugar cane.

ACCURACY.—Stage-discharge relation not permanent. Rating curve used July 1 to November 30 well defined between 4 and 200 million gallons per day; curve used December 1 to April 2 and April 3 to June 30, poorly defined. Operation of water-stage recorder satisfactory except November 13 to December 13 and June 19-30; discharge estimated for latter period from records of flow of neighboring streams.

Discharge measurements of Nailikihale Stream near Huelo, Maui, during the year ending June 30, 1918.

[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..... | 0.28 | 4.8 | 3.1 | Apr. 18..... | 0.46 | 28 | 18 |
| Jan. 29..... | .61 | 11.5 | 7.4 | May 17..... | .62 | 47 | 30 |
| Mar. 7..... | 1.07 | 37 | 24 | | | | |

Daily discharge in million gallons of Nailikihale Stream near Huelo, Maui, for the year ending June 30, 1918.

| Day. | July. | Aug. | Sept. | Oct. | Nov. | Dec. | Jan. | Feb. | Mar. | Apr. | May. | June. |
|---------|-------|------|-------|------|-------|-------|------|-------|------|-------|------|-------|
| 1..... | 7.8 | 10 | 3.0 | 2.0 | 2.5 | ..... | 7.8 | 18 | 26 | 58 | 23 | 18 |
| 2..... | 6.6 | 9.0 | 3.0 | 2.5 | 4.6 | ..... | 4.6 | 12 | 49 | 258 | 18 | 14 |
| 3..... | 6.6 | 9.0 | 3.8 | 2.5 | 3.0 | ..... | 9.0 | 9.0 | 53 | 367 | 29 | 14 |
| 4..... | 14 | 9.0 | 3.8 | 2.5 | 5.6 | ..... | 16 | 9.0 | 62 | 102 | 67 | 14 |
| 5..... | 29 | 9.0 | 3.0 | 2.5 | 3.8 | ..... | 7.8 | 7.8 | 45 | 130 | 32 | 14 |
| 6..... | 14 | 9.0 | 3.0 | 2.5 | 3.0 | ..... | 5.6 | 7.8 | 23 | 223 | 20 | 14 |
| 7..... | 10 | 9.0 | 2.5 | 2.5 | 14 | ..... | 4.6 | 7.8 | 32 | 116 | 20 | 10 |
| 8..... | 9.0 | 9.0 | 2.5 | 2.5 | 5.6 | ..... | 14 | 16 | 26 | 116 | 18 | 7.8 |
| 9..... | 9.0 | 7.8 | 2.5 | 2.5 | 4.6 | ..... | 16 | 231 | 32 | 249 | 18 | 10 |
| 10..... | 10 | 6.6 | 2.5 | 2.5 | 3.0 | ..... | 6.6 | 67 | 62 | 267 | 42 | 26 |
| 11..... | 9.0 | 6.6 | 2.0 | 2.5 | 3.0 | ..... | 67 | 62 | 207 | 84 | 20 | 29 |
| 12..... | 7.8 | 6.6 | 2.0 | 2.5 | 3.0 | ..... | 16 | 62 | 116 | 49 | 62 | 78 |
| 13..... | 7.8 | 12 | 2.0 | 2.5 | ..... | ..... | 10 | 23 | 42 | 42 | 62 | 23 |
| 14..... | 6.6 | 9.0 | 2.0 | 3.0 | ..... | 14 | 7.8 | 18 | 35 | 67 | 29 | 18 |
| 15..... | 6.6 | 6.6 | 2.0 | 4.6 | ..... | 9.0 | 12 | 16 | 29 | 49 | 38 | 67 |
| 16..... | 6.6 | 7.8 | 2.0 | 3.8 | ..... | 6.6 | 20 | 12 | 96 | 32 | 42 | 35 |
| 17..... | 6.6 | 6.6 | 2.0 | 3.0 | ..... | 4.6 | 9.0 | 29 | 58 | 23 | 32 | 29 |
| 18..... | 6.6 | 6.6 | 2.0 | 2.5 | ..... | 4.6 | 7.8 | 12 | 26 | 20 | 23 | 18 |
| 19..... | 6.6 | 6.6 | 2.0 | 2.5 | ..... | 4.6 | 6.6 | 35 | 20 | 18 | 18 | 16 |
| 20..... | 6.6 | 6.6 | 2.0 | 2.5 | ..... | 12 | 14 | 183 | 16 | 23 | 18 | 16 |
| 21..... | 6.6 | 6.6 | 2.0 | 2.5 | ..... | 20 | 6.6 | 62 | 16 | 20 | 18 | 14 |
| 22..... | 6.6 | 32 | 2.0 | 2.5 | ..... | 20 | 7.8 | 26 | 14 | 29 | 18 | 14 |
| 23..... | 7.8 | 12 | 2.0 | 2.5 | ..... | 12 | 6.6 | 20 | 12 | 18 | 23 | 14 |
| 24..... | 7.8 | 7.8 | 2.5 | 2.0 | ..... | 9.0 | 9.0 | 18 | 32 | 16 | 26 | 14 |
| 25..... | 7.8 | 6.6 | 2.5 | 2.0 | ..... | 6.6 | 12 | 14 | 183 | 16 | 35 | 14 |
| 26..... | 7.8 | 6.6 | 2.5 | 2.0 | ..... | 6.6 | 6.6 | 14 | 45 | 14 | 18 | 12 |
| 27..... | 7.8 | 5.6 | 2.5 | 2.0 | ..... | 5.6 | 7.8 | 14 | 26 | 23 | 38 | 12 |
| 28..... | 6.6 | 5.6 | 2.5 | 2.0 | ..... | 4.6 | 6.6 | 42 | 20 | 20 | 84 | 12 |
| 29..... | 6.6 | 4.6 | 2.0 | 2.0 | ..... | 4.6 | 7.8 | ..... | 16 | 29 | 26 | 10 |
| 30..... | 6.6 | 4.6 | 2.0 | 2.0 | ..... | 4.6 | 29 | ..... | 26 | 53 | 18 | 10 |
| 31..... | 6.6 | 3.8 | ..... | 2.0 | ..... | 4.6 | 20 | ..... | 38 | ..... | 18 | ..... |

Monthly discharge of Nailiilihae Stream near Huelo, Maui, for the year ending June 30, 1918.

| Month. | Discharge. | | | | Total run-off. | |
|---------------------|--------------------------|----------|-------|---------------------|------------------|------------|
| | Million gallons per day. | | | Second-foot (mean). | Million gallons. | Acre-feet. |
| | Maximum. | Minimum. | Mean. | | | |
| July..... | 29 | 6.6 | 8.56 | 13.2 | 265 | 814 |
| August..... | 32 | 3.8 | 8.33 | 12.9 | 258 | 792 |
| September..... | 3.8 | 2.0 | 2.40 | 3.71 | 72 | 221 |
| October..... | 4.6 | 2.0 | 2.50 | 3.87 | 77 | 238 |
| November 1-12..... | 14 | 2.5 | 4.64 | 7.18 | 56 | 171 |
| December 14-31..... | 20 | 4.6 | 8.53 | 13.2 | 154 | 471 |
| January..... | 67 | 4.6 | 12.3 | 19.0 | 382 | 1,170 |
| February..... | 231 | 7.8 | 37.4 | 57.9 | 1,050 | 3,210 |
| March..... | 207 | 12 | 47.8 | 74.0 | 1,480 | 4,550 |
| April..... | 367 | 14 | 84.4 | 131 | 2,530 | 7,770 |
| May..... | 84 | 18 | 30.7 | 47.5 | 953 | 2,920 |
| June..... | 78 | 7.8 | 19.9 | 30.8 | 597 | 1,830 |
| The period..... | | | | | 7,870 | 24,200 |

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, 1918, when station was discontinued.

GAGE.—Stevens water-stage recorder installed March 7, 1918, replacing 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 year, 7.22 feet at 5 a. m. May 28 (discharge, about 700 million gallons per day, or 1,080 second-feet); stage probably considerably higher a. m. April 3, float caught on water-stage recorder; minimum stage recorded, 0.6 foot May 11, 31, and June 1-7 (discharge, 0.4 million gallons per day, or 0.6 second-foot).

1913-1918: Maximum stage recorded, 9.5 feet May 1, 1916 (discharge computed from extension of the rating curve, about 1,000 million gallons per day, or 1,550 second-feet); minimum stage recorded, in May and June, 1918.

DIVERSIONS.—Nearly all low-water flow diverted by Old Hamakua ditch above station after February 5, 1918.

REGULATION.—By diversion only.

UTILIZATION.—Ordinary flow of stream is diverted by ditches of East Maui Irrigation Co. for irrigation of sugar cane.

ACCURACY.—Stage-discharge relation not permanent. Rating curves fairly well defined above 1 million gallons per day. Operation of water-stage recorder unsatisfactory. No attempt has been made to estimate flow for periods of missing gage record except June 27-30. Records fair above and poor below 1 million gallons per day.

Discharge measurements of Kailua Stream near Huelo, Maui, during the year ending June 30, 1918.

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

| Date. | Gage height (feet). | Discharge. | | Date. | Gage height (feet). | Discharge. | |
|--------------|---------------------|--------------|--------------------------|-------------|---------------------|--------------|--------------------------|
| | | Second-foot. | Million gallons per day. | | | Second-foot. | Million gallons per day. |
| Sept. 4..... | 1.15 | 1.3 | 0.85 | Mar. 4..... | 2.36 | 74 | 48 |
| Dec. 13..... | 1.22 | 6.7 | 4.4 | May 17..... | .72 | .85 | .55 |
| Jan. 29..... | .96 | 2.5 | 1.6 | | | | |

Daily discharge, in million gallons, of Kailua Stream near Huelo, Maui, for the year ending June 30, 1918.

| Day. | July. | Aug. | Sept. | Oct. | Nov. | Dec. | Mar. | Apr. | May. | June. |
|---------|-------|------|-------|-------|-------|-------|-------|-------|------|-------|
| 1..... | 3.6 | 2.9 | 1.1 | 0.85 | 0.6 | ..... | ..... | 7.6 | 0.5 | 0.4 |
| 2..... | 3.6 | 3.6 | 1.1 | .85 | 2.2 | ..... | ..... | ..... | .5 | .4 |
| 3..... | 3.6 | 3.6 | 1.1 | .6 | 2.9 | ..... | ..... | ..... | 1.0 | .4 |
| 4..... | 5.3 | 2.2 | .85 | .6 | 10 | ..... | ..... | ..... | 3.4 | .4 |
| 5..... | 12 | 2.2 | .85 | .6 | 6.4 | ..... | ..... | ..... | .5 | .4 |
| 6..... | 6.4 | 2.2 | .85 | .6 | ..... | ..... | ..... | ..... | .45 | .4 |
| 7..... | 4.4 | 2.2 | .85 | .6 | ..... | ..... | ..... | 45 | .45 | .4 |
| 8..... | 3.6 | 1.6 | .85 | .6 | ..... | ..... | 5.6 | 45 | .45 | .45 |
| 9..... | 3.6 | 1.6 | .6 | .6 | ..... | ..... | 1.9 | ..... | .45 | .6 |
| 10..... | 5.3 | 2.2 | .6 | .6 | ..... | ..... | 16 | ..... | 2.4 | 2.4 |
| 11..... | 3.6 | 1.6 | .6 | .6 | ..... | ..... | ..... | ..... | .4 | 16 |
| 12..... | 2.9 | 1.6 | .6 | .6 | ..... | ..... | ..... | ..... | 36 | 24 |
| 13..... | 2.2 | 5.3 | .6 | .6 | ..... | 4.0 | ..... | ..... | 28 | .5 |
| 14..... | 2.2 | 7.4 | .6 | .6 | ..... | 3.4 | ..... | ..... | 1.0 | 24 |
| 15..... | 2.2 | 3.6 | .6 | .6 | ..... | 2.4 | ..... | ..... | .8 | 39 |
| 16..... | 2.2 | 2.2 | .6 | .6 | ..... | 1.9 | ..... | ..... | 1.2 | 33 |
| 17..... | 2.2 | 2.2 | .6 | .6 | ..... | 1.2 | ..... | ..... | .8 | 2.4 |
| 18..... | 2.2 | 1.6 | .6 | .6 | ..... | 1.5 | ..... | .5 | .5 | .5 |
| 19..... | 1.6 | 1.6 | .6 | .6 | ..... | 2.9 | ..... | .5 | .5 | .45 |
| 20..... | 1.6 | 1.6 | .6 | .45 | ..... | 13 | ..... | .5 | .5 | .5 |
| 21..... | 1.1 | 1.6 | .6 | .45 | ..... | 10 | ..... | .5 | .5 | .5 |
| 22..... | 1.1 | 16 | .6 | .45 | ..... | 5.6 | ..... | .8 | .5 | 1.2 |
| 23..... | 3.6 | 7.4 | .6 | .45 | ..... | 3.4 | ..... | .5 | .5 | .45 |
| 24..... | 3.6 | 3.6 | .6 | ..... | ..... | 2.9 | ..... | .5 | 14 | .45 |
| 25..... | 3.6 | 2.2 | .6 | ..... | ..... | 1.9 | ..... | .5 | 14 | .6 |
| 26..... | 2.9 | 2.2 | .6 | ..... | ..... | 1.2 | ..... | .5 | .5 | .45 |
| 27..... | 2.9 | 2.2 | .6 | ..... | ..... | 1.2 | ..... | .5 | 13 | .45 |
| 28..... | 3.6 | 2.2 | .85 | ..... | ..... | 1.2 | ..... | .5 | 91 | .45 |
| 29..... | 3.6 | 2.2 | .85 | ..... | ..... | 1.2 | 45 | 1.2 | 2.4 | .45 |
| 30..... | 2.9 | 1.6 | .85 | ..... | ..... | ..... | 1.2 | 16 | .45 | .45 |
| 31..... | 2.9 | 1.6 | ..... | ..... | ..... | ..... | 3.4 | ..... | .4 | ..... |

Monthly discharge of Kailua Stream near Huelo, Maui, for the year ending June 30, 1918.

| Month. | Discharge. | | | | Total run-off. | |
|---------------------|--------------------------|----------|-------|---------------------|------------------|------------|
| | Million gallons per day. | | | Second-foot (mean). | Million gallons. | Acre-feet. |
| | Maximum. | Minimum. | Mean. | | | |
| July..... | 12 | 1.1 | 3.42 | 5.29 | 106 | 325 |
| August..... | 16 | 1.6 | 3.09 | 4.78 | 96 | 294 |
| September..... | 1.1 | .6 | .72 | 1.11 | 22 | 66 |
| October 1-23..... | .85 | .45 | .60 | .93 | 14 | 42 |
| November 1-5..... | 10 | .6 | 4.42 | 6.84 | 22 | 68 |
| December 13-29..... | 13 | 1.2 | 3.46 | 5.35 | 59 | 181 |
| May..... | 91 | .4 | 7.00 | 10.8 | 217 | 666 |
| June..... | 39 | .4 | 5.07 | 7.84 | 152 | 467 |

HOOLAWALILII 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, 1918.

GAGE.—Stevens water-stage recorder installed June 19, 1914, at same site 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.—1911–1918: Maximum stage recorded, 3.4 feet at 8.15 a. m. April 3, 1918 (discharge computed from extension of rating curve, 800 million gallons per day, or 1,240 second-foot); minimum stage recorded, 0.00 foot October 1 and 2, 1917 (discharge, 0.55 million gallons per day, or 0.85 second-foot).

DIVERSIONS.—None.

REGULATION.—None.

ACCURACY.—Stage-discharge relation not permanent. Rating curves well defined between 2 and 30 million gallons per day. Operation of water-stage recorder satisfactory except August 2–22, for which period discharge was estimated from flow of Honopou Stream. Records good between 2 and 30 million gallons per day when water-stage recorder was operating; fair for other periods.

Discharge measurements of Hoolawalilii Stream near Huelo, Maui, during the year ending June 30, 1918.

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

| Date. | Gage height (feet). | Discharge. | |
|--------------|------------------------|--------------|--------------------------|
| | | Second-foot. | Million gallons per day. |
| Sept. 4..... | 0.03 | 1.1 | 0.75 |
| Jan. 25..... | .24 | 7.3 | 4.7 |
| May 17..... | .24 | 7.6 | 4.9 |

Daily discharge, in million gallons, of Hoolawaliili Stream near Huelo, Maui, for the year ending June 30, 1918.

| Day. | July. | Aug. | Sept. | Oct. | Nov. | Dec. | Jan. | Feb. | Mar. | Apr. | May. | June. |
|---------|-------|------|-------|------|-------|------|------|-------|------|-------|------|-------|
| 1..... | 2.2 | 1.3 | 0.8 | 0.55 | 0.8 | 2.7 | 2.2 | 5.2 | 5.2 | 11.7 | 6.9 | 5.2 |
| 2..... | 2.2 | 1.3 | .8 | .55 | .8 | 1.9 | 2.2 | 3.4 | 6.9 | 11.6 | 5.2 | 5.2 |
| 3..... | 2.2 | 1.3 | .8 | .6 | .75 | 1.7 | 5.2 | 3.4 | 6.9 | 285 | 5.2 | 3.4 |
| 4..... | 2.2 | .8 | .8 | .6 | .8 | 1.4 | 3.4 | 3.4 | 15.4 | 33 | 11.7 | 3.4 |
| 5..... | 3.2 | .8 | .8 | .65 | .8 | 1.4 | 3.4 | 3.4 | 15.4 | 33 | 6.9 | 3.4 |
| 6..... | 3.2 | .8 | .8 | .65 | .8 | 1.4 | 2.2 | 3.4 | 6.9 | 78 | 5.2 | 3.4 |
| 7..... | 2.2 | .8 | .8 | .6 | 1.0 | 1.4 | 2.2 | 3.4 | 5.2 | 33 | 5.2 | 2.2 |
| 8..... | 2.2 | .8 | .8 | .65 | .8 | 1.4 | 3.4 | 2.2 | 5.2 | 19 | 5.2 | 2.2 |
| 9..... | 2.2 | .8 | .8 | .6 | .8 | 1.4 | 3.4 | 78 | 5.2 | 116 | 3.4 | 2.2 |
| 10..... | 2.2 | .8 | .8 | .6 | .8 | 1.4 | 2.2 | 24 | 9.3 | 240 | 5.2 | 5.2 |
| 11..... | 2.2 | .8 | .8 | .65 | .8 | 1.4 | 9.3 | 15.4 | 96 | 50 | 3.4 | 5.2 |
| 12..... | 2.2 | .8 | .8 | .7 | .7 | 1.4 | 5.2 | 19 | 63 | 19 | 5.2 | 33 |
| 13..... | 2.2 | 1.3 | .8 | .7 | .7 | 1.4 | 3.4 | 9.3 | 24 | 11.7 | 15.4 | 9.3 |
| 14..... | 2.2 | 1.3 | .8 | .8 | .7 | 1.4 | 3.4 | 6.9 | 15.4 | 19 | 6.9 | 6.9 |
| 15..... | 2.2 | .8 | .8 | .85 | .7 | 1.4 | 5.2 | 5.2 | 9.3 | 15.4 | 6.9 | 15.1 |
| 16..... | 2.2 | .8 | .65 | .8 | .75 | 1.4 | 5.2 | 5.2 | 33 | 9.3 | 5.2 | 9.3 |
| 17..... | 2.2 | .8 | .65 | .8 | .75 | 1.4 | 3.4 | 6.9 | 28 | 6.9 | 5.2 | 9.3 |
| 18..... | 2.2 | .8 | .65 | .8 | .75 | 1.4 | 3.4 | 5.2 | 11.7 | 5.2 | 5.2 | 6.9 |
| 19..... | 2.2 | .8 | .65 | .8 | .7 | 1.4 | 3.4 | 6.9 | 9.3 | 5.2 | 5.2 | 5.2 |
| 20..... | 1.3 | .8 | .65 | .8 | .7 | 2.2 | 6.9 | 116 | 6.9 | 5.2 | 3.4 | 5.2 |
| 21..... | 1.3 | .8 | .6 | .8 | .75 | 3.4 | 3.4 | 38 | 5.2 | 5.2 | 3.4 | 5.2 |
| 22..... | 1.3 | 3.4 | .6 | .8 | .75 | 3.4 | 9.3 | 11.7 | 5.2 | 5.2 | 3.4 | 5.2 |
| 23..... | 2.2 | .8 | .6 | .8 | .8 | 3.4 | 5.2 | 9.3 | 5.2 | 5.2 | 5.2 | 5.2 |
| 24..... | 2.2 | .8 | .6 | .8 | 1.0 | 2.2 | 5.2 | 6.9 | 5.2 | 3.4 | 3.4 | 3.4 |
| 25..... | 2.2 | .8 | .6 | .8 | .8 | 2.2 | 5.2 | 5.2 | 85 | 3.4 | 3.4 | 3.4 |
| 26..... | 1.3 | .8 | .6 | .8 | 1.0 | 2.2 | 5.2 | 5.2 | 19 | 3.4 | 3.4 | 3.4 |
| 27..... | 1.3 | .8 | .6 | .8 | .9 | 2.2 | 3.4 | 3.4 | 9.3 | 3.4 | 5.2 | 3.4 |
| 28..... | 1.3 | .8 | .65 | .8 | 1.0 | 2.2 | 3.4 | 5.2 | 6.9 | 3.4 | 19 | 3.4 |
| 29..... | 1.3 | .8 | .6 | .8 | 1.7 | 2.2 | 3.4 | ----- | 5.2 | 5.2 | 6.9 | 3.4 |
| 30..... | 1.3 | .8 | .6 | .85 | 6.9 | 2.2 | 5.2 | ----- | 6.9 | 15.4 | 5.2 | 3.4 |
| 31..... | 1.3 | .8 | ----- | .8 | ----- | 2.2 | 5.2 | ----- | 6.9 | ----- | 5.2 | ----- |

Monthly discharge of Hoolawaliili Stream near Huelo, Maui, for the year ending June 30, 1918.

| Month. | Discharge. | | | | Total run-off. | |
|----------------|--------------------------|----------|-------|---------------------|------------------|------------|
| | Million gallons per day. | | | Second feet (mean). | Million gallons. | Acre-feet. |
| | Maximum. | Minimum. | Mean. | | | |
| July..... | 3.2 | 1.3 | 2.03 | 3.14 | 62 | 193 |
| August..... | 3.4 | .8 | .96 | 1.49 | 30 | 91 |
| September..... | .8 | .6 | .71 | 1.10 | 21 | 65 |
| October..... | .85 | .55 | .73 | 1.13 | 23 | 69 |
| November..... | 6.9 | .7 | 1.03 | 1.59 | 31 | 95 |
| December..... | 3.4 | 1.4 | 1.89 | 2.92 | 59 | 180 |
| January..... | 9.3 | 2.2 | 4.28 | 6.62 | 133 | 407 |
| February..... | 116 | 2.2 | 14.7 | 22.7 | 411 | 1,260 |
| March..... | 96 | 5.2 | 17.4 | 26.9 | 538 | 1,660 |
| April..... | 235 | 3.4 | 38.8 | 60.0 | 1,160 | 3,570 |
| May..... | 19 | 3.4 | 5.99 | 9.27 | 186 | 570 |
| June..... | 33 | 2.2 | 6.02 | 9.31 | 181 | 554 |
| The year..... | 285 | .55 | 7.78 | 12.0 | 2,840 | 8,710 |

HOOLOWANUI 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, 1918.

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 pool composed of boulders; probably permanent.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 5.05 feet at 9.45 a. m. April 3 (discharge, about 400 million gallons per day, or 620 second-feet); minimum stage recorded, -0.19 foot October 26 (discharge, 0.15 million gallons per day, or 0.2 second-foot.).

1910-1918: Maximum stage recorded, 5.4 feet at 11.30 p. m. May 1, 1916 (discharge, computed from extension of rating curve, about 440 million gallons per day, or 680 second-feet); minimum stage recorded October 26, 1917.

DIVERSIONS.—None.

REGULATION.—None.

ACCURACY.—Stage-discharge relation practically permanent. Rating curve well defined between 2 and 60 million gallons per day. Operation of water-stage recorder satisfactory except July 9-22 and July 29 to August 23; discharge for these periods estimated from records of flow of neighboring streams. Records good between 2 and 60 million gallons per day, poor below 2 and above 60 million gallons per day.

Discharge measurements of Hoolawanui Stream near Huelo, Maui, during the year ending June 30, 1918.

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

| Date. | Gage height (feet). | Discharge. | |
|--------------|---------------------|--------------|--------------------------|
| | | Second-feet. | Million gallons per day. |
| Sept. 4..... | -0.10 | | 0.5 |
| Mar. 7..... | .67 | 0.8 | 10 |
| May 17..... | .53 | 10.8 | 7.0 |

Daily discharge, in million gallons, of Hoolawanui Stream near Huelo, Maui, for the year ending June 30, 1918.

| Day. | July. | Aug. | Sept. | Oct. | Nov. | Dec. | Jan. | Feb. | Mar. | Apr. | May. | June. |
|---------|-------|------|-------|------|-------|------|------|-------|------|-------|------|-------|
| 1..... | 1.8 | 0.8 | 0.5 | 0.4 | 0.35 | 5.0 | 2.2 | 5.9 | 10 | 12 | 7.9 | 6.8 |
| 2..... | 1.8 | .8 | .5 | .4 | .5 | 2.8 | 1.4 | 4.2 | 19 | 88 | 6.8 | 5.9 |
| 3..... | 1.8 | .8 | .5 | .35 | .5 | 2.2 | 3.4 | 3.4 | 23 | 166 | 6.8 | 5.0 |
| 4..... | 2.2 | .75 | .5 | .3 | .7 | 1.8 | 3.4 | 2.8 | 35 | 42 | 13 | 4.2 |
| 5..... | 3.4 | .75 | .5 | .3 | .65 | 1.8 | 2.2 | 2.8 | 23 | 37 | 7.9 | 4.2 |
| 6..... | 2.2 | .75 | .5 | .3 | .5 | 1.4 | 2.2 | 2.8 | 13 | 67 | 6.8 | 4.2 |
| 7..... | 1.8 | .75 | .5 | .3 | 2.0 | 1.4 | 1.8 | 2.8 | 12 | 35 | 5.9 | 3.4 |
| 8..... | 1.8 | .75 | .5 | .3 | .8 | 1.1 | 3.4 | 4.2 | 10 | 26 | 5.0 | 3.4 |
| 9..... | 1.8 | .75 | .5 | .3 | .65 | 1.1 | 5.0 | 80 | 7.9 | 88 | 5.0 | 4.2 |
| 10..... | 1.8 | .65 | .5 | .35 | .6 | 1.1 | 2.2 | 30 | 14 | 171 | 9.0 | 5.9 |
| 11..... | 1.8 | .65 | .5 | .4 | .5 | 1.1 | 21 | 28 | 67 | 58 | 5.0 | 7.9 |
| 12..... | 2.2 | .65 | .6 | .35 | .4 | 1.1 | 5.9 | 30 | 44 | 28 | 14 | 24 |
| 13..... | 2.2 | 1.1 | .5 | .3 | .4 | 1.4 | 4.2 | 16 | 23 | 19 | 23 | 10 |
| 14..... | 1.8 | 1.1 | .5 | .4 | .4 | 1.8 | 3.4 | 10 | 18 | 28 | 10 | 7.9 |
| 15..... | 1.8 | .8 | .5 | .65 | .3 | 1.4 | 5.0 | 7.9 | 13 | 23 | 9.0 | 24 |
| 16..... | 1.8 | .75 | .5 | .6 | .3 | 1.1 | 9.0 | 6.8 | 24 | 14 | 9.0 | 16 |
| 17..... | 1.8 | .65 | .5 | .35 | .3 | 1.1 | 4.2 | 12 | 21 | 12 | 7.9 | 14 |
| 18..... | 1.8 | .65 | .5 | .3 | .3 | 1.1 | 4.2 | 5.9 | 13 | 10 | 6.8 | 10 |
| 19..... | 1.4 | .5 | .5 | .3 | .3 | .9 | 3.4 | 14 | 10 | 7.9 | 5.9 | 7.9 |
| 20..... | 1.4 | .5 | .5 | .3 | .3 | 2.8 | 10 | 91 | 7.9 | 7.9 | 5.0 | 7.9 |
| 21..... | 1.1 | .5 | .45 | .3 | .3 | 4.2 | 4.2 | 37 | 6.8 | 6.8 | 5.0 | 6.8 |
| 22..... | 1.1 | 1.8 | .4 | .2 | .5 | 6.8 | 5.9 | 19 | 5.9 | 7.9 | 5.0 | 7.9 |
| 23..... | 1.2 | 1.1 | .5 | .2 | 1.1 | 5.0 | 5.0 | 13 | 5.0 | 5.9 | 5.0 | 6.8 |
| 24..... | .85 | .7 | .4 | .2 | 2.2 | 2.2 | 5.0 | 10 | 9.0 | 5.0 | 6.8 | 5.9 |
| 25..... | .8 | .65 | .5 | .2 | .8 | 1.8 | 4.2 | 7.9 | 74 | 5.0 | 10 | 5.9 |
| 26..... | .8 | .65 | .6 | .15 | 1.1 | 1.8 | 3.4 | 6.8 | 23 | 4.2 | 5.0 | 5.9 |
| 27..... | .75 | .55 | .5 | .2 | .8 | 1.8 | 3.4 | 5.9 | 14 | 5.0 | 6.8 | 5.0 |
| 28..... | .75 | .5 | .65 | .4 | .8 | 1.8 | 2.8 | 13 | 10 | 5.0 | 37 | 4. |
| 29..... | .75 | .5 | .6 | .5 | 4.2 | 1.8 | 3.4 | ----- | 7.9 | 7.9 | 14 | 4.2 |
| 30..... | .75 | .5 | .5 | .6 | 19 | 1.4 | 7.9 | ----- | 9.0 | 19 | 10 | 4.2 |
| 31..... | .75 | .5 | ----- | .4 | ----- | 1.4 | 5.9 | ----- | 10 | ----- | 7.9 | ----- |

Monthly discharge of Hoolawanui Stream near Huelo, Maui, for the year ending June 30, 1918.

| Month. | Discharge. | | | | Total run-off. | |
|----------------|--------------------------|----------|-------|--------------------|------------------|------------|
| | Million gallons per day. | | | Second-foot (mean) | Million gallons. | Acre-feet. |
| | Maximum. | Minimum. | Mean. | | | |
| July..... | 3.4 | 0.75 | 1.55 | 2.40 | 48 | 147 |
| August..... | 1.8 | .5 | .74 | 1.14 | 23 | 70 |
| September..... | .65 | .4 | .50 | .77 | 15 | 46 |
| October..... | .65 | .15 | .34 | .53 | 11 | 32 |
| November..... | 19 | .3 | 1.38 | 2.14 | 42 | 127 |
| December..... | 6.8 | .9 | 2.05 | 3.17 | 64 | 195 |
| January..... | 21 | 1.4 | 4.79 | 7.41 | 149 | 456 |
| February..... | 91 | 2.8 | 16.9 | 26.1 | 473 | 1,450 |
| March..... | 74 | 5.0 | 18.8 | 29.1 | 582 | 1,790 |
| April..... | 171 | 4.2 | 33.7 | 52.1 | 1,010 | 3,100 |
| May..... | 37 | 5.0 | 9.1 | 14.1 | 282 | 866 |
| June..... | 24 | 3.4 | 7.79 | 12.2 | 234 | 717 |
| The year..... | 171 | .15 | 8.04 | 12.4 | 2,930 | 9,000 |

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, 1918.

GAGE.—Stevens water-stage recorder, installed June 19, 1914, at same site 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 year, 3.55 feet at 8 a. m. April 3 and at 12.01 a. m. April 10 (discharge, about 152 million gallons per day, or 236 second-feet); minimum stage recorded, 0.05 foot September, October, and November (discharge, 0.2 million gallon per day, or 0.3 second-foot).

1910-1918: Maximum stage recorded, 3.7 feet at 10 p. m. May 1, 1916 (discharge, computed from extension of rating curve, about 160 million gallons per day, or 248 second-feet); minimum stage recorded in September, October, and November, 1917.

DIVERSIONS.—None.

REGULATION.—None.

UTILIZATION.—Ordinary flow is diverted by ditches of East Maui Irrigation Co. for irrigation of sugar cane.

ACCURACY.—Stage-discharge relation practically permanent. Rating curve fairly well defined between 2 and 6 million gallons per day. Operation of water-stage recorder satisfactory, except May 8-12, for which discharge was estimated from flow of neighboring streams. Records fair between 2 and 6 million gallons per day; poor below 2 and above 6 million gallons per day.

Discharge measurements of Honopou Stream near Huelo, Maui, during the year ending June 30, 1918.

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

| Date. | Gage height (feet). | Discharge. | |
|--------------|---------------------|--------------|--------------------------|
| | | Second-foot. | Million gallons per day. |
| Sept. 4..... | 0.08 | 0.4 | 0.25 |
| Jan. 25..... | .33 | 3.6 | 2.3 |
| May 13..... | .50 | 9.6 | 6.2 |

Daily discharge, in million gallons, of Honopou Stream near Huelo, Maui, for the year ending June 30, 1918.

| Day. | July. | Aug. | Sept. | Oct. | Nov. | Dec. | Jan. | Feb. | Mar. | Apr. | May. | June. |
|---------|-------|------|-------|------|-------|------|------|-------|------|-------|------|-------|
| 1..... | 0.5 | 0.8 | 0.5 | 0.5 | 0.5 | 2.4 | 1.8 | 2.4 | 3.8 | 6.5 | 3.0 | 3.0 |
| 2..... | .5 | .8 | .5 | .5 | .5 | 1.3 | 1.3 | 2.4 | 5.5 | 32 | 2.4 | 3.0 |
| 3..... | .5 | .8 | .5 | .5 | .5 | 1.3 | 3.8 | 1.8 | 4.6 | 56 | 2.4 | 3.0 |
| 4..... | .8 | .5 | .5 | .5 | .5 | 1.3 | 3.8 | 1.8 | 9.5 | 15 | 5.5 | 2.4 |
| 5..... | 1.3 | .5 | .5 | .5 | .5 | .8 | 1.8 | 1.8 | 7.5 | 15 | 3.0 | 2.4 |
| 6..... | .8 | .5 | .5 | .2 | .5 | .8 | 1.8 | 1.8 | 5.5 | 34 | 2.4 | 2.4 |
| 7..... | .5 | .5 | .5 | .2 | .8 | .8 | 1.3 | 1.3 | 4.6 | 20 | 2.4 | 2.4 |
| 8..... | .5 | .5 | .5 | .2 | .5 | .8 | 1.8 | 1.3 | 4.6 | 14 | 2.4 | 2.4 |
| 9..... | .5 | .5 | .5 | .2 | .5 | .8 | 2.4 | 26 | 3.8 | 42 | 1.8 | 2.4 |
| 10..... | .5 | .5 | .5 | .2 | .5 | .8 | 1.8 | 11 | 6.5 | 75 | 5.5 | 3.8 |
| 11..... | .5 | .5 | .5 | .2 | .2 | .8 | 6.5 | 8.5 | 26 | 32 | 2.4 | 3.8 |
| 12..... | .8 | .5 | .2 | .2 | .2 | .8 | 3.8 | 11 | 20 | 17 | 4.6 | 14 |
| 13..... | .8 | .8 | .2 | .2 | .2 | .5 | 2.4 | 6.5 | 11 | 12 | 5.5 | 6.5 |
| 14..... | .5 | .8 | .2 | .2 | .2 | .8 | 3.4 | 5.5 | 8.5 | 14 | 4.6 | 4.6 |
| 15..... | .5 | .5 | .2 | .5 | .2 | .8 | 3.0 | 4.6 | 7.5 | 12 | 3.8 | 11 |
| 16..... | .5 | .5 | .2 | .5 | .2 | .8 | 3.8 | 3.8 | 13 | 8.5 | 3.8 | 7.5 |
| 17..... | .5 | .5 | .2 | .2 | .2 | .8 | 2.4 | 6.5 | 11 | 6.5 | 3.0 | 7.5 |
| 18..... | .5 | .5 | .2 | .2 | .2 | .8 | 3.0 | 7.5 | 7.5 | 5.5 | 3.0 | 5.5 |
| 19..... | .5 | .5 | .2 | .2 | .2 | .8 | 2.4 | 6.5 | 6.5 | 4.6 | 2.4 | 5.5 |
| 20..... | .5 | .5 | .2 | .2 | .2 | 3.0 | 6.5 | 40 | 5.5 | 3.8 | 2.4 | 4.6 |
| 21..... | .5 | .5 | .2 | .2 | .2 | 2.4 | 3.0 | 17 | 4.6 | 3.8 | 1.8 | 4.6 |
| 22..... | .5 | 2.4 | .2 | .2 | .5 | 3.0 | 7.5 | 9.5 | 3.8 | 3.8 | 1.8 | 4.6 |
| 23..... | .8 | .5 | .2 | .2 | .8 | 3.0 | 3.8 | 7.5 | 3.0 | 3.0 | 2.4 | 3.8 |
| 24..... | .8 | .5 | .2 | .2 | 1.8 | 1.8 | 3.8 | 5.5 | 6.5 | 2.4 | 2.4 | 3.0 |
| 25..... | .8 | .5 | .2 | .2 | .8 | 1.8 | 3.8 | 4.6 | 28 | 1.8 | 2.4 | 3.8 |
| 26..... | .8 | .5 | .5 | .2 | .8 | 1.3 | 2.4 | 3.8 | 11 | 1.8 | 1.8 | 3.8 |
| 27..... | .5 | .5 | .5 | .2 | .8 | 1.3 | 2.4 | 3.8 | 7.5 | 1.8 | 2.4 | 3.0 |
| 28..... | .5 | .5 | .5 | .2 | .8 | 1.3 | 1.8 | 3.8 | 6.5 | 1.3 | 14 | 3.0 |
| 29..... | .5 | .5 | .5 | .5 | 2.4 | 1.3 | 2.4 | ..... | 5.5 | 3.0 | 5.5 | 3.0 |
| 30..... | .5 | .5 | .5 | .5 | 5.5 | 1.3 | 3.0 | ..... | 5.5 | 7.5 | 4.6 | 3.0 |
| 31..... | .8 | .5 | ..... | .5 | ..... | 1.3 | 2.4 | ..... | 6.5 | ..... | 3.8 | ..... |

Monthly discharge of Honopou Stream near Huelo, Maui, for the year ending June 30, 1918.

| Month. | Discharge. | | | | Total run-off. | |
|----------------|--------------------------|----------|-------|---------------------|------------------|------------|
| | Million gallons per day. | | | Second foot (mean). | Million gallons. | Acre-feet. |
| | Maximum. | Minimum. | Mean. | | | |
| July..... | 1.3 | 0.5 | 0.61 | 0.94 | 19 | 58 |
| August..... | 2.4 | .5 | .61 | .94 | 19 | 58 |
| September..... | .5 | .2 | .36 | .56 | 11 | 33 |
| October..... | .5 | .2 | .30 | .46 | 9 | 29 |
| November..... | 5.5 | .2 | .72 | 1.11 | 22 | 66 |
| December..... | 3.0 | .5 | 1.32 | 2.04 | 41 | 126 |
| January..... | 7.5 | 1.3 | 3.02 | 4.67 | 94 | 287 |
| February..... | 40 | 1.3 | 7.25 | 11.2 | 203 | 623 |
| March..... | 28 | 3.0 | 8.41 | 13.0 | 261 | 800 |
| April..... | 75 | 1.3 | 15.2 | 23.5 | 456 | 1,400 |
| May..... | 14 | 1.8 | 3.52 | 5.45 | 109 | 335 |
| June..... | 14 | 2.4 | 4.44 | 6.87 | 133 | 409 |
| The year..... | 75 | .2 | 3.77 | 5.83 | 1,380 | 4,220 |

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, 1918.

GAGE.—Friez water-stage recorder.

DISCHARGE MEASUREMENTS.—Made by 25-foot Cippoletti weir.

CHANNEL AND CONTROL.—Large pool at weir.

EXTREMES OF DISCHARGE.—See monthly discharge table.

DIVERSION.—None.

REGULATION.—By gates at frequent intervals.

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 New Hamakua ditch at Halehaku weir, near Huelo, Maui, for the year ending June 30, 1918.

| Day. | July. | Aug. | Nov. | Dec. | Jan. | Feb. | Mar. | Apr. | May. | June. |
|------|-------|-------|-------|------|------|-------|------|-------|------|-------|
| 1. | 42.9 | 22.7 | ----- | 67.5 | 41.5 | 20.0 | 46.7 | 56.2 | 69.8 | 68.7 |
| 2. | 39.2 | 29.5 | ----- | 64.8 | 35.3 | 15.7 | 47.4 | 56.9 | 70.6 | 68.7 |
| 3. | 34.4 | 28.3 | ----- | 64.4 | 35.1 | 14.5 | 45.3 | 56.3 | 70.5 | 65.0 |
| 4. | 41.8 | 20.6 | ----- | 64.1 | 68.6 | 13.7 | 46.9 | 54.1 | 71.6 | 60.4 |
| 5. | 52.4 | 15.7 | ----- | 58.3 | 61.5 | 14.2 | 46.1 | 56.1 | 70.7 | 56.4 |
| 6. | 56.2 | 16.3 | ----- | 48.7 | 43.6 | 17.2 | 44.8 | 56.2 | 67.6 | 53.4 |
| 7. | 38.3 | 19.3 | ----- | 42.2 | 35.7 | 16.5 | 66.6 | 56.1 | 67.1 | 49.7 |
| 8. | 33.2 | 17.9 | ----- | 38.5 | 48.3 | 16.0 | 56.5 | 56.2 | 68.9 | 48.1 |
| 9. | 30.6 | 22.5 | ----- | 32.3 | 70.3 | 62.4 | 56.5 | 56.8 | 68.0 | 49.9 |
| 10. | 38.5 | 22.2 | ----- | 28.9 | 54.7 | 62.0 | 56.9 | 55.8 | 72.6 | 57.7 |
| 11. | 29.1 | 20.3 | ----- | 28.0 | 67.7 | 57.8 | 57.2 | 55.8 | 68.8 | 68.2 |
| 12. | 22.9 | 25.9 | ----- | 32.1 | 69.9 | 61.5 | 56.2 | 55.3 | 70.2 | 69.1 |
| 13. | 21.0 | 39.5 | ----- | 47.2 | 62.8 | 49.8 | 56.2 | 26.4 | 69.6 | 69.0 |
| 14. | 20.7 | 38.0 | ----- | 50.8 | 52.0 | 42.7 | 56.2 | 12.7 | 68.8 | 69.0 |
| 15. | 22.6 | 23.1 | ----- | 56.2 | 35.9 | 35.0 | 56.2 | 54.0 | 69.2 | 69.3 |
| 16. | 24.2 | 18.5 | ----- | 43.8 | 56.6 | 30.7 | 56.2 | 47.3 | 68.9 | 68.2 |
| 17. | 23.1 | 17.2 | ----- | 36.8 | 54.3 | 48.8 | 56.2 | 41.9 | 68.9 | 69.0 |
| 18. | 20.3 | 8.0 | ----- | 28.3 | 42.4 | 33.0 | 56.2 | 38.5 | 68.8 | 69.0 |
| 19. | 19.7 | ----- | ----- | 26.8 | 44.0 | 44.7 | 56.2 | 51.6 | 68.6 | 68.5 |
| 20. | 18.1 | ----- | ----- | 51.1 | 63.6 | 71.3 | 56.2 | 55.7 | 68.8 | 68.7 |
| 21. | 17.7 | ----- | ----- | 52.6 | 50.9 | 45.5 | 55.9 | 56.1 | 68.1 | 68.9 |
| 22. | 22.3 | 1.7 | ----- | 70.2 | 50.9 | 44.7 | 56.1 | 56.0 | 70.9 | 69.2 |
| 23. | 39.1 | ----- | ----- | 69.8 | 65.6 | 38.4 | 55.8 | 56.9 | 69.1 | 69.0 |
| 24. | 35.8 | ----- | 15.4 | 64.3 | 57.3 | 32.3 | 56.2 | 60.1 | 69.4 | 69.0 |
| 25. | 25.0 | ----- | 59.2 | 59.4 | 45.9 | 28.1 | 56.9 | 57.0 | 69.4 | 59.3 |
| 26. | 22.3 | ----- | 61.3 | 43.4 | 43.4 | 26.2 | 56.2 | 58.5 | 68.6 | 68.4 |
| 27. | 20.9 | ----- | 60.4 | 36.7 | 45.5 | 23.7 | 56.2 | 64.7 | 69.1 | 68.9 |
| 28. | 31.5 | ----- | 56.2 | 35.2 | 42.2 | 35.2 | 56.2 | 66.4 | 70.7 | 68.4 |
| 29. | 20.9 | ----- | 61.1 | 34.5 | 27.7 | ----- | 56.2 | 69.8 | 68.5 | 67.2 |
| 30. | 19.6 | ----- | 69.4 | 34.8 | 26.1 | ----- | 56.2 | 72.8 | 69.0 | 69.1 |
| 31. | 20.2 | ----- | ----- | 34.5 | 19.3 | ----- | 56.2 | ----- | 68.8 | ----- |

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

Monthly discharge of New Hamakua ditch at Halehaku weir, near Huelo, Maui, for the year ending June 30, 1918.

| Month. | Discharge. | | | | Total run-off. | |
|--------------------|--------------------------|----------|-------|---------------------|------------------|------------|
| | Million gallons per day. | | | Second-foot (mean). | Million gallons. | Acre-foot. |
| | Maximum. | Minimum. | Mean. | | | |
| July. | 42.9 | 17.7 | 29.2 | 45.2 | 904 | 2,780 |
| August (19 days). | 39.5 | 1.7 | 21.4 | 33.1 | 407 | 1,250 |
| November (7 days). | 69.4 | 15.4 | 54.7 | 84.6 | 383 | 1,180 |
| December. | 70.2 | 26.8 | 46.6 | 72.1 | 1,450 | 4,430 |
| January. | 70.3 | 19.3 | 49.0 | 75.8 | 1,520 | 4,660 |
| February. | 71.3 | 13.7 | 35.8 | 55.4 | 1,000 | 3,080 |
| March. | 66.6 | 44.8 | 54.7 | 84.6 | 1,690 | 5,200 |
| April. | 72.8 | 12.8 | 53.3 | 82.5 | 1,600 | 4,910 |
| May. | 72.6 | 67.1 | 69.3 | 107 | 2,150 | 6,590 |
| June. | 69.3 | 48.1 | 65.1 | 101 | 1,950 | 5,990 |
| The year. | ----- | ----- | ----- | ----- | 13,100 | 40,100 |

NEW HAMAKUA DITCH AT HONOPOU, NEAR HUELO, MAUI.

LOCATION.—300 feet below Honopou Stream crossing and about $7\frac{1}{2}$ miles by road and trail west of Huelo.

RECORDS AVAILABLE.—January 25 to June 30, 1918.

GAGE.—Stevens water-stage recorder.

DISCHARGE MEASUREMENTS.—Made from plank at gage.

CHANNEL AND CONTROL.—Sides and bottom of ditch, hardpan and fairly smooth; banks steep; straight for 75 feet above and 25 feet below gage. No well defined control; stage-discharge may be affected by collection of mud and gravel on bottom of ditch.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 4.57 feet at 8.45 a. m. May 28 (discharge, 96 millions gallons per day, or 149 second-feet); minimum stage recorded, 1.0 foot February 4 (discharge, 12 million gallons per day, or 19 second-feet).

DIVERSIONS.—Ditch receives greater part of flow of Koolau ditch at Alo division weir, and diverts water from streams west of that point.

REGULATION.—By gates at frequent intervals.

UTILIZATION.—For irrigation of sugar cane.

ACCURACY.—Stage-discharge relation practically permanent prior to April 2, when a slide occurred in the ditch below gage causing backwater. Rating curve January 25 to April 1 well defined; April 2 to June 30 fairly well defined. Operation of water-stage recorder satisfactory. Records prior to April 2 good; April 2 to June 30 fair.

Discharge measurements of New Hamakua ditch at Honopou, near Huelo, Maui, during the year ending June 30, 1918.

[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. |
| Oct. 9..... | 0.85 | 15.0 | 9.7 | Mar. 8..... | 3.89 | 117 | 77 |
| Jan. 25..... | 3.72 | 111 | 72 | May 10..... | 4.28 | 116 | 76 |

Daily discharge, in million gallons, of New Hamakua ditch at Honopou, near Huelo, Maui, for the year ending June 30, 1918.

| Day. | Jan. | Feb. | Mar. | Apr. | May. | June. | Day. | Jan. | Feb. | Mar. | Apr. | May. | June. |
|---------|------|------|------|------|------|-------|---------|------|------|------|------|------|-------|
| 1..... | | 18 | 69 | 78 | 70 | 75 | 16..... | | 29 | 80 | 54 | 75 | 76 |
| 2..... | | 14 | 80 | 70 | 70 | 74 | 17..... | | 46 | 78 | 50 | 75 | 76 |
| 3..... | | 13 | 69 | 70 | 70 | 68 | 18..... | | 33 | 78 | 43 | 74 | 75 |
| 4..... | | 12 | 80 | 59 | 74 | 62 | 19..... | | 44 | 76 | 51 | 74 | 75 |
| 5..... | | 13 | 77 | 68 | 70 | 59 | 20..... | | 80 | 72 | 66 | 70 | 74 |
| 6..... | | 16 | 58 | 70 | 68 | 55 | 21..... | | 72 | 68 | 66 | 68 | 72 |
| 7..... | | 15 | 78 | 69 | 70 | 52 | 22..... | | 49 | 66 | 67 | 72 | 74 |
| 8..... | | 14 | 77 | 68 | 72 | 51 | 23..... | | 38 | 60 | 62 | 69 | 74 |
| 9..... | | 74 | 77 | 72 | 67 | 61 | 24..... | | 32 | 62 | 61 | 70 | 72 |
| 10..... | | 60 | 78 | 74 | 75 | 75 | 25..... | 74 | 26 | 82 | 62 | 75 | 72 |
| 11..... | | 56 | 82 | 68 | 74 | 75 | 26..... | 60 | 26 | 80 | 61 | 75 | 72 |
| 12..... | | 61 | 80 | 36 | 74 | 78 | 27..... | 58 | 23 | 78 | 66 | 75 | 70 |
| 13..... | | 45 | 80 | 35 | 75 | 76 | 28..... | 44 | 44 | 76 | 66 | 78 | 70 |
| 14..... | | 40 | 78 | 61 | 75 | 75 | 29..... | 24 | | 72 | 68 | 76 | 69 |
| 15..... | | 35 | 77 | 64 | 75 | 76 | 30..... | 23 | | 75 | 69 | 76 | 69 |
| | | | | | | | 31..... | 17 | | 77 | | 75 | |

Monthly discharge of New Hamakua ditch at Honopou, near Huelo, Maui, for the year ending June 30, 1918.

| Month. | Discharge. | | | | Total run-off. | |
|--------------------|--------------------------|----------|-------|---------------------|------------------|------------|
| | Million gallons per day. | | | Second-foot (mean). | Million gallons. | Acre-feet. |
| | Maximum. | Minimum. | Mean. | | | |
| January 25-31..... | 74 | 17 | 42.9 | 66.4 | 300 | 922 |
| February..... | 80 | 12 | 36.7 | 56.8 | 1,030 | 3,150 |
| March..... | 82 | 58 | 74.8 | 116 | 2,320 | 7,120 |
| April..... | 78 | 43 | 62.5 | 96.7 | 1,870 | 5,750 |
| May..... | 78 | 67 | 72.8 | 113 | 2,260 | 6,930 |
| June..... | 78 | 51 | 70.1 | 108 | 2,100 | 6,450 |
| The period..... | | | | | 9,880 | 30,300 |

OLD HAMAKUA DITCH AT HONOPOU, NEAR HUELO, MAUI.

LOCATION.—250 feet below intake in Honopou Stream and 7 miles by road and trail west of Huelo.

RECORDS AVAILABLE.—January 25 to June 30, 1918.

GAGE.—Stevens water-stage recorder.

DISCHARGE MEASUREMENTS.—Made from plank at gage.

CHANNEL AND CONTROL.—Sides and bottom of ditch are of hardpan with small amount of rock and gravel; banks high and steep; straight for 250 feet above and 150 feet below gage. Control is concrete slab 12 inches thick rising 4 inches above bed of ditch, 5 feet below gage.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 3.17 feet at 6.15 p. m. March 11 (discharge, 60 million gallons per day, or 93 second-feet); minimum stage recorded, ditch occasionally dry.

DIVERSIONS.—Ditch heads at Naililihaele Stream and picks up water from streams west of that point.

REGULATION.—By gates at frequent intervals.

UTILIZATION.—For irrigation of sugar cane.

ACCURACY.—Stage-discharge relation practically permanent. Rating curve well defined. Operation of water-stage recorder satisfactory except February 22-27, clock stopped; discharge estimated from maximum and minimum pencil record at 1.0 million gallons per day. Records good.

Discharge measurements of Old Hamakua ditch at Honopou, near Huelo, Maui, during the year ending June 30, 1918.

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

| Date. | Gage height (feet). | Discharge. | |
|--------------|---------------------|--------------|--------------------------|
| | | Second-feet. | Million gallons per day. |
| Jan. 25..... | 0.92 | 6.6 | 4.3 |
| Mar. 8..... | 2.07 | 40 | 26 |
| May 13..... | 2.13 | 41 | 27 |

Daily discharge in million gallons of Old Hamakua ditch at Honopou, near Huelo, Maui, for the year ending June 30, 1918.

| Day. | Jan. | Feb. | Mar. | Apr. | May. | June. | Day. | Jan. | Feb. | Mar. | Apr. | May. | June. |
|------|------|------|------|------|------|-------|------|------|------|------|------|------|-------|
| 1. | | 0.6 | 8.0 | 28 | 17 | 8.8 | 16. | | 1.0 | 36 | 1.0 | 21 | 32 |
| 2. | | .6 | 12 | 34 | 11 | 5.2 | 17. | | 2.7 | 29 | .8 | 18 | 34 |
| 3. | | .8 | 1.3 | 30 | 14 | 2.0 | 18. | | 1.0 | 28 | .8 | 13 | 25 |
| 4. | | .6 | 16 | 20 | 28 | 1.0 | 19. | | 4.6 | 22 | 1.6 | 7.2 | 17 |
| 5. | | .6 | 10.3 | 13 | 19 | 1.0 | 20. | | 29 | 13 | 5.8 | 2.3 | 12 |
| 6. | | .6 | 1.6 | 24 | 16 | .8 | 21. | | 14 | 5.8 | 5.8 | 2.0 | 13 |
| 7. | | .6 | 28 | 19 | 9.6 | 1.0 | 22. | | | 2.7 | 16 | 4.6 | 18 |
| 8. | | .8 | 27 | 12 | 3.1 | .8 | 23. | | | 1.0 | 2.0 | 4.6 | 18 |
| 9. | | 34 | 29 | 28 | 3.1 | 1.0 | 24. | | | 4.6 | 2.3 | 5.8 | 10 |
| 10. | | 7.2 | 40 | 28 | 22 | 22 | 25. | 6.5 | | 32 | 2.0 | 18 | 11 |
| 11. | | 4.1 | 52 | 20 | 5.8 | 26 | 26. | 1.0 | | 27 | 2.0 | 8.0 | 13 |
| 12. | | 5.8 | 34 | 26 | 28 | 34 | 27. | | | 26 | 16 | 20 | 10 |
| 13. | | 1.3 | 32 | 14 | 27 | 30 | 28. | .6 | 5.8 | 20 | 16 | 28 | 10 |
| 14. | | 1.3 | 34 | 8.8 | 22 | 21 | 29. | .6 | | 11 | 26 | 27 | 8.0 |
| 15. | | 1.0 | 29 | 3.1 | 22 | 29 | 30. | .8 | | 16 | 28 | 19 | 9.6 |
| | | | | | | | 31. | .6 | | 27 | | 12 | |

Monthly discharge of Old Hamakua ditch at Honopou, near Huelo, Maui, for the year ending June 30, 1918.

| Month. | Discharge. | | | | Total run-off. | |
|--------------------|--------------------------|----------|-------|---------------------|------------------|------------|
| | Million gallons per day. | | | Second feet (mean). | Million gallons. | Acre-feet. |
| | Maximum. | Minimum. | Mean. | | | |
| January 25-31..... | 6.5 | 0.6 | 1.56 | 2.41 | 11 | 335 |
| February..... | 34 | .6 | 4.43 | 6.85 | 124 | 381 |
| March..... | 52 | 1.0 | 21.1 | 32.6 | 655 | 2,010 |
| April..... | 34 | .8 | 14.5 | 22.4 | 434 | 1,340 |
| May..... | 28 | 2.0 | 14.8 | 22.9 | 458 | 1,410 |
| June..... | 34 | .8 | 14.1 | 21.8 | 424 | 1,300 |
| The period..... | | | | | | 6,980 |

KAUHIKOA DITCH¹ 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 June 30, 1918.

GAGE.—Friez water-stage recorder.

DISCHARGE MEASUREMENTS.—By 25-foot sharp-crested weir.

CHANNEL AND CONTROL.—Large pool at weir.

EXTREMES OF DISCHARGE.—See monthly-discharge table.

DIVERSIONS.—None.

REGULATION.—By gates at frequent intervals.

UTILIZATION.—Irrigation of sugar cane.

ACCURACY.—Records good.

COOPERATION.—Daily-discharge record copied from records of East Maui Irrigation Co.

¹ New alinement of Old Hamakua ditch west of Halehaku Gulch.

Daily discharge, in million gallons, of Kauhikoa ditch at Opana weir, near Huelo, Maui, for the year ending June 30, 1918.

| Day. | July. | Aug. | Sept. | Oct. | Nov. | Dec. | Jan. | Feb. | Mar. |
|------|-------|------|-------|------|------|------|------|------|------|
| 1. | | | 13.6 | 12.4 | 10.1 | 15.3 | | 4.7 | |
| 2. | | | 12.7 | 8.6 | 21.2 | 2.8 | | 2.9 | |
| 3. | | | 12.2 | 7.6 | 24.9 | 1.0 | 8.8 | 2.2 | |
| 4. | | | 11.7 | 7.2 | 29.8 | .5 | 13.3 | 1.9 | |
| 5. | 1.0 | | 11.6 | 6.8 | 44.0 | .3 | 1.8 | 1.5 | |
| 6. | | .7 | 11.3 | 7.7 | 30.4 | .2 | | 1.3 | 1.9 |
| 7. | | | 11.2 | 9.3 | 47.8 | .1 | | 1.0 | 33.3 |
| 8. | | | 10.8 | 7.9 | 53.4 | | | .8 | |
| 9. | | | 10.7 | 7.0 | 51.3 | | | 82.7 | |
| 10. | | | 10.7 | 6.8 | 46.7 | | | 42.5 | |
| 11. | | | 10.8 | 7.8 | 32.1 | | 20.8 | 33.9 | |
| 12. | | | 11.4 | 7.7 | 18.8 | | 11.1 | 48.2 | |
| 13. | | | 15.6 | 6.8 | 14.8 | | 3.0 | 21.5 | |
| 14. | | | 13.7 | 9.5 | 13.6 | | 1.4 | 14.3 | |
| 15. | | | 10.9 | 24.2 | 13.0 | .3 | 1.8 | 10.4 | |
| 16. | | | 10.6 | 20.6 | 11.7 | | 13.7 | 8.5 | |
| 17. | | | 10.1 | 11.7 | 10.7 | | 3.5 | 23.4 | |
| 18. | | 7.6 | 9.4 | 8.8 | 9.8 | | .5 | 10.6 | |
| 19. | | 16.1 | 8.9 | 7.6 | 16.1 | | | 22.6 | |
| 20. | | 16.3 | 8.8 | 7.2 | 24.3 | 1.4 | 14.4 | 83.1 | |
| 21. | | 17.2 | 8.8 | 7.1 | 13.9 | 2.9 | 4.7 | 28.5 | |
| 22. | | 50.7 | 7.0 | 6.7 | 26.4 | 22.2 | 19.5 | | |
| 23. | | 58.5 | 8.3 | 6.4 | 53.5 | 14.8 | 11.4 | | |
| 24. | | 41.7 | 8.3 | 6.6 | 53.5 | 1.5 | 16.7 | | |
| 25. | | 29.3 | 8.2 | 6.0 | 2.7 | | 36.7 | | |
| 26. | | 21.1 | 11.2 | 5.6 | .2 | | 20.3 | | |
| 27. | | 18.4 | 12.9 | 5.2 | | | 15.0 | | |
| 28. | | 16.3 | 17.4 | 7.0 | | | 6.4 | | |
| 29. | | 15.1 | 14.7 | 13.0 | 5.7 | | 1.5 | | |
| 30. | | 14.2 | 15.8 | 26.5 | 47.5 | | 9.2 | | |
| 31. | | 14.2 | | 14.4 | | | 7.2 | | |

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

Monthly discharge of Kauhikoa ditch at Opana weir, near Huelo, Maui, for year ending June 30, 1918.

| Month. | Discharge. | | | | Total run-off. | |
|-------------------------|--------------------------|----------|-------|---------------------|------------------|------------|
| | Million gallons per day. | | | Second-feet (mean). | Million gallons. | Acre-feet. |
| | Maximum. | Minimum. | Mean. | | | |
| July (2 days)..... | 1.0 | 0.7 | 0.85 | 1.32 | 2 | 5 |
| August (14 days)..... | 58.5 | 7.6 | 24.0 | 37.1 | 337 | 1,030 |
| September..... | 17.4 | 7.0 | 11.3 | 17.5 | 339 | 1,040 |
| October..... | 26.5 | 5.2 | 9.60 | 14.9 | 298 | 913 |
| November (28 days)..... | 53.5 | .2 | 23.0 | 40.2 | 728 | 2,230 |
| December (13 days)..... | 22.2 | .1 | 4.87 | 7.54 | 63 | 194 |
| January (23 days)..... | 36.7 | .5 | 10.6 | 16.4 | 243 | 748 |
| February (21 days)..... | 83.1 | .8 | 21.3 | 33.0 | 446 | 1,370 |
| March (2 days)..... | 33.3 | 1.9 | 17.6 | 27.2 | 35 | 108 |
| The year..... | | | | | 2,490 | 7,640 |

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, 1918.

GAGE.—Friez water-stage recorder.

DISCHARGE MEASUREMENTS.—Made by sharp-crested weir 16½ feet long, with bottom and end contractions.

CHANNEL AND CONTROL.—Large pool back of weir.

EXTREMES OF DISCHARGE.—See monthly discharge table.

DIVERSIONS.—None.

REGULATION.—By gates at frequent intervals.

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, 1918.

| Day. | July. | Aug. | Sept. | Oct. | Nov. | Dec. | Jan. | Feb. | Mar. | Apr. | May. | June. |
|---------|-------|------|-------|------|-------|------|------|-------|------|-------|------|-------|
| 1..... | 45.2 | 31.7 | 15.1 | 13.1 | 9.3 | 53.5 | 42.4 | 36.5 | 35.7 | 57.9 | 56.9 | 57.9 |
| 2..... | 33.2 | 33.1 | 14.9 | 9.2 | 30.9 | 41.5 | 22.7 | 34.2 | 42.0 | 58.7 | 54.1 | 57.4 |
| 3..... | 37.5 | 22.8 | 14.2 | 8.7 | 32.6 | 55.1 | 35.6 | 25.5 | 41.6 | 55.4 | 57.3 | 55.0 |
| 4..... | 47.7 | 19.3 | 13.5 | 8.1 | 35.0 | 49.5 | 45.5 | 33.1 | 45.8 | 31.6 | 57.7 | 47.1 |
| 5..... | 46.4 | 20.7 | 12.9 | 7.7 | 33.9 | 51.3 | 53.8 | 32.8 | 46.5 | 24.1 | 57.7 | 39.4 |
| 6..... | 40.9 | 19.9 | 12.7 | 11.1 | 21.4 | 47.5 | 29.6 | 32.2 | 41.2 | 33.0 | 57.6 | 36.8 |
| 7..... | 33.8 | 24.0 | 13.2 | 9.7 | 41.7 | 42.3 | 27.2 | 35.2 | 58.6 | 33.9 | 57.9 | 38.4 |
| 8..... | 28.8 | 21.6 | 13.5 | 7.5 | 46.9 | 35.7 | 38.3 | 33.0 | 59.4 | 32.4 | 56.6 | 39.6 |
| 9..... | 32.2 | 29.7 | 12.9 | 7.3 | 49.2 | 36.0 | 54.1 | 51.8 | 58.5 | 33.9 | 48.6 | 37.3 |
| 10..... | 41.4 | 20.5 | 13.2 | 7.5 | 42.3 | 34.3 | 14.9 | 49.4 | 57.3 | 25.6 | 56.0 | 48.0 |
| 11..... | 26.2 | 25.3 | 11.4 | 11.8 | 27.9 | 34.6 | 45.0 | 43.5 | 58.3 | 15.3 | 58.1 | 57.4 |
| 12..... | 26.0 | 37.2 | 15.1 | 7.8 | 15.6 | 42.5 | 52.3 | 44.0 | 55.1 | 14.3 | 58.3 | 57.6 |
| 13..... | 24.8 | 47.6 | 21.5 | 7.0 | 16.8 | 56.7 | 35.1 | 42.9 | 57.7 | 12.8 | 58.4 | 57.3 |
| 14..... | 23.9 | 38.9 | 13.1 | 8.1 | 15.9 | 52.6 | 24.8 | 39.2 | 58.9 | 12.2 | 58.0 | 56.9 |
| 15..... | 30.5 | 21.3 | 12.7 | 22.0 | 15.1 | 53.5 | 21.1 | 40.4 | 57.7 | 12.0 | 58.1 | 57.3 |
| 16..... | 27.4 | 19.8 | 11.9 | 19.2 | 13.2 | 46.7 | 51.3 | 42.3 | 58.6 | 10.5 | 58.1 | 57.6 |
| 17..... | 26.0 | 18.5 | 11.1 | 11.1 | 14.4 | 37.1 | 45.1 | 53.7 | 57.6 | 8.6 | 57.9 | 57.2 |
| 18..... | 24.2 | 15.9 | 10.7 | 8.6 | 15.1 | 33.8 | 41.8 | 53.7 | 56.9 | 8.0 | 57.7 | 56.7 |
| 19..... | 21.7 | 15.6 | 10.6 | 8.6 | 13.1 | 33.7 | 43.8 | 57.1 | 57.4 | 8.8 | 57.5 | 50.7 |
| 20..... | 20.9 | 20.0 | 10.9 | 8.1 | 20.7 | 49.5 | 52.8 | 56.8 | 57.9 | 14.8 | 56.1 | 46.7 |
| 21..... | 24.0 | 17.7 | 10.5 | 7.8 | 15.5 | 47.7 | 39.3 | 35.7 | 57.7 | 23.4 | 52.8 | 56.3 |
| 22..... | 34.0 | 50.2 | 10.4 | 7.0 | 24.0 | 55.9 | 50.1 | 20.2 | 57.5 | 21.7 | 51.4 | 55.9 |
| 23..... | 50.7 | 48.2 | 10.2 | 7.3 | 51.3 | 54.2 | 45.7 | 19.4 | 55.7 | 16.5 | 48.9 | 57.8 |
| 24..... | 23.7 | 33.4 | 9.0 | 7.2 | 55.8 | 51.6 | 42.8 | 21.5 | 50.6 | 13.8 | 50.9 | 58.0 |
| 25..... | 27.6 | 21.8 | 10.7 | 6.2 | 52.6 | 52.5 | 50.3 | 21.0 | 58.5 | 32.8 | 56.8 | 53.9 |
| 26..... | 27.3 | 19.7 | 15.9 | 5.7 | 49.9 | 42.3 | 41.3 | 20.3 | 57.3 | 46.4 | 52.3 | 55.3 |
| 27..... | 22.6 | 19.7 | 15.1 | 5.9 | 46.3 | 41.7 | 40.6 | 22.1 | 57.5 | 54.3 | 58.2 | 55.1 |
| 28..... | 29.1 | 18.0 | 15.5 | 11.7 | 48.2 | 37.1 | 37.6 | 28.6 | 57.8 | 57.8 | 58.1 | 53.6 |
| 29..... | 20.5 | 17.5 | 20.3 | 24.3 | 54.9 | 31.5 | 43.3 | ..... | 57.8 | 58.7 | 58.0 | 52.5 |
| 30..... | 24.3 | 16.9 | 17.3 | 36.9 | 56.9 | 26.5 | 55.6 | ..... | 57.9 | 58.7 | 58.0 | 51.6 |
| 31..... | 23.7 | 18.0 | ..... | 12.0 | ..... | 24.9 | 57.8 | ..... | 58.0 | ..... | 58.0 | ..... |

Monthly discharge of Lowrie ditch at Opana weir, near Huelo, Maui, for the year ending June 30, 1918.

| Month. | Discharge. | | | | Total run-off. | |
|----------------|--------------------------|----------|-------|---------------------|------------------|------------|
| | Million gallons per day. | | | Second-feet (mean). | Million gallons. | Acre-feet. |
| | Maximum. | Minimum. | Mean. | | | |
| July..... | 50.7 | 20.5 | 30.5 | 47.2 | 946 | 2,900 |
| August..... | 50.2 | 15.6 | 25.3 | 39.1 | 784 | 2,410 |
| September..... | 21.5 | 9.0 | 13.3 | 20.6 | 400 | 1,220 |
| October..... | 36.9 | 5.7 | 10.8 | 16.7 | 334 | 1,030 |
| November..... | 56.9 | 9.3 | 32.2 | 49.8 | 966 | 2,960 |
| December..... | 56.7 | 24.9 | 43.7 | 67.6 | 1,350 | 4,160 |
| January..... | 57.8 | 14.9 | 41.3 | 63.9 | 1,280 | 3,930 |
| February..... | 57.1 | 19.4 | 37.0 | 57.2 | 1,040 | 3,180 |
| March..... | 59.4 | 35.7 | 54.5 | 84.3 | 1,690 | 5,180 |
| April..... | 58.7 | 8.0 | 29.6 | 45.8 | 888 | 2,730 |
| May..... | 58.4 | 48.6 | 56.2 | 87.0 | 1,740 | 5,350 |
| June..... | 58.0 | 36.8 | 52.1 | 80.6 | 1,560 | 4,800 |
| The year..... | 50.4 | 5.7 | 35.6 | 55.1 | 13,000 | 39,800 |

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, 1918.

GAGE.—Friez water-stage recorder.

DISCHARGE MEASUREMENTS.—Made by sharp-crested weir, $16\frac{1}{2}$ feet long, with bottom and end contractions.

CHANNEL AND CONTROL.—Large pool at weir.

EXTREMES OF DISCHARGE.—See monthly-discharge table.

DIVERSIONS.—None.

REGULATION.—By gates at frequent intervals.

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, 1918.

| Day. | July. | Aug. | Sept. | Oct. | Nov. | Dec. | Jan. | Feb. | Mar. | Apr. | May. | June. |
|---------|-------|------|-------|------|-------|------|------|-------|------|-------|------|-------|
| 1..... | 13.0 | 1.5 | 1.1 | 0.8 | 0.7 | 60.3 | 11.1 | 79.7 | 43.2 | 67.6 | 4.0 | 26.0 |
| 2..... | 8.9 | 1.8 | 1.1 | .8 | .7 | 35.2 | 2.1 | 67.6 | 39.8 | 84.1 | 4.0 | 21.6 |
| 3..... | 7.3 | 1.4 | 1.0 | .8 | .9 | 33.6 | 14.7 | 34.3 | 34.7 | 39.4 | 4.0 | 12.8 |
| 4..... | 14.8 | 1.5 | 1.0 | .8 | 18.1 | 23.8 | 37.3 | 13.8 | 38.7 | 16.8 | 3.8 | 17.4 |
| 5..... | 35.4 | 1.1 | 1.0 | .8 | 14.8 | 8.8 | 15.6 | 34.9 | 39.0 | 16.8 | 11.6 | 18.4 |
| 6..... | 15.9 | 1.1 | 1.0 | .7 | 7.0 | 5.4 | 2.7 | 32.7 | 36.8 | 24.1 | 58.4 | 18.0 |
| 7..... | 7.0 | 1.2 | .9 | .7 | 32.2 | 9.2 | 1.5 | 29.9 | 63.2 | 23.5 | 34.4 | 19.8 |
| 8..... | 5.5 | 1.2 | .9 | .7 | 29.3 | 7.1 | 8.0 | 19.7 | 76.4 | 25.3 | 24.3 | 18.9 |
| 9..... | 5.4 | 1.2 | .9 | .7 | 28.4 | 1.3 | 55.8 | 76.6 | 88.8 | 26.9 | 12.9 | 15.2 |
| 10..... | 5.5 | 1.2 | .9 | .7 | 1.7 | .9 | 12.0 | 79.8 | 51.2 | 28.1 | 65.1 | 64.4 |
| 11..... | 2.1 | 1.1 | .8 | .7 | 1.1 | .8 | 71.5 | 59.6 | 28.5 | 18.0 | 39.9 | 70.9 |
| 12..... | 1.6 | 1.2 | .8 | .7 | .7 | 3.0 | 51.8 | 38.4 | 25.9 | 14.6 | 25.6 | 88.1 |
| 13..... | 1.6 | 4.5 | .8 | .7 | .7 | 18.8 | 13.7 | 35.4 | 46.5 | 13.6 | 82.1 | 82.9 |
| 14..... | 1.8 | 2.9 | .8 | .7 | .7 | 20.5 | 11.4 | 27.4 | 62.4 | 13.5 | 85.2 | 34.5 |
| 15..... | 1.7 | 1.3 | .8 | .8 | .6 | 32.4 | 18.4 | 19.1 | 68.8 | 13.1 | 20.3 | 63.3 |
| 16..... | 1.6 | 1.2 | .8 | .7 | .6 | 2.2 | 56.8 | 13.6 | 78.6 | 13.0 | 81.5 | 87.8 |
| 17..... | 1.6 | 1.2 | .8 | .7 | .6 | .9 | 9.0 | 24.7 | 71.1 | 12.9 | 71.7 | 78.1 |
| 18..... | 1.5 | 1.1 | .8 | .7 | .6 | .8 | 4.8 | 24.3 | 72.9 | 12.4 | 42.2 | 34.9 |
| 19..... | 3.9 | 1.1 | .8 | .7 | .6 | .7 | 5.5 | 22.8 | 63.8 | 12.8 | 22.4 | 31.9 |
| 20..... | 1.3 | 1.1 | .8 | .7 | .8 | 22.3 | 53.7 | 27.2 | 63.8 | 12.9 | 15.6 | 37.7 |
| 21..... | 1.2 | 1.1 | .8 | .7 | .6 | 10.0 | 10.1 | 24.9 | 55.4 | 23.0 | 9.7 | 39.7 |
| 22..... | 1.4 | 40.8 | .8 | .7 | 6.4 | 68.4 | 16.3 | 27.4 | 38.3 | 45.8 | 23.3 | 53.4 |
| 23..... | 22.8 | 34.5 | .8 | .7 | 40.7 | 63.8 | 38.1 | 29.2 | 22.8 | 67.6 | 13.1 | 63.0 |
| 24..... | 3.5 | 12.8 | .8 | .7 | 59.7 | 17.2 | 25.5 | 28.6 | 27.0 | 7.3 | 33.7 | 19.7 |
| 25..... | 1.4 | 7.2 | .8 | .7 | 45.5 | 7.9 | 45.9 | 28.3 | 86.9 | 3.8 | 83.4 | 47.7 |
| 26..... | 1.4 | 1.6 | .8 | .7 | 38.4 | 1.7 | 26.1 | 33.6 | 74.1 | 3.4 | 43.3 | 55.6 |
| 27..... | 1.4 | 1.4 | .8 | .7 | 13.3 | 1.4 | 22.8 | 36.5 | 57.6 | 2.9 | 79.2 | 42.0 |
| 28..... | 1.6 | 1.2 | .8 | .7 | 16.0 | 1.9 | 14.7 | 42.3 | 54.4 | 13.3 | 88.1 | 26.1 |
| 29..... | 1.5 | 1.1 | .8 | .7 | 25.5 | 14.8 | 15.5 | ----- | 56.0 | 66.4 | 86.0 | 30.0 |
| 30..... | 1.6 | 1.1 | .8 | .8 | 81.7 | .7 | 76.3 | ----- | 55.0 | 4.8 | 64.1 | 21.1 |
| 31..... | 1.5 | 1.1 | ----- | .7 | ----- | .7 | 75.7 | ----- | 65.3 | ----- | 33.3 | ----- |

Monthly discharge of Haiku ditch at Peahi weir, near Huelo, Maui, for the year ending June 30, 1918.

| Month. | Discharge. | | | | Total run-off. | |
|----------------|---------------------------|----------|-------|---------------------|------------------|------------|
| | Millions gallons per day. | | | Second-foot (mean). | Million gallons. | Acre-feet. |
| | Maximum. | Minimum. | Mean. | | | |
| July..... | 35.4 | 1.2 | 5.70 | 8.82 | 177 | 542 |
| August..... | 40.8 | 1.1 | 4.32 | 6.68 | 134 | 411 |
| September..... | 1.1 | .8 | .86 | 1.33 | 26 | 79 |
| October..... | .8 | .7 | .72 | 1.11 | 22 | 68 |
| November..... | 81.7 | .6 | 15.6 | 24.1 | 469 | 1,440 |
| December..... | 68.4 | .7 | 15.5 | 24.0 | 466 | 1,470 |
| January..... | 76.3 | 1.5 | 26.6 | 41.2 | 824 | 2,530 |
| February..... | 79.8 | 13.6 | 36.2 | 56.0 | 1,010 | 3,110 |
| March..... | 88.8 | 22.8 | 54.4 | 84.2 | 1,690 | 5,180 |
| April..... | 84.1 | 2.9 | 24.3 | 37.6 | 728 | 2,240 |
| May..... | 88.1 | 3.8 | 40.8 | 63.1 | 1,270 | 3,880 |
| June..... | 88.1 | 12.8 | 41.4 | 64.1 | 1,240 | 3,810 |
| The year..... | 88.8 | .6 | 22.1 | 34.2 | 8,060 | 24,800 |

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 during the year ending June 30, 1918.

| Date. | Stream. | Locality. | Gage height (feet). | Discharge. | |
|---------|----------------------------|---|---------------------|--------------|--------------------------|
| | | | | Second-foot. | Million gallons per day. |
| July 21 | Waihee..... | Near Waihee..... | 2.20 | 42 | 27 |
| 24 | West Wailuanui..... | Near Keanae..... | .80 | 3.0 | 1.9 |
| Aug. 2 | do..... | do..... | .75 | 2.7 | 1.8 |
| Feb. 7 | Kouala..... | Near Lahaina..... | .54 | 4.9 | 3.1 |
| Dec. 11 | Spreckels ditch..... | Above Puohakamoa stream, near Huelo. | | 33 | 22 |
| Mar. 27 | Old Hamakua ditch..... | 250 feet below Oanui intake of Kailua stream, near Huelo. | | 31 | 20 |
| 27 | do..... | 150 feet above Hoolawalilili Stream, near Huelo. | | 32 | 21 |
| 27 | Middle Halawa..... | Kailua side of Hoolawanui, 25 feet above Old Hamakua ditch intake near Huelo. | | .1 | .06 |
| 27 | Branch of Waipio..... | First stream east of Hoolawalilili, 150 feet above New Hamakua ditch intake near Huelo. | | .4 | .25 |
| 27 | do..... | Second stream east of Hoolawalilili, 30 feet above New Hamakua ditch intake near Huelo. | | .35 | .25 |
| 27 | do..... | Third stream east of Hoolawalilili, 30 feet above New Hamakua ditch intake near Huelo. | | .25 | .15 |
| 27 | Huelo stream..... | 75 feet above New Hamakua ditch, near Huelo. | | 1.4 | .9 |
| 27 | Branch of Huelo..... | At trail crossing near Huelo. No water diverted into New Hamakua ditch. | | 1.05 | .7 |
| 27 | Branch of Hoolua..... | First stream west of first camp west of Kailua, 50 feet above New Hamakua ditch near Huelo. | | .5 | .35 |
| 27 | do..... | First wasteway west of Kailua, 100 feet above New Hamakua ditch near Huelo. | | .2 | .15 |
| 27 | Honawana..... | 25 feet above New Hamakua ditch, near Huelo. | | .95 | .6 |
| 27 | Branch of Honawana..... | 6 feet above New Hamakua ditch, near Huelo. | | .6 | .4 |
| 28 | Branch of Naililihale..... | 100 feet above New Hamakua ditch, near ditchman's house near Huelo. | | .4 | .25 |
| 28 | Branch of Papaea..... | First stream west of Naililihale, 50 feet above New Hamakua ditch, near Huelo. | | .25 | .15 |

Miscellaneous measurements on Maui during the year ending June 30, 1918—Continued.

| Date. | Stream. | Locality. | Gage height (feet). | Discharge. | |
|---------|------------------------------|---|---------------------|--------------|--------------------------|
| | | | | Second-feet. | Million gallons per day. |
| Mar. 28 | Branch of Papaea..... | Second stream west of Naililihale, at camp, 125 feet above New Hamakua ditch, near Huelo. | ..... | 0.5 | 0.3 |
| 28 |do..... | Third stream west of Naililihale, 10 feet above New Hamakua ditch, near Huelo. | ..... | .5 | .3 |
| 28 | West branch Oopuola..... | 200 feet above New Hamakua ditch, near Huelo. | ..... | .6 | .4 |
| 28 | Branch of Oopuola..... | 20 feet above trail crossing and intake, near Huelo. | ..... | .6 | .4 |
| 28 | Main Oopuola..... | 200 feet above New Hamakua ditch, near Huelo. | ..... | 1.75 | 1.1 |
| 28 | Branch of Makanale..... | 50 feet above New Hamakua ditch, near Huelo. | ..... | .11 | .07 |
| 28 | Main branch of Makanale..... | 20 feet above fall and intake into tunnel of New Hamakua ditch, at Korean camp, near Huelo. | ..... | .45 | .3 |
| 28 | Koalea..... | Under trail bridge below New Hamakua ditch, near Huelo. No water diverted into ditch. | ..... | 5.0 | 3.2 |
| 28 | Branch of Kolea..... | Under trail bridge, near Huelo. | ..... | .3 | .2 |
| 28 | Left branch of Kolea..... | 30 feet above New Hamakua ditch, near Huelo. Right branch not measured, estimated the same. | ..... | .65 | .45 |
| 28 | Right branch of Alo..... | 20 feet above Spreckels ditch, near Huelo. | ..... | .55 | .35 |
| 28 | Branch of Puohakamoa..... | First tributary, 75 feet above Spreckels ditch, near Huelo. | ..... | .5 | .35 |
| Apr. 4 | Puohakamoa..... | 500 feet above Haiku-uka boundary..... | ..... | 10.6 | 6.8 |
| 5 |do..... |do..... | ..... | 6.9 | 4.5 |
| 15 |do..... |do..... | ..... | 5.4 | 3.5 |
| 16 |do..... |do..... | ..... | 4.4 | 2.8 |
| 4 | East branch of Waikamoi..... | At trail crossing near Haiku-uka boundary. | ..... | 8.3 | 5.4 |
| 5 |do..... |do..... | ..... | 4.4 | 2.9 |
| 15 |do..... |do..... | ..... | 4.8 | 3.1 |
| 16 |do..... |do..... | ..... | 8.3 | 2.1 |
| 4 | West branch of Waikamoi..... |do..... | ..... | 18 | 12 |
| 5 |do..... |do..... | ..... | 15 | 9.5 |
| 15 |do..... |do..... | ..... | 14 | 9.0 |
| 16 |do..... |do..... | ..... | 6.5 | 4.2 |
| 4 | Naililihale No. 1..... |do..... | ..... | .75 | .5 |
| 5 |do..... |do..... | ..... | .5 | .35 |
| 15 |do..... |do..... | ..... | .5 | .3 |
| 16 |do..... |do..... | ..... | .4 | .25 |
| 4 | Naililihale No. 2..... |do..... | ..... | 1.75 | 1.15 |
| 5 |do..... |do..... | ..... | 1.65 | 1.05 |
| 15 |do..... |do..... | ..... | 1.7 | 1.1 |
| 16 |do..... |do..... | ..... | .85 | .55 |
| 4 | Naililihale No. 3..... |do..... | ..... | .25 | .15 |
| 5 |do..... |do..... | ..... | .14 | .09 |
| 15 |do..... |do..... | ..... | .25 | .15 |
| 16 |do..... |do..... | ..... | .15 | .1 |
| 4 | Naililihale No. 4..... |do..... | ..... | .75 | .5 |
| 5 |do..... |do..... | ..... | .5 | .35 |
| 15 |do..... |do..... | ..... | .45 | .3 |
| 16 |do..... |do..... | ..... | .4 | .25 |
| 4 | Kailua..... |do..... | ..... | 11 | 7 |
| 5 |do..... |do..... | ..... | 8.5 | 5.5 |
| 15 |do..... |do..... | ..... | 7.9 | 5.1 |
| 16 |do..... |do..... | ..... | 4.2 | 2.7 |
| 18 | Halehaku..... | 125 feet above Kouhikoa ditch, near Huelo. | ..... | .35 | .2 |
| 18 |do..... | 150 feet above intake to side ditch, near Huelo. | ..... | 1.6 | 1.1 |
| 19 | Kapaloalaca..... | Just above Lowrie ditch flume, near Huelo. | ..... | 8.2 | 5.3 |
| 19 | Lowrie ditch..... | Above tunnel with outfall into Halawa stream, near Huelo. | ..... | 7.7 | 5.0 |
| 19 | Waihee ditch..... | In wasteway above gate in ditch, 1,000 feet above Lowrie ditch, near Huelo. | ..... | 2.9 | 1.9 |

NOTE.—Streams 50 to 75 per cent above normal Mar. 27 due to showers night of Mar. 26. Streams slightly above normal Mar. 28 due to light showers night of Mar. 27.

ISLAND OF MOLOKAI.

HALAWA STREAM NEAR HALAWA, MOLOKAI.

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

RECORDS AVAILABLE.—July 1, 1917, to June 30, 1918.

GAGE.—Stevens water-stage recorder.

DISCHARGE MEASUREMENTS.—Made by wading.

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

EXTREMES OF DISCHARGE.—Maximum stage recorded, 7.5 feet at 8 a. m. April 4 (discharge, from extension of rating curve, 730 million gallons per day, or 1,130 second-feet); minimum stage recorded, 0.35 foot October 13-15 and 19 (discharge, 0.8 million gallons per day, or 1.2 second-feet).

DIVERSIONS.—None.

REGULATION.—None.

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

ACCURACY.—Stage-discharge relation permanent except for change made by flood of March 11. Rating curves applicable as follows: August 28 to March 11 well defined between 2.0 and 15 million gallons per day; March 12 to June 30 well defined between 4.0 and 100 million gallons per day. Rating curves fairly well defined outside of limits given. Operation of water-stage recorder unsatisfactory; no record July 1 to August 27, August 30 to September 9, September 11 to October 7, October 20-26, October 28 to November 4, November 6-18, and February 19-23. Records good within above limits of rating curves, when water-stage recorder was operating. Records poor when discharge was estimated.

Discharge measurements of Halawa Stream near Halawa, Molokai, during the year ending June 30, 1918.

[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. 19..... | 0.51 | 2.3 | 1.5 | Mar. 12..... | 1.98 | 84 | 55 |
| 19..... | .52 | 2.7 | 1.7 | Apr. 22..... | 1.69 | 59 | 38 |
| 20..... | .48 | 2.1 | 1.4 | 22..... | 1.54 | 49 | 32 |
| Jan. 21..... | 1.06 | 12.7 | 8.2 | 23..... | 1.15 | 29 | 19 |
| 22..... | .99 | 10.4 | 6.7 | June 3..... | .75 | 11.1 | 7.2 |

Daily discharge, in million gallons, of Halawa Stream near Halawa, Molokai, for the year ending June 30, 1918.

| Day. | Aug. | Sept. | Oct. | Nov. | Dec. | Jan. | Feb. | Mar. | Apr. | May. | June. |
|------|------|-------|------|------|------|------|------|------|------|------|-------|
| 1. | | 2.2 | | | 5.8 | 15.5 | 30 | 13.4 | 53 | 21.3 | 9.1 |
| 2. | | 2.2 | | | 4.5 | 21.5 | 8.4 | 15.2 | 140 | 15.3 | 9.9 |
| 3. | | 2.2 | | | 4.3 | 11.0 | 5.8 | 14.0 | 236 | 78 | 7.7 |
| 4. | | 2.1 | | | 10.6 | 5.8 | 5.0 | 37 | 208 | 24 | 6.6 |
| 5. | | 2.1 | | | 19.2 | 4.5 | 4.3 | 39 | 199 | 21.3 | 6.2 |
| 6. | | 2.1 | | | 11.5 | 4.2 | 4.2 | 32 | 124 | 15.3 | 5.6 |
| 7. | | 2.0 | | | 44 | 7.3 | 4.2 | 15.6 | 64 | 11.9 | 5.3 |
| 8. | | 2.0 | 1.3 | | 18.4 | 8.0 | 4.0 | 10.6 | 30 | 10.3 | 6.3 |
| 9. | | 2.0 | 1.2 | | 25 | 4.5 | 137 | 41.0 | 155 | 9.1 | 9.3 |
| 10. | | 1.9 | 1.2 | | 5.1 | 4.3 | 38 | 100 | 200 | 12.9 | 59 |
| 11. | | | 1.5 | | 4.0 | 11.2 | 12.2 | 187 | 81 | 11.2 | 23 |
| 12. | | | 1.3 | | 3.5 | 28 | 12.8 | 112 | 38 | 37 | 46 |
| 13. | | | 1.0 | | 3.0 | 7.1 | 7.7 | 135 | 50 | 38 | 20.6 |
| 14. | | | .9 | | 2.9 | 8.0 | 6.1 | 72 | 45 | 12.2 | 14.0 |
| 15. | | | 1.4 | | 3.0 | 5.5 | 5.2 | 40 | 28 | 42 | 92 |
| 16. | | | 2.3 | | 2.6 | 6.0 | 64 | 158 | 55 | 78 | 29 |
| 17. | | | 1.7 | | 2.5 | 17.2 | 107 | 124 | 29 | 20.0 | 15.6 |
| 18. | | | 1.0 | | 2.3 | 5.5 | 19.4 | 32 | 16.8 | 13.4 | 10.7 |
| 19. | | | 1.0 | 1.6 | 2.2 | 31 | 135 | 20.3 | 16.8 | 11.0 | 8.7 |
| 20. | | | .9 | 1.7 | 2.0 | 28 | | 16.2 | 49 | 9.3 | 17.4 |
| 21. | | | .9 | 1.4 | 2.0 | 9.7 | | 12.2 | 17.4 | 8.3 | 50 |
| 22. | | | .9 | 1.4 | 1.9 | 9.5 | | 11.2 | 56 | 8.7 | 46 |
| 23. | | | .8 | 1.2 | 1.9 | 12.1 | 100 | 9.9 | 16.8 | 19.1 | 18.0 |
| 24. | | | .8 | 2.1 | 13.5 | 7.9 | 38 | 54 | 13.7 | 23 | 18.0 |
| 25. | | | .8 | 8.0 | 22 | 10.0 | 17.7 | 122 | 11.2 | 25 | 11.5 |
| 26. | | | .7 | 42 | 9.1 | 14.1 | 11.2 | 25 | 11.0 | 26 | 13.2 |
| 27. | | | .7 | 15.0 | 23 | 6.1 | 11.7 | 14.5 | 38 | 18.3 | 10.7 |
| 28. | | 2.3 | | 4.5 | 34 | 4.7 | 16.1 | 18.3 | 40 | 46 | 18.0 |
| 29. | | 2.3 | | 6.5 | 10.9 | 27 | | 38 | 94 | 34 | 42 |
| 30. | | 2.3 | | 18.2 | 9.3 | 12.5 | | 49 | 94 | 13.7 | 24 |
| 31. | | 2.3 | | | 4.0 | 7.9 | | 56 | | 11.0 | |

NOTE.—Discharge estimated as follows: Sept. 11-15, 4.0 M. G. D.; Sept. 16 to Oct. 7, 1.5 M. G. D.; Oct. 28-31, 2.0 M. G. D.; Nov. 1-3, 1.5 M. G. D.; Nov. 4-10, 5.0 M. G. D.; Nov. 11-18, 1.8 M. G. D.; Feb. 19 and 23 as given, Feb. 20-22, 50 M. G. D. Discharge interpolated at other times when water stage recorder was not operating.

Monthly discharge of Halawa Stream near Halawa, Molokai, for the year ending June 30, 1918.

| Month. | Discharge. | | | Total run-off. | | |
|------------------------------|--------------------------|----------|-------|---------------------|------------------|------------|
| | Million gallons per day. | | | Second-foot (mean). | Million gallons. | Acre-feet. |
| | Maximum. | Minimum. | Mean. | | | |
| July ^a | | | 2.50 | 3.87 | 77.5 | 238 |
| August ^a | | | 2.50 | 3.87 | 77.5 | 238 |
| September ^a | | | 2.11 | 3.26 | 63.3 | 201 |
| October ^b | 2.3 | .7 | 1.32 | 2.04 | 40.8 | 126 |
| November ^b | 42 | | 5.25 | 8.12 | 158 | 483 |
| December..... | 44 | 1.9 | 9.93 | 15.4 | 308 | 945 |
| January..... | 31 | 4.2 | 11.5 | 17.8 | 356 | 1,030 |
| February..... | 137 | 4.0 | 34.1 | 52.8 | 955 | 2,930 |
| March..... | 187 | 9.9 | 52.4 | 81.1 | 1,620 | 4,990 |
| April..... | 256 | 11.0 | 73.6 | 114 | 2,210 | 6,780 |
| May..... | 78 | 8.3 | 23.4 | 36.2 | 725 | 2,230 |
| June..... | 92 | 5.3 | 21.8 | 33.7 | 653 | 2,010 |
| The year..... | 236 | .7 | 19.8 | 30.6 | 7,240 | 22,300 |

^a Estimate based on comparison with Honokahau Stream, Maui.

^b Partially estimated by comparison with Honokahau Stream, Maui.

MISCELLANEOUS MEASUREMENTS.

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

Miscellaneous measurements on Molokai during the year ending June 30, 1918.

| Date. | Stream. | Location. | Gage height (feet). | Discharge. | |
|---------|--------------------------------------|---|---------------------|--------------|--------------------------|
| | | | | Second-feet. | Million gallons per day. |
| Jan. 22 | Right branch of Halawa..... | 15 feet above confluence with left branch of Halawa. | 0.99 | 7.3 | 4.7 |
| 22 | First ditch on right side of Halawa. | One quarter of a mile below gaging station on Halawa. | ..... | 1.1 | .7 |
| 22 | Taro ditch on right side of Halawa. | 300 feet below intake, and 800 feet below crossing of Halawa. | ..... | .4 | .25 |
| 22 | Ditch on left side of Halawa.. | 150 feet below intake and 350 feet below crossing of Halawa. | ..... | 1.8 | 1.2 |

ISLAND OF HAWAII.

WAILUKU RIVER NEAR HILO, HAWAII.

LOCATION.—Below confluence of all main branches, 300 feet above intake of Hilo Electric Light Co.'s power canal and $1\frac{1}{2}$ miles above Hilo.

RECORDS AVAILABLE.—March 21, 1911, to July 21, 1913, and January 2 to June 30, 1918.

GAGE.—Stevens water-stage recorder. March 21, 1911, to July 21, 1913, Barrett & Lawrence water-stage recorder at same location and datum.

DISCHARGE MEASUREMENTS.—Made from cable or by wading.

CHANNEL AND CONTROL.—One channel at all stages; straight for 200 feet above and 350 feet below gage; right bank slopes gently; left bank steep and high. Control is concrete diversion dam and portal of power canal; probably permanent.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 24.5 feet, high-water mark of flood, February 19 (discharge, estimated from extension of rating curve, 9,000 million gallons per day, or 13,900 second-feet); minimum stage recorded, 6.2 feet January 9 (discharge, 68 million gallons per day, or 105 second-feet).

Maximum stage during period of record February 19, 1918; minimum stage recorded, 4.11 feet June 7, 1912 (discharge, 21 million gallons per day, or 32 second-feet).

DIVERSIONS.—Hilo Boarding School ditch and several plantation flumes divert small amounts of water above station.

REGULATION.—None.

UTILIZATION.—For power, fluming sugar cane, and irrigation of taro.

ACCURACY.—Stage-discharge relation permanent. Rating curve well defined between 90 and 3,000 million gallons per day. Operation of water-stage recorder satisfactory. Records good between 90 and 3,000 million gallons per day; fair above and below those limits.

Discharge measurements of Wailuku River near Hilo, Hawaii, during the year ending June 30, 1918.

[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. |
| Feb. 21..... | 14.35 | 4,100 | 2,650 | Mar. 23..... | 8.43 | 276 | 178 |
| 21..... | 14.02 | 3,750 | 2,420 | 25..... | 9.74 | 707 | 457 |
| 22..... | 11.90 | 2,010 | 1,300 | 25..... | 10.57 | 945 | 611 |
| 22..... | 11.82 | 1,920 | 1,240 | Apr. 25..... | 8.12 | 213 | 137 |
| 23..... | 10.85 | 1,210 | 785 | May 1..... | 7.50 | 152 | 98 |
| 23..... | 10.75 | 1,080 | 698 | June 11..... | 7.56 | 153 | 99 |

Daily discharge, in million gallons, of Wailuku River near Hilo, Hawaii, for the year ending June 30, 1918.

| Day. | Jan. | Feb. | Mar. | Apr. | May. | June. | Day. | Jan. | Feb. | Mar. | Apr. | May. | June. |
|---------|------|------|-------|-------|-------|-------|---------|-------|-------|------|------|------|-------|
| 1..... | | 568 | 411 | 160 | 98 | 334 | 16..... | 85 | | 411 | 434 | 422 | 204 |
| 2..... | | 389 | 304 | 389 | 106 | 284 | 17..... | 80 | | 334 | 345 | 434 | 265 |
| 3..... | 81 | | 256 | 470 | 568 | 212 | 18..... | 78 | | 284 | 265 | 284 | 174 |
| 4..... | 196 | | 188 | 518 | 1,550 | 174 | 19..... | 76 | | 256 | 256 | 220 | 146 |
| 5..... | 91 | | 188 | 506 | 568 | 153 | 20..... | 74 | | 324 | 238 | 181 | 130 |
| 6..... | 76 | | 188 | 334 | 356 | 130 | 21..... | 72 | | 247 | 238 | 238 | 167 |
| 7..... | 70 | | 140 | 265 | 265 | 118 | 22..... | 70 | 1,280 | 204 | 181 | 256 | 196 |
| 8..... | 68 | | 122 | 635 | 247 | 104 | 23..... | 70 | 780 | 188 | 167 | 174 | 181 |
| 9..... | 68 | | 115 | 1,810 | 220 | 100 | 24..... | 90 | 708 | 174 | 146 | 153 | 204 |
| 10..... | 69 | | 188 | 1,420 | 220 | 92 | 25..... | 955 | 730 | 555 | 134 | 146 | 304 |
| 11..... | 668 | | 446 | 830 | 181 | 100 | 26..... | 1,680 | 1,000 | 542 | 130 | 134 | 265 |
| 12..... | 212 | | 1,920 | 1,260 | 167 | 356 | 27..... | 1,200 | 620 | 345 | 125 | 134 | 188 |
| 13..... | 140 | | 1,200 | 1,490 | 174 | 212 | 28..... | | 446 | 482 | 256 | 118 | 378 |
| 14..... | 118 | | 708 | 730 | 160 | 140 | 29..... | 1,490 | | 204 | 115 | 730 | 140 |
| 15..... | 94 | | 530 | 635 | 238 | 174 | 30..... | 1,600 | | 167 | 106 | 555 | 146 |
| | | | | | | | 31..... | 780 | | 153 | | 470 | |

Monthly discharge of Wailuku River near Hilo, Hawaii, for the year ending June 30, 1918.

| Month. | Discharge. | | | Total run-off. | |
|-------------------|--------------------------|----------|-------|---------------------|------------------|
| | Million gallons per day. | | | Second-feet (mean). | Million gallons. |
| | Maximum. | Minimum. | Mean. | | |
| January 3-31..... | 1,680 | 68 | 372 | 576 | 10,800 |
| March..... | 1,920 | 115 | 373 | 577 | 11,500 |
| April..... | 1,810 | 106 | 482 | 746 | 14,400 |
| May..... | 1,550 | 98 | 323 | 500 | 10,000 |
| June..... | 356 | 92 | 186 | 288 | 5,570 |
| | | | | | 30,700 |
| | | | | | 17,100 |

HILO BOARDING SCHOOL DITCH NEAR HILO, HAWAII.

LOCATION.—200 feet below upper crossing of county road at Pihoonua, $3\frac{1}{2}$ miles west of Hilo.

RECORDS AVAILABLE.—February 23 to June 30, 1918.

GAGE.—Gurley weekly water-stage recorder.

DISCHARGE MEASUREMENTS.—Made by 3-foot sharp-crested weir with full contractions.

CHANNEL AND CONTROL.—Weir basin is pool about 10 by 20 feet, having a set of baffles 15 feet above weir to reduce velocity of approach.

EXTREMES OF DISCHARGE.—Maximum stage recorded, 1.13 feet at 6 a. m. March 12 (weir overflowed); minimum stage recorded, 0.25 foot April 20 (discharge, 0.8 million gallons per day, or 1.2 second-feet).

DIVERSIONS.—Ditch diverts from Wailuku River.

REGULATION.—By spillways.

UTILIZATION.—For irrigation and domestic supply.

ACCURACY.—Conditions at weir good for stages below 2.2 million gallons per day and are excellent; above that stage there is slight velocity of approach and records are fair.

Daily discharge, in million gallons, of Hilo Boarding School ditch near Hilo, Hawaii, for the year ending June 30, 1918.

| Day. | Mar. | Apr. | May. | June. | Day. | Mar. | Apr. | May. | June. |
|---------|------|------|------|-------|---------|------|------|------|-------|
| 1..... | | 1.5 | 1.7 | 1.8 | 16..... | 3.0 | 0.95 | 1.6 | 2.3 |
| 2..... | | 1.7 | 1.0 | 2.3 | 17..... | 2.1 | .95 | 1.6 | 2.4 |
| 3..... | 5.5 | 1.6 | 2.5 | 2.2 | 18..... | 1.6 | .9 | 2.0 | 2.1 |
| 4..... | 5.2 | 1.5 | 3.3 | 1.9 | 19..... | 1.5 | .85 | 3.1 | 2.0 |
| 5..... | 4.7 | 1.4 | 1.8 | 1.4 | 20..... | 1.6 | .8 | 1.8 | 1.8 |
| 6..... | 4.3 | 1.9 | 1.4 | 1.1 | 21..... | 2.3 | .85 | 1.8 | 2.1 |
| 7..... | 4.4 | 2.5 | 1.4 | .95 | 22..... | 2.5 | .9 | 2.1 | 2.3 |
| 8..... | 3.8 | 1.6 | 1.7 | 1.0 | 23..... | 2.1 | .95 | 1.7 | 2.0 |
| 9..... | 3.4 | 2.0 | 1.6 | 1.4 | 24..... | 2.1 | .9 | 1.6 | 2.3 |
| 10..... | 4.9 | 2.1 | 1.6 | 1.2 | 25..... | 2.0 | .9 | 1.6 | 2.7 |
| 11..... | 6.0 | 1.7 | 1.4 | 1.4 | 26..... | 2.0 | 1.1 | 1.5 | 2.6 |
| 12..... | 6.2 | 1.4 | 2.5 | 2.6 | 27..... | 1.9 | 1.8 | 1.7 | 2.2 |
| 13..... | 4.4 | 1.2 | 2.3 | 2.0 | 28..... | 1.8 | 1.8 | 1.9 | 1.9 |
| 14..... | 3.5 | 1.1 | 2.0 | 2.2 | 29..... | 1.6 | 1.8 | 1.8 | 1.6 |
| 15..... | 3.2 | 1.0 | 1.9 | 2.3 | 30..... | 1.5 | 1.8 | 1.6 | 2.0 |
| | | | | | 31..... | 1.5 | | 1.5 | |

NOTE.—No gage-height record Apr. 21, 22, 28, May 24, 25, and June 28, discharge interpolated.

Monthly discharge of Hilo Boarding School ditch near Hilo, Hawaii, for the year ending June 30, 1918.

| Month. | Discharge. | | | | Total run-off. | |
|-----------------|--------------------------|----------|-------|---------------------|------------------|------------|
| | Million gallons per day. | | | Second-foot (mean). | Million gallons. | Acre-feet. |
| | Maximum. | Minimum. | Mean. | | | |
| March 3-31..... | 6.2 | 1.5 | 3.12 | 4.83 | 91 | 278 |
| April..... | 2.5 | .8 | 1.38 | 2.14 | 41 | 127 |
| May..... | 3.3 | 1.0 | 1.84 | 2.85 | 57 | 175 |
| June..... | 2.7 | .95 | 1.94 | 3.00 | 58 | 179 |
| The period..... | | | | | 247 | 759 |

LOWER HAMAKUA DITCH AT MAIN WEIR, NEAR KUKUIHAELE, HAWAII.

LOCATION.—Just below portal of last tunnel from Waipio Gulch, half a mile southwest of Pacific sugar mill, at Kukuihaele. This ditch diverts all ordinary run-off from headwaters of the Waipio basin below the Upper Hamakua ditch.

RECORDS AVAILABLE.—July 18, 1910, to June 30, 1918.

GAGE.—Watson water-stage recorder.

DISCHARGE MEASUREMENTS.—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 determinations by weir formulas within 2 per cent.

EXTREMES OF DISCHARGE.—See monthly discharge table.

UTILIZATION.—Irrigation of sugar cane and domestic supply.

ACCURACY.—Records good.

COOPERATION.—Records furnished by the Hawaiian Irrigation Co.

Daily discharge, in million gallons, of Lower Hamakua ditch at main weir near Kukuihaele, Hawaii, for the year ending June 30, 1918.

| Day. | July. | Aug. | Sept. | Oct. | Nov. | Dec. | Jan. | Feb. | Mar. | Apr. | May. | June. |
|---------|-------|------|-------|------|-------|------|------|-------|------|-------|------|-------|
| 1..... | 34.6 | 29.9 | 27.5 | 25.6 | 32.0 | 42.0 | 25.2 | 33.2 | 33.6 | 34.7 | 33.6 | 34.6 |
| 2..... | 37.6 | 34.1 | 27.3 | 25.5 | 38.3 | 37.4 | 25.2 | 29.9 | 34.1 | 34.6 | 35.0 | 34.4 |
| 3..... | 34.9 | 32.3 | 27.2 | 27.8 | 51.0 | 33.3 | 25.8 | 28.1 | 33.7 | 34.2 | 34.0 | 34.4 |
| 4..... | 31.2 | 29.9 | 27.9 | 27.9 | 52.4 | 33.0 | 31.7 | 26.9 | 34.5 | 34.6 | 35.0 | 32.3 |
| 5..... | 40.4 | 28.3 | 28.6 | 27.1 | 47.5 | 29.3 | 36.2 | 26.3 | 33.7 | 34.0 | 35.0 | 31.6 |
| 6..... | 44.7 | 27.8 | 27.2 | 25.5 | 3.42 | 29.3 | 28.3 | 26.9 | 33.7 | 34.6 | 34.9 | 31.6 |
| 7..... | 45.1 | 27.9 | 26.9 | 25.7 | 53.0 | 43.8 | 25.5 | 29.3 | 34.7 | 35.3 | 34.9 | 31.5 |
| 8..... | 35.1 | 28.1 | 26.9 | 25.5 | 51.7 | 31.7 | 26.3 | 26.3 | 33.3 | 34.0 | 35.1 | 31.4 |
| 9..... | 32.9 | 28.1 | 27.1 | 25.3 | 52.4 | 28.1 | 35.0 | 34.2 | 33.5 | 31.1 | 35.3 | 31.4 |
| 10..... | 31.9 | 27.9 | 26.8 | 25.3 | 40.7 | 28.3 | 35.9 | 29.9 | 35.6 | 7.5 | 34.9 | 33.1 |
| 11..... | 30.9 | 27.9 | 26.3 | 25.3 | 48.9 | 27.5 | 42.7 | 23.3 | 34.3 | 2.3 | 34.8 | 34.4 |
| 12..... | 30.1 | 28.1 | 27.8 | 25.0 | 40.7 | 26.9 | 37.4 | ..... | 34.3 | 32.6 | 34.2 | 34.4 |
| 13..... | 29.5 | 32.3 | 34.5 | 24.8 | 33.0 | 36.7 | 34.0 | ..... | 33.0 | 34.6 | 34.2 | 31.6 |
| 14..... | 29.0 | 42.0 | 58.0 | 24.8 | 29.9 | 34.9 | 34.9 | ..... | 34.3 | 33.1 | 34.9 | 34.1 |
| 15..... | 29.1 | 31.7 | 41.1 | 24.9 | 28.7 | 34.9 | 28.1 | ..... | 34.3 | 35.7 | 35.0 | 34.7 |
| 16..... | 28.9 | 28.9 | 31.3 | 26.1 | 28.1 | 23.8 | 37.4 | 3.6 | 35.0 | 23.6 | 34.9 | 34.7 |
| 17..... | 29.3 | 28.1 | 29.8 | 30.3 | 26.9 | 28.5 | 33.0 | 33.6 | 34.6 | 33.2 | 35.0 | 34.6 |
| 18..... | 29.1 | 27.5 | 28.9 | 26.5 | 26.9 | 28.9 | 30.5 | 34.2 | 34.3 | 34.4 | 34.2 | 34.4 |
| 19..... | 29.9 | 27.6 | 28.3 | 25.6 | 26.3 | 38.7 | 28.1 | 34.2 | 34.3 | 34.0 | 34.2 | 34.7 |
| 20..... | 28.9 | 28.1 | 27.8 | 25.3 | 26.3 | 33.0 | 27.5 | 33.0 | 33.7 | 34.7 | 33.8 | 35.0 |
| 21..... | 28.9 | 29.6 | 27.5 | 25.0 | 25.8 | 25.8 | 26.5 | 32.3 | 32.5 | 34.6 | 33.6 | 34.7 |
| 22..... | 29.5 | 49.2 | 27.2 | 27.2 | 26.3 | 40.7 | 27.5 | 34.2 | 32.5 | 34.9 | 35.0 | 34.8 |
| 23..... | 32.9 | 43.9 | 27.2 | 38.2 | 33.0 | 36.8 | 27.5 | 33.0 | 33.1 | 34.6 | 35.0 | 31.9 |
| 24..... | 30.7 | 32.3 | 27.2 | 34.6 | 43.4 | 30.9 | 26.3 | 33.6 | 35.0 | 34.2 | 35.0 | 33.5 |
| 25..... | 29.6 | 29.9 | 26.9 | 28.1 | 41.4 | 28.1 | 26.3 | 31.7 | 34.5 | 33.8 | 34.3 | 34.2 |
| 26..... | 28.9 | 28.9 | 26.9 | 26.9 | 36.1 | 27.1 | 31.1 | 31.7 | 33.1 | 35.5 | 36.2 | 34.6 |
| 27..... | 28.6 | 28.4 | 27.2 | 28.6 | 36.1 | 26.6 | 33.6 | 32.0 | 35.3 | 34.4 | 36.1 | 34.2 |
| 28..... | 28.1 | 27.8 | 26.9 | 27.1 | 36.8 | 27.7 | 28.6 | 32.9 | 35.2 | 33.7 | 32.2 | 34.1 |
| 29..... | 29.3 | 27.5 | 26.9 | 26.2 | 33.0 | 27.3 | 26.0 | ..... | 35.3 | 34.2 | 33.4 | 34.2 |
| 30..... | 28.5 | 27.8 | 26.9 | 25.6 | 40.7 | 26.5 | 31.6 | ..... | 34.7 | 35.0 | 36.7 | 34.8 |
| 31..... | 28.4 | 27.2 | ..... | 25.3 | ..... | 25.5 | 36.1 | ..... | 34.2 | ..... | 35.0 | ..... |

NOTE.—No discharge Feb. 12-15.

Monthly discharge of Lower Hamakua ditch at main weir near Kukuihaele, Hawaii, for year ending June 30, 1918.

| Month. | Discharge. | | | Total run-off. | |
|-------------------------|--------------------------|----------|-------|------------------|------------|
| | Million gallons per day. | | | Million gallons. | Acre-feet. |
| | Maximum. | Minimum. | Mean. | | |
| July..... | 45.1 | 28.1 | 31.8 | 49.2 | 986 |
| August..... | 49.2 | 27.2 | 30.6 | 47.3 | 949 |
| September..... | 58.0 | 26.3 | 29.3 | 45.3 | 878 |
| October..... | 38.2 | 24.8 | 26.9 | 41.6 | 833 |
| November..... | 58.3 | 25.8 | 38.0 | 58.8 | 1,140 |
| December..... | 43.8 | 23.8 | 31.4 | 48.6 | 973 |
| January..... | 42.7 | 25.2 | 30.6 | 47.3 | 950 |
| February (24 days)..... | 34.2 | 3.6 | 29.8 | 46.1 | 714 |
| March..... | 35.6 | 32.5 | 34.1 | 52.8 | 1,060 |
| April..... | 35.7 | 2.3 | 31.9 | 49.4 | 958 |
| May..... | 36.7 | 32.2 | 34.7 | 53.7 | 1,080 |
| June..... | 35.0 | 31.4 | 33.7 | 52.1 | 1,010 |
| The year..... | ..... | ..... | ..... | ..... | 11,500 |
| | | | | | 35,400 |

UPPER HAMAKUA DITCH AT PUUALALA AND RESERVOIR NO. 3 WEIRS, NEAR KUKUIHAELE, HAWAII.

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, 1918. 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 table.

DIVERSIONS.—This ditch diverts all ordinary run-off from upper headwaters of Waipio Gulch.

UTILIZATION.—Irrigation of sugar cane and domestic supply.

ACCURACY.—Record good.

COOPERATION.—Records furnished by the Hawaiian Irrigation Co.

Daily discharge, in million gallons, of Upper Hamakua ditch at Puualala and reservoir No. 3 weirs, near Kukuihaele, Hawaii, for the year ending June 30, 1918.

| Day. | July. | Aug. | Sept. | Oct. | Nov. | Dec. | Jan. | Feb. | Mar. | Apr. | May. | June. |
|---------|-------|------|-------|-------|-------|------|------|-------|------|-------|------|-------|
| 1..... | 2.8 | 3.7 | ----- | ----- | 5.8 | 10.2 | 0.3 | 8.3 | 25.1 | 19.2 | 20.5 | 18.0 |
| 2..... | 3.8 | 5.0 | ----- | ----- | 24.9 | 4.9 | .3 | 2.0 | 25.7 | 33.6 | 17.7 | 18.6 |
| 3..... | 2.8 | 4.2 | ----- | ----- | 10.1 | 3.5 | .5 | 2.3 | 30.0 | 19.8 | 28.2 | 10.8 |
| 4..... | 3.6 | 2.2 | ----- | ----- | 12.0 | 2.8 | 7.1 | .9 | 22.7 | 17.5 | 27.2 | 7.5 |
| 5..... | 16.8 | 1.8 | ----- | ----- | 10.1 | 1.6 | 4.0 | 8 | 14.0 | 18.5 | 17.0 | 6.8 |
| 6..... | 15.2 | .8 | ----- | ----- | 5.0 | 4.8 | 1.3 | 1.4 | 9.5 | 15.5 | 10.8 | 5.5 |
| 7..... | 12.8 | .7 | ----- | ----- | 25.2 | 16.3 | .7 | 2.3 | 9.4 | 21.1 | 9.4 | 5.9 |
| 8..... | 5.4 | .7 | ----- | ----- | 19.7 | 4.1 | .5 | 1.6 | 6.0 | 29.9 | 7.0 | 5.1 |
| 9..... | 2.8 | .7 | ----- | ----- | 14.1 | 2.0 | 6.0 | 30.0 | 6.0 | 29.2 | 14.7 | 7.2 |
| 10..... | 2.4 | .7 | ----- | ----- | 6.2 | 1.0 | 5.6 | 29.0 | 15.0 | 24.5 | 17.5 | 7.1 |
| 11..... | 2.0 | .7 | ----- | ----- | 13.4 | 1.1 | 21.6 | 26.4 | 15.8 | 8.6 | 13.0 | 24.2 |
| 12..... | 1.9 | .7 | 5.7 | ----- | 6.2 | .9 | 5.0 | 27.1 | 18.5 | 7.1 | 20.0 | 27.7 |
| 13..... | .8 | 5.2 | 15.3 | ----- | 4.8 | 2.8 | 2.8 | 15.7 | 17.5 | 10.7 | 25.0 | 18.9 |
| 14..... | .8 | 11.8 | 9.7 | ----- | 3.4 | 3.0 | 4.2 | 11.4 | 15.5 | 11.2 | 25.6 | 14.8 |
| 15..... | 1.7 | 5.5 | 2.9 | ----- | 3.2 | 2.7 | 3.3 | 4.4 | 14.8 | 12.5 | 23.3 | 15.7 |
| 16..... | .9 | 3.4 | ----- | ----- | 1.8 | 2.0 | 18.4 | 3.6 | 11.2 | 11.1 | 22.4 | 17.1 |
| 17..... | 1.0 | 1.9 | ----- | ----- | 1.7 | 1.2 | 6.4 | 8.8 | 9.0 | 7.2 | 24.4 | 19.0 |
| 18..... | 1.1 | .8 | ----- | ----- | 1.7 | 5.0 | 2.6 | 14.6 | 4.7 | 7.1 | 16.3 | 19.4 |
| 19..... | 2.4 | .8 | ----- | ----- | 1.5 | 6.7 | 2.0 | 18.3 | 3.6 | 5.7 | 12.9 | 17.5 |
| 20..... | 2.1 | 1.0 | ----- | ----- | .5 | 4.2 | 2.9 | 28.7 | 3.2 | 3.2 | 10.3 | 17.4 |
| 21..... | 2.1 | 5.6 | ----- | ----- | .5 | 3.1 | 3.1 | 13.9 | 2.7 | 17.3 | 8.3 | 25.2 |
| 22..... | 2.3 | 20.0 | ----- | ----- | .5 | 5.8 | 4.1 | 14.5 | 2.4 | 16.1 | 9.2 | 24.1 |
| 23..... | 1.2 | 10.0 | ----- | 5.5 | 1.0 | 2.5 | 4.0 | 24.1 | 2.5 | 7.9 | 11.1 | 18.9 |
| 24..... | 1.3 | 4.6 | ----- | 1.7 | 7.7 | 1.3 | 2.1 | 13.5 | 4.6 | 6.9 | 13.0 | 20.2 |
| 25..... | 1.3 | 2.8 | ----- | ----- | 6.8 | 2.3 | 1.7 | 8.8 | 26.6 | 6.8 | 9.6 | 18.2 |
| 26..... | 1.3 | .7 | ----- | ----- | 5.0 | .7 | 9.5 | 8.2 | 21.7 | 5.5 | 11.8 | 10.2 |
| 27..... | 1.0 | .7 | ----- | ----- | 3.1 | .5 | 11.5 | 17.4 | 16.0 | 15.7 | 17.2 | 17.0 |
| 28..... | .9 | .7 | ----- | ----- | 7.0 | .5 | 4.7 | 19.8 | 13.9 | 8.7 | 20.1 | 11.3 |
| 29..... | 1.5 | .4 | ----- | ----- | 2.6 | .5 | 1.9 | ----- | 8.3 | 5.6 | 14.8 | 10.4 |
| 30..... | 1.5 | .4 | ----- | ----- | 23.8 | .5 | 8.9 | ----- | 3.6 | 21.3 | 18.6 | 19.0 |
| 31..... | 2.0 | .4 | ----- | ----- | ----- | .4 | 16.9 | ----- | 3.9 | ----- | 18.4 | ----- |

NOTE.—No flow on days for which no discharge is given.

Monthly discharge of Upper Hamakua ditch at Puualala and reservoir No. 3 weirs, near Kukuihaele, Hawaii, for the year ending June 30, 1918.

| Month. | Discharge. | | | | Total run-off. | |
|---------------|--------------------------|----------|-------|------------------------|---------------------|----------------|
| | Million gallons per day. | | | Second-foot (mean). | Million gallons. | Acre- feet. |
| | Maximum. | Minimum. | Mean. | | | |
| July..... | 16.8 | 0.8 | 3.21 | 4.97 | 100 | 305 |
| August..... | 20.0 | .4 | 3.18 | 4.92 | 99 | 303 |
| November..... | 25.2 | .5 | 7.64 | 11.8 | 229 | 703 |
| December..... | 16.3 | .4 | 3.19 | 4.94 | 99 | 303 |
| January..... | 21.6 | .3 | 5.29 | 8.18 | 164 | 503 |
| February..... | 30.0 | .8 | 12.8 | 19.8 | 358 | 1,100 |
| March..... | 30.0 | 2.4 | 12.4 | 19.2 | 383 | 1,180 |
| April..... | 33.6 | 3.2 | 14.2 | 22.0 | 425 | 1,310 |
| May..... | 28.2 | 7.0 | 16.6 | 25.7 | 515 | 1,580 |
| June..... | 27.7 | 5.1 | 15.3 | 23.7 | 459 | 1,410 |

KOHALA DITCH ABOVE HONOKANE GULCH, NEAR KOHALA, HAWAII.

LOCATION.—In crosscut of tunnel in Awini section of ditch, 2,000 feet above Awini weir, and 8 miles southeast of Niuli.

RECORDS AVAILABLE.—February 19 to June 30, 1918.

GAGE.—Friez water-stage recorder.

DISCHARGE MEASUREMENTS.—Made from plank at gage.

CHANNEL AND CONTROL.—Probably permanent. Ditch is in tunnel cut in hard rock.

EXTREMES OF DISCHARGE.—Maximum stage recorded, 3.34 feet at 6.15 p. m. April 9 (discharge, 32 million gallons per day, or 50 second-feet); minimum stage recorded, 0.65 foot April 12, 19 and 20 (discharge, 5.6 million gallons per day, or 8.7 second-feet).

DIVERSIONS.—Ditch diverts water from large number of small streams.

REGULATION.—By gates at intervals.

UTILIZATION.—For irrigation of sugar cane and for power development.

ACCURACY.—Stage-discharge relation permanent. Rating curve well defined between 6 and 30 million gallons per day. Operation of recorder fairly satisfactory for published record. Records fair for all stages.

Discharge measurements of Kohala ditch above Honokane Gulch, near Kohala, Hawaii, during the year ending June 30, 1918.

[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. |
| Feb. 19..... | 3.13 | 45 | 29 | Apr. 29..... | 1.00 | 12.9 | 8.3 |
| Mar. 21..... | 1.32 | 19.2 | 12 | June 15..... | 2.44 | 35 | 23 |

Daily discharge, in million gallons, of Kohala ditch above Honokane Gulch, near Kohala, Hawaii, for the year ending June 30, 1918.

| Day. | Feb. | Mar. | Apr. | May. | June. | Day. | Feb. | Mar. | Apr. | May. | June. |
|---------|------|------|------|------|-------|---------|------|------|------|------|-------|
| 1..... | | | | 16 | 12.8 | 16..... | | 26 | 6.4 | 14.6 | 17 |
| 2..... | | | | 13.2 | 16 | 17..... | | 13.6 | 6.0 | 13.6 | 19 |
| 3..... | | | | 22 | 10.5 | 18..... | | 17 | 6.0 | 12.3 | 18 |
| 4..... | | 29 | | | 9.2 | 19..... | | 14.1 | 5.6 | 11.0 | 13.2 |
| 5..... | | 24 | | | 8.2 | 20..... | 29 | 13.2 | 5.6 | 11.0 | 11.0 |
| 6..... | | 22 | | | 6.9 | 21..... | 28 | 11.4 | 6.0 | 11.0 | 14.1 |
| 7..... | | 20 | 11.4 | 6.4 | | 22..... | 26 | 10.5 | 6.0 | 11.0 | 19 |
| 8..... | | 24 | 10.5 | | | 23..... | | 10.0 | 6.0 | 10.5 | 12.3 |
| 9..... | | 25 | 11.8 | | | 24..... | | 11.0 | 6.4 | 12.3 | 11.0 |
| 10..... | | 24 | 17 | 18 | | 25..... | | 28 | 7.4 | 9.6 | 10.5 |
| 11..... | | 28 | 6.0 | 11.4 | | 26..... | | 28 | 8.2 | 8.7 | 10.5 |
| 12..... | | 29 | 5.6 | 15 | | 27..... | | 22 | 13.6 | 11.8 | 10.5 |
| 13..... | | 24 | 6.0 | 22 | | 28..... | | 21 | 11.0 | 17 | 11.4 |
| 14..... | | 27 | 6.4 | 18 | | 29..... | | 20 | 10.5 | 18 | 10.0 |
| 15..... | | 26 | 6.4 | 13.6 | | 30..... | | | 18 | 17 | 15 |
| | | | | | | 31..... | | | | 12.8 | |

KEHENA DITCH NEAR KOHALA, HAWAII.

LOCATION.—At old Honokane weir just below head of west branch of Honokanenui Gulch, about 13 miles by trail southwest of Kohala Ditch Co.'s headquarters at Howi.

RECORDS AVAILABLE.—December 28, 1917, to June 30, 1918.

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

DISCHARGE MEASUREMENTS.—Made from plank across ditch 100 feet above old weir.

CHANNEL AND CONTROL.—Weir basin has concrete walls and is about 25 feet long and 20 feet wide. Control is old wooden weir of three 5-foot panels, with imperfect contractions and no longer sharp crested.

EXTREMES OF DISCHARGE.—Maximum stage recorded, 2.16 feet at 8.15 p. m. January 27 (discharge, 86 million gallons per day, or 133 second-foot); minimum stage recorded, 0.03 foot, April 20 and June 9 (discharge, 0.2 million gallons per day, or 0.3 second-foot).

DIVERSIONS.—Ditch diverts water from several small streams.

REGULATION.—By head gates.

UTILIZATION.—For irrigation of sugar cane.

ACCURACY.—Stage-discharge relation permanent. Operation of water-stage recorder satisfactory. Rating curve well defined below 4 million gallons per day and records good below that stage; curve for stages above 4 million gallons per day not based on discharge measurements, but on account of uniform conditions at weir, determinations of daily discharges by extensions of rating curve are fair.

Discharge measurements of Kehena ditch near Kohala, Hawaii, during the year ending June 30, 1918.

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

| Date. | Gage height (feet). | Discharge. | | Date. | Gage height (feet). | Discharge. | |
|--------------|---------------------|--------------|--------------------------|--------------|---------------------|--------------|--------------------------|
| | | Second-foot. | Million gallons per day. | | | Second-foot. | Million gallons per day. |
| Feb. 16..... | 0.14 | 2.4 | 1.6 | Apr. 27..... | 0.12 | 1.85 | 1.2 |
| Mar. 20..... | .11 | 1.6 | 1.0 | June 14..... | .20 | 4.5 | 2.9 |

Daily discharge, in million gallons, of Kehena ditch near Kohala, Hawaii, for the year ending June 30, 1918.

| Day. | Dec. | Jan. | Feb. | Mar. | Apr. | May. | June. |
|---------|------|------|------|------|------|------|-------|
| 1..... | | 0.7 | 26 | 35 | 6.3 | 8.1 | 8.1 |
| 2..... | | .7 | 9.6 | 42 | 39 | 3.9 | 9.6 |
| 3..... | | .0 | 4.4 | 28 | 24 | 20 | 5.2 |
| 4..... | | .0 | 2.8 | 20 | 18 | 39 | 3.4 |
| 5..... | | .9 | 2.6 | 11.2 | 22 | 33 | 3.0 |
| 6..... | | 2.8 | 1.9 | 6.3 | 16 | 24 | 2.3 |
| 7..... | | 1.5 | 3.4 | 4.4 | 15 | 16 | 2.3 |
| 8..... | | 3.2 | 3.4 | 3.0 | 33 | 11.2 | .5 |
| 9..... | | 20 | 9.6 | 2.1 | 24 | 9.6 | .2 |
| 10..... | | 11.2 | 39 | 15 | 15 | 16 | .5 |
| 11..... | | 28 | 39 | 22 | 4.7 | 5.8 | 6.9 |
| 12..... | | 6.6 | 44 | 22 | 1.7 | 7.5 | 26 |
| 13..... | | 4.2 | 15 | 9.6 | 2.6 | 15 | 9.6 |
| 14..... | | 3.9 | 5.2 | 20 | 1.7 | 15 | 3.2 |
| 15..... | | 2.6 | 2.6 | 15 | 1.2 | 7.5 | 16 |
| 16..... | | 26 | 1.7 | 5.2 | 1.0 | 8.1 | 12.9 |
| 17..... | | 6.6 | 20 | 3.7 | .7 | 8.1 | 16 |
| 18..... | | 3.0 | 12.9 | 2.1 | .4 | 4.9 | 12.9 |
| 19..... | | 2.1 | 24 | 1.5 | .3 | 2.3 | 9.6 |
| 20..... | | 9.6 | 37 | 1.0 | .2 | 1.9 | 11.2 |
| 21..... | | 7.5 | 24 | .9 | 1.0 | 2.1 | 12.9 |
| 22..... | | 6.9 | 16 | .9 | 3.0 | 6.6 | 11.2 |
| 23..... | | 3.7 | 26 | .9 | 1.5 | 4.7 | 7.2 |
| 24..... | | 2.1 | 20 | .9 | 1.0 | 3.9 | 6.3 |
| 25..... | | 2.6 | 9.6 | 26 | .9 | 2.3 | 9.6 |
| 26..... | | 16 | 8.1 | 22 | .9 | 2.6 | 6.9 |
| 27..... | | 46 | 15 | 9.6 | 1.0 | 6.9 | 3.0 |
| 28..... | | 51 | 35 | 4.4 | 1.2 | 8.1 | 2.6 |
| 29..... | 7.8 | 33 | | 2.3 | 1.2 | 8.1 | 1.9 |
| 30..... | 1.9 | 31 | | 1.7 | 15 | 8.1 | 8.1 |
| 31..... | .9 | 31 | | 1.7 | | 9.6 | |

Monthly discharge of Kehena ditch near Kohala, Hawaii, for the year ending June 30, 1918.

| Month. | Discharge. | | | | Total run-off. | |
|------------------------|--------------------------|----------|-------|---------------------|------------------|------------|
| | Million gallons per day. | | | Second-foot (mean). | Million gallons. | Acre-feet. |
| | Maximum. | Minimum. | Mean. | | | |
| January (29 days)..... | 51 | 0.7 | 12.6 | 19.5 | 364 | 1,120 |
| February..... | 44 | 1.7 | 16.4 | 25.4 | 458 | 1,410 |
| March..... | 42 | .9 | 11.0 | 17.0 | 340 | 1,050 |
| April..... | 39 | .2 | 8.45 | 13.1 | 254 | 778 |
| May..... | 39 | 1.9 | 10.3 | 15.9 | 320 | 980 |
| June..... | 26 | .2 | 7.64 | 11.8 | 229 | 703 |
| The period..... | | | | | 1,960 | 6,040 |

WAOIHINU SPRINGS, MAUKA STATION, NEAR NAALEHU, HAWAII.

LOCATION.—Below confluence of several small streams issuing from Waiohinu Springs (sometimes called Hoao Springs), 4 feet above intake to Waiohinu water-supply system, 6 feet above intake to pipe leading to Hutchinson plantation, 1 mile north of Waiohinu, and 3 miles by trail northwest of Naalehu.

RECORDS AVAILABLE.—November 29, 1917, to June 30, 1918.

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

DISCHARGE MEASUREMENTS.—Made by 2.5 foot rectangular, sharp-crested weir, with full end contractions.

CHANNEL AND CONTROL.—Weir basin is about 6 feet wide and 10 feet long.

EXTREMES OF DISCHARGE.—Maximum stage recorded, 0.67 foot at 3 a. m. February 20 (discharge, 2.8 million gallons per day, or 4.3 second-feet); minimum stage recorded, 0.10 foot December 1-6 and January 11 and 12 (discharge, 0.17 million gallons per day, or 0.26 second-foot).

DIVERSIONS.—None.

REGULATION.—None.

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

ACCURACY.—Stage-discharge relation practically permanent. Operation of water-stage recorder satisfactory, except May 12-19 (no record); discharge estimated at 0.60 million gallons per day. Records good.

Daily discharge, in million gallons, of Waiohinu Springs, mauka station, near Naalehu, Hawaii, for the year ending June 30, 1918.

| Day. | Dec. | Jan. | Feb. | Mar. | Apr. | May. | June. |
|---------|------|------|-------|------|-------|-------|-------|
| 1..... | 0.17 | 0.54 | 1.17 | 1.04 | 0.54 | 0.66 | 0.54 |
| 2..... | .17 | .58 | 1.08 | .95 | .54 | .66 | .47 |
| 3..... | .17 | .40 | .91 | .91 | .54 | .66 | .47 |
| 4..... | .17 | .37 | .86 | .91 | .54 | .58 | .47 |
| 5..... | .17 | .37 | .82 | .91 | .54 | .62 | .47 |
| 6..... | .17 | .37 | .78 | .82 | .54 | .66 | .47 |
| 7..... | .20 | .31 | .74 | .78 | .58 | .66 | .47 |
| 8..... | .20 | .25 | .70 | .74 | .62 | .66 | .47 |
| 9..... | .20 | .22 | .66 | .70 | .66 | .66 | .51 |
| 10..... | .20 | .22 | .58 | .66 | .78 | .70 | .58 |
| 11..... | .20 | .17 | .58 | .66 | .86 | .70 | .66 |
| 12..... | .20 | .17 | .58 | .66 | .82 | ..... | .70 |
| 13..... | .22 | .28 | .62 | .66 | .82 | ..... | .70 |
| 14..... | .22 | .31 | .54 | .74 | .74 | ..... | .70 |
| 15..... | .22 | .34 | .51 | .99 | .74 | ..... | .70 |
| 16..... | .22 | .34 | .54 | 1.17 | .78 | ..... | .70 |
| 17..... | .31 | .34 | .62 | 1.13 | .78 | ..... | .70 |
| 18..... | .40 | .34 | .91 | .86 | .78 | ..... | .70 |
| 19..... | .34 | .34 | 1.37 | .86 | .78 | ..... | .70 |
| 20..... | .34 | .28 | 1.82 | .74 | .78 | .51 | .70 |
| 21..... | .40 | .28 | 1.66 | .70 | .66 | .54 | .70 |
| 22..... | .51 | .25 | 1.41 | .70 | .47 | .58 | .66 |
| 23..... | .44 | .28 | 1.17 | .66 | .47 | .58 | .54 |
| 24..... | .44 | .28 | 1.04 | .70 | .51 | .58 | .54 |
| 25..... | .44 | .37 | 1.04 | .70 | .54 | .58 | .54 |
| 26..... | .47 | .70 | 1.04 | .70 | .51 | .51 | .58 |
| 27..... | .58 | 1.17 | 1.04 | .70 | .54 | .51 | .58 |
| 28..... | .62 | 1.17 | 1.04 | .70 | .58 | .54 | .54 |
| 29..... | .62 | 1.17 | ..... | .70 | .62 | .58 | .54 |
| 30..... | .58 | 1.22 | ..... | .70 | .62 | .58 | .47 |
| 31..... | .51 | 1.22 | ..... | .54 | ..... | .58 | ..... |

Monthly discharge of Waiohinu Springs, mauka station, near Naalehu, Hawaii, for the year ending June 30, 1918.

| Month. | Discharge. | | | Total run-off. | | |
|-----------------|--------------------------|----------|-------|---------------------|------------------|------------|
| | Million gallons per day. | | | Second-foot (mean). | Million gallons. | Acre-feet. |
| | Maximum. | Minimum. | Mean. | | | |
| December..... | 0.62 | 0.17 | 0.326 | 0.504 | 10.1 | 31.0 |
| January..... | 1.22 | .17 | .473 | .732 | 14.6 | 45.0 |
| February..... | 1.82 | .51 | .922 | 1.43 | 25.8 | 79.2 |
| March..... | 1.17 | .54 | .787 | 1.22 | 24.4 | 74.9 |
| April..... | .86 | .47 | .643 | .995 | 19.3 | 59.2 |
| May..... | ..... | ..... | .603 | .933 | 18.7 | 57.4 |
| June..... | .70 | .47 | .586 | .907 | 17.6 | 54.0 |
| The period..... | ..... | ..... | ..... | ..... | 130 | 401 |

WAOIHINU SPRINGS, MAKAI STATION, NEAR NAALEHU, HAWAII.

LOCATION.—At same location as old Hutchinson Plantation weir, 150 feet below intake to Waiohinu water-supply system, 1 mile north of Waiohinu and 3 miles by trail northwest of Naalehu.

RECORDS AVAILABLE.—November 29, 1917, to June 30, 1918.

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

DISCHARGE MEASUREMENTS.—Made by a rectangular, sharp-crested weir 1.5 feet long.

CHANNEL AND CONTROL.—Weir basin is 8 feet long and 4 feet wide, made of redwood planks, and provided with set of baffles.

EXTREMES OF DISCHARGE.—Maximum stage recorded, 0.4 foot at 12.10 a. m. March 16 (discharge, 0.77 million gallon per day, or 1.19 second-feet); minimum stage recorded, 0.10 foot December 1-6 (discharge, 0.10 million gallon per day, or 0.15 second-foot).

DIVERSIONS.—Pipe line supplying Waiohinu village and Kamaoa homesteads diverts water above station.

REGULATION.—By diversion only.

UTILIZATION.—For irrigation and fluming cane and for stock.

ACCURACY.—Stage-discharge relation practically permanent. Operation of water-stage recorder satisfactory, except May 12-18, no record, and discharge interpolated. Records good.

Daily discharge, in million gallons, of Waiohinu Springs, makai station, near Naalehu, Hawaii, for the year ending June 30, 1918.

| Day. | Dec. | Jan. | Feb. | Mar. | Apr. | May. | June. |
|---------|------|------|-------|------|-------|------|-------|
| 1..... | 0.10 | 0.24 | 0.69 | 0.75 | 0.46 | 0.51 | 0.37 |
| 2..... | .10 | .28 | .69 | .75 | .46 | .51 | .37 |
| 3..... | .10 | .28 | .69 | .72 | .48 | .51 | .37 |
| 4..... | .10 | .28 | .69 | .72 | .53 | .51 | .37 |
| 5..... | .10 | .24 | .66 | .72 | .51 | .44 | .37 |
| 6..... | .10 | .24 | .64 | .72 | .51 | .34 | .37 |
| 7..... | .12 | .24 | .59 | .69 | .48 | .34 | .34 |
| 8..... | .12 | .20 | .56 | .69 | .51 | .34 | .37 |
| 9..... | .12 | .18 | .56 | .66 | .59 | .34 | .41 |
| 10..... | .12 | .18 | .51 | .61 | .69 | .34 | .53 |
| 11..... | .12 | .18 | .48 | .61 | .72 | .34 | .56 |
| 12..... | .15 | .18 | .48 | .64 | .72 | .35 | .64 |
| 13..... | .15 | .22 | .46 | .64 | .69 | .35 | .66 |
| 14..... | .15 | .24 | .46 | .66 | .64 | .35 | .64 |
| 15..... | .15 | .24 | .44 | .75 | .64 | .35 | .61 |
| 16..... | .20 | .24 | .39 | .77 | .64 | .36 | .58 |
| 17..... | .24 | .20 | .48 | .72 | .64 | .36 | .53 |
| 18..... | .24 | .20 | .61 | .72 | .64 | .36 | .53 |
| 19..... | .28 | .20 | .66 | .72 | .64 | .37 | .51 |
| 20..... | .32 | .18 | .72 | .66 | .59 | .34 | .46 |
| 21..... | .37 | .18 | .75 | .56 | .51 | .37 | .39 |
| 22..... | .46 | .18 | .75 | .48 | .51 | .39 | .39 |
| 23..... | .46 | .18 | .72 | .48 | .51 | .37 | .41 |
| 24..... | .51 | .20 | .72 | .51 | .51 | .39 | .41 |
| 25..... | .51 | .28 | .72 | .51 | .51 | .37 | .43 |
| 26..... | .34 | .41 | .75 | .51 | .51 | .37 | .43 |
| 27..... | .34 | .69 | .75 | .51 | .51 | .37 | .41 |
| 28..... | .32 | .69 | .75 | .46 | .51 | .39 | .41 |
| 29..... | .32 | .69 | ..... | .44 | .51 | .39 | .41 |
| 30..... | .28 | .69 | ..... | .44 | .51 | .39 | .34 |
| 31..... | .28 | .69 | ..... | .44 | ..... | .37 | ..... |

Monthly discharge of Waiohinu Springs, makai station, near Naalehu, Hawaii, for the year ending June 30, 1918.

| Month. | Discharge. | | | | Total run-off. | |
|-----------------|--------------------------|----------|-------|---------------------|------------------|------------|
| | Million gallons per day. | | | Second-feet (mean). | Million gallons. | Acre-feet. |
| | Maximum. | Minimum. | Mean. | | | |
| December..... | 0.51 | 0.10 | 0.234 | 0.362 | 7.3 | 22.3 |
| January..... | .69 | .18 | .301 | .466 | 9.3 | 28.6 |
| February..... | .75 | .39 | .620 | .959 | 17.4 | 53.3 |
| March..... | .77 | .44 | .621 | .961 | 19.3 | 59.1 |
| April..... | .72 | .46 | .563 | .871 | 16.9 | 51.8 |
| May..... | .51 | .34 | .383 | .593 | 11.9 | 36.4 |
| June..... | .66 | .34 | .454 | .702 | 13.6 | 41.8 |
| The period..... | ..... | ..... | ..... | ..... | 95.7 | 293 |

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 Hawaii during the year ending June 30, 1918.

| Date. | Stream. | Locality. | Gage height (feet). | Discharge. | |
|----------|---|---|---------------------|--------------|--------------------------|
| | | | | Second-feet. | Million gallons per day. |
| Sept. 24 | Wailuku River..... | At old gaging station, near Hilo..... | ..... | 2.3 | 15 |
| 29 | do..... | do..... | ..... | 18 | 11 |
| 24 | Right Main Branch of Wailuku River..... | Elevation about 1,125 feet, near Hilo..... | ..... | 9.4 | 6.1 |
| 29 | do..... | do..... | ..... | 6.6 | 4.3 |
| 24 | Kapehu..... | 500 feet above trail crossing. Stream is also known as Middle Fork of Wailuku River. | ..... | 2.4 | 1.5 |
| 29 | do..... | do..... | ..... | 3.5 | 2.3 |
| 29 | Waiou..... | At outlet of pool below falls, elevation 1,000 feet. Stream also known as Left Branch of Wailuku River. | ..... | 1.35 | .85 |
| 24 | Branch of Kapehu..... | At trail crossing, near Hilo..... | ..... | 1.3 | .85 |
| 24 | Branch of Wailuku River.... | At trail crossing, near Hilo, elevation 1,225 feet. | ..... | .2 | .15 |

RAINFALL.

GENERAL CONDITIONS.

The rainfall of the Hawaiian Islands is extremely variable, ranging from a few inches at several low-level, leeward localities to nearly 600 inches per annum, at elevations exceeding 2,000 feet on the windward sides of the islands. Valleys on the same sides of the islands and within a few miles of each other may have a variation in mean annual precipitation of several hundred per cent. The rainfall may also vary greatly in the same valley at 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.

Most of the daily rain gages maintained by the United States Weather Bureau are at low levels. Lack of funds and the absence of residents have prevented the bureau from maintaining stations at high levels, but it obtains a number of daily records from occupants and caretakers of mountain houses and ranches. The data furnished by the Weather Bureau are therefore generally of little value in determining stream run-off.

When high levels have been accessible and funds available high-level rain gages, which are read at monthly, bimonthly, or longer intervals, have been established by this office and some valuable records obtained. To determine the precipitation throughout the Territory accurately 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 the following companies and individuals:

Kauai: Kekaha Sugar Co.; Hawaiian Sugar Co.; Grove Farm Plantation; W. F. Sanborn, of Princeville Ranch; Kauai Electric Co.; J. McClellan.

Oahu: F. Meyer; United States Army; Koolau Agricultural Co.; Hawaii Preserving Co.

Maui: Wailuku Sugar Co.; Honolua Ranch; Hawaiian Commercial & Sugar Co.; Maui Board of Supervisors; Pioneer Mill Co.; Olowalu Sugar Co.

The tables on pages 166-167 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. Intake of Kauai Electric Co.'s canal, 6 miles back of Hanalei; 700 feet above sea level; records furnished by Kauai Electric Co.

2. 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.

3. 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 ready by employee of Kauai Electric Co.

4. 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.

5. About 40 feet north of Sanborn's residence, 2 miles from Hanalei; 105 feet above sea level; records furnished by Princeville ranch.

6. 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.

7. Residence of W. S. Newlun, about $4\frac{1}{2}$ miles west of Kapaa; 375 feet above sea level.

8. 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.

9. 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.

10. At ditchman's house, 500 feet west of Papuaa Reservoir, 6 miles west of Lihue; 500 feet above sea level.

11. 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.

12. Hanapepe Valley, on the 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.

13. 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.

14. Waimea, in Mr. J. McClellan's yard, 10 feet above sea level; Mr. McClellan aids in obtaining record.

15. At the stream-gaging station on Kalihiwai River, 10 miles from Hanalei via Kauai Electric Co.'s power-line trail; 700 feet above sea level.

16. At stream-gaging station in upper Hanalei Valley, about 2 miles north by foot trail of Summit Camp on power-line trail; about 700 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. At elevation 970 feet in upper Kalihi Valley, about 2 miles above Catholic orphanage.

5. Wahiawa Water Co.'s 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 the Waiialua Agricultural Co.'s ditch intake.)

6. Hawaiian Preserving Co.'s office, Wahiawa; 950 feet above sea level; records are furnished by Hawaiian Preserving Co.

7. Makaha, near Waianae, on property of Waianae plantation; 1,300 feet above sea level; records furnished by F. Meyer, manager Waianae plantation.

8. About 250 feet from Koloa Stream gaging station, 3 miles by trail southwest of Laie; 550 feet above sea level.

9. On left bank of Maole Stream, at head of first falls in Hillebrand Glen, about $2\frac{1}{2}$ miles from end of Nuuanu Valley street car line; 1,200 feet above sea level.

MAUI.

1. Waikamoi Gulch, on Kula pipe line at reservoir, 3 miles from Olinda and 7 miles from Makawao; 4,200 feet above sea level.

2. 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.

3. Olinda, on Kula pipe line, 4 miles east of Makawao; 4,000 feet above sea level.

4. 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.

5. West slope of Puu Kukui, about one-half of a mile south of Honokawai Gulch; about $4\frac{1}{2}$ miles east of Kaanapali and $8\frac{1}{2}$ miles from Lahaina; 2,500 feet above sea level.

6. 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.

7. 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.

8. Rim of extinct crater of Mount Eke; 14 miles by trail from Honokahau; 4,500 feet above sea level.

Island of Oahu.

| | | | | | | | | | | | | | | | | |
|---|---------------------------------|------------------------------|--|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| 1 | Nunau Pali..... | Sept. 23, 1910-June 30, 1918 | 2:1..... | 2.80 | 4.20 | 6.00 | 4.40 | 10.20 | 13.10 | 16.60 | 8.60 | 27.00 | 28.90 | 12.80 | 5.00 | 139.6 |
| 2 | Manoa..... | May 17, 1915-June 30, 1918 | 1:10..... | 8.61 | 6.87 | 7.21 | 7.33 | 16.45 | 9.29 | 8.67 | 10.42 | 23.06 | 25.69 | 13.51 | 12.30 | 149.41 |
| 3 | Kalihi..... | Sept. 8, 1914-June 30, 1918 | 1:10..... | 4.81 | 5.52 | 5.80 | 3.96 | 12.90 | 10.34 | 11.39 | 11.20 | 17.71 | 20.76 | 8.97 | 7.99 | 121.35 |
| 4 | Kalihi-mauka..... | Feb. 7, 1917-June 30, 1918 | 2:1..... | 5.80 | 6.20 | 11.20 | 3.60 | 13.00 | 9.80 | 14.20 | 13.60 | 24.40 | 32.60 | 14.80 | 10.40 | 159.80 |
| 5 | Wahiawa Water Co.'s Intake..... | May 30, 1913-June 30, 1918 | 2:1..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | 202.7 |
| 6 | Hawaii Preserving Co.. | Mar. 1, 1913-June 30, 1918 | Records furnished by Hawaii Preserving Co. | 2:35 | 1.17 | 5.55 | 2.83 | 3.80 | 8.48 | 8.57 | 5.23 | 5.88 | 9.34 | 2.59 | .85 | 56.64 |
| 7 | Makaha..... | Aug. 1, 1912-June 30, 1918 | Records furnished by F. Meyer. | 5.94 | 4.12 | 4.78 | 2.84 | 5.85 | 10.92 | 14.80 | 11.81 | 9.21 | 21.01 | 1.65 | 3.19 | 96.12 |
| 8 | Koloa..... | Oct. 30, 1915-June 30, 1918 | 2:1..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | 108.2 |
| 9 | Hillebrand Glen No. 2. | May 6, 1916-June 30, 1918 | 2:1..... | 5.60 | 8.00 | 7.80 | 6.00 | 17.00 | 14.20 | 16.20 | 12.40 | 27.20 | 31.80 | 13.00 | 14.20 | 173.4 |

Island of Maui.

| | | | | | | | | | | | | | | | | |
|---|------------------------|------------------------------|--|-------|------|------|------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| 1 | Waikamoi Gulch..... | Oct. 12, 1910-June 30, 1918 | Records furnished by Maui County engineer. | 11.31 | 8.46 | 5.82 | 6.49 | 25.67 | 7.34 | 15.74 | 33.86 | 41.74 | 65.55 | 19.79 | 17.59 | 259.36 |
| 2 | Puehikamoa..... | May 1, 1911-June 30, 1918 |do..... | 11.15 | 8.58 | 6.05 | 5.13 | 22.08 | 6.42 | 14.17 | 31.03 | 39.78 | 62.84 | 24.34 | 16.69 | 248.26 |
| 3 | Olinda..... | Sept. 26, 1910-June 30, 1918 |do..... | 7.99 | 2.90 | 2.88 | 3.19 | 7.56 | 3.32 | 13.34 | 11.13 | 12.96 | 16.78 | 3.74 | 1.39 | 80.18 |
| 4 | Puukukui, upper slope. | Oct. 13, 1911-June 30, 1918 | Records furnished by Pioneer Mill Co. | 7.0 | 16.0 | 5.0 | 15.0 | 44.0 | 26.0 | 32.0 | 54.0 | 56.0 | 72.0 | 28.0 | 45.0 | 401.0 |
| 5 | Puukukui, lower slope. |do..... |do..... | 8 | 1.0 | 3.2 | 2.6 | 4.4 | 4.4 | 9.0 | 16.4 | 14.4 | 21.2 | 6.8 | 2.6 | 86.8 |
| 6 | Honokahau Ridge..... | Mar. 10, 1913-June 30, 1918 | 2:1..... | 3.6 | 4.4 | 1.6 | 38.0 | 6.6 | 9.4 | 10.6 | 20.6 | 29.0 | 49.0 | 13.0 | 12.8 | 198.0 |
| 7 | Honokahau Gulch..... | Feb. 1, 1907-June 30, 1918 | Records furnished by Honolulu ranch. | 4.17 | 3.09 | 3.04 | 3.93 | 9.27 | 11.35 | 12.76 | 27.22 | 44.31 | 64.29 | 15.17 | 13.15 | 211.75 |
| 8 | Mount Eke..... | Mar. 10, 1913-June 30, 1918 | 5:1..... | 9.0 | 10.5 | 5.5 | 50.0 | 13.5 | 13.0 | 11.5 | 35.0 | 60.5 | 60.0 | 20.5 | 30.5 | 319.5 |



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