WATER RESOURCES OF THE YAP ISLANDS

By Otto van der Brug

U.S. GEOLOGICAL SURVEY

Water-Resources Investigations Report 82-357

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CONVERSION TABLE

The following table may be used to convert measurements in the inch-pound system to the International System of Units (SI).

Multiply	By		To obtain
Length			
inch (in)	25.4	----	millimeter (mm)
foot (ft)	0.3048	----	meter (m)
mile (mi)	1.609	----	kilometer (km)
Area			
acre	4,047	----	square meter (m^2)
square foot (ft^2)	0.0929	----	square meter (m^2)
square mile (mi^2)	2.590	----	square kilometer (km^2)
Volume			
acre-foot (acre-ft)	1,233	----	cubic meter (m^3)
cubic foot (ft^3)	0.02832	----	cubic meter (m^3)
gallon (gal)	3.785	----	liter (L)
million gallons (Mgal)	3,785	----	cubic meter (m^3)
Volume Per Unit Time (includes Flow)			
cubic foot per second (ft^3/s)	0.02832	----	cubic meter per second (m^3/s)
cubic foot per second-day (ft^3/s-d)	2,447	----	cubic meter (m^3)
gallon per minute (gal/min)	0.06309	----	cubic decimeter per second (dm^3/s)
gallon per day (gal/d)	90.85	----	cubic decimeter per second (dm^3/s)
million gallons per day (Mgal/d)	0.04381	----	cubic meter per second (m^3/s)
Miscellaneous			
cubic foot per second per square mile [$(ft^3/s)/mi^2$]	0.01093	----	cubic meter per second per square kilometer [$(m^3/s)/km^2$]
micromho per centimeter at 25° Celsius (µmho/cm at 25°C)	1	----	microsiemens per centimeter at 25° Celsius (µS/cm at 25°C)

DEFINITION OF TERMS

Water Resources

Acre-foot (acre-ft) is the quantity of water required to cover one acre to a depth of one foot and is equivalent to 43,560 cubic feet or 325,851 gallons.

Control designates a feature downstream from the gage that determines the stage-discharge relation at the gage. This feature may be a natural constriction of the channel, an artificial structure, or a uniform cross section over a long reach of the channel.

Cubic foot per second (ft^3/s) is the rate of discharge representing a volume of one cubic foot passing a given point during one second and is equivalent to 7.48 gallons per second or 448.8 gallons per minute.

Cubic foot per second day ($ft^3/s\text{-}d$) is the volume of water represented by a flow of one cubic foot per second for 24 hours. It is equivalent to 86,400 cubic feet, 1.93875 acre-feet, or 646,317 gallons.

Discharge is the volume of water that passes a given point within a given period of time.

Mean discharge (mean) is the arithmetic average of individual daily mean discharges during a specified period.

Instantaneous discharge is the discharge at a particular instant of time. If this discharge is reported instead of the daily mean, the heading of the discharge column in the table is "Discharge."

Dissolved is that material in a representative water sample which passes through a 0.45-µm membrane filter.

Drainage area of a stream at a specific location is that area, measured in a horizontal plane, enclosed by a topographic divide from which direct surface runoff from precipitation normally drains by gravity into the river above the specified point.

Gage height is the water-surface elevation referred to some arbitrary gage datum.

Gaging station is a particular site on a stream where systematic observations of hydrologic data are obtained.

Hardness of water is a physical-chemical characteristic that is commonly recognized by the increased quantity of soap required to produce lather, due mostly to the presence of alkaline earths (principally calcium and magnesium) and is expressed as equivalent calcium carbonate ($CaCO_3$).

Micrograms per liter (µg/L) is a unit expressing the concentration of chemical constituents in solution as mass (micrograms) of solute per unit volume (liter) of water. One thousand micrograms per liter is equivalent to one milligram per liter.

Milligrams per liter (mg/L) is a unit expressing the concentration of chemical constituents in solution as mass (milligrams) of solute per unit volume (liter) of water.

Partial-record station is a particular site where limited streamflow and/or water-quality data are collected systematically over a period of years for use in hydrologic analyses.

Runoff in inches shows the depth to which the drainage area would be covered if all the runoff for a given time period were uniformly distributed on it.

Sediment is solid material that originates mostly from disintegrated rocks and is transported by, suspended in, or deposited from water; it includes chemical and biochemical precipitates and decomposed organic material, such as humus. The quantity, characteristics, and cause of the occurrence of sediment in streams are influenced by environmental factors. Some major factors are degree of slope, length of slope, soil characteristics, land usage, and quantity and intensity of precipitation.

Specific conductance is a measure of the ability of a water to conduct an electrical current. It is expressed in micromhos per centimeter at 25°C. Specific conductance is related to the type and concentration of ions in solution and can be used for approximating the dissolved-solids content of the water. Commonly, the concentration of dissolved solids (in milligrams per liter) is about 65 percent of the specific conductance (in micromhos). This relation is not constant from stream to stream, and it may vary in the same source with changes in the composition of the water.

Stage is the water-surface altitude referred to some arbitrary gage datum (gage height).

Stage-discharge relation is the relation between gage height (stage) and volume of water per unit of time, flowing in a channel.

Streamflow is the discharge that occurs in a natural channel. Although the term "discharge" can be applied to the flow of a canal, the word "streamflow" uniquely describes the discharge in a surface stream course. The term "streamflow" is more general than "runoff" as streamflow may be applied to discharge whether or not it is affected by diversion or regulation.

Turbidity of a sample is the reduction of transparency due to the presence of particulate matter. In this report it is expressed in Nephelometric Turbidity Units (NTU).

Geology

Alluvium: Soil, sand, gravel, or similar material deposited by running water.

Amphibolite: A granulose metamorphic rock consisting essentially of amphibole and plagioclase, and commonly containing quartz, epidote, or garnet.

Basement rock: The assemblage of metamorphic and igneous rocks that underlie the sedimentary and unmetamorphosed volcanic rocks in any particular region.

Breccia: A rock consisting of consolidated angular rock fragments larger than sand grains.

Dike: A tabular body of igneous rock that cuts across the structure of adjacent rocks or cuts massive rocks.

Facies: Designates the aspect or appearance of a mass of earth material different in one or several respects from surrounding material.

Fault: A break or fracture in material of the earth's crust, along which there has been movement.

Muck: Organic material which is decomposed enough so that identification of plant parts is impossible.

Metamorphic rocks: Rock formed by recrystallization of an igneous or sedimentary rock under the influence of heat, pressure, or both.

Schist: A metamorphic rock that splits into thin, irregular plates because of the presence of parallel grains of mica or other cleavable minerals.

Sill: A tabular body of igneous rock that has been injected, while molten, between layers of sedimentary or igneous rock.

Tectonic: Pertaining to the rock structures and landforms resulting from deformation of the earth's crust.

Tuff: Indurated pyroclastic rocks of grain generally finer than 4 mm (equivalent to volcanic ash or dust).

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ABSTRACT

The Yap Islands consist of four major islands, Yap, Gagil-Tamil, Maap, and Rumung. Of these, Yap Island has more than half the total land area, most of the population, and almost all of the economic development. The islands of Maap and Rumung together compose only 15 percent of the land area and population.

Average annual rainfall over the Yap Islands amounts to 122 inches. Rainfall-runoff comparisons indicate that about half of the annual rainfall runs off to the ocean on Yap Island and Gagil-Tamil. Streams on Gagil-Tamil are perennial but streams on Yap Island are dry an average of 3 month per year due to geologic differences.

Analyses of water samples from 23 sources show the good quality and the chemical similarity of surface and ground water.

This report summarizes the hydrologic data collected and provides interpretations that can be used by the planning and public works officials of Yap to make decisions concerning development and management of their water resources.

INTRODUCTION

Cooperation

In 1968, the U.S. Geological Survey and the Trust Territory of the Pacific Islands signed a joint funding agreement to systematically collect streamflow data.

This program was expanded in 1972, with the addition of several rain gages, and again in 1974, when a senior geologist, Dan Davis, was assigned nearly full-time to Trust Territory Headquarters to provide advice on exploratory drilling and ground-water development. The collection and analyses of water-quality data were introduced into the program in 1979 with the collection of samples from most streams on the Yap Islands.

Under the cooperative program, the Trust Territory Government agreed to provide labor, equipment, services, and funds to be matched on an equal-value basis by the Geological Survey. The Survey assumed the responsibility of supervision, data compilation and analyses, and publication.

In 1981, after the formation of the Federated States of Micronesia, the responsibility for the matching funds and services was transferred from the Trust Territory Government to the separate states.

Purpose and Scope

The bulk of the hydrologic data collected by the Geological Survey since 1967 on the major islands in the Trust Territory of the Pacific Islands consists of records of discharge and stage of most of the principal streams. More recently, the data base has been expanded to include information on ground-water resources, water quality, and rainfall. Most of the data have been published by the Geological Survey in its annual release "Water Resources Data for Hawaii and Other Pacific Areas," and for 1968-70 in Water-Supply Paper 2137. Miscellaneous measurements made prior to 1968 were published in the 1968 annual report.

This report has two purposes: first, to provide a summary of available water-resources information for the Yap Islands; and second, to provide interpretations that can be used by planning and public works officials of Yap to make decisions on the future development and management of their water resources.

Geographic Setting

The Yap Islands are part of the Western Caroline Islands and lie between 9°27' and 9°38' N. latitude and 138°03' and 138°12' E. longitude, 450 miles southwest of Guam, 1,100 miles east of Manila, 1,900 miles south of Tokyo, and 3,800 miles west of Honolulu (fig. 1).

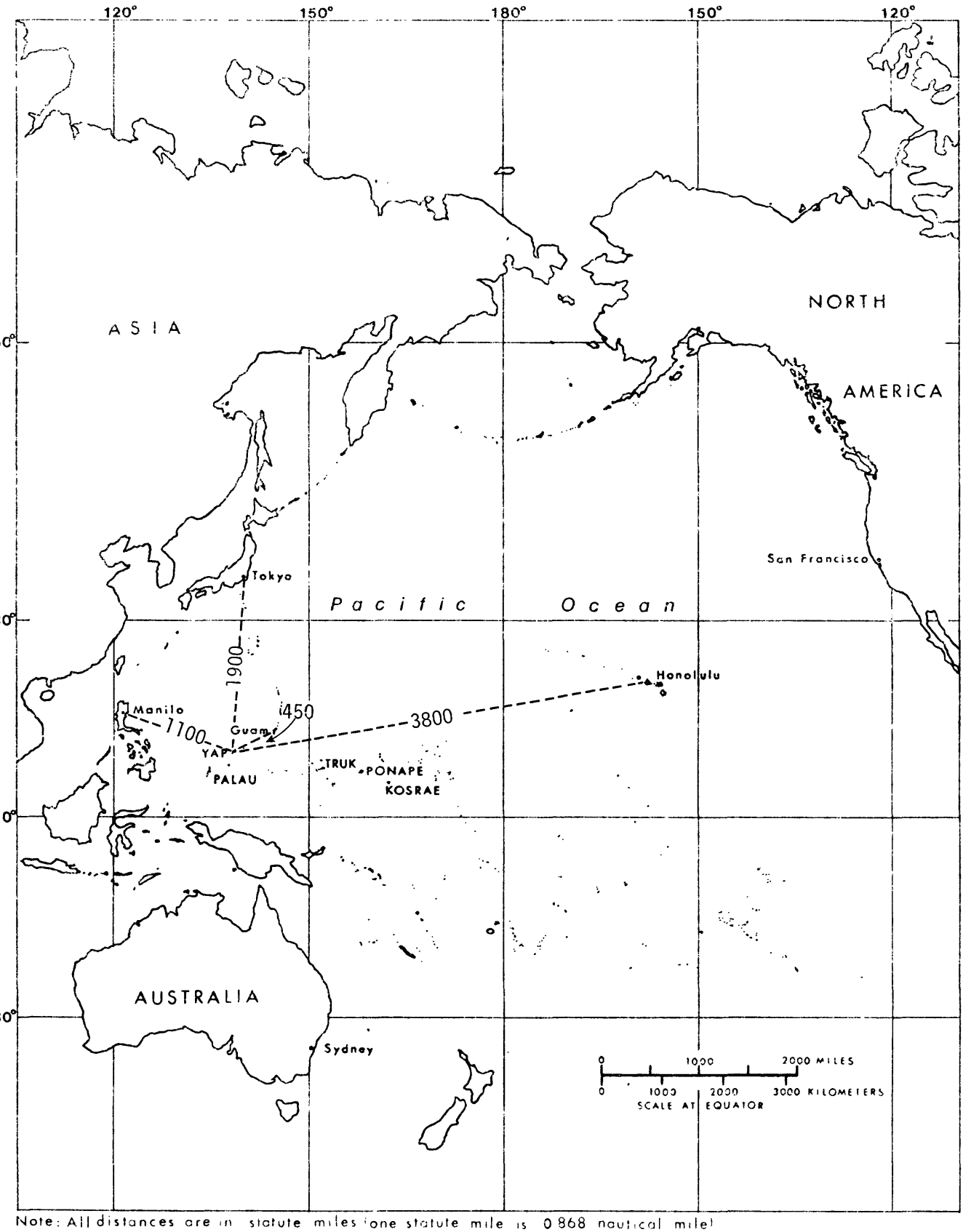
The islands of Yap, Gagil-Tamil, Maap, and Rumung are the four major islands and have a total land area of 38 mi^2 (square miles). The smaller islands of Maap (4.1 mi^2) and Rumung (1.6 mi^2) are separated from Yap and Gagil-Tamil by narrow, shallow channels. Mangrove swamps border much of the shoreline, whereas the interior is mountainous with forested valleys and rolling grass-covered hills. A mountain range runs in a north-south direction along the eastern coasts and averages about 600 feet in height on Yap Island and about 250 feet on the other three islands. Plains are found at lower elevations in central Gagil-Tamil and southern Yap.

History

In 1525, the Portuguese Navigator, Diego de Rocha, was blown off course on a trip from the Island of Celebes to Ternate Island. He spent some time on a large island which, from his descriptions, could only have been Yap Island. The next recorded western contact with Yap came 100 years later when a Dutch expedition under Schapendam visited Yap and Ulithi, an atoll 106 miles east of the Yap Islands (Friis, 1967).

Although generally considered to be in the Spanish sphere of interest, Spain showed little interest in the Caroline Islands until Germany tried to claim the islands in 1885. This dispute between Spain and Germany was settled the following year by Pope Leo XIII in favor of Spain.

Spanish rule ended in 1899 when Germany purchased the Caroline Islands. The Germans were succeeded by the Japanese who occupied the Yap Islands in 1914 after the outbreak of World War I. In 1920, Japan received a mandate from the League of Nations to administer the islands. After withdrawing from the League in 1935, Japan annexed the islands as part of its empire. At this time there were 392 Japanese on the Yap Islands (Great Britain Naval Intelligence Div., 1945). The Japanese population grew rapidly with the influx of troops and the military construction.



Note: All distances are in statute miles (one statute mile is 0.868 nautical mile)

Figure 1. Location of the Yap Islands.

In 1945 after the end of World War II, Americans occupied the islands which will remain under American Administration until their impending independence as a state of the Federated States of Micronesia.

Population

Nearly 8,000 people live in the islands, which is double the population of 25 years ago, according to Trust Territory statistics (U.S. Department of State, annual reports). Since World War II, the yearly population increase has been 3 to 4 percent; practically all from births exceeding deaths. This increase reversed a long period of population decrease, which began with the first European contact.

In 1783, the population was estimated at 40,000, which appears exaggerated. The estimate in 1862 was 10,000. During the German Administration (1899-1914), 84 inhabited villages were counted along with 150 deserted sites. The population had decreased to 6,328 in 1910 and in 1935, only 3,713 were counted (Great Britain Naval Intelligence Div. 1945).

Because of lower temperatures and traditional dependence on the sea for subsistence, most of the population lives in villages scattered along the coast. The only town on Yap is Colonia, the seat of Government during German, Japanese, and American Administrations, and now, the capital of Yap State.

The economic base of the islands is narrow. Practically all employment is with the Government in Colonia.

Previous Investigations

The earliest known reports on the Yap Islands were a petrographic study of rocks by Erich Kaiser in 1901 (Kaiser, 1902) and a later one by Koert and Finckh (Johnson and others, 1960).

The first geologic study was made during the Japanese Administration when a map by Risaburo Tayama of the geology of Yap was published (Tayama, 1935). Since World War II, several studies have been made by scientists from the U.S. Geological Survey. Josiah Bridge participated in an economic survey of mineral resources in 1946 (Bridge, 1946), and Charles G. Johnson worked on detailed geologic mapping of Yap during 1947-48 and again in 1956 (Johnson and others, 1960). Arthur M. Piper wrote a report in 1947 titled, "Water Resources of Guam and the ex-Japanese Mandated Islands in the Western Pacific."

A soil survey was made by Richard J. Alvis and Robert L. Hetzler in 1956-57 for the large volume, "Military Geology of Yap Islands," written by Messrs. Johnson, Alvis, and Hetzler, with the exception of the weather and climate sections.

Very little water-resources data had been collected prior to the start of the cooperative U.S. Geological Survey-Trust Territory program in 1968 with the exception of rainfall information, available for most years since 1900, which was compiled for this report from several sources.

Acknowledgments

From the preliminary reconnaissance made by M. M. Miller in 1965 (written communication, 1965) until the present time, the cooperation of the Headquarters Staff of the Trust Territory of the Pacific Islands on Saipan and of officials in the Yap District has been outstanding.

Special commendations are made to the following officials: Koichi L. Wong, who has been involved in all phases of this work since 1965; Louis F. Irving, who acted as liaison with Trust Territory Headquarters; the Yap District Directors of Public Works, W. F. Dupont and M. Melarei; and those listed below who did most of the data collection:

Mark Loochaz	1967-1969
Richard Mungwaath	1969-1970
George Giltharngan	1970-1971
Florentin Yangilmau (Palau)	1972
Hers Bosil	1973-1975
Adrian Gimed	1975-present.

CLIMATE

General

Because the Yap Islands lie near the Equator in an immense ocean, the climate is generally warm and humid. Temperatures vary little, averaging about 27°C, with the difference between the means of the warmest and coolest month for the period 1921-81 being only 2.6°C. From 1949-81, the maximum temperature was 30.5°C and the minimum 24.1°C. Relative humidity averages 83 percent annually, and is generally lowest in the afternoons between February and April and highest in the early morning hours from June through December.

There are two principal seasons separated by short-duration transition periods. December through April is the "dry" season, with predominant trade winds from the east to northeast. July through October is the "wet" season, characterized by heavy showers, occasional thunderstorms, west and southwesterly winds interspersed with frequent periods of light winds and calms.

Typhoons on Yap are rare, as most pass well north of the islands in a westerly direction. The worst typhoon known to strike Yap occurred on December 17, 1920, causing five deaths and the destruction of 1,330 houses from flooding of coastal areas (Government of the Philippine Islands, Weather Bureau, December 1920). Maximum windspeed was estimated at 100 miles per hour. Other destructive typhoons occurred in 1918 and on December 15, 1925, which, combined with a tsunami, destroyed more than 90 percent of all houses.

Rainfall averages 122 inches per year, with monthly rainfall extremes ranging from 0.2 inch for April 1926 to 45.9 inches for July 1911 (table 1).

Rainfall

Although rainfall records for Yap, other than those at or near Colonia, are of short duration or uncertain quality or both, they do show there is little difference in annual rainfall throughout the Yap Islands.

Although rain showers often are localized, the relatively low profile of the islands will cause these showers to occur at random, and thus are averaged in the yearly total.

Table 1. Long-term means, minimums and maximums of rainfall, in inches, at or near Colonia during period 1901-82

(No record available 1909, 1910, 1944-48)

	Number of years	Mean	Percent	Minimum monthly	Year	Maximum monthly	Year	[1]/ 24-hour maximum	Year
January	75	7.5	6.1	[2]/ 1.5	1913	23.1	1955	10.45	1958
February	74	5.7	4.7	[3]/ 0.7	1915	22.6	1902	5.94	1962
March	73	5.8	4.8	0.8	1929	17.1	1911	5.09	1963
April	74	5.9	4.8	0.2	1926	18.2	1956	6.57	1962
May	75	9.5	7.8	2.6	1926	19.3	1928	10.06	1967
June	75	11.0	9.0	3.4	1913	32.0	1982	13.17	1982
July	75	15.5	12.7	4.8	1904	45.9	1911	9.92	1911
August	75	15.4	12.6	5.1	1973	32.1	1940	7.57	1970
September	75	13.7	11.2	5.8	1915	28.2	1904	8.35	1978
October	74	12.5	10.2	2.6	1976	24.0	1933	5.32	1961
November	74	10.1	8.2	1.2	1913	22.5	1924	8.91	1960
December	73	9.6	7.9	2.2	1928	23.1	1938	5.61	1981
Year		[4]/ 122.1	100	0.2	1926	45.9	1911	13.17	1982

[1]/ For period 1902-08, 1911, 1913-20, 1949-81.

[2]/ Rainfall for January 1983 was less: 1.25 inches.

[3]/ Rainfall for February 1983 was less: 0.27 inches.

[4]/ Sum of 12 monthly means.

Cumulative rainfall readings at Geological Survey rain gages are of short duration and because of vandalism and other problems, some readings were not made. Some evaporation may have occurred between readings but data given in tables 22 and 23 in the Hydrologic Data section correlate well with National Weather Service records.

The available rainfall record of the U.S. Coast Guard LORAN station on Gagil-Tamil for 1969-73, 1976 (table 21) compared well with the record of the Weather Service station at Yap Airport (table 19) except for the 29-percent difference shown by the 1970 totals. The LORAN station reading of 4.10 inches for August 1970 appears to be inaccurate because streamflow records for Gilaew Spring, Gagil-Tamil, for the month of August 1970 show the highest monthly discharge of the year which is consistent with the Weather Service Yap Airport rainfall total of 25.45 inches for the month. In December 1981, the U.S. Geological Survey established a recording rain gage at about the same location as the previous U.S. Coast Guard station (table 24).

Table 2 lists the locations and periods for which rainfall records have been collected on the Yap Islands and figure 2 shows the location of these rain gages. In the Hydrologic Data section, tables 17-19 list the monthly and annual totals of rainfall records for most of the period 1900-1983.

Evaporation

Pan evaporation data for Yap are available from July 1978 to December 1982 and are summarized in table 25 in the Hydrologic Data section. Table 25 also lists monthly pan evaporation data for the Island of Guam beginning in January 1956. The monthly values of the common period of record (July 1978 to December 1982) are not well correlated; however, comparison of the evaporation totals for the common period (53 months) is close (Guam is 8 percent higher). Until the evaporation record for Yap is longer, the annual evaporation data from Guam could be used to estimate the annual evaporation on Yap. Based on the data compiled in table 25, the average annual evaporation for Guam for the period January 1956 to December 1982 is 76.98 inches. This was determined by averaging the monthly data and adding the means. Monthly records ranged between 24 and 26 years. For the short period of record on Yap, the total of monthly means is 75.15 inches.

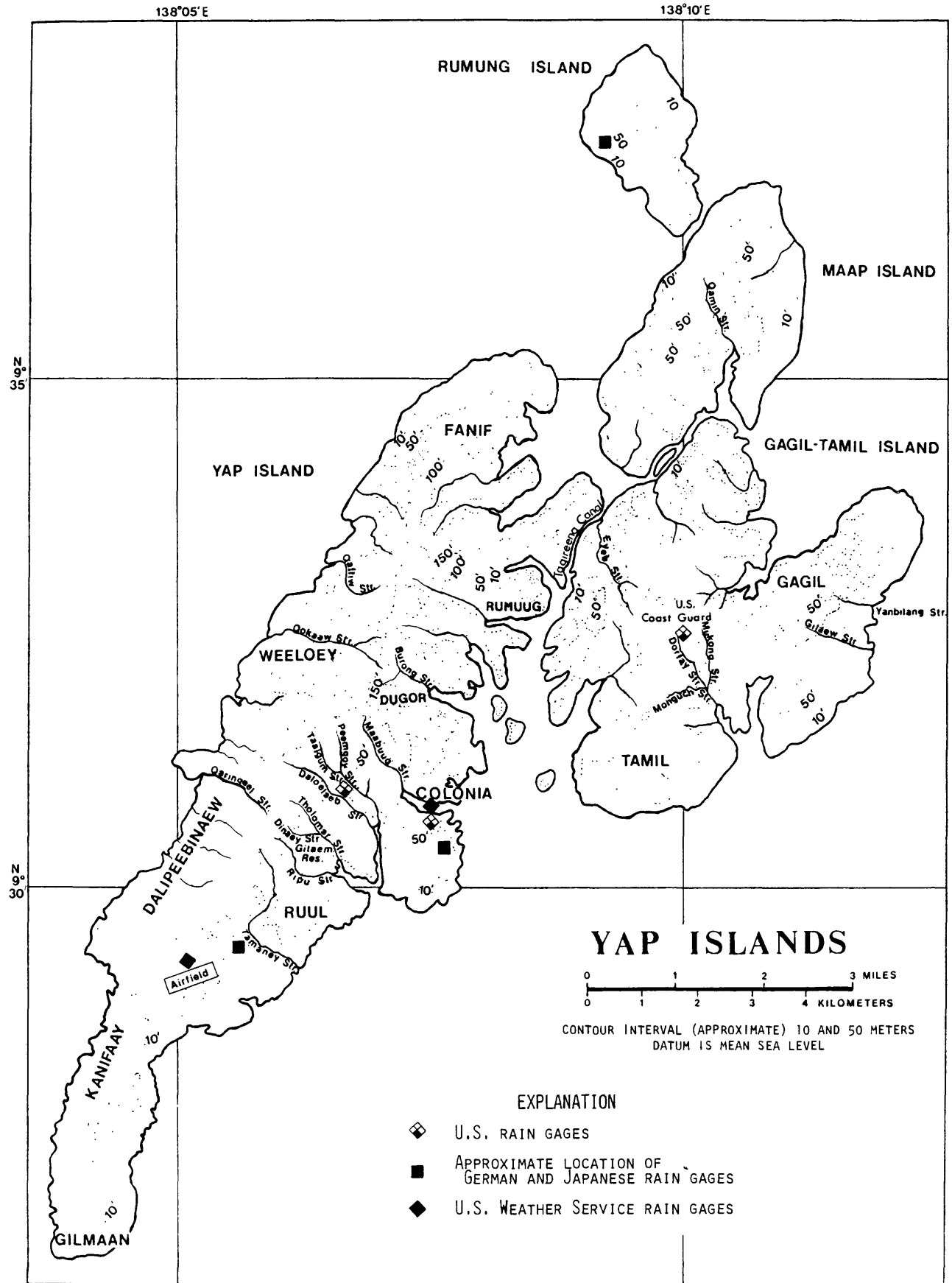
Figure 3 illustrates the seasonal relationship between rainfall, temperature, and evaporation (from Guam) for the Yap Islands.

Table 2. Rainfall records of the Yap Islands

Period	Location	Latitude north	Longitude east	Altitude (ft)	Source
1899-1900 -	Rumung	9°37'	138°09'	170	German records.
1901-14 ---	Near present Airport, Yap.	9°30'	138°05'	30	Do.
1914-42 ---	Meeth, Yap (near Colonia).	9°30'	138°08'	114	Japanese records.
1948-51 ---	Colonia	9°31'	138°08'	53	U.S. Navy.
1951-68 ---	do.	9°31'	138°08'	53	U.S. Weather Service.
1968-83 ---	Airport, Yap	9°29'17"	138°05'04"	44	Do.
1969-73, 1976 ---	Gagil	9°32'48"	138°10'08"	75	U.S. Coast Guard.
1974-79 ---	Taalgum, Yap	9°31'02"	138°06'33"	200	USGS, cumulative.
1974-76, 1978 ---	Colonia, Yap	9°30'44"	138°07'29"	25	Do.
1981-83 ---	Gagil	9°32'52"	138°10'09"	75	USGS, continuous.

Air Temperatures

Monthly mean air temperatures for Yap for the period 1921-1981 are listed in tables 26 and 27 in the Hydrologic Data section. From these data the mean annual air temperature is 27.3°C. Other readings of air temperature were made in conjunction with surface-water temperature readings during streamflow measurements and can be found in tables 62-81 in the Hydrologic Data section.



Base from U.S. Geological Survey
Yap Islands 1981 (preliminary).

FIGURE 2. LOCATION OF RAIN GAGES

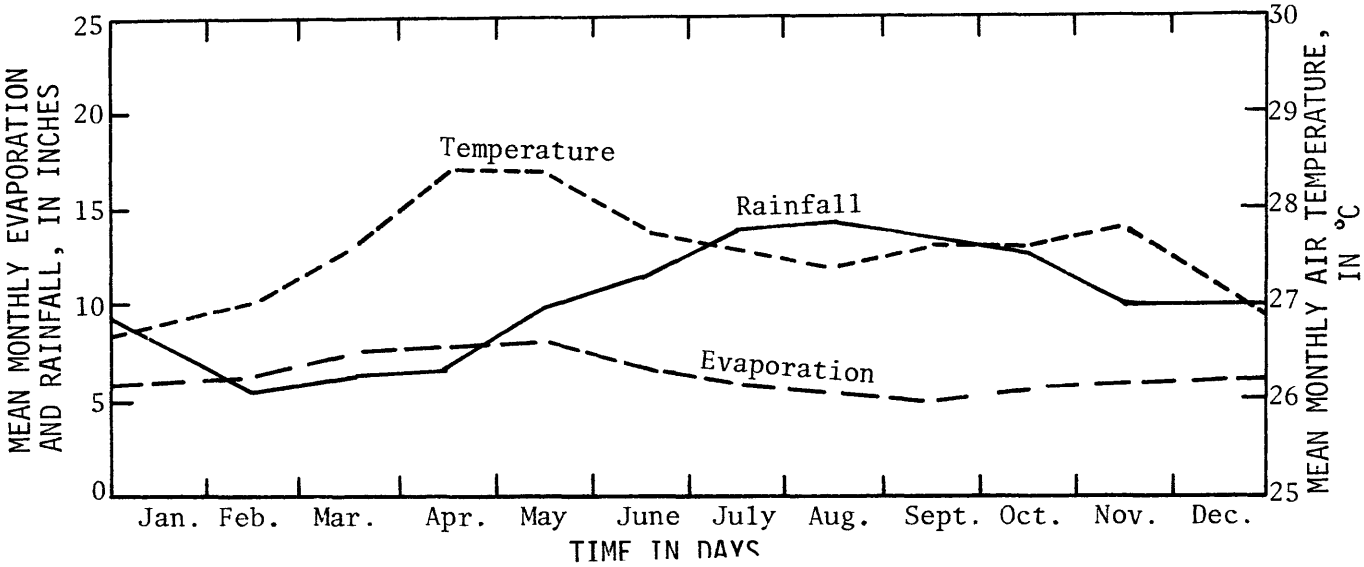


Figure 3. Yap rainfall, temperature, and Guam evaporation, 1956-80.

GEOLOGY

This chapter is a summary from "Military Geology of Yap Islands, Caroline Islands" (Johnson and others, 1960).

Descriptive Geology

The geologic map of the Yap Islands (fig. 4) shows the major rock units that are found on the islands.

The basement rocks were named the Yap Formation by Tayama (1935) who defined it as "*** the crystalline schists which develop on Yap proper." This formation underlies the northern three-fourths of Yap Island, the northwestern three-fourths of Rumung, and a prominent ridge in western Gagil-Tamil. A small outcrop occupies the hilltop at Leebinaew, on eastern Gagil-Tamil, at the site of a destroyed lighthouse.

The Yap Formation is a complex of metamorphic rocks of the green schist and amphibolite facies, that have a considerable range in texture but only a rather limited range in mineral composition. The formation is pre-Miocene, possibly Mesozoic, in age. The thickness of the formation is unknown. It is the basement rock (the lowermost, oldest rock) on the island and its lower limits, therefore, are not exposed.

The rocks of the Yap Formation weather to fat clay, which is gray to greenish in color near the weathered rock surface, and grades upward to yellowish and, in some places, red clay at the surface of the ground.

Serpentinite dikes and sills, mostly 1 to 10 feet thick and of unknown extent, are scattered throughout the Yap Formation; most are serpentinized peridotite. The rock is dense, dark green to nearly black, with faint grayish-green spots or mottles. Only the large outcrop areas in Gagil-Tamil are included on the geologic map; outcrops on Yap Island are too small to be shown. The age of the serpentine cannot be determined more closely than pre-Miocene (pre-Tertiary).

The serpentinite weathers to a ferruginous clay. As much as 27 feet of this material was measured with an auger. The clay contains iron and a small percentage of nickel. During World War II, the Japanese South Seas Development Co. prospected the deposits and shipped some ore to Korea and Japan for smelting.

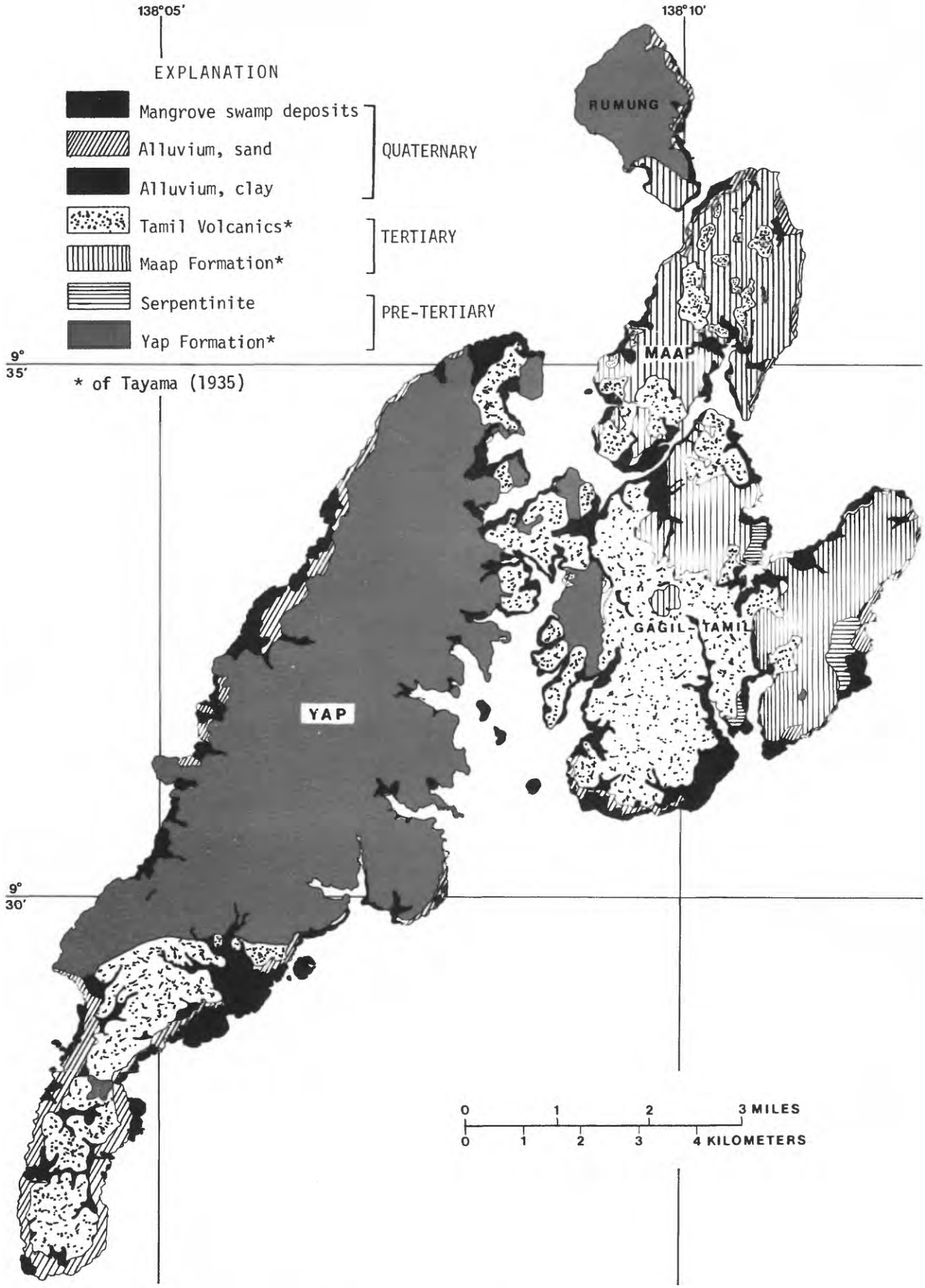


Figure 4. Geology of the Yap Islands (Johnson and others, 1960).

Overlying the basement rocks in the northeastern part is the Oligocene Map (Maap) Formation of Tayama (1935), composed entirely of fragmental rock of both tectonic and sedimentary origin, and includes breccia, conglomerate and interbedded sandstone and siltstone. The formation is named from good exposures in the sea cliffs along the east side of Maap. It also crops out on Gagil-Tamil and Rumung.

The breccia of the Map (Maap) Formation is a massive deposit of angular to subangular fragments, mostly of metamorphic rocks but including a great variety of other rock types, embedded in a matrix of finely crushed rock. Fragment sizes range from less than 1 inch to 9 feet. The matrix is light gray in color and is composed of sand-size to clay-size particles of ground rock.

Gravel- to silt-size sediments occupy channels cut into the breccia, and are faulted into it. Particle size of the conglomerate ranges from fine sand to boulders. The conglomerate grades laterally and vertically into deposits of sandstone and siltstone. Most of it is well bedded and up to 8 feet thick.

Faulting of the Map (Maap) Formation has greatly complicated the structure and stratigraphy of the sedimentary rocks. At almost every outcrop of the Map (Maap) Formation there are faults, most nearly vertical, that cut the breccia or sedimentary deposits, or both.

The thickness of the Map (Maap) Formation is variable and any figure given for it is highly speculative. It is thickest on Maap where it may exceed 250 feet. The formation is considered relatively thin in eastern Gagil-Tamil, as there are many outcrops of serpentine and rock of the Yap Formation in the area.

The Tomil (Tamil) Volcanics of Tayama (1935), composed of andesitic tuffs, volcanic breccias, and lava flows, all almost completely weathered to clay, unconformably overlie the breccia and basement rocks in the central part and the southern-most tip of the Yap Islands. The formation was deposited upon strongly eroded older rocks and probably is at least several hundred feet thick in central Gagil-Tamil, where it is typically exposed. The Tomil (Tamil) Volcanics probably are Oligocene and Miocene in age (12-28 million years ago). Hilltops of the underlying Yap and Map (Maap) Formations protrude through the volcanic deposits in central Gagil-Tamil and on southern and northern Yap Island.

The Tomil (Tamil) Volcanics are mostly deeply weathered to a kaolinitic clay. The clays generally are deeply eroded because they support only sparse vegetation and central Gagil-Tamil is a wasteland of bare slopes and gullies; some of the gullies are 50 feet deep, entirely in clay. Such erosion is not as well developed on Maap and southern Yap Island, but bare slopes and washes are common.

"Most alluvial deposits are restricted to beaches, because most streams on Yap are narrow with steep gradients and, therefore, have no flood plains of alluvium. Only near the shore, where the streams flow at or near sea level does stream alluvium accumulate to any great amount; in such places it is mixed with sand blown and washed in from the beach. The largest accumulations of alluvium are on the southern tip of Yap Island, northwestern Yap Island, the eastern side of Gagil-Tomil, and on the east and north shores of Map.

"Mangrove swamps discontinuously border the shores of all the islands of Yap. Sandy black muck is deposited in the swamps. The muck is thick and soft where the water circulation in the swamp is very sluggish as along the shores of Tomil Harbor; it is thinner, more sandy, and much more firmly packed where water circulation is rapid, as in swamps along shores exposed to winds and the sea."

Water-Bearing Characteristics

"The bedrock of Yap is dense and fractures are tight or are filled with clay; the rock has very low permeability and contains little water. It is unsuited for development of water supplies by means of wells. The only practical means of developing supplies are shallow dug wells, wellpoints driven in the alluvium, or seep development. Most streams are fed by seeps from along the banks, rather than from springs.

"The best locations for dug wells or wellpoints in the alluvium of coastal flats are along the inland margins of the wider flats. Wells in such locations are more likely to contain fresh water, and they have the least tidal fluctuation. Wells near the shoreline or on narrow flats are likely to produce brackish water, and the water levels will fluctuate almost as much as the tidal range."

WATER RESOURCES

General

The systematic collection of water-resources information was begun in March 1968 when five gaging stations were constructed on Yap Island and one on Gagil-Tamil. Additionally, nine low-flow partial-record stations were established (fig. 5). At the end of 1974, the gaging station on Gagil-Tamil was moved from Gilaew Spring to the principal water source on the island, Mukong Stream. In April 1979, the gaging station at Taalgum Stream, Yap, was discontinued and was relocated in December 1981 on Qatliw Stream, Yap. Also in December 1981, the Daloelaeb Stream, Yap, gaging station was moved to Eyeb Stream, Gagil-Tamil.

At gaging stations (figs. 6, 7), continuous records of gage height are obtained and from these records daily, monthly and annual discharge totals are computed. Daily figures of discharge can be found in the Geological Survey publications or obtained from the Honolulu District office and the Guam Sub-district office.

Because the number of streams on which streamflow information is likely to be needed far exceeds the number of stream-gaging stations feasible to operate at one time, the Geological Survey collects limited streamflow data at sites other than gaging stations. When limited streamflow data are collected on a systematic basis over a period of years for use in hydrologic analyses, the site at which the data are collected is called a partial-record station. Discharge measurements made at partial-record stations in the Yap Islands are listed in the Hydrologic Data section, tables 37-47. Discharge measurements made at sites not included in the partial-record program are called measurements at miscellaneous sites (table 48).

Since 1979, water samples have been collected by the Geological Survey at 23 sites for chemical analyses. No systematic collection of ground-water data has been made, but in 1979 a number of exploratory wells were drilled and pumping tests were made (Lyon Associates, 1980). In 1982, 13 production wells were drilled and pumping tests made (Nance, 1982).

Prior to 1968, virtually no water-resources data were available except for rainfall data.

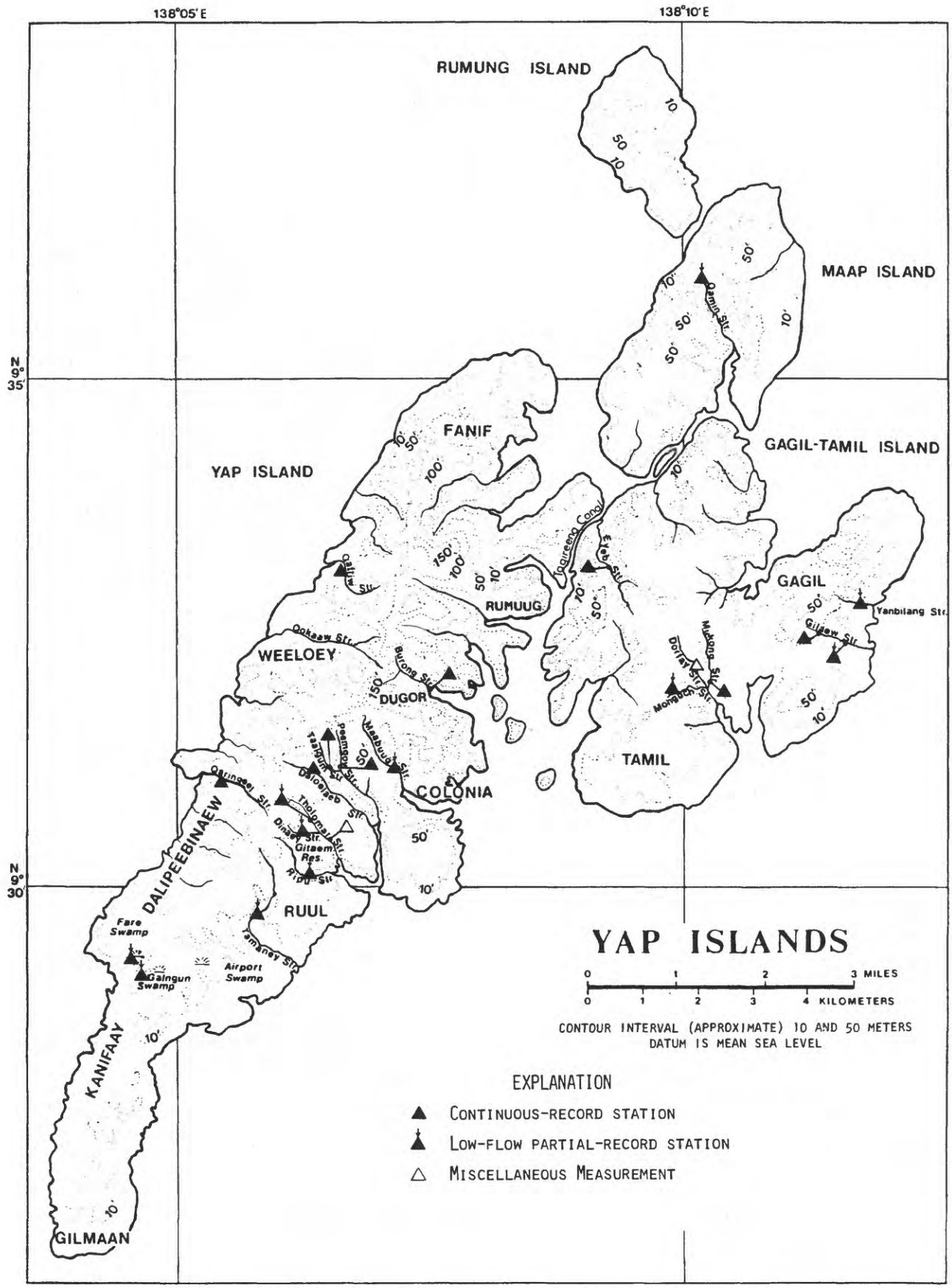


FIGURE 5. LOCATION OF SURFACE-WATER DATA-COLLECTION SITES.

Figure 6. Downstream view of gaging station on Mukong Stream, Gagil-Tamil.

Figure 7. Upstream view of gaging station on Qaringeel Stream, Yap.

Surface Water

General

Although the Yap Islands have an average yearly rainfall of 122 inches, there are no perennial streams on the Island of Yap where all streams usually will be dry during part of the dry season, ranging from a few days to several months. The largest stream in yearly discharge, Qaringeel Stream, has been dry an average of 10 weeks a year during 1969-82. The streams go dry because they have small drainage areas (only a few exceed a quarter of a square mile) and the water retention of the soil and rock of their watershed is low. The principle geologic formation of the drainage areas of all Yap streams is the green schist of the Yap Formation of Tayama (1935).

On Gagil-Tamil, the geologic formation is quite different (see fig. 4). There, Mukong Stream and adjacent streams in the central valley are not known to go dry. The principal geologic formation is the deeply weathered Tomil (Tamil) Volcanics of Tayama (1935), which allows greater infiltration of rainfall, and subsequent release to the streams during long periods of dry weather. Additionally, the drainage area of Mukong Stream is much larger than any stream on Yap Island. The different character of the flow of Mukong Stream compared to that of the Yap stations is illustrated by the flow-duration curves of figure 8.

Table 3 lists the streams and locations where flow data have been collected. As an added means of identification, each gaging station and partial-record station has been assigned a station number. In assigning the numbers, no distinction is made between partial-record and continuous-record gaging stations. Gaps are left in the numbers to allow for new stations that may be established. This numbering system is used nationwide.

Table 3. Surface-water stations in the Yap Islands

Station number	Station name	Drain. area (mi^2)	Location			Period of record (water years)	Remarks
			Latitude north	Longitude east	Altitude (ft)		
16892000	Qatliw (Atelu) Stream, Yap	0.31	9°32'58"	138°06'41"	40	1980-81	Low-flow partial record.
						February to September 1982	Continuous record.
16892400	Qaringeel (Aringel) Stream, Yap	.24	9°31'03"	138°05'31"	15	April 1968 to Sept. 1982	Do.
16892450	Faraq (Fara) Swamp outlets, Yap	.29	9°29'08"	138°04'24"			
			9°29'15"	138°04'21"	5	1968-73	Low-flow partial record.
16892460	Galngun Swamp outlet, Yap	.16	9°29'04"	138°04'40"	30	do.	Do.
16892500	Tamaney Stream, Yap	.17	9°29'49"	138°05'53"	30	1968-82	Do.
16892600	Ripu Stream, Yap	.29	9°30'10"	138°06'25"	10	do.	Do.
16892650	Dinaey (Dinay) Stream, Yap	.04	9°30'33"	138°06'14"	75	1980-82	Do.
16892680	Tholomar Stream, Yap	.10	9°30'37"	138°06'18"	75	1980-82	Do.
16892700	Tholomar (Thalomar) Stream, Yap	.13	9°30'34"	138°06'21"	70	1968-74	Do.
16892800	Daloelaeb (Dalolab) Stream, Yap	.07	9°31'05"	138°06'22"	110	April 1968 to Dec. 1981	Continuous record.
16892900	Peemgoy (Pemgoy) Stream, Yap	.14	9°31'08"	138°06'36"	55	April 1968 to July 1982	Do.
16893000	Taalgum (Talagu) Stream, Yap	.08	9°31'09"	138°06'34"	75	April 1968 to April 1979	Do.
16893050	Mabuuq (Mabu) Stream, Yap	.30	9°31'16"	138°07'00"	45	1968-72	Low-flow partial record.
16893100	Burong Stream, Yap	.23	9°32'05"	138°07'19"	15	April 1968 to Sept. 1982	Continuous record.
16893180	Monguch Stream, Gagil-Tamil	.18	9°31'59"	138°09'57"	20	1980-82	Low-flow partial record.
16893190	Dorfay Stream, Gagil-Tamil	.20	9°32'08"	138°10'13"	10	1981-82	Miscellaneous measurements.
16893200	Mukong Stream, Gagil-Tamil	.50	9°32'05"	138°10'18"	5	Dec. 1974 to June 1978,	
						Oct. 1978 to Sept. 1982	Continuous record.
16893300	Gilaew (Bileiy) Spring, Gagil-Tamil	--	9°32'16"	138°11'17"	60	April 1968 to Sept. 1974	Continuous record.
						1975-79	Low-flow partial record.
16893310	Gilaew (Bileiy) Stream, Gagil-Tamil	.15	9°32'12"	138°11'29"	15	1968-78	Do.
16893350	Yanbilang Stream, Gagil-Tamil	.03	9°32'45"	138°11'48"	5	1968-72	Do.
16893400	Eyeb Stream, Gagil-Tamil	.22	9°33'11"	138°09'14"	15	1980-81	Do.
						January to September 1982	Continuous record.
16893500	Qamin (Amin) Stream, Maap	.19	9°35'57"	138°10'15"	45	1980-81	Low-flow partial-record.
---	Dalibaech Stream, Yap	.25	9°30'32"	138°06'22"	65	1965	Miscellaneous measurement.

Note: The spelling of names, drainage areas, and locations for most stations differ from those used in "Water Resources Data for Hawaii and other Pacific Areas", 1968 to 1980. These had been based on 1954 Army Map Service 1:25,000-scale map and 10-meter contours (International Spheroid) whereas the revised figures are based on the 1981 USGS maps with 1:10,000 scale and 5-meter contours (Clarke Spheroid of 1866).

Data collected at continuous-record stations consist of records of stage and measurements of discharge of the streams. Records of stage are obtained from a water-stage recorder that provides a continuous graph of the fluctuations of the water level at the station site. Measurements of discharge are made with a current meter.

For continuous-record stations, rating tables giving the discharge for a range of stage (gage height) are prepared from stage-discharge relation curves defined by the discharge measurements at the stations. Application of the daily mean stage to the rating table gives the daily mean discharge from which the monthly and the yearly mean discharges are computed. These records are published in the annual reports, "Water Resources Data for Hawaii and other Pacific Areas", for the water year, which begins on October 1 and ends on September 30.

Tables with monthly and annual totals, annual maximums, minimums, and means are presented in the Hydrologic Data section. Peak discharges and their times of occurrence and corresponding gage heights are listed for all peaks above a selected base discharge are given. The base discharge is selected so that an average of about three peaks a year can be presented. Time is expressed in 24-hour local standard time.

At the partial-record sites only low-flow data are collected. Most measurements are made during periods of base flow, when streamflow is primarily from ground-water storage. These measurements, when correlated with the simultaneous discharge of a nearby stream where continuous records are available, will provide an estimate of the low-flow potential of the partial-record site.

A comparison of the monthly yields from gaged streams on Yap and Gagil-Tamil is provided in table 4. The table also lists the percentage of days without flow for each month. The annual percentage of "0" flow days varies for the Yap stations from 14 percent at Peemgoy Stream to 38 percent at Daloelaeb Stream and averages 26 percent, which is more than 3 months of the year.

Table 4. Mean monthly discharge in cubic feet per second, monthly percentage of annual means, and percent of no-flow days

Name	Years of record		Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Annual
Qaringeel (Aringel) Stream, Yap	13-14	Daily mean	1.57	0.85	1.03	0.66	0.38	0.33	0.33	0.56	1.12	2.06	1.91	1.98	1.10
		Percent of total	12.3	6.6	8.0	5.2	3.0	2.6	2.6	4.4	8.8	16.1	14.9	15.5	100
		Percent of "0" days	3.5	8.5	2.0	24.3	50.1	58.1	70.5	30.9	7.1	1.4	0.2	0	21.4
Daloelaeb (Dalolab) Stream, Yap	13-14	Daily mean	.58	.38	.36	.21	.12	.12	.10	.16	.37	.68	.70	.66	.37
		Percent of total	13.1	8.5	8.1	4.7	2.7	2.7	2.3	3.6	8.3	15.3	15.8	14.9	100
		Percent of "0" days	20.1	20.8	27.8	48.4	70.8	76.7	80.5	59.4	22.4	9.0	6.0	12.9	37.9
Peemgoy (Pemgoy) Stream, Yap	13-14	Daily mean	.93	.49	.51	.37	.21	.16	.15	.27	.59	1.08	1.02	1.08	.59
		Percent of total	13.6	7.2	7.4	5.4	3.1	2.3	2.2	3.9	8.6	15.7	14.9	15.7	100
		Percent of "0" days	0	3.3	1.5	9.4	21.3	35.2	53.3	29.7	7.6	3.2	1.2	0	13.8
Taalgum (Talagu) Stream, Yap	11-12	Daily mean	.49	.31	.27	.21	.10	.12	.10	.15	.35	.62	.57	.60	.33
		Percent of total	12.6	7.9	6.9	5.3	2.6	3.2	2.7	3.9	8.9	15.9	14.6	15.5	100
		Percent of "0" days	6.1	9.7	8.5	31.4	63.2	73.3	73.9	53.0	23.4	10.2	7.6	4.5	30.4
Burong Stream, Yap	13-14	Daily mean	1.47	.74	.99	.56	.33	.27	.24	.35	.88	1.76	1.60	1.86	.93
		Percent of total	13.6	6.8	7.3	5.2	3.0	2.5	2.2	3.2	8.1	16.2	14.8	17.1	100
		Percent of "0" days	5.0	7.9	2.5	26.1	49.6	68.5	74.0	55.3	24.8	5.8	1.8	1.0	26.9
Mukong Stream, Gagil-Tamil	6- 7	Daily mean	2.56	1.32	2.44	1.68	.94	.48	.64	1.00	1.99	3.20	3.08	2.95	1.88
		Percent of total	11.5	5.9	11.0	7.5	4.2	2.2	2.9	4.5	8.9	14.4	13.8	13.2	100
		Percent of "0" days	0	0	0	0	0	0	0	0	0	0	0	0	0
Gilaew (Bilely) Spring, Gagil-Tamil	6- 7	Daily mean	.26	.13	.08	.10	.05	.08	.04	.05	.09	.15	.19	.25	.13
		Percent of total	17.8	8.6	5.2	6.5	3.5	5.7	2.9	3.5	6.3	10.2	12.8	17.0	100
		Percent of "0" days	0	0	0	13.9	27.2	33.3	28.6	29.0	28.6	19.3	14.3	6.6	17.0

Streamflow characteristics

Rainfall-runoff relations.--Annual rainfall totals from the National Weather Service station at the Yap Airport (table 19) are used for all rainfall-runoff calculations.

The data in table 5 indicate that on Yap Island about half the annual rainfall runs off as streamflow. As most streams on Yap are dry during much of January to May, table 6 was compiled to determine the rainfall-runoff ratio only during the wet months, June to December, for comparison with the yearly ratio. The table shows that during the wet season, the mean percentage of direct runoff of Yap stations is only 7 percent higher than the yearly runoff percentage.

Because the average yearly rainfall for the 13-year period (1969-81) used for the rainfall-runoff ratio is 120.11 inches, and the long-term (1949-81) average is 121.30 inches, the rainfall totals for the 13-year period can be considered representative of average conditions.

For better comparison between the Yap stations and Mukong Stream, the average percentage of runoff was also computed for only those years when complete records were available for both (tables 5 and 6). This showed that the annual percentage of runoff was practically the same. For the wet months, June to December, the average runoff of the Yap stations was 9 percent higher than for Mukong Stream, indicating that on Gagil-Tamil more rainfall became infiltration than on Yap.

A confirmation of the uniformity of the rainfall in the Yap Islands and the rainfall-runoff relationship of the streams on Yap is the similarity of the regression correlations of the annual runoff at Qaringeel Stream with the rainfall at Yap Airport, $Y = 0.024 X^{1.64}$, and of the annual runoff of Burong Stream with the Yap Airport rainfall, $Y = 0.026 X^{1.60}$, where Y is the runoff and X is the rainfall.

Table 5. Annual rainfall-runoff comparison, 1969-81

(All data on calendar-year basis and in inches)

Year	Annual rainfall Yap Airport	Qaringeel Stream drainage area 0.24 mi^2 Mean	Per-cent	Daloelaeb Stream drainage area 0.07 mi^2 Mean	Per-cent	Peemgoy Stream drainage area 0.14 mi^2 Mean	Per-cent	Taalgum Stream drainage area 0.08 mi^2 Mean	Per-cent	Burong Stream drainage area 0.23 mi^2 Mean	Per-cent	Mean of 5 Yap sta-tions	[1/] Mukong Stream drainage area 0.50 mi^2 Mean	Per-cent
1969	119.80	61.65	51	69.81	58	52.36	44	62.78	52	48.98	41	49	--	--
1970	112.35	57.12	51	69.81	62	49.45	44	57.69	51	53.70	48	51	--	--
1971	148.30	82.58	56	96.96	65	65.93	44	83.14	56	73.77	50	54	--	--
1972	113.16	55.43	49	62.05	55	43.63	38	44.12	39	48.98	43	45	--	--
1973	94.03	38.46	41	50.42	54	42.66	45	35.63	38	37.77	40	44	--	--
1974	147.71	88.80	60	96.96	66	87.26	59	79.75	54	81.44	55	59	--	--
1975	116.21	64.48	55	75.63	65	60.11	52	62.78	54	54.30	47	55	54.02	47
1976	114.50	52.60	46	63.99	56	59.14	52	52.60	46	47.21	41	48	57.28	50
1977	104.10	52.60	51	54.30	52	49.45	48	44.12	42	43.08	41	47	52.94	51
1978	119.18	63.34	53	79.51	67	67.87	57	61.08	51	56.66	48	55	--	--
1979	124.49	60.52	49	67.87	55	58.17	47	--	--	57.23	46	--	39.64	(1)
1980	120.35	62.21	52	67.87	56	53.33	44	--	--	54.30	45	--	45.34	(1)
1981	127.24	72.39	57	81.44	64	67.87	53	--	--	66.10	52	--	54.57	(1)
Mean	120.11		52		60		48		48		46	51		49
Mean 1975-77	111.60		51		58		51		47		43	50		49

The percentage of rainfall in a drainage basin which runs off is determined by converting the mean discharge of the area from cubic feet per second to inches $\frac{ft^3/s \times 13.574}{mi^2}$ and comparing to the rainfall in inches during the same period.

(1) Since 1978, small amount of water is pumped at times from site about 500 feet upstream.

Table 6. Rainfall-runoff comparison for June to December, 1969-81

(All data on calendar-year basis and in inches)

Year	June-Dec. rainfall Yap Airport	Qaringeel Stream drainage area 0.24 mi^2 Mean	Qaringeel Stream drainage area 0.24 mi^2 Percent	Daloelaeb Stream drainage area 0.07 mi^2 Mean	Daloelaeb Stream drainage area 0.07 mi^2 Percent	Peemgoy Stream drainage area 0.14 mi^2 Mean	Peemgoy Stream drainage area 0.14 mi^2 Percent	Taalgum Stream drainage area 0.08 mi^2 Mean	Taalgum Stream drainage area 0.08 mi^2 Percent	Burong Stream drainage area 0.23 mi^2 Mean	Burong Stream drainage area 0.23 mi^2 Percent	Mean of 5 Yap stations	Mukong Stream drainage area 0.50 mi^2 Mean	Mukong Stream drainage area 0.50 mi^2 Percent
1969	101.66	59.69	59	68.22	67	51.16	50	60.68	60	47.75	47	57	--	--
1970	84.07	53.06	63	64.80	77	42.63	51	51.73	62	47.75	57	62	--	--
1971	89.20	52.72	59	61.39	69	44.34	50	51.73	58	52.60	59	59	--	--
1972	68.20	35.81	52	39.79	58	27.85	41	27.85	41	33.39	49	48	--	--
1973	77.75	38.47	49	50.02	64	42.07	54	35.81	46	37.72	49	52	--	--
1974	101.77	68.64	67	75.04	74	65.94	65	61.68	61	60.55	60	65	--	--
1975	72.59	42.44	58	52.30	72	42.63	59	49.74	69	39.10	54	62	36.74	51
1976	75.90	41.12	54	52.30	69	46.61	61	42.78	56	37.68	50	58	41.96	55
1977	84.79	49.41	58	52.30	61	47.18	56	42.78	50	42.56	50	55	46.56	55
1978	97.42	59.36	61	76.17	78	63.10	65	57.70	59	52.59	54	63	--	--
1979	97.59	58.55	60	65.94	66	55.71	57	--	--	56.40	58	--	35.21	(1)
1980	88.72	51.40	58	57.98	65	44.91	51	--	--	44.64	50	--	35.65	(1)
1981	97.30	64.34	66	68.91	71	56.79	58	--	--	55.93	58	--	--	--
Mean	87.46		59		68		55		56		53	58		
Mean 1975-77	77.76		57		67		59		58		51	58		53

(1) Since 1978, small amount of water is pumped at times from site about 500 feet upstream.

Flow-duration curves.--A flow-duration curve is a cumulative frequency curve showing the percentage of time within the total period of record that a specified daily discharge was equaled or exceeded. It combines in one curve the flow characteristics of a stream throughout the range of discharge without regard to the sequence of occurrence. The general shape of such a curve is influenced by many factors, such as basin slope and cover, ground-water contributions, precipitation, and diversions or inflows.

The curve is plotted from a flow-duration table, which shows the distribution of daily discharge by different class limits in increasing order of magnitude. Discharge in cubic feet per second is plotted on the ordinate and percent-of-time equaled or exceeded is plotted on the abscissa. The flow-duration tables in this report are based on distribution of the daily discharge.

For comparison of the curves for different streams, data covering the same period should be used to avoid including an extremely dry or wet year in one set and not in the other.

Flow-duration curves are used to determine the percent of time that a certain amount of water was available during the period of record. This information is essential for planning of stream diversions for water supply or to assess hydroelectric potential.

The flow-duration curves for four streams on Yap and one on Gagil-Tamil are given in figure 8. The streams, their drainage area, and the period of record are:

	Area (mi^2)	Years of record
Qaringeel Stream, Yap	0.24	11
Daloelaeb Stream, Yap	.07	11
Peemgoy Stream, Yap	.14	11
Burong Stream, Yap	.23	11
Mukong Stream, Gagil-Tamil	.50	3

The duration curve for Taalgum Stream, Yap, for which 10 years of data are available, is not plotted because the curve is almost identical to the one of Daloelaeb Stream.

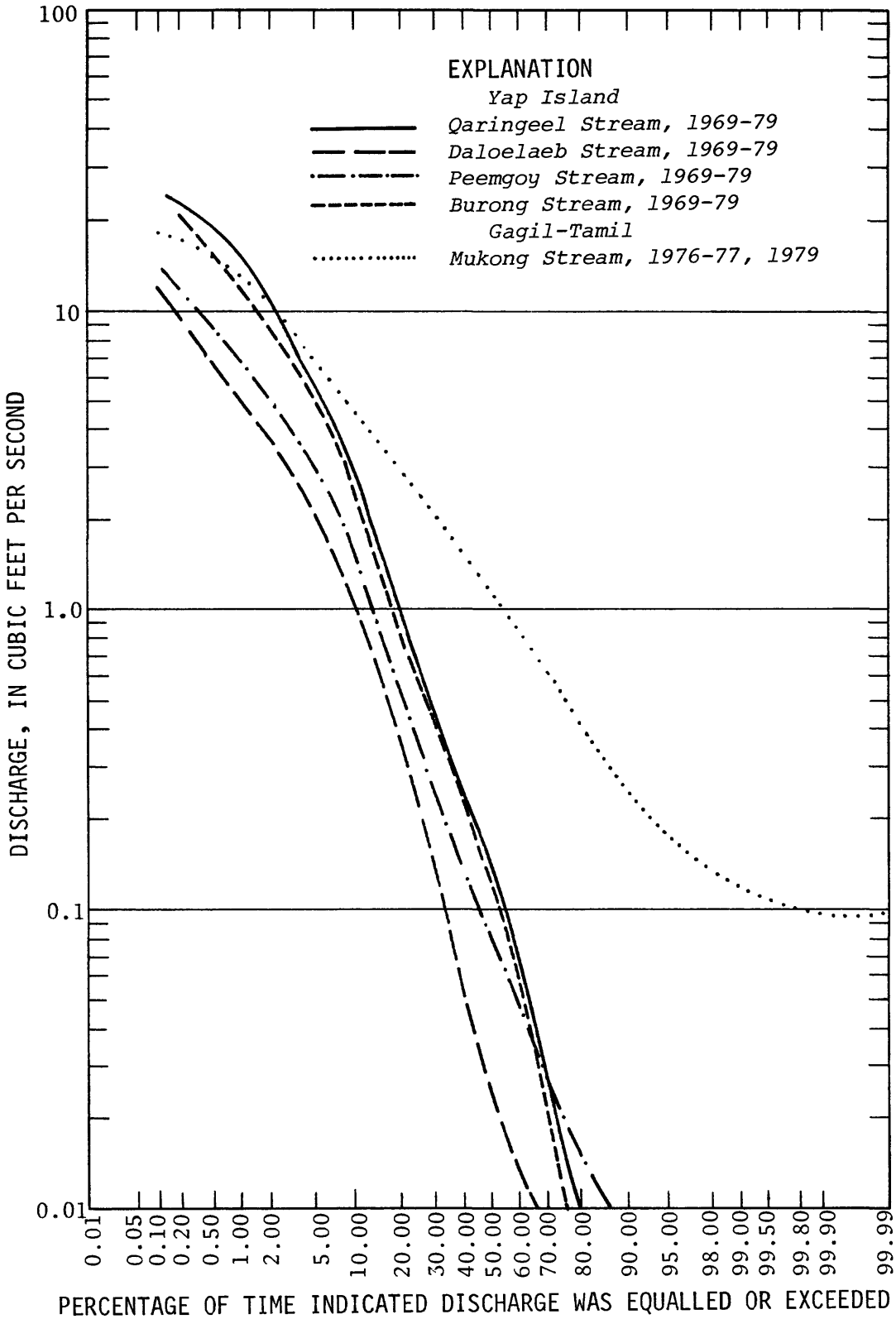


Figure 8. Flow-duration curves of four streams on Yap Island and one on Gagil-Tamil.

The similarity of the duration curves of all five Yap stations shows the comparability of their drainage areas; the only exception being Peemgoy Stream with some retention of rainfall in the watershed. This retention is also indicated by Peemgoy Stream having the fewest number of days without flow.

Only 3 years of complete record without diversion of some of the flow are available for Mukong Stream on Gagil-Tamil, but the mean rainfall during these 3 years differs by only 1 percent from the mean rainfall during the 11-year period used for the Yap streams. The contrast between the curves indicates a difference in the geology of the drainage areas as described previously.

Low-flow frequency tables.--Low-flow tables show the lowest mean discharge for certain periods of consecutive days. Because all Yap streams have no flow during part of the dry season, low-flow frequency curves would not be very meaningful and only the tables are provided (table 7).

For Mukong Stream, Gagil-Tamil, only a few years of complete record are available and this station is not included in the table.

High-flow frequency curves.--High-flow frequency curves show the maximum mean discharge for certain periods of consecutive days and its likelihood of occurrence. These curves can also be used to show the frequency of instantaneous annual peak discharge.

Figures 9-13 show the recurrence intervals of the maximum mean discharge for six periods of consecutive days for the five continuous-record stations on Yap Island. The period of record for the continuous-record stations on Gagil-Tamil was of insufficient length to be used for frequency curves. The uniformity of the curves for the Yap stations show the similarity of their basins.

Figure 14 shows the magnitude and frequency of annual and instantaneous peak flows for four continuous-record stations on Yap with 11 years of complete record.

High-flow frequency curves provide information needed to determine the size of reservoirs and diversion structures.

Frequency curves for annual peak flows are needed to size and design storm drainage systems, culverts and bridge openings.

Table 7. Lowest mean value for a number of consecutive days for years ending September 30

(Discharge in cubic feet per second)

Year	Days						
	1	7	14	30	60	90	120
				Qaringeel Stream, Yap			
1969	0	0	0	0	0	0	0.01
1970	0	0	0	0	.05	.12	.19
1971	.01	.03	.13	.50	.81	.80	.92
1972	0	0	0	.03	.06	.26	.48
1973	0	0	0	0	0	0	0
1974	0	0	0	.07	.21	.34	.56
1975	0	0	0	0	0	.01	.34
1976	0	0	0	0	.06	.08	.24
1977	0	0	0	0	0	0	.01
1978	0	0	0	0	0	0	0
1979	0	0	0	0	0	.06	.05
1980	0	0	0	0	.06	.23	.29
				Daloelaeb Stream, Yap			
1969	0	0	0	0	0	0	0
1970	0	0	0	0	.01	.03	.05
1971	0	0	.02	.17	.23	.23	.27
1972	0	0	0	.01	.02	.07	.16
1973	0	0	0	0	0	0	0
1974	0	0	0	0	.05	.09	.17
1975	0	0	0	0	0	0	.08
1976	0	0	0	0	.02	.03	.08
1977	0	0	0	0	0	0	.01
1978	0	0	0	0	0	0	0
1979	0	0	0	0	0	.02	.02
1980	0	0	0	0	0	.08	.08
				Peemgoy Stream, Yap			
1969	0	0	0	0	0	0	0.01
1970	0	0	0	0	.02	.08	.11
1971	.01	.02	.05	.18	.32	.31	.37
1972	0	0	0	.01	.03	.10	.21
1973	0	0	0	0	0	0	0
1974	0	0	0	.02	.11	.20	.34
1975	0	0	0	0	.01	.03	.14
1976	0	0	.01	.01	.04	.05	.12
1977	0	0	0	0	0	0	.02
1978	0	0	.01	.01	.01	.01	.03
1979	0	.01	.01	.01	.01	.04	.04
1980	0	0	0	.01	.02	.11	.11

Table 7. Lowest mean value for a number of consecutive days for years ending September 30--Continued

(Discharge in cubic feet per second)

Year	Days						
	1	7	14	30	60	90	120
				Taalgum Stream, Yap			
1969	0	0	0	0	0	0	0.01
1970	0	0	0	0	0	.03	.04
1971	.01	.01	.03	.12	.26	.25	.28
1972	0	0	0	.01	.02	.06	.13
1973	0	0	0	0	0	0	0
1974	0	0	0	0	.05	.10	.18
1975	0	0	0	0	0	.01	.07
1976	0	0	0	0	.02	.03	.07
1977	0	0	0	0	0	0	.01
1978	0	0	0	0	0	0	0
				Burong Stream, Yap			
1969	0	0	0	0	0	0	0
1970	0	0	0	0	.01	.07	.11
1971	.01	.03	.06	.39	.59	.64	.71
1972	0	0	0	.02	.05	.13	.36
1973	0	0	0	0	0	0	0
1974	0	0	0	.02	.20	.38	.54
1975	0	0	0	0	0	.01	.15
1976	0	0	0	0	.04	.05	.13
1977	0	0	0	0	0	0	0
1978	0	0	0	0	0	0	.01
1979	0	0	0	0	0	.03	.03
1980	0	0	0	0	.02	.21	.26

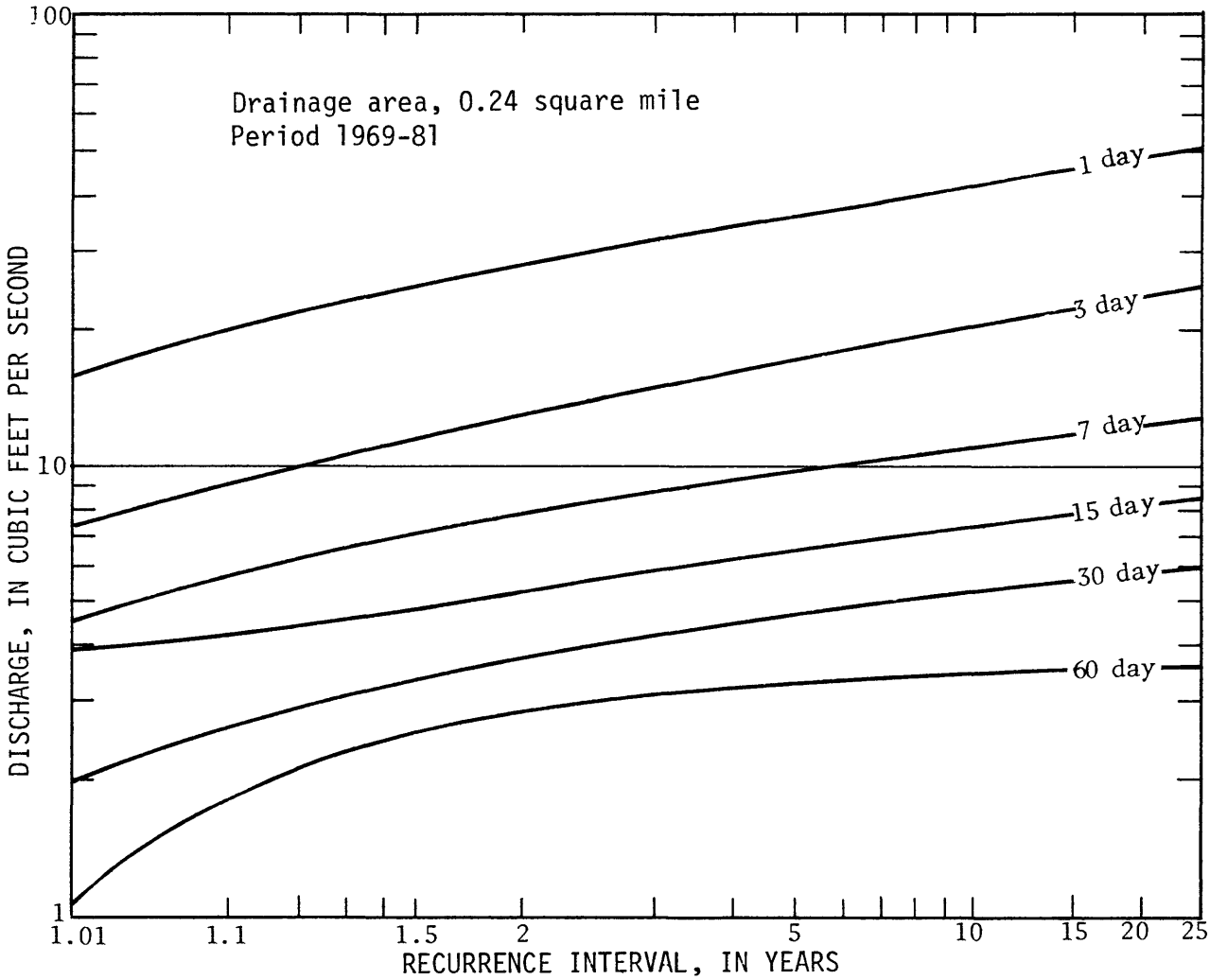


Figure 9. Magnitude and frequency of highest mean discharge for duration indicated. Qaringeel Stream, Yap.

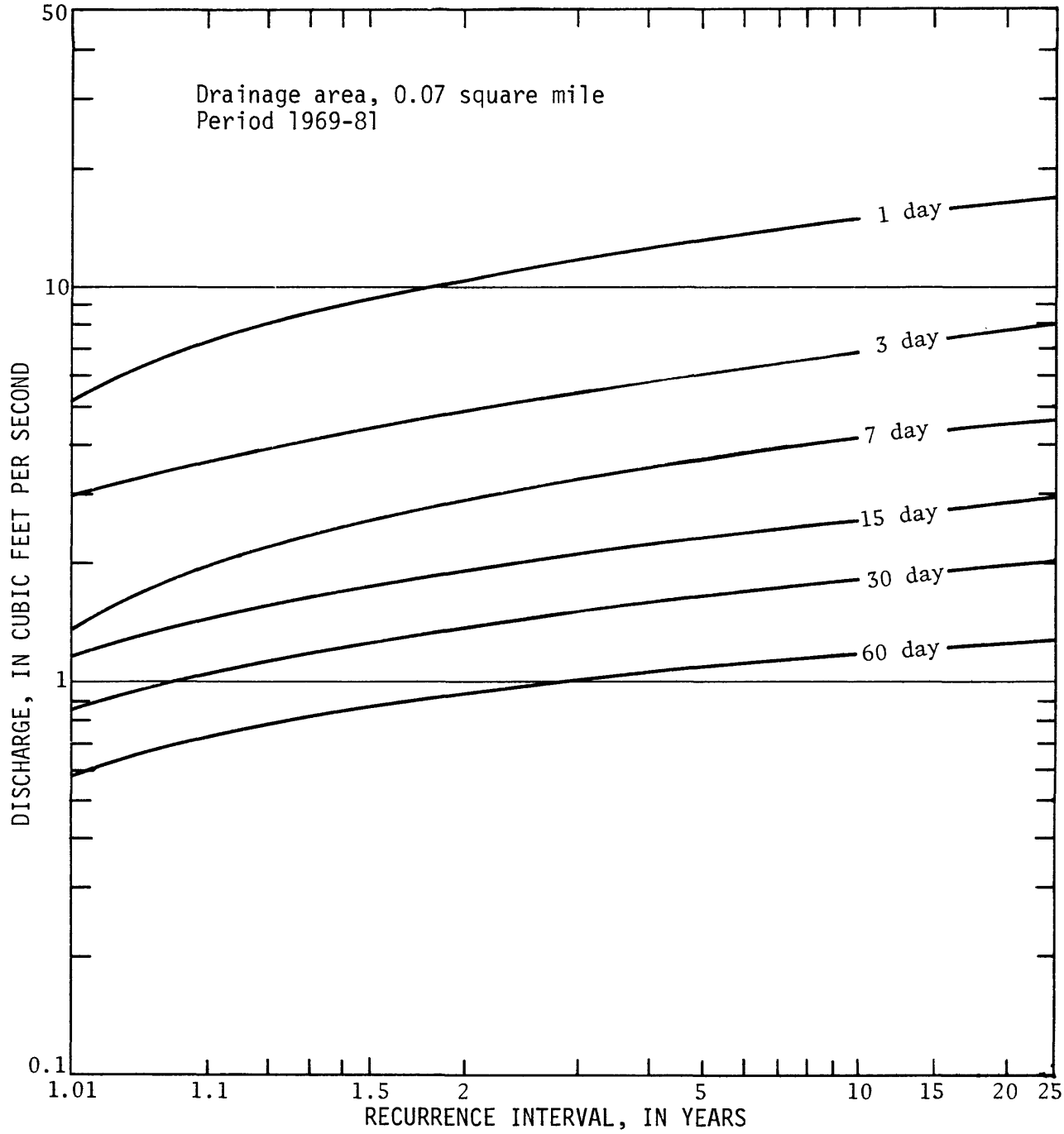


Figure 10. Magnitude and frequency of highest mean discharge for duration indicated. Daloelaeb Stream, Yap.

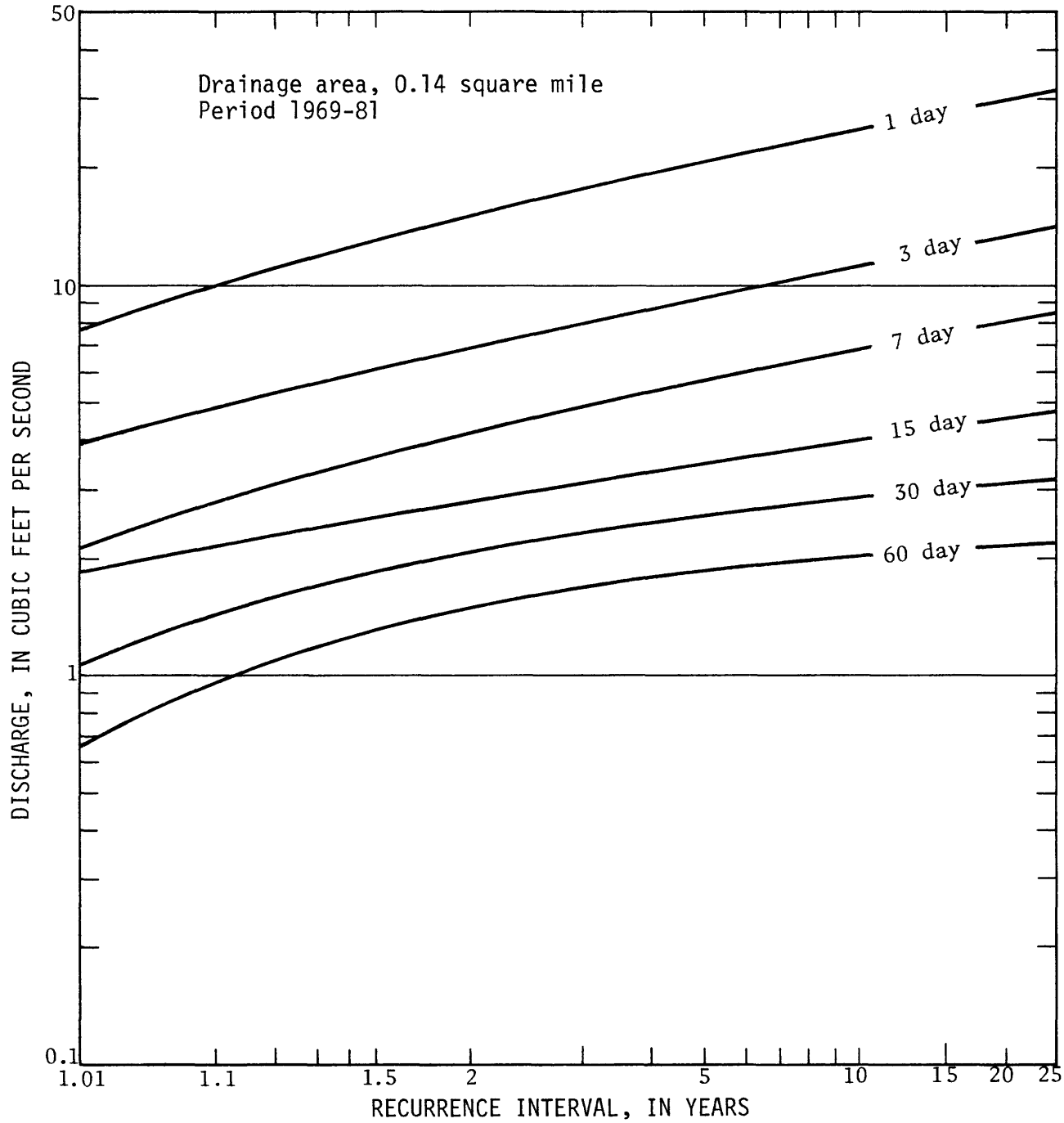


Figure 11. Magnitude and frequency of highest mean discharge for duration indicated. Peemgoy Stream, Yap.

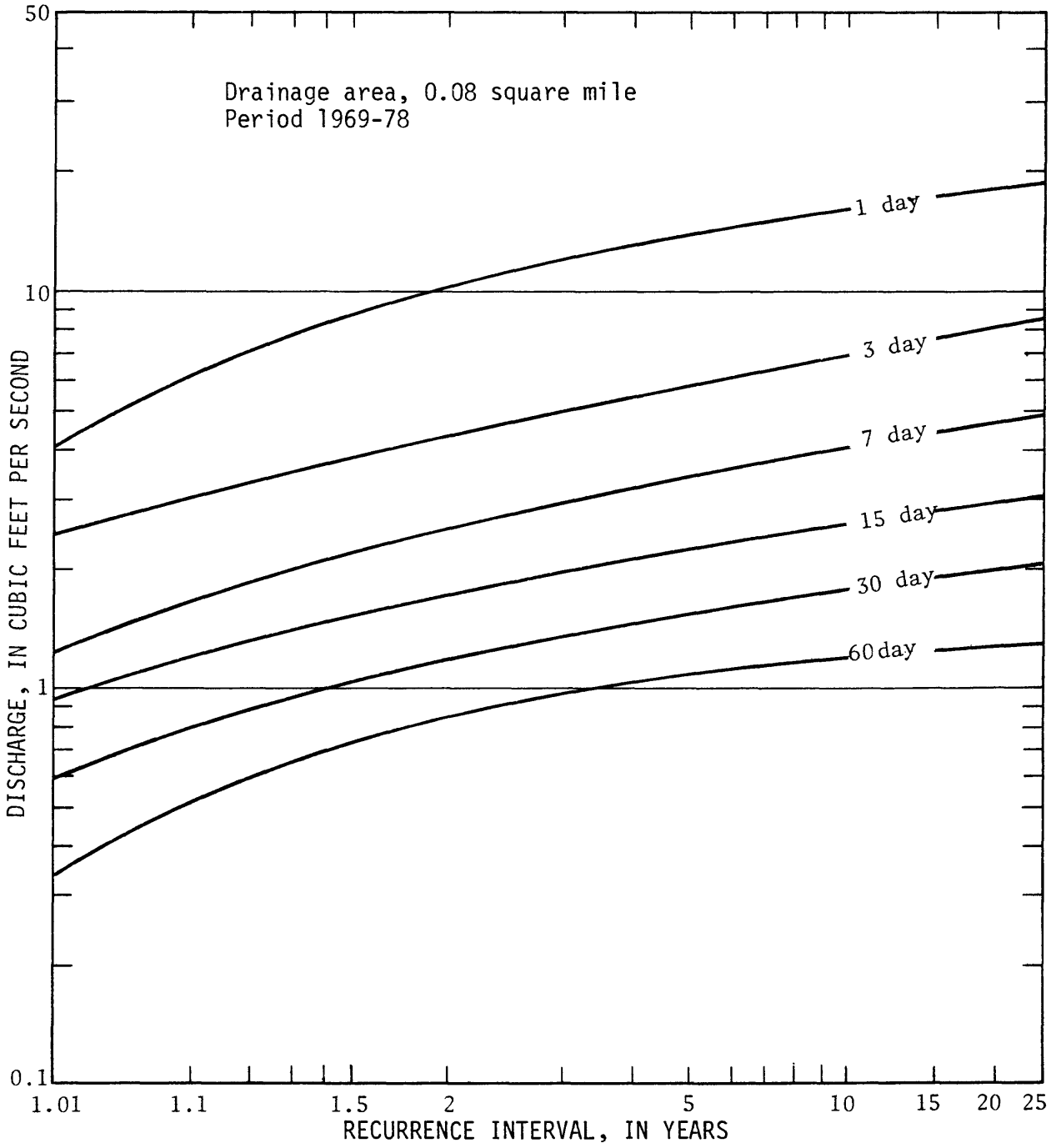


Figure 12. Magnitude and frequency of highest mean discharge for duration indicated. Taalgum Stream, Yap.

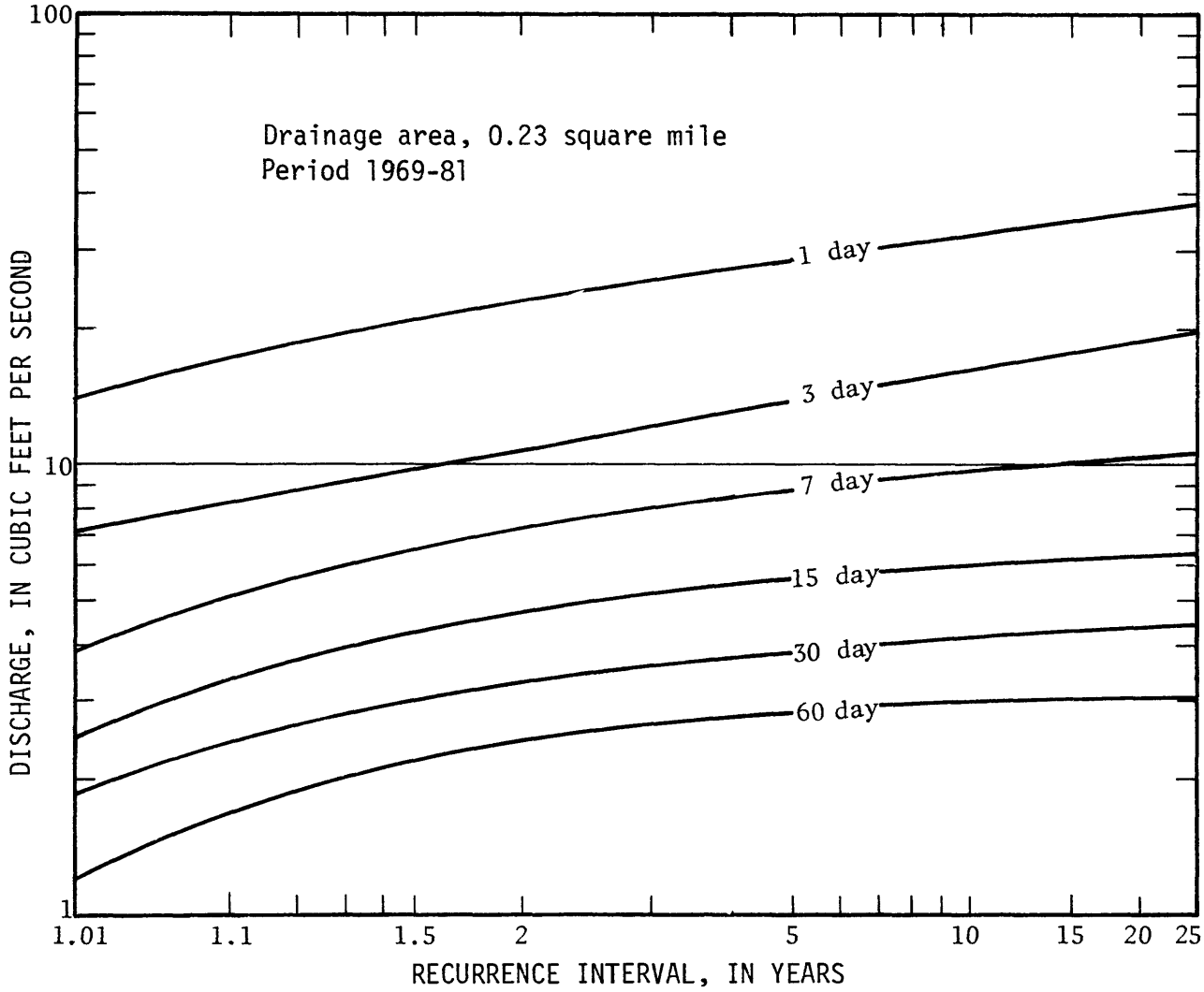


Figure 13. Magnitude and frequency of highest mean discharge for duration indicated. Burong Stream, Yap.

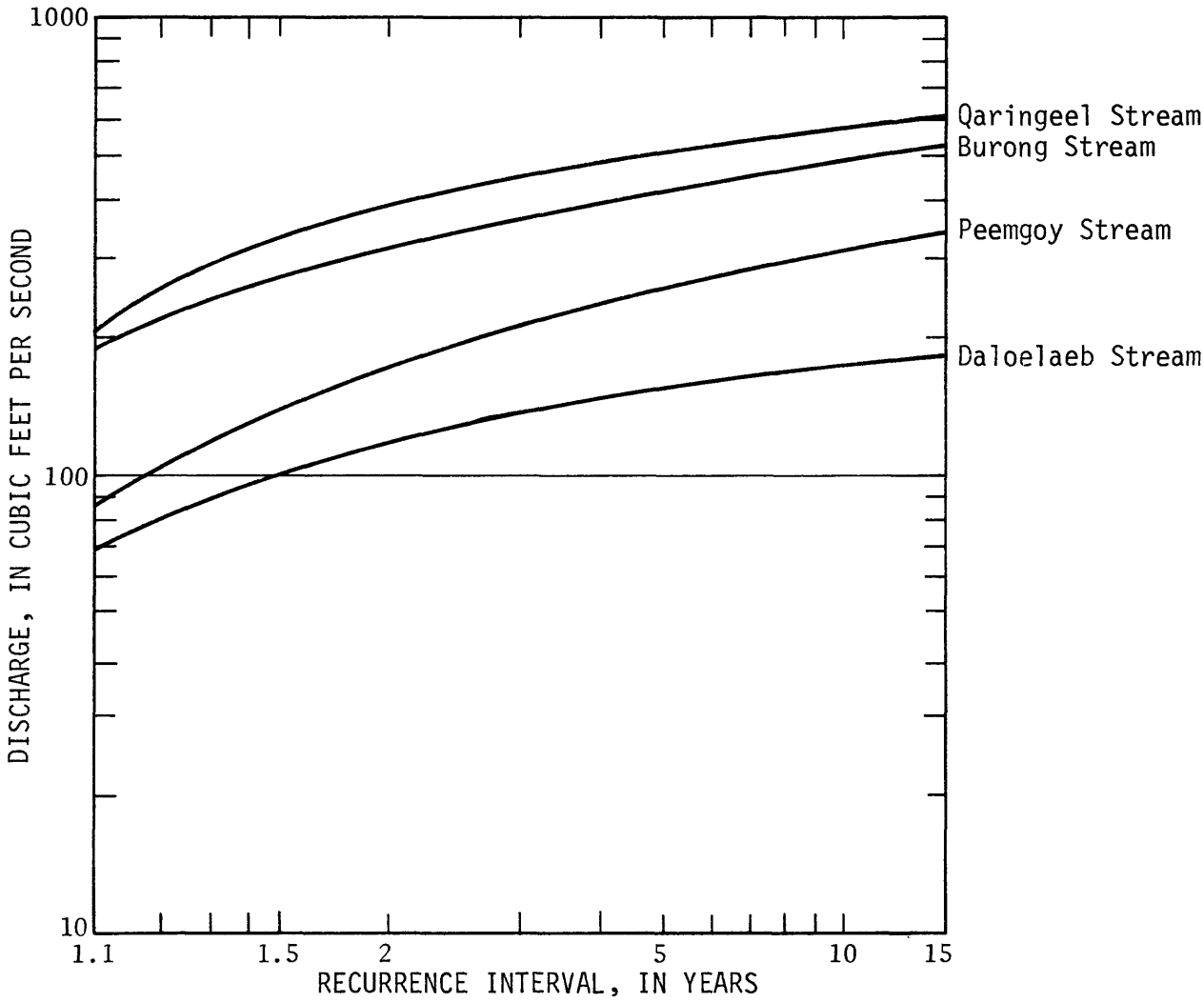


Figure 14. Magnitude and frequency of annual and instantaneous peak flows for four continuous-record stations on Yap Island, 1969-79.

Correlation of partial record with continuous record

A low-flow partial-record station is operated to determine the low-flow characteristics of a stream through correlation with concurrent discharges at continuous-record gaging stations.

The discharge measurements of five partial-record stations were correlated with discharge records for nearby gaging stations (table 8). Because Mabuuq Stream, is nearly equidistant from Peemgoy and Burong Streams, a correlation with both streams was made, and this yielded almost identical results. The correlation with Burong Stream was selected because of the better correlation coefficient and lower standard error.

Discharge measurements for all partial-record stations could not be correlated with discharges at continuous-record stations because flow characteristics of Faraq and Galngun Swamp outlets differ from those of the continuous-record stations and discharge of Yanbilang Stream, Gagil-Tamil proved to be too small for correlation.

Figures 15-19 show the regression lines of the five partial-record stations. From these lines, a reasonable estimate of low flows can be made using the known discharge of the nearest continuous-record station.

Historical and existing developments

Because of the prolonged dry season, normally from January to May, the limited quantity of rain stored as ground water, and the small drainage areas, all streams on Yap Island are dry part of the year. As a consequence, there is a need for surface-water storage. The first storage dam was built on Tamaney Stream during the German Administration. This earthen dam, about 8 feet high and 100 feet long at an altitude of about 25 feet, was built to store water primarily for a communication station and a nearby German settlement. The center of the dam was subsequently washed out by floodflows. Local residents say that the reservoir wasn't used during the Japanese Administration.

Gitaem was the site of the first central water supply system in Yap. An earthen dam was built across Dalibaech Stream in 1951 with a storage capacity of 2 Mgal (million gallons). Water from the reservoir was distributed by 3-and 4-inch galvanized pipes. Later (1965), a treatment plant was installed with a 200-gal/min (gallons per minute) capacity.

Table 8. Correlation between discharges at low-flow partial-record and continuous-record stations

[Y, discharge at partial-record station; X, discharge at continuous-record station]

Partial-record station	Drainage area (square miles)	Continuous record station	Drainage area (square miles)	Correlation coefficient	Standard error in percent	Regression equation
Tamaney Stream, Yap	0.17	Qaringeel Stream, Yap	0.24	0.93	0.12	$Y = 0.702\ X^{0.897}$
Ripu Stream, Yap	.29	Qaringeel Stream, Yap	.24	.95	.10	$Y = .844\ X^{0.913}$
Tholomar Stream, Yap	.13	Qaringeel Stream, Yap	.24	.96	.12	$Y = 1.009\ X^{0.899}$
Mabuuq Stream, Yap	.24	Peemgoy Stream, Yap	.14	.93	.21	$Y = 1.792\ X^{0.895}$
		Burong Stream, Yap	.23	.96	.14	$Y = .865\ X^{0.870}$
Gilaew Stream, Gagil-Tamil	.15	Gilaew Spring, Gagil-Tamil	--	.88	.17	$Y = 1.819\ X^{0.872}$

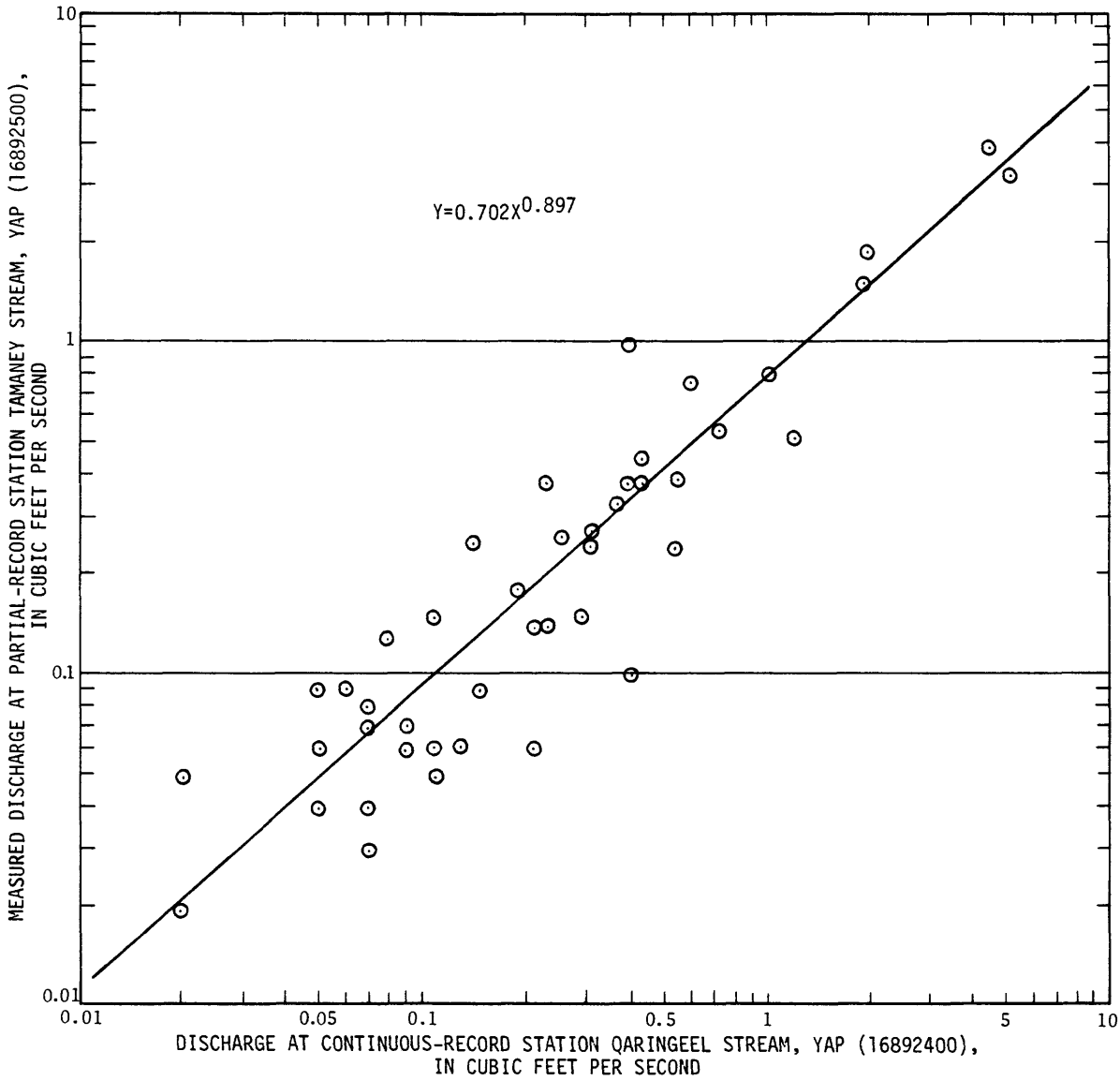


Figure 15. Correlation between discharges at Tamaney and Qaringeel Streams.

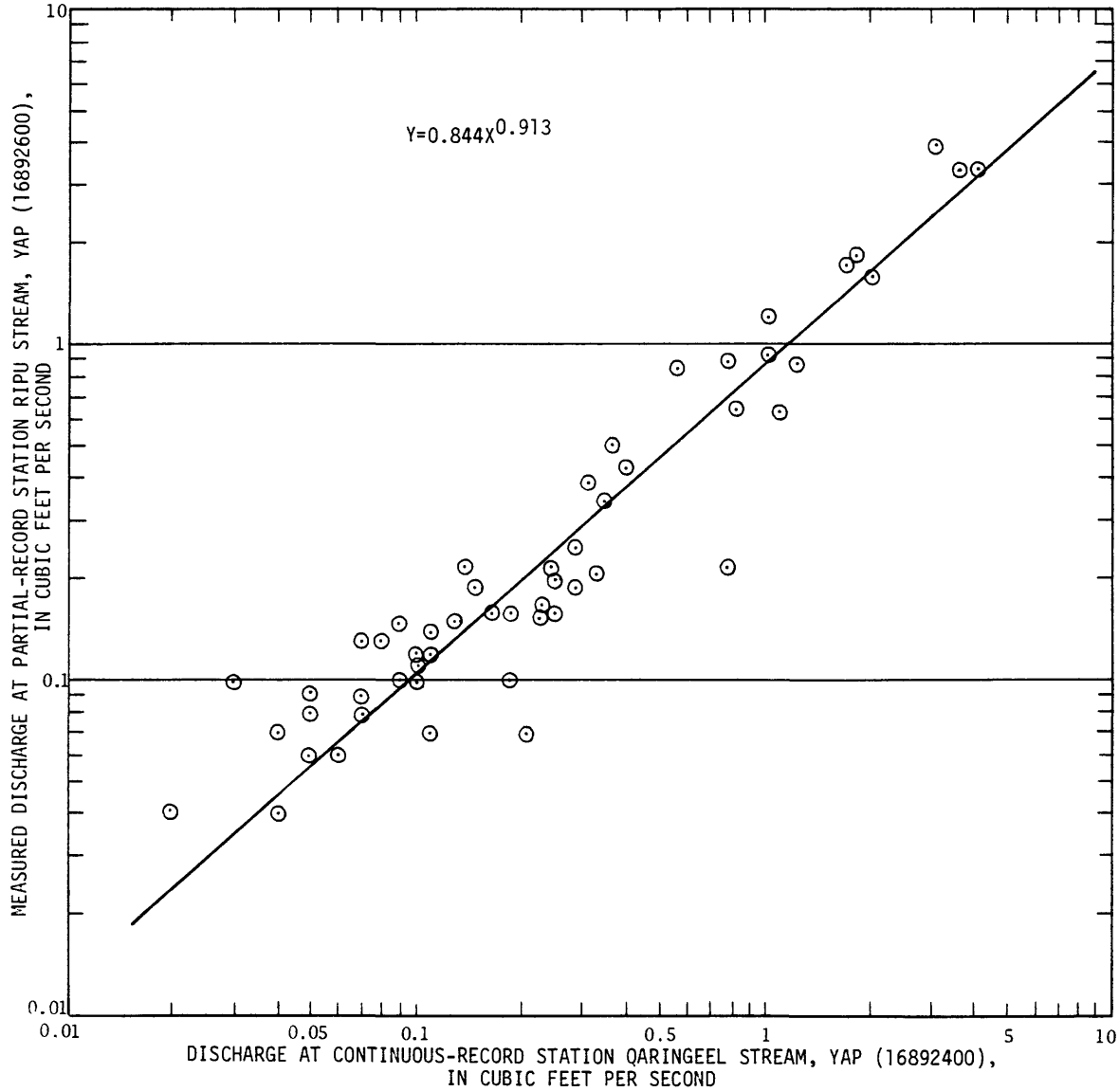


Figure 16. Correlation between discharges at Ripu and Qaringeel Streams.

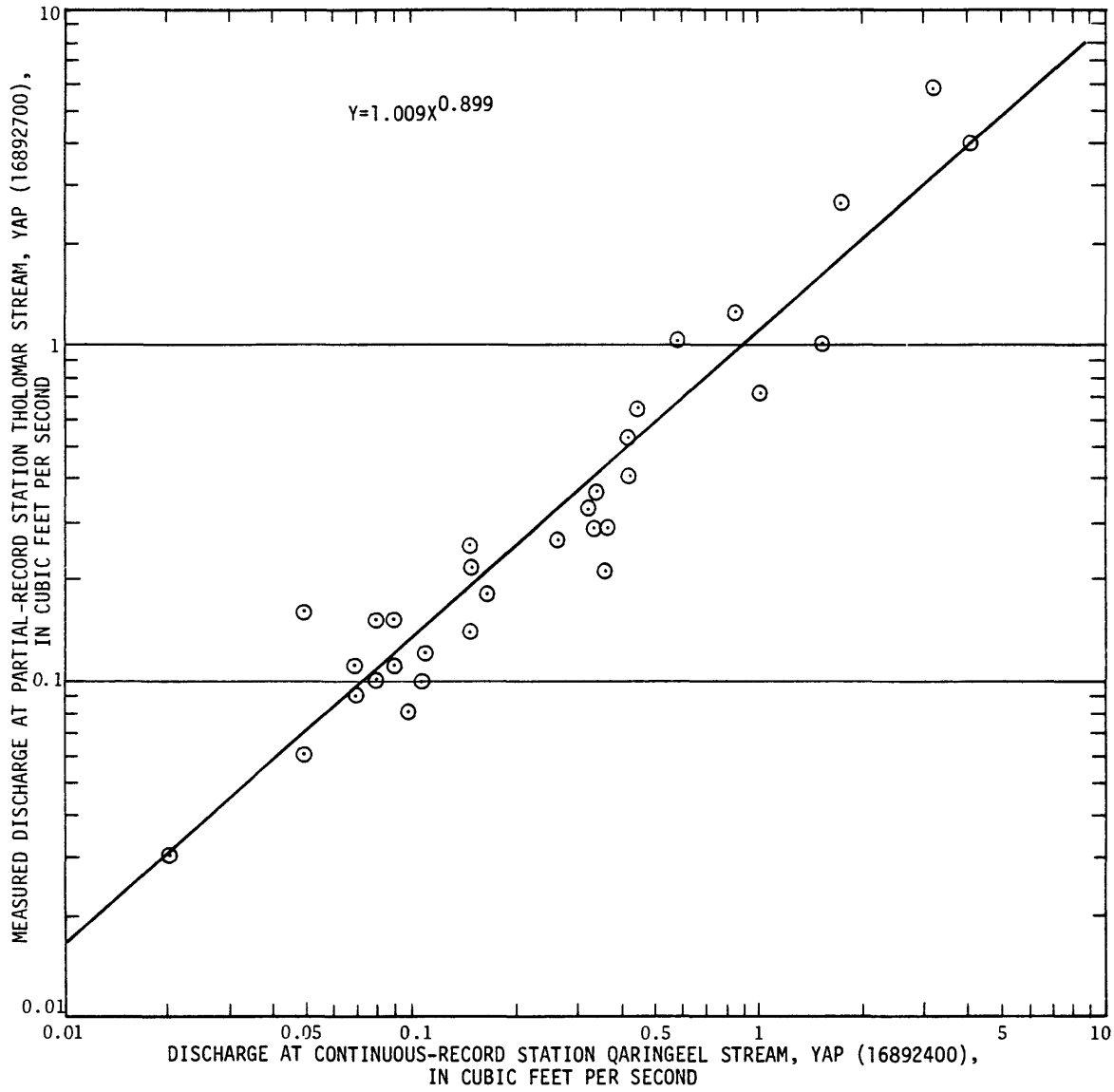


Figure 17. Correlation between discharges at Tholomar and Qaringeel Streams.

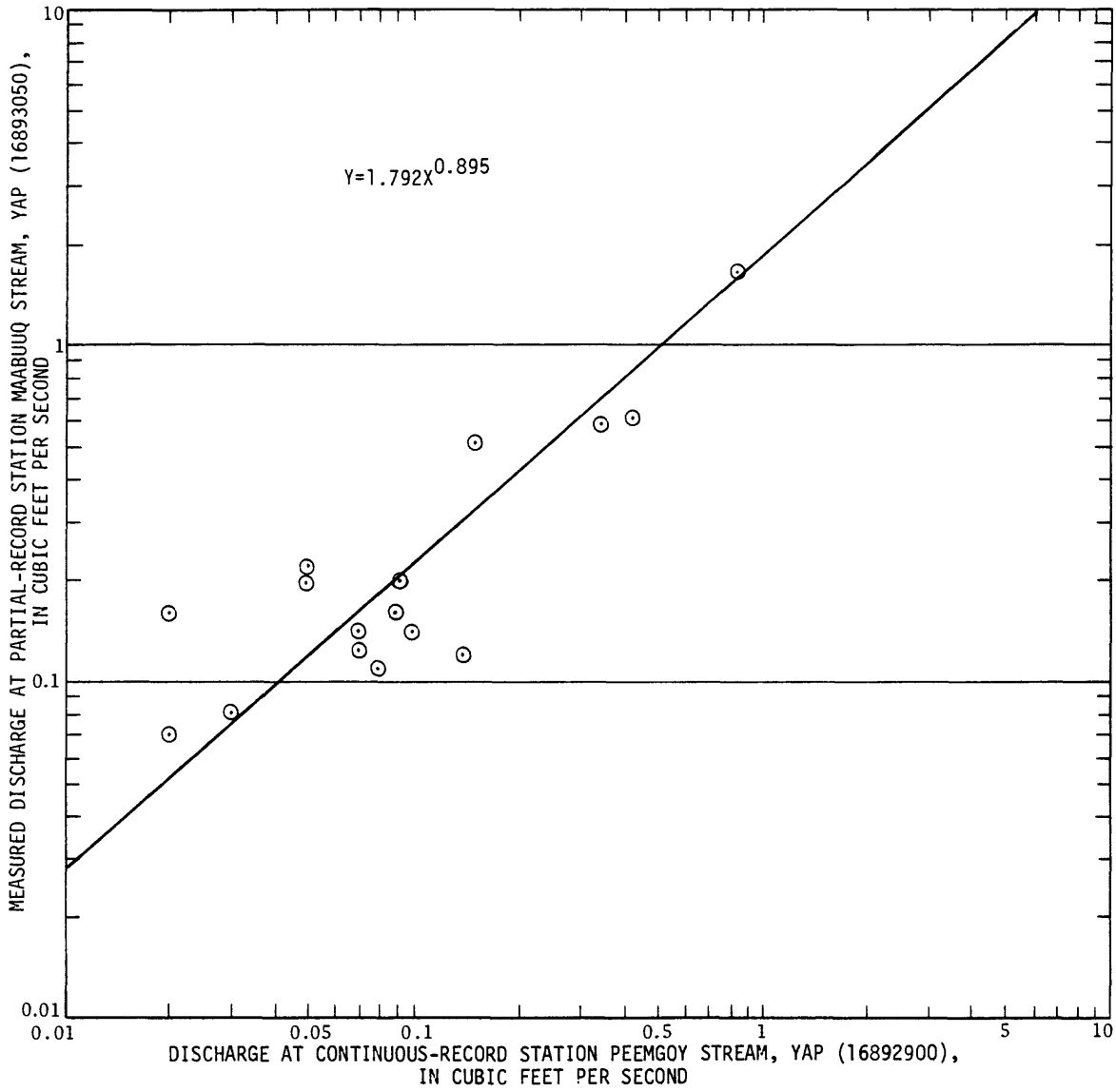


Figure 18. Correlation between discharges at Maabuuq and Peemgoy Streams.

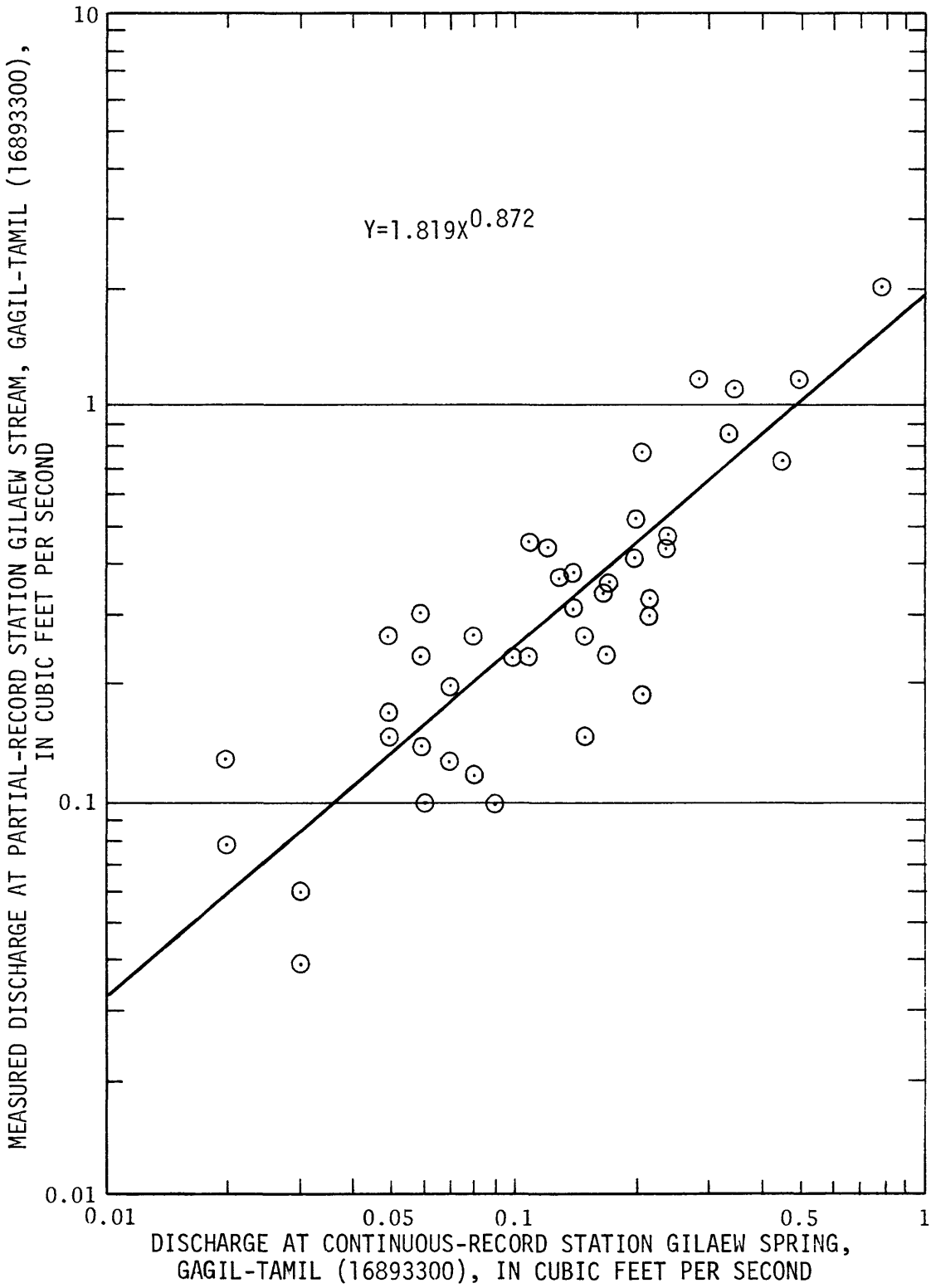


Figure 19. Correlation between discharges at Gilaew Stream and Gilaew Spring.

Miller and Arnow (written communication, 1965) estimated that 20,000-25,000 gal/d (gallons per day) were pumped from the Gitaem Reservoir to a 42,000-gallon tank for use at the high school plus faculty homes and to three 12,000-gallon concrete tanks in Colonia built by the Japanese. Also 40,000 to 50,000 gal/d were distributed by gravity to Colonia. In 1959, a 450,000-gallon emergency storage reservoir was constructed at the Colonia dock area. This emergency reservoir also received rain runoff from the roof of the supply building. Water from this reservoir was used to supply ships and, via two booster pumps near the Spanish well, to the three 12,000-gallon tanks. Leakage of the old 4-inch distribution pipes was estimated by Austin, Smith and Associates, Inc. (1967) to be 40-45 percent of the total water production.

The supply of drinking water for Colonia often would be insufficient during the dry season. It then was necessary to haul water from a pond at the airfield and to severely limit consumption. This pond, which is called Airport Swamp or Luweech Swamp, averages about 500 feet in diameter and is estimated to be 10-15 feet deep. It has never been known to go dry (fig. 20).

A new dam at Gitaem was completed in 1975 and increased the water-storage capacity by 25 Mgal (figs. 21 and 22).

Water production of the treatment plant at the lower dam is metered and a log is kept at the site (fig. 23). No production figures were available for periods when the meters were not working. For 1978, however, meter readings were almost complete and showed a mean monthly clear-water production of 9 Mgal with a maximum monthly output of 11 Mgal during September of that year.

In 1975, part of the old distribution system was replaced by 6-inch to 10-inch asbestos distribution pipes. Two 1-Mgal storage tanks were then built at Nimaar and in Dalipeebinaew (fig. 24).

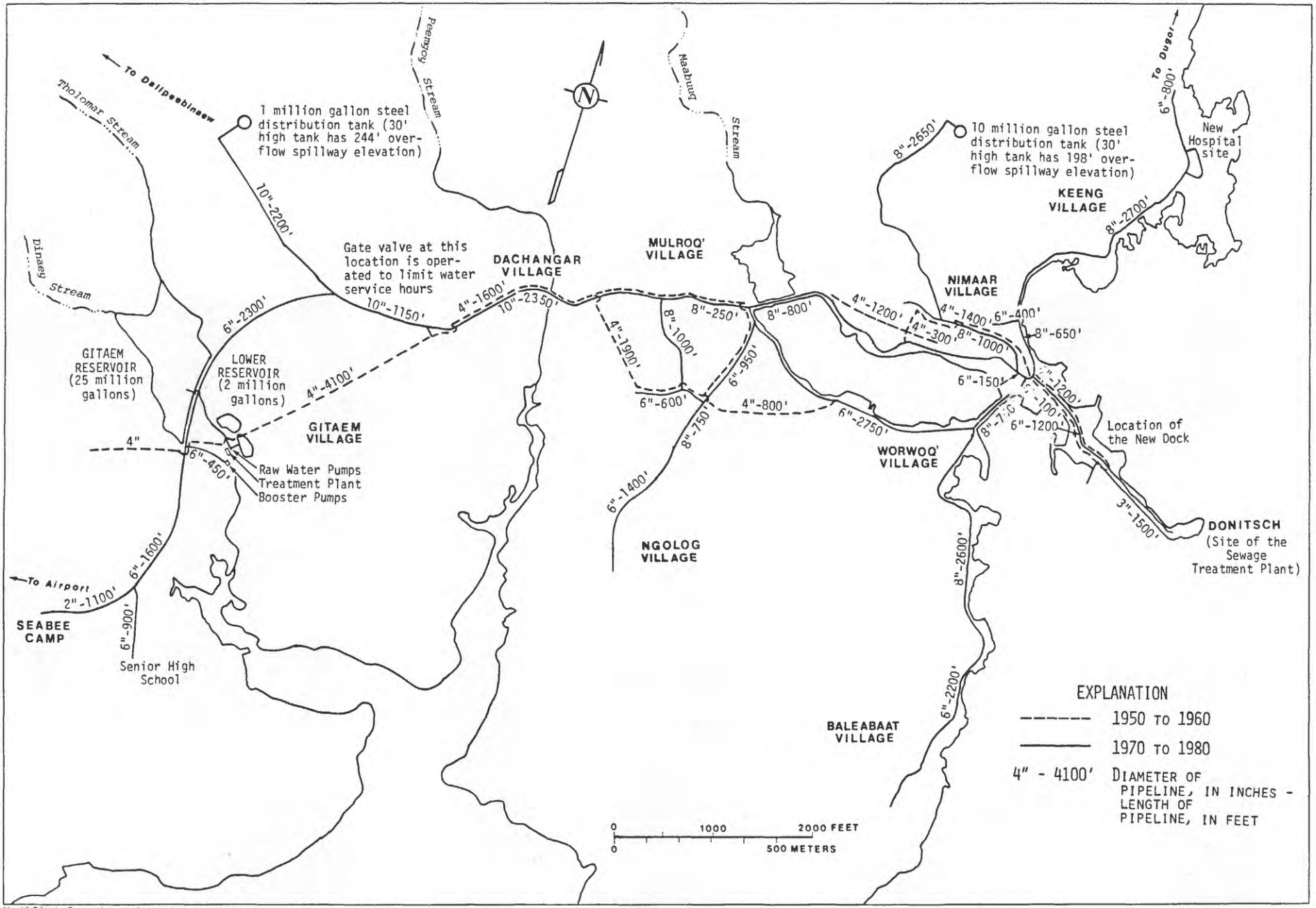
By 1980, almost all of the remaining 4-inch pipes were replaced, but the problem of leakage remained. This leakage is caused by poor connections between the old and new pipes, breaks in the new pipes where insufficient cushion material was used, and open or dripping water fixtures.

Figure 20. Airport swamp with wreck of Japanese fighter plane (view facing north).

Figure 21.
25-Mgal (upper)
reservoir at Gitaem, Yap
(view facing north).

Figure 22.
2-Mgal (lower)
reservoir at Gitaem, Yap
(view facing north).

Figure 23.
Treatment plant at
Gitaem, Yap (view
facing west).



Modified from Lyon Associates, 1980

FIGURE 24. COLONIA CENTRAL WATER SYSTEM.

Lyon Associates (1980) calculated leakage to be 240 gal/min. This necessitated closing the distribution system except for a few hours per day as the amount of leakage during a 24-hour period would be 345,000 gallons, exceeding the capacity of the treatment plant.

Young and others (1977) took six grab samples from the distribution system (date and location of samples unspecified, table 9) which showed that although the total coliform count in the upper Gitaem Reservoir was 5,800 per 100 mL (milliliters) and 95 per 100 mL in the lower reservoir, the levels in the distribution system were very low.

On April 8, 1979, the tap water in Colonia had a pH of 9.1 and a specific conductance of 170 µmhos (micromhos) (USGS). The reason for this high pH reading is not known. From table 9 it appears the pH varies depending on where the sample was taken from the distribution system.

A chemical analysis of a water sample taken by the Geological Survey on September 20, 1980 of the finished water from the Gitaem treatment plant is shown in table 57 in the Hydrologic Data section. The pH reading for this sample appears to be normal.

Ground Water

Historical developments

Historically, villages depended upon rain catchments, shallow dug wells, and springs for water. The only known ground-water development was a well dug by the Spanish in a coastal flat of Colonia. After the construction of the dam on Dalibaech Stream in 1951, the well was used only occasionally until abandoned because of a slow recovery rate. During the Japanese Administration, concrete cisterns were built and wells dug in some villages, but most of these have fallen into disrepair.

In the early days of the American Administration (1947), a 10-foot deep, 10-foot diameter well was dug about 300 feet west of the Spanish well in Colonia (see figure 28). At the time, the Spanish and the American wells were connected by a pipeline, and water was pumped from the American well to the Spanish well and from there to service tanks. It is not known whether the American well was used for any length of time.

Table 9. Results of chemical and microbiological analyses on six grab samples from the Colonia water-distribution system

[Total dissolved solids estimated on the basis of 65 percent of conductivity, as indicated in U.S. Geological Survey Water Supply Paper 1454. All determinations were made in the field (Young and others, 1977)]

Parameter	Units	Concentration		
		Low	High	Mean
Chloride	mg/L	9	16	13
Chlorine residual (total)	mg/L	0.0	0.3	0.1
Conductivity	µmho	95	180	140
Dissolved solids	mg/L	62	117	91
Color, color units	--	< 5	45	26
Fluoride	mg/L	0.1	0.5	0.2
Hardness as $CaCO_3$	mg/L	68	103	92
pH	--	7.2	8.8	7.8
Temperature	^{o}C	29	32	31
Total coliform per 100 mL	--	0	1	0
Nitrate as N	mg/L	4	6	4
Turbidity	NTU	--	--	4

Nature and occurrence

In "Military Geology of the Yap Islands," the authors concluded that because of dense bedrock with clayfilled fractures, the rock would have low permeability and contain little water. This was concluded on the basis of surface reconnaissance, as no drilling equipment was available.

Sunn, Low, Tom, and Hara, Inc. (1971) recognized the availability of ground water in central Tamil and, to a certain extent, in southern Yap on the basis of tests made on existing shallow wells and hand augering. Two wells were located on Tamil, one about 1,600 feet south of the LORAN station, the other about 2,300 feet north of Tamilang School at altitudes of 50 and 40 feet above mean sea level, respectively (fig. 25). At both sites the water surface was 3 inches below ground level but was quickly drawn down when bailed or pumped. The authors concluded that development of ground water in the central valley of Tamil might not be feasible as the ground water is perched at the shallow depth on stiff clayey silt and the aquifers have low permeability with a very limited storage capacity.

An existing spring at an altitude of 40 feet in Daabach on the west coast of Tamil, with a flow rate of 3.7 gal/min (measuring date not given), could supply water to the local inhabitants but this was not thought feasible for development as dwellings are widely scattered (fig. 25). However, Nance (1979) reports that the spring supplied water through a 2-inch polyethylene pipe to Rumuug village on Yap Island.

At Gagil municipality, two shallow borings were drilled on east Gagil near the coast, but because of contamination of the ground water by decayed organic matter, no pumping tests were made and the area was considered unsuitable for water supply.

In Kanifaay, in southern Yap, two shallow wells were found. The first, about 650 feet west of the existing church and school in a narrow ravine at about a 15-foot altitude (fig. 25), has a diameter of 4 feet and is partly lined with steel casing with the water table standing several inches below the collar. Local residents reported that the well water was used for drinking. Information on the yield was not available.

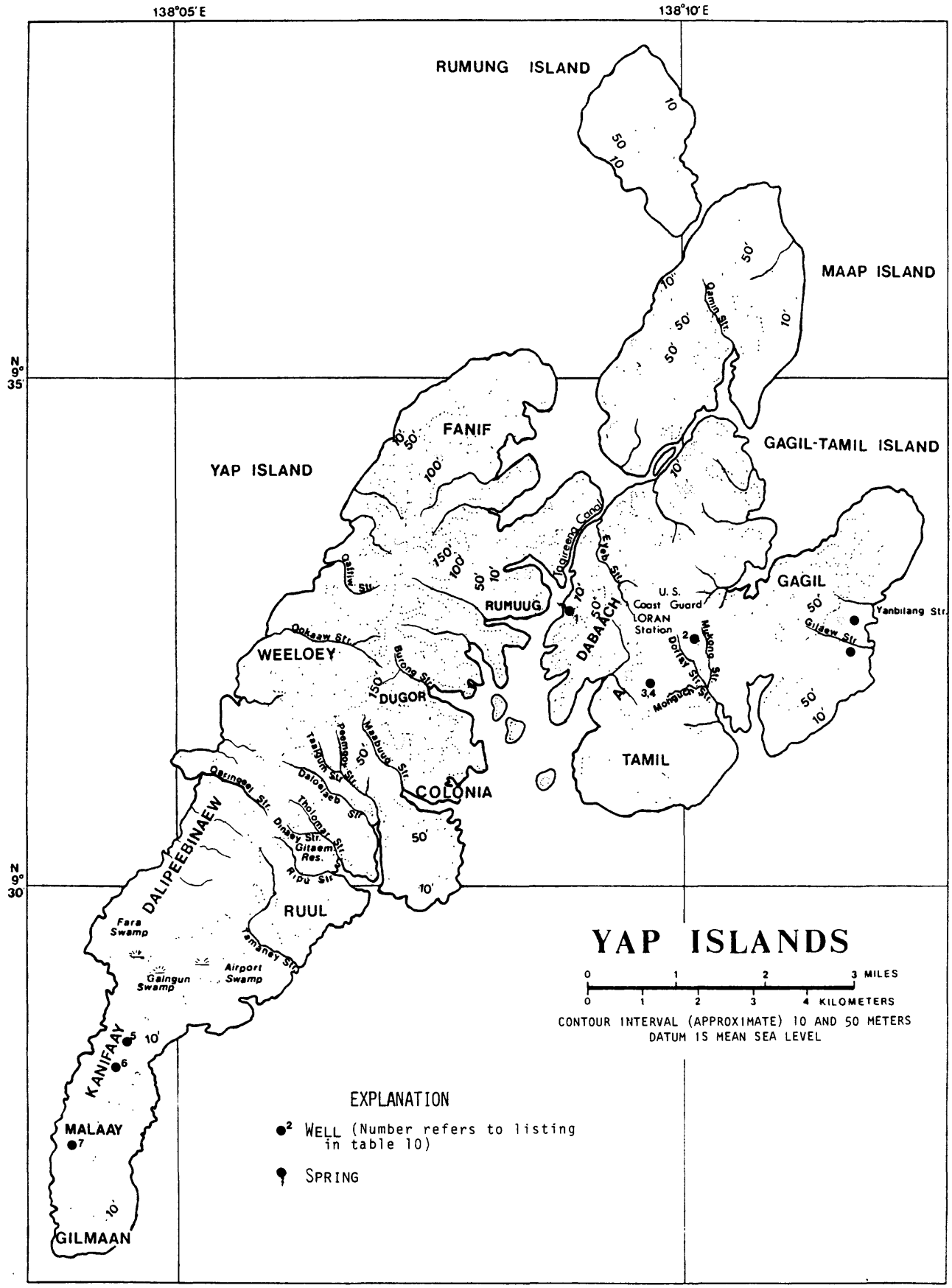


FIGURE 25. LOCATION OF WELLS AND SPRING ON GAGIL-TAMIL AND SOUTHERN YAP, 1971.

The second well is located southwest of the first, at an altitude of approximately 5 feet. It is about 4 feet square and lined with schist boulders. The water table was standing at about 1.4 feet below ground surface. According to local residents the well was abandoned because of salinity and poor supply during the dry season.

Three 6-inch-diameter, 9-foot-deep holes were drilled for pumping and observation about 250 feet east of the central-road and Malaay village-road intersection. Water was encountered at a depth of 3.2 feet but dropped 1.6 feet after 4 hours when pumped at a rate of 6 gal/min, remaining at that level for an additional 2 hours of pumping.

From their investigation the authors (Sunn, Low, Tom, and Hara, 1971) concluded that shallow ground-water sources in southern Yap could be developed satisfactorily throughout most of Kanifaay municipality, using infiltration galleries in the wider coastal flats and shallow dug wells above narrow flats. Measurements of chloride and dissolved solids at seven sites are listed in table 10.

Table 10. Partial chemical analyses of water samples taken January 1971

[Source: Sunn, Low, Tom and Hara, 1971]

Site Number	Location	Chloride (mg/L)	Total dissolved solids (mg/L)
1	Daabach (Deboch Village) Spring, Tamil	10.5	136
2	Test well near LORAN station, Tamil	10	58
3	Test well near Tamil School	15	20
4	Test well near Tamil School	10.5	88
5	Existing well in Kanifaay	13.5	178
6	Existing well in Kanifaay	7	276
7	Test well in Malaay (Malai), Kanifaay	7	360

In 1977, while testing drilling equipment for subsurface investigations for a proposed new airport, Lyon Associates Inc. (Nance, 1979) drilled a test hole behind the Communication Station near the existing airport. The bit penetrated 30 feet of clayey soil followed by 70 feet of sandy silt. The hole was cased with 2-inch galvanized pipe, and since then the well has been producing water for the Communication Station at a rate of about 300-500 gal/d. (For chemical analyses of the water by USGS, see table 60.)

In 1979, 15 exploratory wells were drilled by Lyon Associates (fig. 26). One hole was drilled in serpentine rock next to Gagil School. Below 13 feet of sand and silt, decomposed serpentine was encountered grading into highly fractured rock 7 feet farther down. No water was found. Four wells were drilled in Tamil and, below a surface layer of 5-14 feet of clayey soil, sandy silt was found to a depth ranging from 33 feet to about 100 feet where basement rock of schist was encountered. Similar conditions were encountered at three drilling sites near the Yap Airport. The basement rock was almost impermeable and formed a bottom to the sand and silt which contained some water. Because of the areal extent of this layer of sand and silt, this aquifer should be able to yield a limited amount of water (Nance, 1979).

In southern Yap, where three wells also were drilled, no permeable material was encountered, as the clayey silt was found to be resting directly on the basement rock. This rock, decomposed schist at the top and fractured schist below, was considered impermeable as the fractures appeared to be filled with clay (Nance, 1979). This differs from the findings of Sunn, Low, Tom, and Hara (1971) who concluded that shallow wells in or near the coastal flats could be developed satisfactorily.

On the west coast of Yap Island four wells were drilled, three in schist and one in the alluvial material of the Qokaaw River valley. Permeability of the rock formation was poor and ground-water yield questionable, at best. The Qokaaw well proved to be located in an old mangrove swamp.

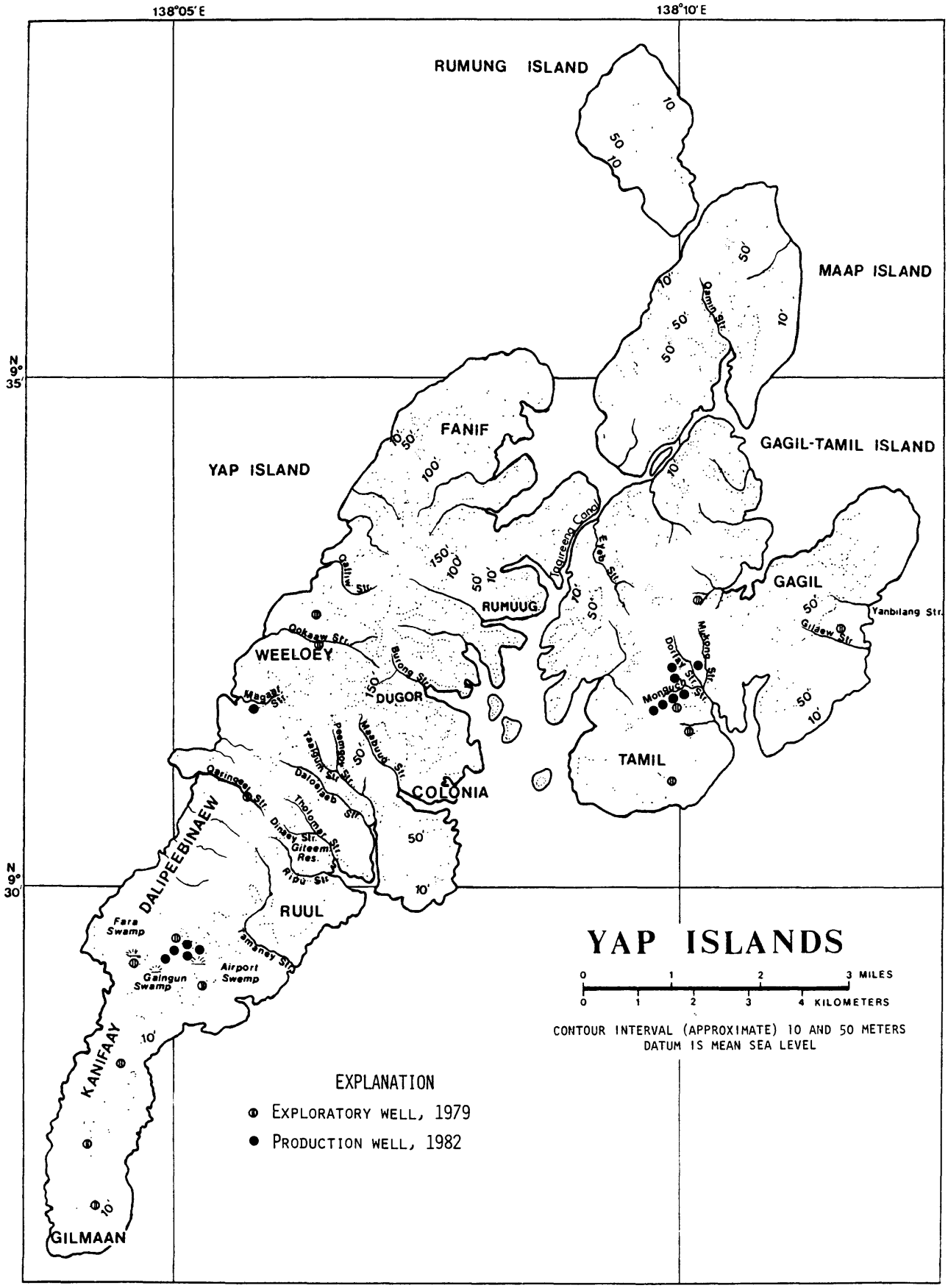


FIGURE 26. LOCATION OF WELLS DRILLED IN 1979 AND 1982.

Lyon Associates (1980) concluded that the large aquifers in central Tamil and the airport area would be well suited for ground-water development. Although the permeability of the deeper sandy silt is not high, the central Tamil aquifer could provide water for most of the people on Gagil-Tamil, and the airport aquifer could supply all of southern Yap. Water use in the villages is estimated to be as low as 20-40 gallons per person per day. Drilling logs, pumping tests, and a listing of the springs, seeps, and dug wells of the Yap Islands can be found in "Yap Islands, Groundwater Exploration April to August 1979" by Tom Nance for Lyon Associates, Inc.

Following the recommendations of Nance, 13 wells were drilled in the first few months of 1982--7 in the central valley of Tamil, 5 near the Yap airport, and 1 at Magaaf Stream, Yap (fig. 26). On Tamil, the depths of the 4 southernmost wells varied from 71 to 87 feet below mean sea level and the depths of the other 3 wells varied from 93 to 145 feet. The water-bearing formation of the Mukong Stream well was white coral rock and that of the other 6 wells, medium-hard brown rock. The combined aquifer yield is expected to exceed 200 gal/min (Nance, 1982). A 24-hour pumping test of three of the southernmost wells caused drawdown at all wells except the Mukong Stream well. This indicates that the Mukong Stream well draws from a separate aquifer. Water from the wells will be pumped to a 100,000-gallon tank for distribution to nearby villages.

Five wells were drilled northwest of the Airport Swamp on Yap Island. All were drilled until hard schist rock was encountered at a depth of 25 to 50 feet below mean sea level. The water-bearing rock, just above the hard schist, consisted of softer greenish-gray and gray rock. A combined yield of 100 gal/min is expected (Nance, 1982). The water will be used to supply villages in the southern part of the island.

Chemical analyses of water from each aquifer, the two on Tamil and the one near the airport, are given in table 61 and show the water to be of good quality.

The well drilled at Magaaf Stream was located 4 feet from the test hole drilled in 1979. At this well, the water comes from schist rock in the middle depth and the bottom of the well. The yield of the well during the dry season is expected to be at least 10 gal/min.

Drilling logs of the 13 wells and of four test holes and results of pumping tests can be found in "Yap Island Water Well Development, January to March 1982," by Tom Nance (1982) for Lyon Associates, Inc. Readings of the depth to water of 12 of the wells are given in table 11.

Table 11. Depth to water, in feet, of wells on Yap and Gagil-Tamil

[Measuring point is top of casing]

Well	[1] Altitude top of casing (ft)	Depth to water									
Nance, 1982											
Yap Island		1982									
		Feb. 19	Mar. 2	Mar. 9							
Yugamanman 1	42.68	--	--	15.52							
Yugamanman 2	38.83	--	--	12.83							
Timlang 1	42.68	9.01	10.43	11.30							
Timlang 2	40.43	9.10	10.32	11.79							
Timlang 3	44.22	12.33	13.44	13.02							
U.S. Geological Survey											
Yap Island		1982							1983		
		Aug. 3	Sept. 1	Sept. 16	Sept. 30	Oct. 28	Nov. 18	Dec. 22	Jan. 27	Feb. 22	Mar. 30
Magaf	--	8.94	8.95	--	8.73	--	9.63	--	--	--	--
		July 29									
Yugamanman 1	42.68	13.30	12.24	--	13.05	14.53	16.38	15.60	19.69	23.38	26.83
Yugamanman 2	38.83	11.15	10.30	--	10.80	12.06	13.40	12.85	16.19	19.60	23.08
Timlang 1	42.68	8.19	--	--	--	8.61	11.05	9.80	14.82	20.60	25.60
Timlang 2	40.43	8.35	4.54	--	7.43	9.51	12.86	11.58	17.26	21.43	27.10
Timlang 3	44.22	--	6.43	--	8.02	--	--	--	--	--	--
Gagil-Tamil		June 26			Sept. 29					Feb. 21	
Monguch 1	21.38	0	0	0	.17	.40	.64	.40	1.23	1.86	1.69
Monguch 2	26.47	2.97	1.75	1.84	2.32	2.66	2.97	2.58	3.70	4.50	5.60
Monguch 3	--	1.74	1.58	1.70	2.35	2.77	3.13	2.63	3.97	4.87	--
Monguch 4	--	5.63	5.39	5.57	6.43	6.89	7.41	6.75	8.38	9.42	10.78
Mukong	25.83	9.78	9.64	--	10.19	10.38	10.57	10.32	11.37	12.07	12.39
Dorfay 4"	29.93	7.81	7.23	8.00	9.13	9.56	9.65	9.60	debris in well		
Dorfay 6"	30.92	11.49	11.22	11.37	11.67	11.86	11.93	10.60	12.60	13.29	14.39

Note: Yugamanman wells also called Faraq-Lamaer wells and Timlang wells also called Weather Bureau wells.

[1] From Nance, 1982.

Water Quality

General

Rainfall is the source of all surface water of the Yap Islands. The quality of the surface water is good as the concentration of all chemicals analyzed are well within the maximum permissible level recommended for domestic use by the World Health Organization (1971).

A number of stream-water samples were collected from pools at gaging stations where the streams were either not flowing or almost dry when visited. These samples may not be representative of regular streamflow and results are not included in the following assessment of the surface water.

The dissolved solids concentration of surface water on the Island of Yap ranged from 48 to 104 mg/L (milligrams per liter) and on Gagil-Tamil from 23-83 mg/L. Silica concentrations ranging from 9.5 to 23 mg/L and constituting from 20 to 35 percent of the dissolved solids on Yap and concentrations of 4.4 to 18 mg/L constituting from 16 to 36 percent of the dissolved solids on Gagil-Tamil, are characteristic of rain water flowing over tropical volcanic terrain. Other constituents in decreasing order of concentration were chloride, magnesium, calcium, sodium, sulfate, potassium, nitrite plus nitrate nitrogen, and fluoride.

The iron concentration of surface water on Yap Island ranged from 81-450 µg/L (micrograms per liter) with a mean of 237 µg/L (25 analyses). Iron concentrations for streams on Gagil-Tamil were as high as 1,000 µg/L and averaged 332 µg/L (15 analyses). Iron is a minor element in water but can cause considerable problems when the concentration exceeds 300 µg/L. It can cause problems with taste, discoloration, turbidity, and growth of iron bacteria. The World Health Organization (1971) recommended a desirable level of 100 µg/L and a maximum permissible level of 1,000 µg/L.

Runoff from tropical storms is usually flashy and can cause turbidity problems in stream water and coastal waters. However, storm duration is generally short and streams revert to base flow with clear water within a short time. Physical quality data, in terms of specific conductance, pH, temperature and turbidity, are included in the chemical analyses as an integral part of the baseline information.

Specific conductance is expressed in micromhos per centimeter at 25°C. It is a measure of the ability of water to transmit an electric current and is used as an indicator of the concentration of dissolved solids in water; the more dissolved solids, the greater the conductance. The specific conductance of stream water on the Yap Islands did not exceed 138 µmhos.

A measure of acidity or basicity is pH. In natural water, the level of pH depends on chemical and biological processes. For streams on Yap Island, pH values ranged from 7.1 to 7.4 and for Gagil-Tamil from 6.1 to 7.3. The levels are within the recommended range for public water supply (World Health Organization, 1971).

Chemical analyses

Before 1979 there were no systematic chemical analyses made of water from sources in the Yap Islands. In 1928, Hajime Arai took 144 samples from water sources in the Japanese administered islands; a number of these samples were from Yap (Naval Medical Association Bulletin). The analytical results are not listed here because a copy of this publication could not be obtained.

In response to a request by the High Commissioner of the Trust Territory of the Pacific Islands, Ted Arnow of the U.S. Geological Survey reported on the water-supply conditions on Yap (written communication, Nov. 12, 1952). On September 30, 1952, he collected a water sample from the Spanish well in Colonia for chemical analyses (fig. 27). The water had a pH of 7.2, a specific conductance of 513 µmhos and the dissolved constituents listed in table 12.

Water samples for bacteriological and chemical analyses were collected at seven locations in the Yap Islands by Austin, Smith, and Associates (1967) in August 1967 and the results of the chemical analyses are listed in table 13. Bacteriological analysis revealed 600 coliform colonies in a 10-mL sample taken from the Airport Swamp, while untreated water at the Gitaem Reservoir and water from Chamorro Bay and at several locations along the coast near Colonia had in excess of 24,000 coliform colonies per 10 mL.

A water sample taken by the U.S. Geological Survey on August 11, 1978 from the well at the Communication Station showed 20 mg/L chloride and on April 8, 1979, the pH and specific conductance of water from the Airport Swamp were 8.5 and 160 µmhos (USGS). In August 1979, water samples were taken for Lyon Associates (Nance, 1979) from the Faraq test well on Yap and from Monguch Stream on Gagil-Tamil. The analytical results are listed in table 14.

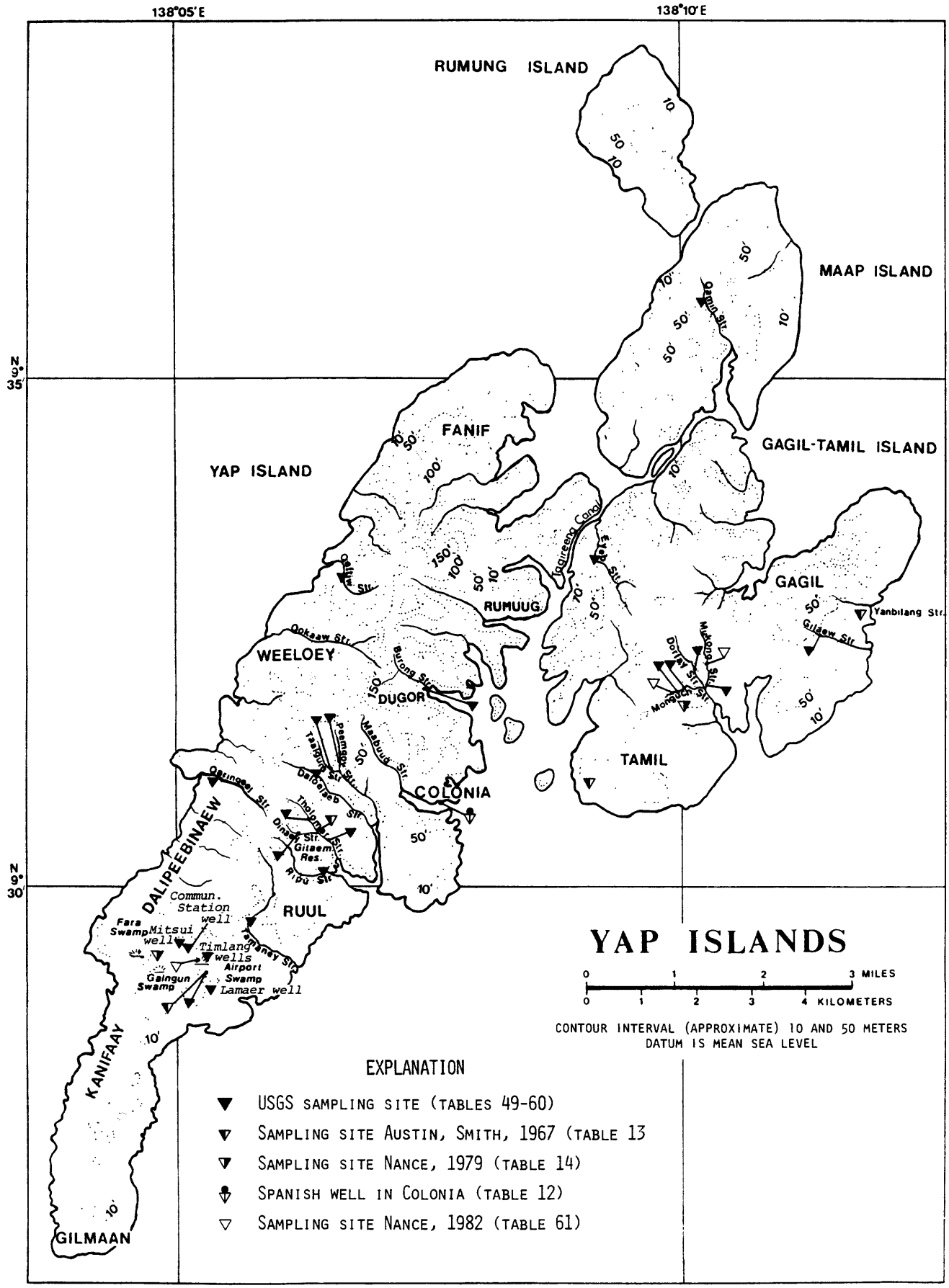


FIGURE 27. LOCATION OF SITES WHERE CHEMICAL ANALYSES OF WATER WERE MADE.

Table 12. Chemical analysis of water from the Spanish well (1952)

[Collected: September 30, 1952. Analyzed by U.S. Geological Survey, Salt Lake City Laboratory]

Dissolved constituent	Mg/L[1/]
Silica (SiO_2)	37
Iron (Fe)	.04
Calcium (Ca)	28
Magnesium (Mg)	43
Sodium (Na)	21
Potassium (K)	.5
Bicarbonate (HCO_3)	316
Sulphate (SO_4)	7.6
Chloride (Cl)	15
Fluoride (F)	0
Nitrate (NO_3)	1.9
Hardness	247
Dissolved solids (Residue at 180°C)	285

[1/] Originally reported in parts per million by Miller and Arnow (written communication, 1965). Parts per million is numerically equivalent to milligrams per liter.

Table 13. Chemical analyses reported by Austin, Smith and Associates (1967)

[Collected: August 1967. Units reported in parts per million]

	Airport Swamp, Yap	Colonia [1/] (untreated)	Colonia [2/] (treated)	Stream on Tamil	Stream on Gagil	Seep on Maap	Seep on Rumung
pH	8.0	7.6	8.5	8.1	8.2	6.8	8.0
Turbidity	0	50	20	0	0	15	10
Alkalinity - $CaCO_3$	15	30	10	30	95	155	105
	10	25	50	10	80	140	85
Chloride	8	12	16	10	15	25	25
Iron	.1	.3	.2	.15	.05	.8	.35
Copper	.05	.05	.05	.05	.15	.1	.25
Manganese	.5	.3	.3	.4	1.2	1.8	2.1
Sulphate	7	13	12	9	11	17	12
Nitrate	--	4.4	8.0	35	18	14	25
Silica	8	--	14	20	40	75	53
Phosphate	3.7	--	.2	.2	.1	.6	.1

[1/] Untreated source of Colonia water-supply system is Tholomar Stream, Yap.

[2/] Treatment not specified.

Table 14. Chemical analyses made for Lyon Associates (1979)

[Source: Nance, 1979. Samples analyzed by Brewer Analytical Laboratories, Honolulu, August 31 to September 14, 1979. Units reported in milligrams per liter]

Chemical constituent	Faraq test well, Yap Aug. 18, 1979	Monguch Stream, Gagil-Tamil Aug. 19, 1979
Fluoride	0.02	0.01
Nitrate nitrogen	.14	.05
Cyanide	< .01	< .01
Sulfate	3	4
Total dissolved solids	156	55
Arsenic	< .05	< .05
Selenium	< .010	< .010
Barium	< 1	< 1
Cadmium	< .010	< .010
Chromium	< .05	< .05
Lead	.02	.02
Silver	< .001	< .001
Copper	.01	.01
Iron	.16	.04
Manganese	.34	.35
Zinc	1.08	.01
Mercury	< .00005	< .00005

In 1979, the U.S. Geological Survey began a program to collect and analyze water samples from all major water sources in the Yap Islands. Results of chemical analyses made of water from 10 streams on the Island of Yap are remarkably similar. The chemical analyses of water from one spring and four streams on Gagil-Tamil show more variation. Water from Monguch Stream proved to be very low in dissolved solids but high in iron concentration. The concentrations of constituents of ground water in Yap and Gagil-Tamil Island are similar to those of the surface water except for a noticeably greater concentration of silica and less dissolved iron in ground water. Tables 49-60 in the Hydrologic Data section list the data obtained thus far at the following locations:

Water temperatures

Stream temperatures do not vary much on the Yap Islands. They fluctuate somewhat with ambient conditions and are normally highest in midafternoon. Temperature is an important consideration because of its effect on chemical reactions and biological activities.

Water temperatures are normally obtained when a discharge measurement of streamflow is made. These temperatures are listed in tables 62-81 in the Hydrologic Data section.

APPLICATION OF DATA FOR FUTURE WATER DEVELOPMENT

Reservoirs

Population growth and higher per-capita water consumption will increase the demand for potable water in Colonia. Population is expected to be nearly 2,000 in 1987 (Hawaii Architects and Engineers, Inc., 1968). Not included in this estimate are those government employees who work and live in Colonia during the week and live elsewhere on the weekends. Lyon Associates (1980) calculated the water demand in 1980 as 118,000 gal/d and estimated a demand of 192,000 gal/d in 1990 and 258,000 gal/d in 2000, using the 3.3 percent annual growth rate of the Quarterly Bulletin of Statistics (Trust Territory of the Pacific Islands, 1979).

A demand to extend the water-distribution system outside Colonia and other areas that are presently served is anticipated. As saltwater conversion is too expensive and substantial ground-water development appears difficult, the most feasible way to increase the public water supply is by surface-water development. Miller and Arnow (written communication, 1965) evaluated some potential surface-water sites as follows:

> On the basis of the above estimated requirements, (in 1965, it was expected that there would be about 3,000 people in the area requiring water service) field investigations were made of several streams that could provide substantially larger supplies than are presently being used. The investigations were mainly in the headwater areas to secure a source of supply for gravity feed to places of use and to greatly reduce the chances for pollution that exist at lower reservoir sites. The sources investigated are described below, and possible dam sites are shown *** (fig. 28).
>
> Mabu Stream.--Mabu Stream heads on the south side of Mt. Matade and drains into Chamorro Bay near Colonia. A dam site was found just below the confluence of two tributaries at about the 50-meter contour. A rough estimate indicates that a dam 30 feet high and 100 to 150 feet long would have a storage capacity of about 20 million gallons.
>
> Pemgoy Stream.--Pemgoy Stream drains the basin immediately west of Mabu. Below its confluence with Talagu Stream at about 25 meters in elevation, it is known as Keyar Stream and flows southeast to Ngolog Bay at Dachngar. A dam site was found at about 35 meters in elevation approximately 500 feet above its confluence with Talagu Stream. A dam at this site approximately 25 feet high and 90 feet long would form a reservoir having a storage capacity of about 10 million gallons. A 35-foot dam about 100 feet long would impound about 20 million gallons.

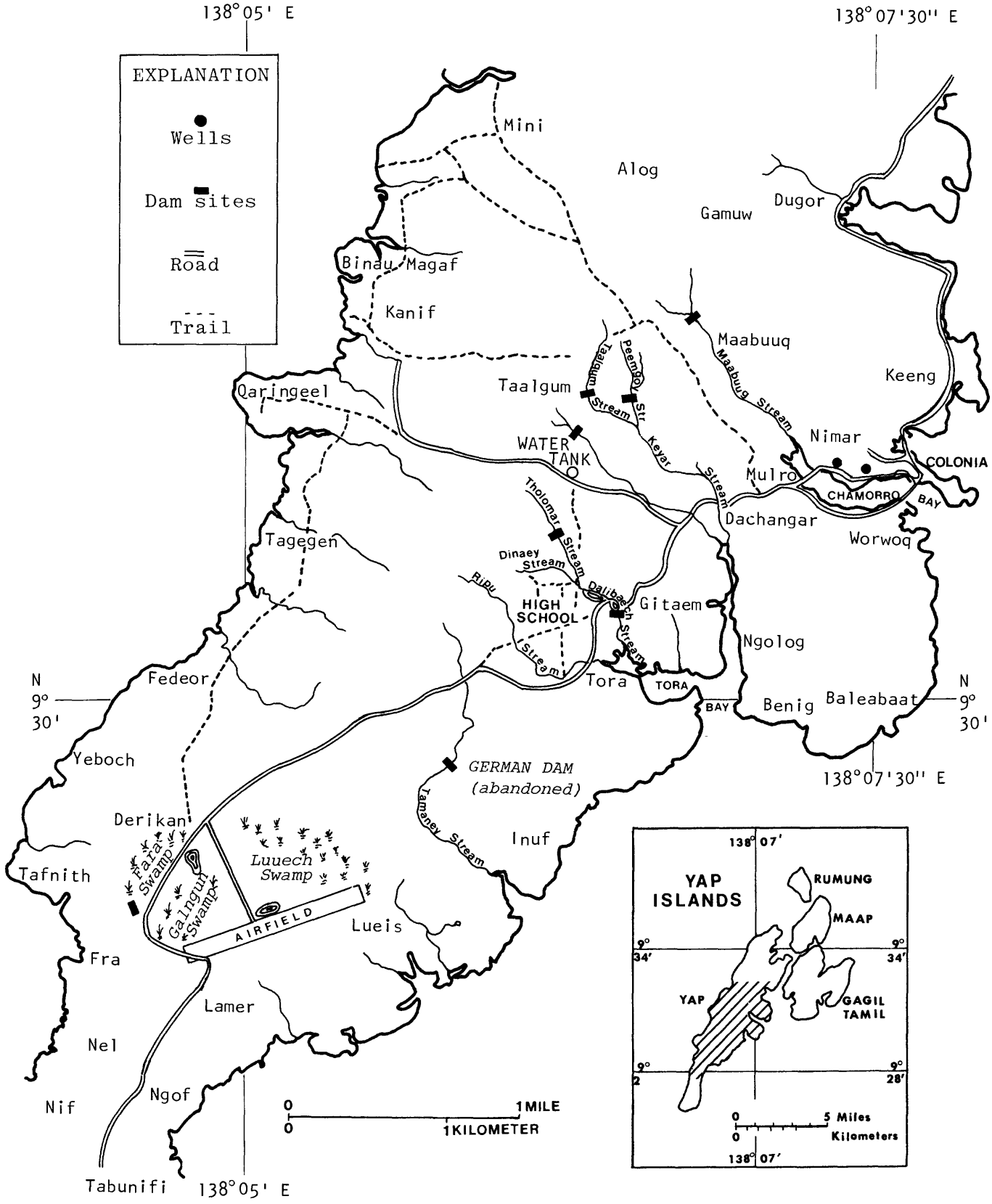


Figure 28. Map of south central Yap Island showing possible dam sites (written communication, Miller and Arnow, 1965).

Talagu Stream.--Talagu Stream presented a good potential dam site at an elevation of about 50 meters. Storage behind a 25-foot dam, 80 feet long, would be about 10 million gallons.

Dalolab Stream.--Dalolab Stream drains the basin immediately southwest of the Talagu-Pemgoy basin and north of the cross-island road to Kanif. It also flows into Ngolog Bay at Dachngar. A 42,000-gallon temporary water-service storage tank is located on a hill between the road and Dalolab Stream at about 77 meters in elevation. A dam site was found at an elevation of about 45 meters roughly 1,000 feet north of the water-tank hill. Storage behind a 25-foot dam, 100 feet long, would be about 10 million gallons.

To illustrate possible yield from a small dam, mass curves of monthly mean discharges (1969-79) were drawn for Daloelaeb (Dalolab), Peemgoy (Pemgoy), and Taalgum (Talagu) Streams. Mass curves are used for storage analyses. Any desired draft rate can be represented by a straight line of appropriate slope drawn for the most critical period. The needed storage is indicated by the maximum vertical distance between the draft rate slope and the mass curve. Figures 29, 30, and 31 show the maximum draft rate for three streams and the required storage. No evaporation losses were considered. These would amount to an average of about half a foot per month (see table 25 in the Hydrologic Data section).

Because the discharge of the three streams during 1969-79 did not fluctuate much, practically all flow could have been utilized with the storage and draft rate shown. As this is the maximum draft rate, any smaller storage with a lesser draft rate could be designed.

The suitability of water from Daloelaeb, Peemgoy and Taalgum Streams for domestic use was shown by chemical analyses of the streamflow (tables 51-53, in the Hydrologic Data section).

Sunn, Low, Tom and Hara, Inc. (1971) proposed a dam below the gaging station site on Mukong Stream, Gagil-Tamil. Concluding that development of adequate ground-water sources would not be feasible, they suggested the following:

> Consideration, therefore, is given to the development of surface waters flowing through the large central valley of Tomil. The drainage area is relatively large and the terrain features appear conducive to the construction of a dam which could impound sufficient quantities of water to meet the needs of both Tomil and Gagil.

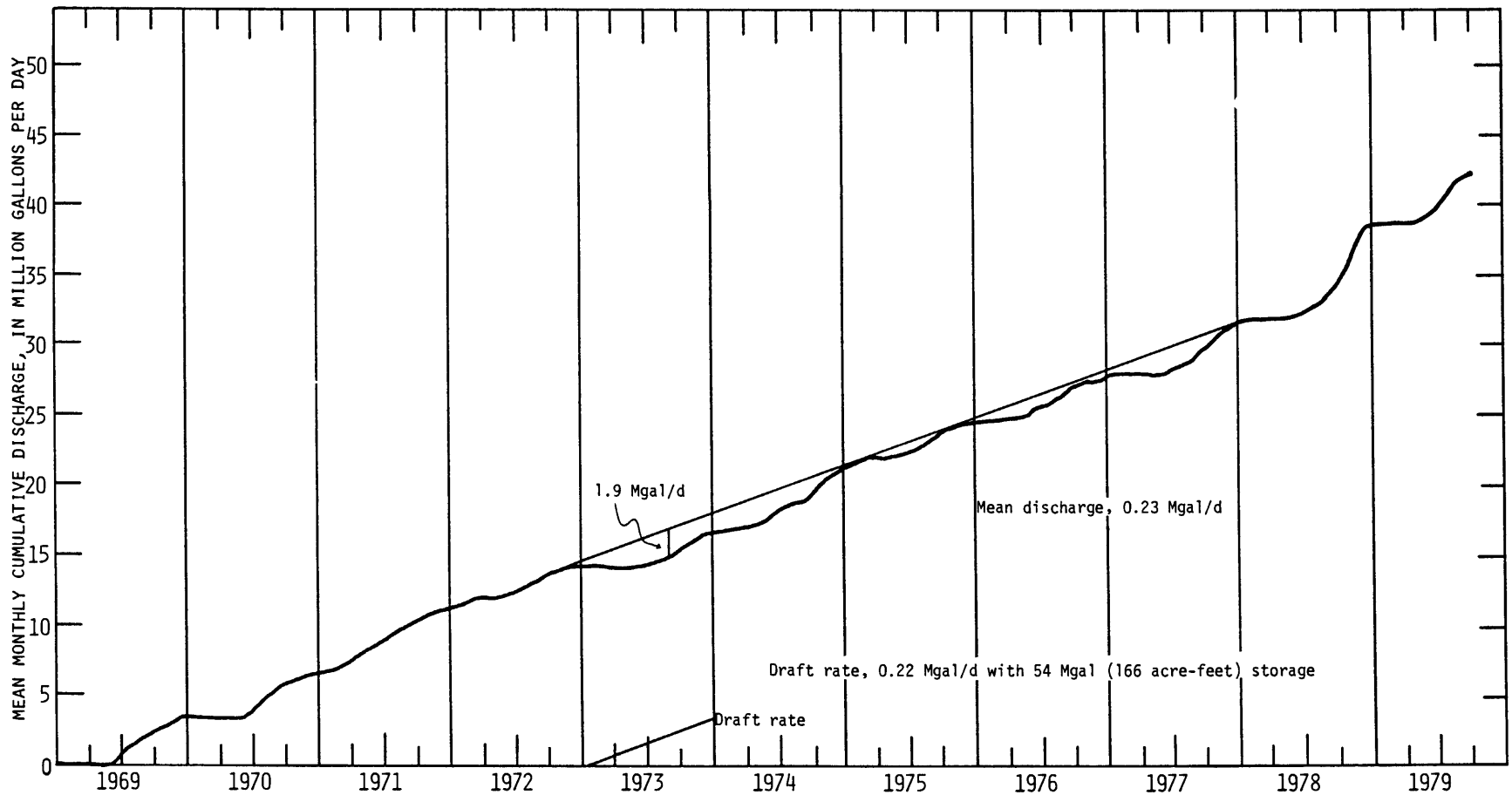


FIGURE 29. MASS CURVE OF MEAN MONTHLY DISCHARGE FOR DALOELAEB STREAM, YAP.

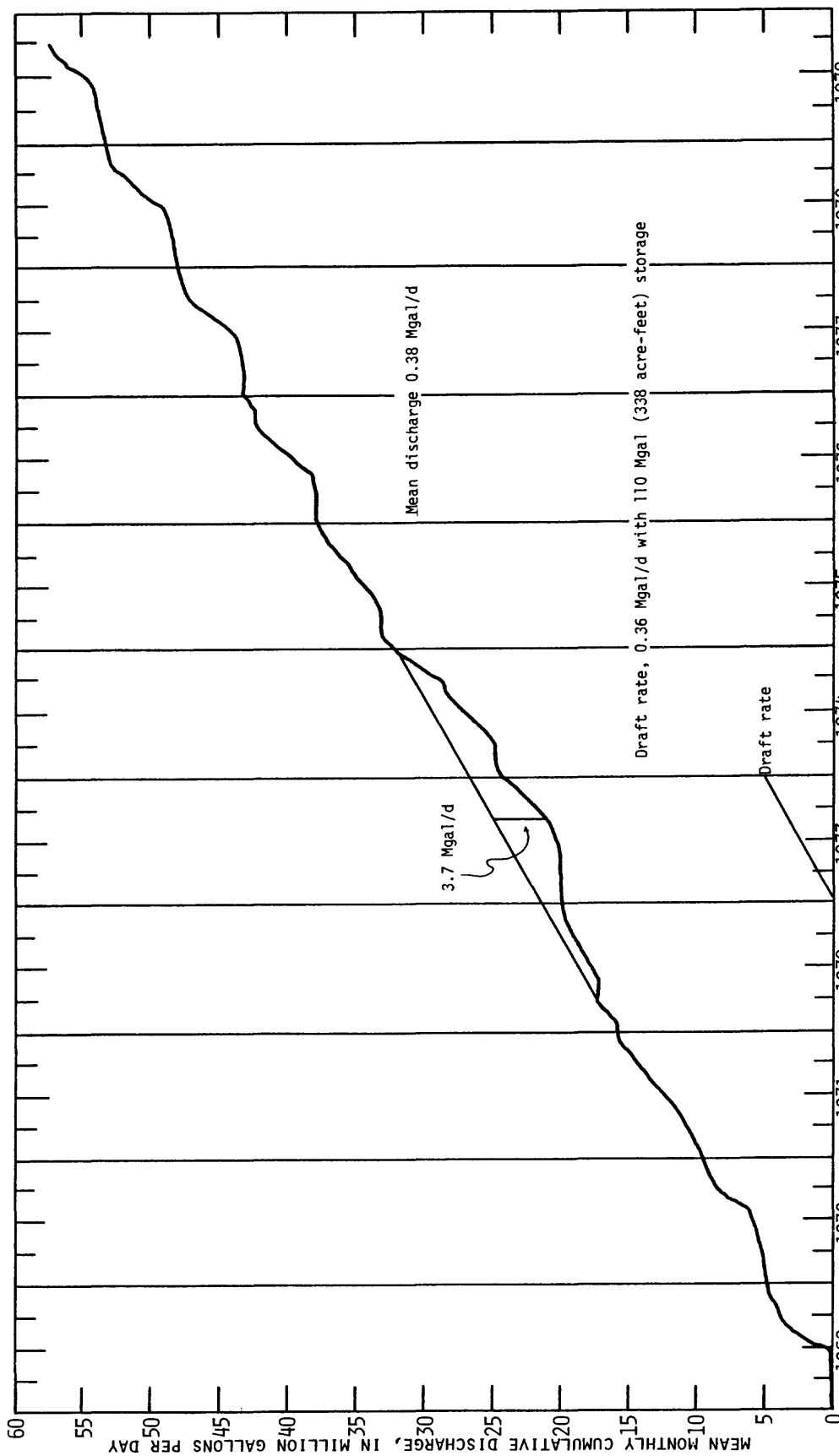


FIGURE 30. MASS CURVE OF MEAN MONTHLY DISCHARGE FOR PEEMGOY STREAM, YAP.

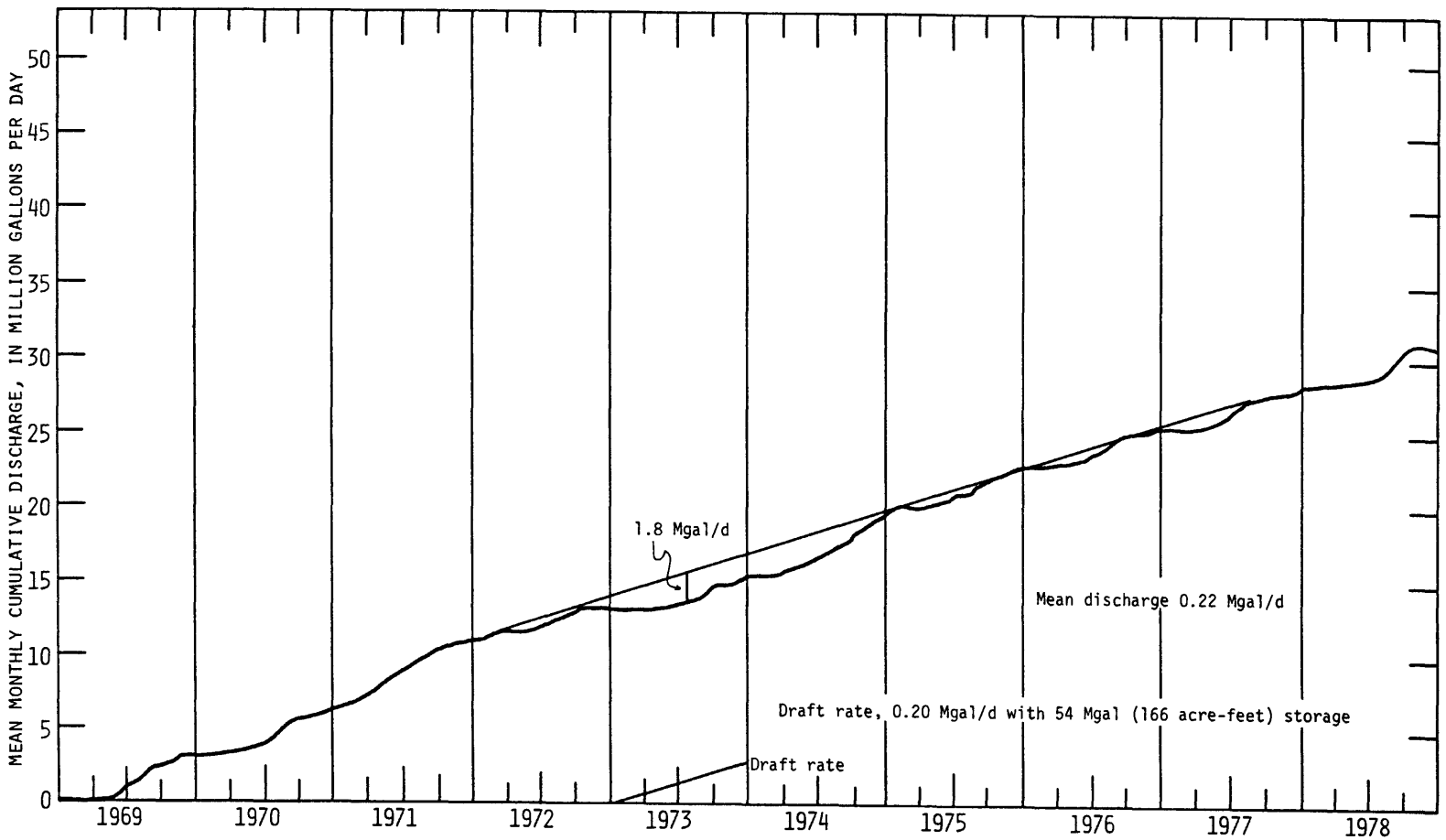


FIGURE 31. MASS CURVE OF MEAN MONTHLY DISCHARGE FOR TAALGUM STREAM, YAP.

Studies based on U.S. Geological Survey maps indicate that a 10-foot high earthen dam located near Maa' village could impound approximately 4.0 million gallons of water, or the equivalent of about 10 weeks storage capacity at present design water consumption rates for Tomil and Gagil. The dam would consist of an earth embankment with an impermeable core, a concrete spillway to pass excess flows, and a low level sluice pipe. Initially the dam would span approximately 600 feet, be 10 feet high from the lowest point of the river, and have a top width of 20 feet. The dam height could easily be raised to provide increased storage capacities and to accomodate future water requirements. Initial water treatment facilities could consist of infiltration galleries which would filter the water prior to chlorination. As water consumption increases, water treatment facilities could be modified or expanded to meet increased demands. Gasoline powered pumps will deliver the treated water through transmission mains to reservoirs located in Tomil and Gagil. Two 100,000 gallon reservoirs are proposed, each providing approximately 5 days storage capacity. One reservoir shall be sited on a high point near Tomil School and the other reservoir sited in Gachpar village, Gagil. Transmission lines will then convey water to community distribution facilities in the village.

It should be noted that all recommendations were made before any streamflow data were available.

Rain Catchments

Although Yapese do not use much water for drinking (coconut water and canned drinks are preferred), some rainwater always has been collected mainly for food preparation. Runoff from roofs or palms is stored in cans, bottles, drums, and various other containers. Because of an average yearly rainfall of more than 120 inches, the use of roofs for rain catchment should provide a good source of water. However, as the rainfall is seasonal, storage is required for water during the dry season.

Small concrete reservoirs (usually 6 x 6 x 8 feet, with a spigot at the base) were built in many villages during the Japanese Administration, but few, if any, are still in use. These reservoirs were filled by rainwater from the roofs of government buildings.

In Colonia, where most of the larger buildings are, few roofs have been used for rain catchments. Because of the cost of constructing many separate storage facilities, their maintenance, prevention of contamination and treatment required, a public water system is preferred. To provide areas outside Colonia with a public water system would be difficult, so the supply of water in these areas will probably come mainly from individual rain catchments or from small scale local development of spring or streamflow.

To project a water supply derived from a roof catchment, mass curves were drawn for the dry periods during 2 years of average rainfall (1960, 1965) and for 2 extremely dry years (1966, 1973).

On figures 32-35, the draft rates for these years are shown for a catchment area of 100 ft^2 with storage facilities of 100, 200, and 300 gallons, assuming 100 percent recovery.

Similar determinations were made for catchment areas of 200 and 300 ft^2, and the results are given in tables 15 and 16.

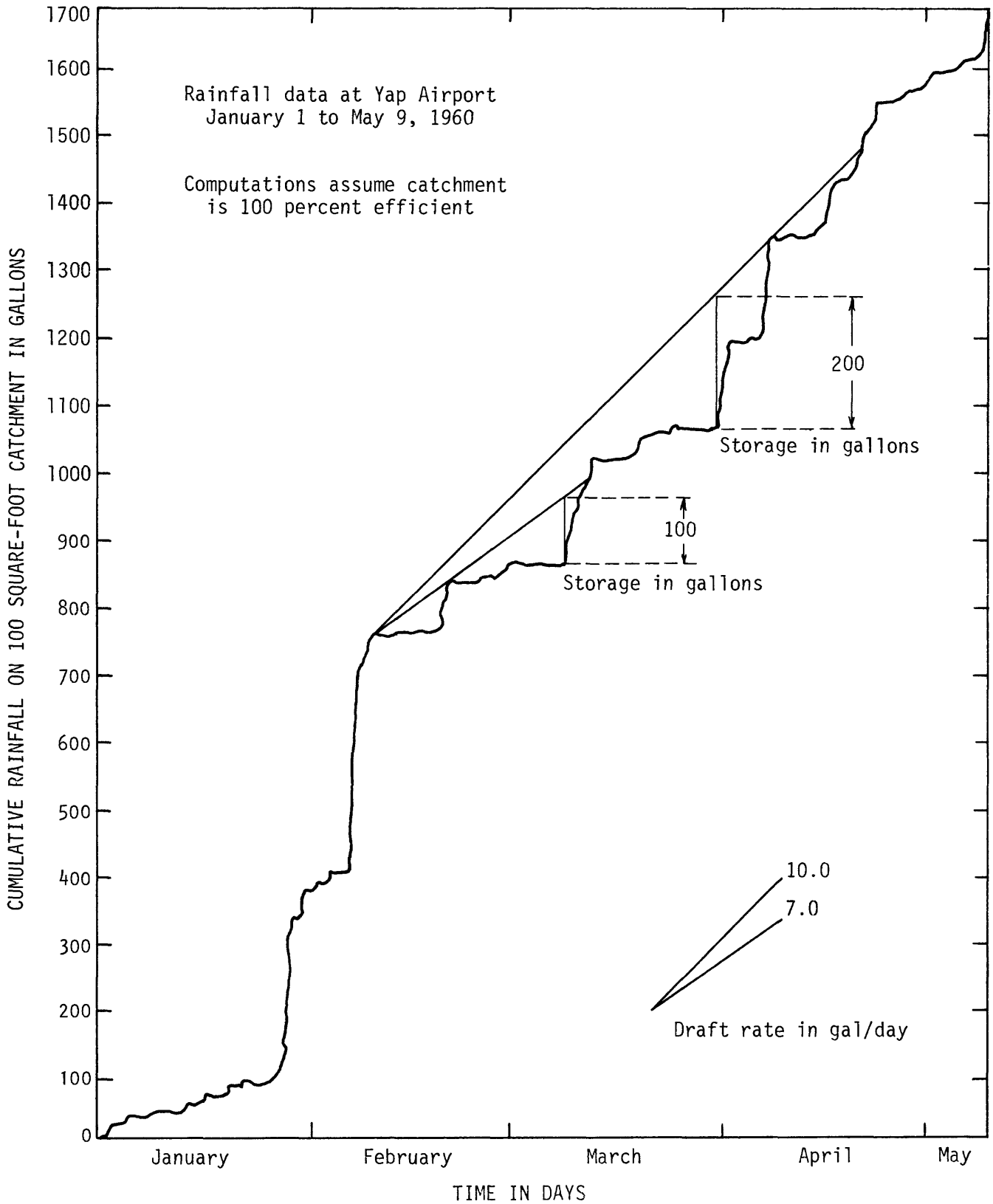


Figure 32. Determination of daily draft rates and storage requirements for rainfall catchment in Yap Islands for the dry period in a year with average rainfall (1960).

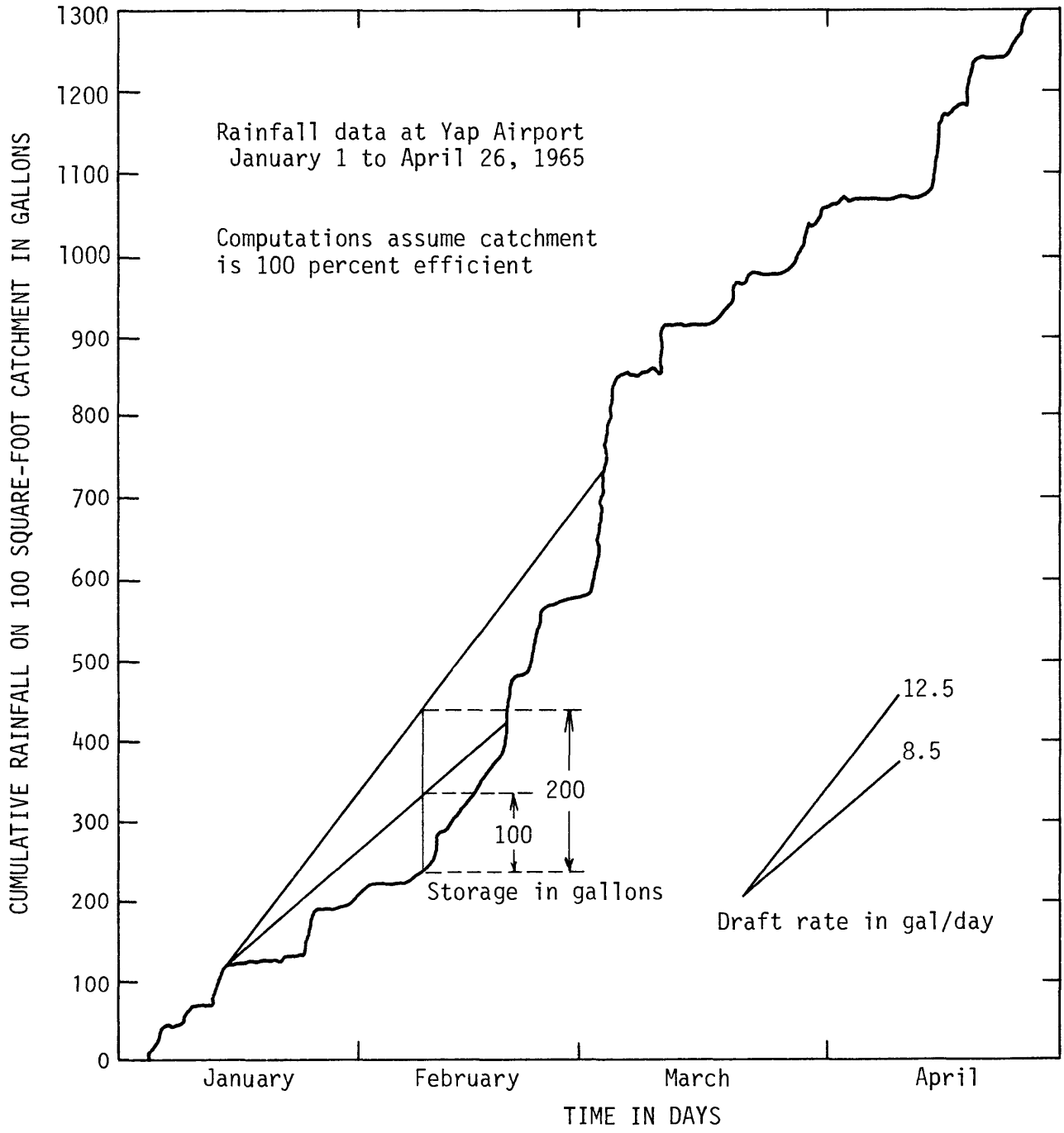


Figure 33. Determination of daily draft rates and storage requirements for rainfall catchment in Yap Islands for the period in a year with average rainfall (1965).

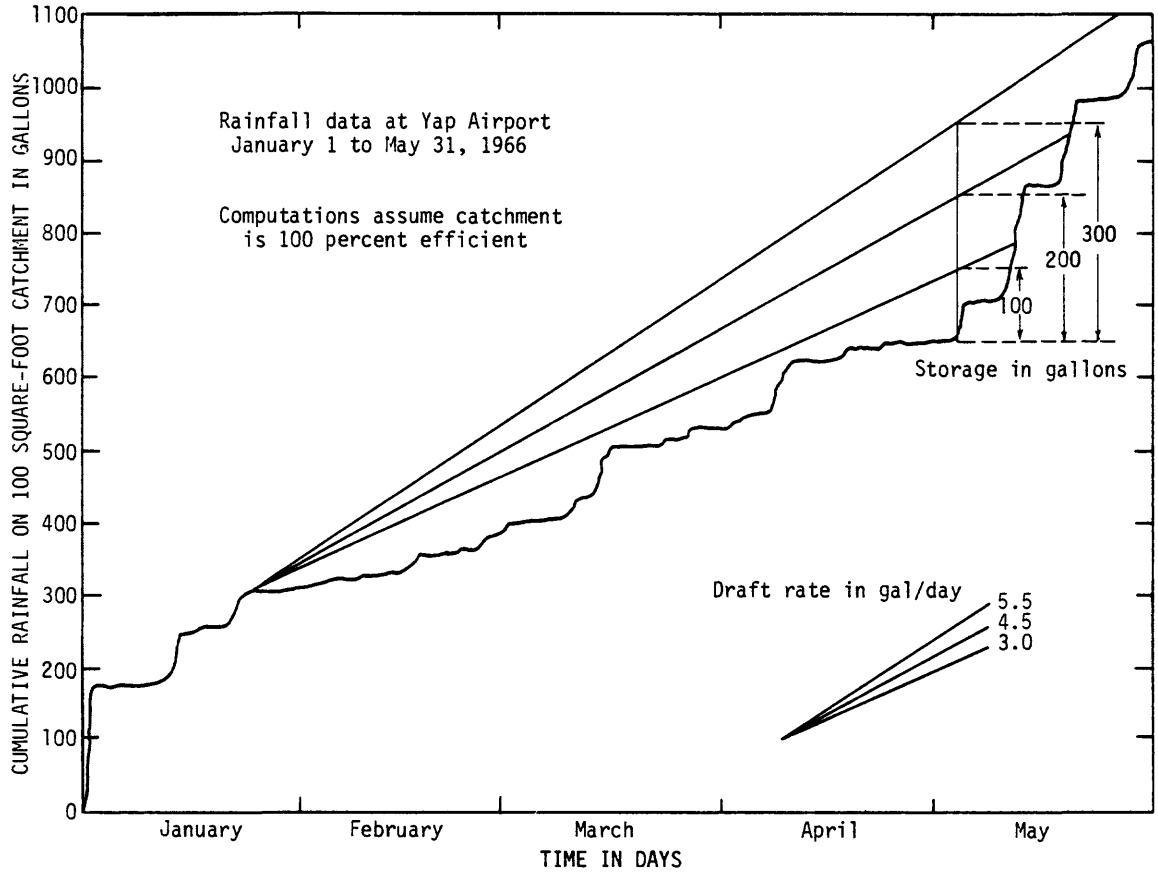


Figure 34. Determination of daily draft rates and storage requirements for rainfall catchment in Yap Islands for the dry period in a very dry year (1966).

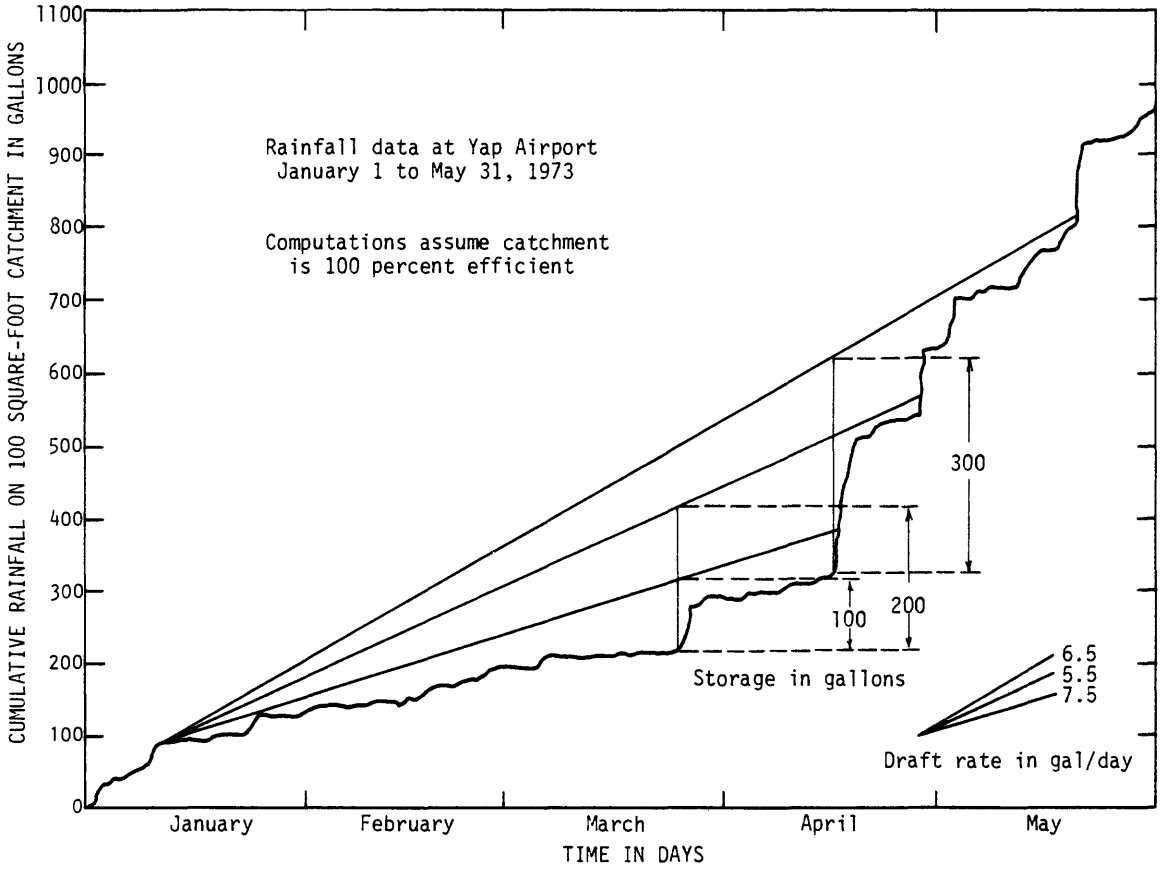


Figure 35. Determination of daily draft rates and storage requirements for rainfall catchment in Yap Islands for the dry period in a very dry year (1973).

Table 15. Draft rate, in gallons, for available storage for several catchment sizes during the dry period of years with average rainfall

Year	Storage (gallon)	Catchment (ft^2) 100	200	300
		Draft rate, (gal/d)		
1960 ----------	100	7.0	10.0	11.5
	200	10	14.5	17.0
	300	--	18.0	22.0
1965 ----------	100	8.5	13.0	15.0
	200	12.5	17.0	22.0
	300	--	21.0	25.5

Table 16. Draft rate, in gallons, for available storage for several catchment sizes during very dry years

Year	Storage (gallon)	Catchment (ft^2) 100	200	300
		Draft rate, (gal/d)		
1966 ----------	100	4.5	6.6	8.0
(January-	200	5.5	9.0	12.5
May)	300	6.5	10.0	13.5
1973 ----------	100	3.0	5.0	6.5
(January-	200	4.5	6.5	8.0
May)	300	5.5	8.0	9.5

SUMMARY

As the population of the Yap Islands continues to increase and the demand for water keeps growing, additional sources of water will have to be developed.

The largest amount of water available is from surface water. However, as all streams on the Island of Yap are dry part of the year, storage facilities would have to be constructed. Water from these reservoirs would be needed for the Central Water Supply System in and around Colonia. In a few areas, ground water would be available for small-scale development and local distribution. This could be supplemented by water from seeps and small streams and in many areas on Gagil-Tamil by diversions from some of the perennial streams.

For all areas outside the Colonia Central Water System, individual rain catchments from the roofs of dwellings should be encouraged. Because no single water source will be able to provide the needed water supply, it will be necessary to combine all available sources in each area to meet the demand.

HYDROLOGIC DATA

Rainfall

Evaporation

Air Temperatures

Streamflow Records

Gaging stations

In tables 28-36, peak discharges, annual minimum discharges, and annual discharges are given for the following gaging stations:

Low-flow partial-record stations

In tables 37-47, the discharge measurements made at the following low-flow partial-record stations are listed:

Miscellaneous measurements

Water Quality

Chemical analyses

Tables 49-60 list the physical properties and constituents of water samples collected and analyzed by the U.S. Geological Survey during 1979-82 for the following locations:

Water temperatures

Water temperatures and instantaneous discharge obtained at the following gaging station and low-flow partial-record station sites are given in tables 62-81. Concurrent air temperatures are listed where available.

Table 17. Monthly and annual rainfall, in inches, during the German Administration

[Converted from millimeters to inches]

Rumung

Source: "Mittheilungen von Forschungreisenden und Gelehrten aus den deutschen Schutzgebieten", 1901.

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1899	--	--	--	--	--	--	--	--	--	--	--	4.1	--
1900	2.4	1.0	1.0	1.4	2.1	5.9	1/ 15.1	1/ 18.7	1/ 12.3	1/ 21.2	1/ 16.6	1/ 11.7	(109.4)

Yap Island

Sources: "Mitt(h)eilungen von Forschungreisenden und Gelehrten aus den deutschen Schutzgebieten"; annual publications 1902, 1913.
"Strategic Bulletins of Oceania" no. 7, publication of Institute of Human Relations, Yale University, 1943.
Government of the Philippine Islands, Weather Bureau.
Manila Central Observatory; annual summaries 1913-14.

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1901	9.5	17.1	8.1	5.8	9.4	7.5	12.1	17.9	6.7	25.0	11.0	7.9	138.0
1902	15.2	22.6	13.9	5.3	12.3	9.2	18.4	19.4	15.4	4.0	4.2	3.9	143.8
1903	2.2	1.5	1.4	5.7	6.1	11.2	15.5	11.1	13.6	22.3	19.0	16.2	125.8
1904	8.6	5.1	13.3	12.8	12.4	12.2	4.8	16.9	28.2	10.1	7.3	2.5	134.2
1905	2.6	4.6	2.6	2.5	7.4	17.4	19.5	17.5	13.2	12.5	6.9	9.1	115.8
1906	3.8	--	--	--	14.8	9.5	12.0	10.4	14.4	7.6	15.4	12.8	--
1907	5.9	13.0	11.4	.3	7.2	12.5	8.6	22.2	14.6	8.7	9.6	14.2	128.2
1908	13.6	4.4	13.1	5.0	8.8	13.8	9.6	19.6	10.5	--	--	--	--
1909	--	--	--	--	--	--	--	--	--	--	--	--	--
1910	--	--	--	--	--	--	--	--	--	--	--	--	--
1911	1.7	8.5	17.1	6.7	9.5	7.7	45.9	14.4	10.3	11.7	2.9	4.8	141.2
1912	2.6	2.6	1.0	3.0	8.9	5.7	16.4	15.4	12.9	12.6	12.7	6.9	100.7
1913	1.5	3.3	1.9	9.0	4.2	3.4	16.9	17.4	14.5	14.7	1.2	5.1	93.1
1914	2.2	9.0	3.7	2.6	5.3	7.7	10.9	10.6	8.1	2/ 5.4	2/ 4.4	2/ 3.0	72.9
Mean	5.8	8.3	8.0	5.3	8.9	9.8	15.9	16.1	13.5	12.2	8.6	7.9	119.4
Years	12	11	11	11	12	12	12	12	12	11	11	11	10

1/ Publications do not report date of change of location to Yap Island. Name of observer from June 22, 1900 is the same as for 1901, 1902. For 1901, latitude and longitude were given for the Yap Island location.

2/ October to December 1914 included in German period although the Yap Islands were already occupied by Japan.

Table 18. Monthly and annual rainfall, in inches, during the Japanese Administration

[Converted from millimeters to inches]

Sources: Government of the Philippine Islands, Weather Bureau, Manila Central Observatory; annual summaries, 1915-20.
"World Weather Records," publication of Smithsonian Institution, 1934, (1921-30), and 1947, (1931-40).
U.S. Weather Bureau, 1959 (1941-43).

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1915	3.2	0.7	2.9	2.8	11.9	15.6	12.2	18.8	5.8	12.8	8.4	14.4	[1/] 109.4
1916	13.9	17.6	12.0	7.7	13.2	15.8	9.5	9.8	17.7	15.3	13.3	6.4	152.2
1917	8.7	4.2	6.8	2.8	12.2	7.9	13.9	9.0	17.5	8.3	11.7	9.4	112.4
1918	10.3	7.6	4.1	12.7	3.7	[2/] 8.5	19.6	17.9	8.0	8.7	7.7	5.9	[2/] 114.7
1919	2.5	2.3	2.4	2.4	7.8	[2/] 4.4	16.7	19.1	10.4	11.6	10.1	6.8	[2/] 96.5
1920	9.2	9.5	3.7	2.8	8.6	10.5	31.1	11.8	8.1	10.3	8.9	(3)	--
1921	3.8	1.6	--	9.2	13.2	7.8	8.7	10.9	10.7	10.2	13.9	12.2	--
1922	9.1	2.8	8.4	3.0	5.3	9.1	11.8	19.1	19.3	5.7	8.8	10.1	112.5
1923	11.4	6.2	6.6	5.1	11.0	20.8	24.9	28.1	12.2	7.4	7.2	6.5	147.4
1924	2.6	1.2	1.0	3.1	8.7	9.4	19.7	11.6	11.4	15.2	22.5	[4/] 13.8	120.2
1925	3.6	3.8	1.4	4.6	8.1	8.9	22.0	20.2	8.3	22.6	7.9	[4/] 14.3	125.7
1926	18.1	3.7	2.1	.2	2.6	10.6	13.5	22.2	16.4	17.1	9.9	6.6	123.0
1927	5.0	13.0	3.6	5.0	8.7	9.6	25.7	25.5	7.7	8.6	13.2	12.9	138.6
1928	3.9	4.8	4.2	5.7	19.3	13.4	16.6	6.6	18.6	11.4	10.0	2.2	116.7
1929	16.7	5.8	.8	10.6	8.1	5.2	15.9	16.3	10.6	14.4	9.1	6.2	119.7
1930	6.0	4.5	1.3	3.4	8.4	16.1	26.9	16.9	19.0	6.7	9.0	19.4	137.6
1931	5.3	1.6	1.0	3.0	9.2	5.9	9.5	14.3	15.2	22.9	19.4	10.9	118.2
1932	5.4	7.1	10.4	2.6	15.8	7.9	21.1	7.8	18.7	9.5	6.7	18.8	131.8
1933	2.3	7.7	3.5	7.7	8.9	6.7	14.5	8.8	9.5	24.0	10.7	10.2	114.5
1934	6.9	6.4	7.3	7.9	7.0	9.0	14.6	25.0	15.6	11.1	14.7	8.0	133.5
1935	7.8	4.4	5.7	6.9	10.2	6.9	15.3	8.6	20.3	9.9	12.7	6.8	115.5
1936	4.9	1.8	8.5	4.4	14.6	8.5	20.2	22.4	15.9	14.6	3.6	6.6	126.0
1937	3.3	3.2	5.5	6.4	6.5	10.2	10.8	19.0	11.2	17.7	8.0	5.9	107.7
1938	8.0	3.2	4.7	8.3	12.1	11.9	14.3	8.1	20.4	12.6	10.1	23.1	136.8
1939	10.1	5.5	2.9	7.6	9.8	4.4	15.5	14.7	16.5	17.8	17.3	5.4	127.5
1940	5.8	6.8	5.7	15.2	4.9	16.5	24.4	32.1	14.5	6.8	8.6	7.6	148.9
1941	4.6	2.4	3.0	1.0	12.1	15.0	14.2	20.4	12.2	3.7	11.0	7.4	107.0
1942	6.0	1.2	2.2	5.4	7.6	6.5	17.9	19.0	13.9	12.2	5.2	10.4	107.5
1943	19.3	5.5	4.5	9.5	9.9	15.3	18.5	11.2	16.2	10.9	14.4	8.2	143.4
Mean	7.5	5.0	4.5	5.8	9.6	10.3	17.2	16.4	13.9	12.4	10.8	9.9	123.9
Years	29	29	28	29	29	29	29	29	29	29	29	28	27
Per-cent	6.1	4.1	3.6	4.7	7.8	8.4	13.9	13.3	11.3	10.0	8.8	8.0	

[1/] 1 day missing.

[2/] 4 days missing.

(3) Rain gage destroyed by typhoon of Dec. 17, 1920.

[4/] Rain gage destroyed by typhoon of Dec. 15, 1925 after 2 p.m.. Replaced on Dec. 16.

Total of monthly means: 123.3 inches.

Table 19. Monthly and annual rainfall, in inches, for the period 1948-83

Obtained by U.S. Navy during 1948-51 and by National Weather Service since 1952 (U.S. National Oceanic and Atmospheric Administration, 1981, 1982-83).

Location: 1948 to March 1968, lat 9°31', long 138°08' (next to Raiview Hotel).

Location: March 1968 to present, lat 9°29', long 138°05', altitude 44 ft, at Yap Airfield. A 4-inch rain gage was used to Dec. 31, 1953 and an 8-inch gage thereafter.

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1948	--	--	--	--	--	--	--	--	11.79	11.46	13.03	15.65	--
1949	8.24	3.99	4.19	5.18	6.62	11.44	4.99	7.62	19.57	15.39	6.09	7.53	100.85
1950	6.92	1.08	16.46	4.25	5.75	12.37	8.92	10.55	14.85	12.11	15.59	11.28	120.13
1951	5.86	10.84	3.46	3.97	7.98	3.40	10.85	16.47	12.58	10.30	6.65	12.45	104.81
1952	4.21	3.27	1.49	6.82	11.49	20.75	12.78	15.81	15.67	17.77	7.80	7.46	125.32
1953	4.03	9.37	7.87	8.22	6.61	20.27	6.51	29.44	6.88	14.20	14.65	12.27	140.32
1954	2.97	1.93	2.37	2.01	12.93	9.91	7.33	8.81	9.74	14.06	13.09	17.05	102.20
1955	23.08	4.86	2.22	7.98	12.29	11.18	12.99	20.01	14.72	15.35	9.95	12.32	146.95
1956	7.78	3.63	8.74	18.15	12.17	11.45	19.56	11.41	12.13	14.26	11.97	14.27	145.52
1957	15.10	4.70	6.53	5.27	6.16	11.48	13.82	11.80	17.60	9.33	1.96	3.65	109.40
1958	13.70	1.46	1.38	2.92	4.68	10.21	15.84	6.07	12.80	9.74	18.53	5.20	102.53
1959	7.75	7.99	9.07	4.38	11.54	4.69	18.95	11.61	11.18	11.61	10.34	11.16	120.27
1960	7.78	6.23	4.22	6.30	12.70	9.46	11.45	11.96	10.63	18.07	20.66	8.13	127.59
1961	11.65	5.66	11.15	4.75	18.08	12.33	12.70	17.25	15.10	21.16	4.42	11.27	145.52
1962	8.53	13.36	7.82	15.95	14.43	7.96	19.44	17.32	12.23	9.65	7.41	15.01	149.11
1963	11.26	12.20	11.13	4.20	7.14	8.77	13.49	28.20	10.25	16.67	7.47	10.17	140.95
1964	2.37	6.47	4.01	7.61	18.23	6.74	9.44	16.72	12.55	11.69	6.19	10.98	113.00
1965	3.32	6.00	7.63	4.25	8.12	10.88	26.47	12.39	17.73	8.42	12.02	3.69	120.92
1966	4.98	1.29	2.31	1.86	6.71	12.52	17.98	9.02	9.59	7.11	8.84	9.97	92.18
1967	12.02	6.25	5.37	11.76	16.00	16.71	14.14	16.45	11.72	12.80	10.44	7.48	141.14
1968	10.77	8.04	3.72	1.82	3.94	5.76	14.24	10.90	10.66	11.21	3.59	8.34	92.99
1969	4.10	1.24	2.08	3.03	7.69	8.78	34.71	11.58	17.03	11.48	9.76	8.32	119.80
1970	4.64	6.17	4.67	3.04	9.76	8.76	8.80	25.45	11.04	12.31	9.56	8.15	112.35
1971	10.42	10.11	13.48	12.25	12.84	13.94	14.12	12.15	13.87	15.15	10.26	9.71	148.30
1972	6.03	10.42	14.21	8.97	5.33	10.18	9.20	11.09	17.60	5.64	9.35	5.14	113.16
1973	2.14	1.00	1.54	5.62	5.98	12.35	10.11	5.13	17.64	14.92	10.57	7.03	94.03
1974	11.84	4.27	9.99	10.07	9.77	14.30	14.40	12.33	9.48	19.11	18.85	13.30	147.71
1975	19.48	1.20	3.12	10.73	9.09	10.67	8.38	11.90	11.25	12.67	6.79	10.93	116.21
1976	7.36	3.19	8.76	6.77	12.52	13.30	11.43	16.29	13.44	2.59	8.88	9.97	114.50
1977	3.94	2.18	2.42	0.91	10.36	7.49	17.21	13.99	18.73	5.76	9.47	11.64	104.10
1978	4.22	5.25	2.04	5.38	4.87	12.89	8.67	18.52	19.17	18.10	11.09	8.98	119.18
1979	3.88	3.16	7.06	3.98	8.82	21.07	14.44	19.57	9.59	12.18	7.34	13.40	124.49
1980	2.32	4.60	6.42	7.72	10.57	13.52	17.84	9.52	12.71	13.41	7.20	14.52	120.35
1981	12.90	8.00	2.89	1.10	5.05	10.77	18.54	13.61	19.03	14.22	10.12	11.01	127.24
1982	7.30	12.58	7.50	2.62	10.49	32.01	13.04	14.26	13.93	9.34	4.95	7.01	135.03
1983	1.25	.27	2.76	1.36	3.59								
1949-82:													
Mean	8.03	5.65	6.16	6.17	9.60	12.01	13.91	14.27	13.60	12.58	9.76	9.96	121.70
Percent	6.6	4.6	5.1	5.1	7.9	9.9	11.4	11.7	11.2	10.3	8.0	8.2	100

Table 20. Mean monthly rainfall, in inches, for a period of 27-28 years prior to 1938 (years not identified)

Location: Lat 9°30' N., long 138°08' E.

Source: "Sailing Directions for the Pacific Islands," U.S. Navy Department, Hydrographic Office, 1938.

Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
6.54	5.89	4.98	5.11	9.99	9.89	16.88	16.35	12.54	11.81	9.97	9.08	119.03

Table 21. Monthly and annual rainfall, in inches, at Gagil-Tamil, 1969-73, 1976

Source: U.S. Coast Guard LORAN station, Gagil-Tamil

Year	Jan.	Feb.	Mar.	Apr.	May	June
1969	4.68	2.32	2.30	4.38	13.46	9.42
1970	4.22	5.00	4.55	4.06	11.94	11.56
1971	9.65	10.29	11.95	10.29	16.99	13.38
1972	--	--	9.52	8.60	2.61	10.65
1973	1.11	1.09	--	--	--	--
1976	--	--	5.18	8.96	12.64	14.91

Year	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1969	23.38	12.30	11.91	12.25	12.08	10.78	119.26
1970	10.70	* 4.10	* 5.22	* 4.82	* 5.82	7.58	* 79.56
1971	20.50	14.01	10.34	15.30	9.20	5.49	147.39
1972	11.54	14.95	22.49	6.02	6.15	5.11	--
1973	--	--	--	--	--	--	--
1976	9.43	14.11	12.75	3.03	7.12	12.64	--

* Appears incorrect.

Table 22. Cumulative rainfall readings, in inches, at Protestant Mission, Colonia, Yap

[Lat 9°30'44" N., long 138°07'29" E., near front of Mission Church in Colonia; altitude, 25 ft (from topographic map)]

Period	Rainfall	Period	Rainfall
	1974		
Apr. 6-23	14.2	July 11-30	7.2
May 9-16	2.8	Sept. 14 to Oct. 10	7.8
May 16 to June 11	9.6	Oct. 10 to Nov. 6	17.2
June 11 to July 11	11.2	Nov. 6 to Dec. 6	11.2
	1975		
Apr. 26 to May 5	6.2	Aug. 15-28	2.0
May 5-14	.8	Aug. 28 to Sept. 22	5.9
May 14 to June 18	8.0	Sept. 22 to Oct. 9	5.2
June 18 to July 14	8.7	Oct. 9 to Nov. 5	7.1
July 14-29	1.8	Nov. 5 to Dec. 14	6.1
July 29 to Aug. 15	11.0	Dec. 4-23	4.0
	1976		
Dec. 23 to Jan. 9	1.7	May 20 to June 16	8.4
Jan. 9-27	2.7	June 16 to July 6	13.0
Jan. 27 to Feb. 4	1.2	July 6-27	11.0
Feb. 4-18	0	July 27 to Aug. 11	6.5
Feb. 18 to Mar. 2	5.0	Aug. 11-27	7.2
Mar. 2-11	1.0	Aug. 27 to Sept. 17	10.9
Mar. 11 to Apr. 2	4.5	Oct. 10 to Nov. 2	1.1
Apr. 2-20	2.3	Nov. 2 to Dec. 3	10.9
Apr. 20 to May 3	1.6	Dec. 3-30	5.2
May 3-20	11.1		
	1978		
Jan. 19 to Feb. 3	1.5	July 25 to Aug. 30	18.3
Feb. 3-23	1.1	Aug. 30 to Sept. 19	14.5
Apr. 1-12	4.0	Sept. 19-29	2.8
May 5-26	3.2	Sept. 29 to Oct. 31	16.6
May 26 to June 16	6.2	Oct. 31 to Nov. 30	7.7
June 16-29	7.5	Nov. 30 to Dec. 12	5.8
June 29 to July 25	5.6	Dec. 12-28	.2

Table 23. Cumulative rainfall readings, in inches, at Taalgum Stream,

[Lat 9°31'02" N., long 138°06'33" E., on hillside along foot trail to Taalgum River gaging station; altitude, 200 ft (from topographic map)]

Period	Rainfall	Period	Rainfall
	1974		
May 8-17	3.2	Sept. 12 to Oct. 10	7.5
May 17 to June 11	11.6	Oct. 10 to Nov. 7	17.0
June 11 to July 11	12.0	Nov. 7 to Dec. 12	11.8
July 11-30	6.5	Dec. 12-31	6.5
	1975		
Jan. 1-12	1.2	Aug. 14-28	1.6
Apr. 26 to May 5	5.3	Aug. 28 to Sept 22	5.9
May 6-14	1.5	Sept. 22 to Oct. 9	4.2
May 14 to June 17	10.5	Oct. 9 to Nov. 5	8.0
June 17 to July 14	12.0	Nov. 5 to Dec. 4	6.7
July 14-29	1.1	Dec. 4-23	4.4
July 29 to Aug. 14	12.8		
	1976		
Dec. 23 to Jan. 9	1.5	June 16 to July 6	7.6
Jan. 9-27	3.3	July 6-27	9.1
Jan. 27 to Feb. 3	1.6	July 27 to Aug. 11	7.8
Feb. 3-17	0	Aug. 11-27	9.0
Feb. 17 to Mar. 2	7.0	Aug. 27 to Sept. 17	9.7
Mar. 2-11	4.0	Oct. 10 to Nov. 2	4.7
Mar. 11 to Apr. 2	5.0	Nov. 2 to Dec. 3	10.5
Apr. 2-20	8.0	Dec. 3-30	9.5
Apr. 20 to May 3	2.1		
May 3-20	11.0	Total	119.3
May 20 to June 16	7.9		
	1977		
Dec. 30 to Jan. 21	2.2	Nov. 16-30	8.2
June 7 to July 1	4.8	Nov. 30 to Dec. 16	8.4
July to Aug. 16	21.1	Dec. 16-29	3.0
Nov. 3-16	4.4		

Table 23. Cumulative rainfall readings, in inches, at Taalgum Stream--Continued

Period	Rainfall	Period	Rainfall
		1978	
Jan. 19 to Feb. 3	1.8	July 25 to Aug. 30	21.2
Feb. 3-23	3.2	Aug. 30 to Sept. 19	14.9
Feb. 23 to Mar. 16	1.2	Sept. 19-29	3.2
Apr. 1-12	5.0	Sept. 29 to Oct. 31	16.1
May 5-26	3.4	Oct. 31 to Nov. 15	6.5
May 26 to June 16	5.1	Nov. 15-30	3.6
June 16-29	6.3	Nov. 30 to Dec. 13	5.9
June 29 to July 25	7.0	Dec. 13-28	1.2
		1979	
Dec. 28 to Jan. 18	5.0	July 26 to Aug. 8	7.1
Jan. 18-30	1.6	Aug. 8-21	10.9
Feb. 14-28	1.0	Aug. 21 to Sept. 5	3.7
Feb. 28 to Mar. 16	5.4	Sept. 5-19	1.2
Mar. 16-29	0	Sept. 19 to Oct. 5	14.1
May 17-31	1.8	Oct. 5-30	6.1
May 31 to June 13	4.1	Oct. 30 to Nov. 19	5.8
June 13-29	9.5	Nov. 19 to Dec. 4	2.1
June 29 to July 11	10.4	Dec. 4-28	12.0
July 11-26	3.2		

Table 24. Daily rainfall, in inches, at continuous-record rain gage at LORAN station, Gagil Tamil

[Lat 9°32'52" N., long 138°10'09" E., in front of the LORAN station administration building; altitude, 70 ft (from topographic map)]

Day	1981 Dec.	1982 Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1	--	0.41	0	0	--	0.06	0.05	*	0.47	0.01	1.20	0.37	0.07
2	--	0	0	0	--	.35	0	*	0	.25	.67	0	.01
3	--	0	0	.01	--	.01	0	*	0	.20	0	0	0
4	--	0	.68	.05	--	0	.07	*	0	0	.11	0	0
5	0	0	1.69	0	--	.01	0	*	.07	1.14	.29	.01	.62
6	.67	0	2.90	.31	--	.46	0	*	0	.48	.48	.05	.79
7	.38	0	.01	*	--	.30	.55	22.52	.40	.96	1.14	0	.25
8	0	0	.65	*	--	0	.05	.47	0	0	.68	1.14	.49
9	.42	.41	.01	*	--	.36	.08	.04	0	0	.72	0	.55
10	.52	.70	0	*	0.41	0	2.02	.19	.40	0	.07	.36	.71
11	.07	.16	0	*	.01	.22	0	.48	.04	0	0	0	.86
12	.68	0	0	*	0	.08	0	.32	.06	0	.01	0	.19
13	0	0	0	*	0	.05	0	.02	0	2.54	.48	.49	1.13
14	.11	0	2.75	*	0	.17	0	0	.49	1.99	0	.12	0
15	.06	0	0	*	0	1.54	.02	4.69	1.09	.17	0	.25	0
16	.04	0	0	.41	.88	1.69	1.75	1.13	3.20	0	0	.10	0
17	0	.17	0	--	0	.10	.89	0	.06	0	.66	0	0
18	0	.08	.10	--	0	1.50	.06	.40	0	0	.64	0	0
19	.05	0	.08	--	0	0	.28	.22	1.68	0	.07	0	0
20	0	0	.32	--	0	.10	7.08	1.20	.62	0	.38	0	0
21	.02	0	0	--	.28	.08	*	0	1.60	0	.11	0	0
22	.07	0	.01	--	.01	0	*	0	.55	0	0	.84	0
23	3.31	.59	.32	--	0	0	*	1.37	.07	0	.65	.04	0
24	.19	4.84	.02	--	0	0	*	.10	0	0	.25	0	.60
25	.80	0	.03	--	0	0	*	.40	0	1.67	0	.11	0
26	.04	0	1.15	--	0	0	*	.11	.82	.08	0	.02	0
27	0	0	0	--	.36	.28	*	0	1.45	.05	0	.01	0
28	0	0	0	--	0	.06	*	0	.95	.24	0	.01	0
29	0	0		--	0	0	*	.06	1.31	0	.06	.26	.02
30	0	0		--	0	.08	*	0	1.54	1.31	0	.82	0
31	0	0		--		.05		0	.12		.59		0
Total	(8.5)	7.36	10.72	(7.0)	(3.2)	7.55	*	(46.62)	16.99	11.09	9.26	5.00	6.29

* Included in following total.

Recorded rainfall June 20 (1300) to June 21 (0600): 15.48 inches (June 21, 0000-0600, 8.64 inches). Rainfall at Yap airport: June 21, 13.17 inches; June 21-30, 17.93 inches; July 1-7, 3.13 inches.

No rainfall record December 1-4, 1981 and March 17 to April 9, 1982. Rainfall estimated on basis of rainfall at Yap airport.

Total for 1982: 131.08 inches.

Table 24. Daily rainfall, in inches, at continuous-record rain gage at LORAN station, Gagil-Tomil--Continued

1983

Year	Jan.	Feb.	Mar.	Apr.	May	June	July
1	0.10	0	0	0	0	0	0.02
2	.01	0	0	0	.05	0	.29
3	0	0	.06	0	0	1.27	1.10
4	0	0	0	0	.02	0	.84
5	0	0	0	.05	.02	0	.23
6	.05	0	0	0	0	0	.11
7	0	0	0	.12	0	0	.18
8	0	0	0	0	.02	0	.20
9	0	0	0	0	.29	0	
10	0	0	0	0	0	.96	
11	0	.07	0	0	0	.13	
12	0	.02	0	0	0	0	
13	0	0	0	0	0	0	
14	0	0	0	.02	0	.84	
15	0	0	0	.01	0	.02	
16	.22	0	.02	.17	0	.19	
17	.11	0	0	.01	0	0	
18	.04	0	0	.05	0	.12	
19	0	0	0	0	0	.70	
20	0	0	0	0	.32	*	
21	0	0	0	0	0	*	
22	0	0	0	0	0	*	
23	0	0	0	0	0	*	
24	0	0	0	0	0	*	
25	0	0	0	0	1.20	*	
26	.17	0	0	.02	.31	*	
27	0	.10	0	0	0	*	
28	0	0	0	0	0	2.83	
29	0		2.10	0	.12	.35	
30	0		.06	0	.70	.52	
31	0		0		0		
Total	0.70	0.19	2.24	0.45	3.05	7.93	

Evaporation

Table 25. Monthly and annual evaporation data for Guam and Yap

[Source: U.S. National Oceanic and Atmospheric Administration, 1956-72, 1973-82]

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
Evaporation data for Guam (in inches) (January 1956 to May 1958 at Fena Lake, August 1958 to present at Weather Service station)													
1956	6.83	6.54	8.24	9.13	8.82	7.81	5.74	5.86	4.49	5.01	5.26	5.92	79.65
1957	6.18	5.99	7.32	8.42	8.71	9.10	7.41	7.76	6.52	5.57	7.28	7.22	87.48
1958	7.48	6.08	7.65	9.34	9.49	--	--						--
								5.48	5.61	6.08	4.64	5.30	--
1959	5.63	6.66	7.60	7.58	9.03	7.96	6.98	5.31	4.52	5.12	4.59	4.89	75.87
1960	4.86	6.26	7.05	8.05	7.17	6.54	5.41	4.71	4.38	4.30	5.03	5.16	68.92
1961	4.27	5.73	6.27	7.00	6.87	5.57	5.08	4.67	4.44	4.63	5.07	4.96	64.56
1962	6.15	4.94	7.81	6.17	7.00	5.20	4.99	4.91	4.28	5.00	4.45	5.26	66.16
1963	4.73	4.31	6.44	6.57	6.21	5.37	5.09	5.82	4.29	5.26	5.11	--	--
1964	5.91	6.39	7.01	6.99	6.76	7.47	6.18	4.75	4.58	4.73	5.95	6.50	73.22
1965	5.35	6.31	8.58	--	--	--	7.35	6.75	4.59	5.56	5.81	5.88	--
1966	7.07	6.55	7.78	9.17	8.88	7.37	7.21	4.71	4.76	5.36	5.39	5.92	80.17
1967	5.18	5.32	5.32	6.07	7.00	5.43	5.06	4.71	4.64	4.60	5.72	5.67	64.72
1968	5.89	6.31	8.50	7.57	7.58	5.89	5.77	4.95	4.49	5.53	4.32	5.35	72.15
1969	5.57	--	8.46	8.96	8.04	8.06	5.74	5.67	4.90	4.55	5.09	5.78	--
1970	4.68	5.90	7.93	8.98	8.06	7.30	6.27	4.28	4.86	4.62	5.80	6.02	74.70
1971	4.61	6.21	6.41	6.65	8.77	6.03	5.38	5.91	5.78	5.74	5.59	7.31	74.39
1972	6.55	6.65	5.75	7.85	8.06	7.26	5.66	5.00	5.87	5.55	4.71	5.67	74.58
1973	5.94	5.46	7.47	8.46	8.14	6.49	5.46	4.79	5.64	5.33	6.26	5.29	74.73
1974	5.81	6.62	6.90	8.27	7.21	5.88	--	5.09	5.61	6.28	5.73	6.93	--
1975	6.13	6.80	8.08	8.35	9.01	9.29	6.18	5.69	6.14	5.70	6.73	6.39	84.49
1976	6.27	5.58	7.22	7.62	7.37	7.65	6.59	6.33	5.47	7.36	6.43	6.56	80.45
1977	6.64	6.49	8.20	9.03	8.48	7.89	7.83	6.99	5.24	5.53	6.27	6.90	85.49
1978	7.30	6.10	9.46	7.72	8.85	6.55	5.90	6.10	5.33	6.32	5.46	5.95	81.04
1979	7.26	6.68	7.76	9.50	10.33	8.44	6.44	6.34	5.26	5.16	5.93	6.36	85.46
1980	7.73	6.43	7.85	7.93	8.05	6.91	6.33	4.84	5.14	5.98	7.10	6.20	80.49
1981	5.54	7.22	8.94	8.13	6.80	7.14	6.78	6.55	7.38	7.01	6.66	5.15	83.30
1982	--	6.20	7.64	8.28	8.06	6.90	5.89	6.28	6.60	5.27	6.08	6.31	--
Mean	5.98	6.14	7.87	7.99	8.03	7.02	6.11	5.56	5.22	5.45	5.65	5.96	76.76
Evaporation data for Yap (in inches)													
1978	--	--	--	--	--	--	5.58	6.70	5.15	5.33	5.06	7.23	--
1979	6.52	6.74	7.49	8.21	7.41	5.90	5.55	6.33	6.15	8.60	6.11	6.11	81.12
1980	5.41	6.16	6.96	6.87	6.32	5.97	6.25	5.96	4.78	6.54	5.24	5.55	72.01
1981	3.99	5.56	7.48	7.69	8.41	4.36	5.31	6.65	7.01	5.56	4.91	5.35	72.28
1982	6.58	5.60	7.12	7.56	5.58	5.70	6.82	7.75	5.70	5.88	5.76	6.37	76.42
Mean	5.62	6.02	7.26	7.58	6.93	5.48	5.90	6.68	5.76	6.38	5.42	6.12	75.46

Totals of monthly means: Guam 76.98, Yap 75.15 inches.

Air Temperatures

Table 26. Monthly and annual mean air temperatures for Yap (1921-50)

Sources: "World Weather Records," publication of Smithsonian Institution, 1934 (1921-30), and 1947 (1931-40).
U.S. Weather Bureau, 1959 (1941-50).

Temperature in °C

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1921	--	--	--	--	--	--	27.0	26.8	26.7	27.0	26.9	26.6	--
1922	26.4	26.7	26.9	27.4	27.4	27.1	26.5	26.4	26.7	27.2	27.0	27.0	26.9
1923	26.5	26.3	26.7	27.3	27.0	26.7	26.4	26.0	26.8	27.0	26.8	26.9	26.7
1924	26.2	26.5	26.8	27.2	27.2	27.2	26.7	27.0	26.9	26.7	26.7	26.8	26.8
1925	27.0	26.9	27.2	27.3	27.2	27.4	26.5	26.6	27.1	26.6	27.0	--	--
1926	26.4	26.6	26.9	27.8	28.3	27.8	27.1	26.6	26.7	27.0	27.2	27.3	27.1
1927	26.9	26.6	27.3	27.4	27.4	27.3	27.0	26.4	--	--	27.2	27.2	--
1928	26.9	27.0	27.3	27.6	27.4	27.1	27.1	27.3	26.6	27.0	27.0	27.0	27.1
1929	26.1	26.0	26.6	26.8	27.0	27.5	26.4	26.5	26.6	26.9	26.8	26.6	26.6
1930	26.8	26.5	27.4	27.6	27.8	27.7	27.4	27.8	27.9	28.6	28.1	27.0	27.5
1931	26.4	26.0	26.6	27.5	27.9	27.9	27.6	27.0	27.2	26.8	26.8	27.1	27.1
1932	27.0	26.2	26.5	27.0	27.0	27.2	26.8	27.0	26.6	27.5	27.2	26.8	26.9
1933	26.6	26.5	26.9	27.3	27.4	27.3	26.8	27.1	27.0	26.5	26.8	26.9	26.9
1934	27.2	26.7	27.0	27.2	27.5	27.3	26.9	26.9	27.1	27.2	26.8	26.9	27.1
1935	26.4	26.8	27.0	27.3	27.5	27.6	26.9	27.3	26.9	27.1	27.1	26.9	27.1
1936	26.6	26.6	26.9	27.2	27.0	27.4	26.8	26.8	27.0	27.1	27.4	27.2	27.0
1937	26.7	26.6	26.7	27.2	27.5	27.2	27.1	26.9	26.9	27.0	27.2	27.3	27.0
1938	26.9	26.7	26.9	27.2	27.0	27.0	27.1	27.2	26.7	26.9	27.0	26.5	26.9
1939	26.6	26.7	26.9	27.4	27.3	27.8	26.8	27.1	26.8	27.1	27.0	27.1	27.0
1940	26.9	26.3	27.0	27.0	27.7	27.5	26.8	26.7	26.9	27.3	27.2	26.9	27.0
1941	26.5	26.4	26.9	27.6	27.6	27.2	26.7	26.4	27.0	27.2	27.3	26.8	27.0
1942	26.5	26.9	27.2	27.3	27.4	27.6	26.3	26.5	26.7	26.9	27.1	26.9	26.9
1943	26.5	26.7	26.7	27.0	27.2	26.8	26.8	26.6	27.0	27.0	26.9	27.0	26.9
1948	--	--	--	--	--	--	--	--	27.4	27.1	27.2	26.8	--
1949	26.7	27.1	27.6	28.3	28.1	27.7	28.0	27.4	27.4	27.6	28.3	27.9	27.7
1950	27.8	27.7	27.8	28.3	28.2	27.8	27.7	27.9	27.6	27.6	27.7	27.3	27.8

Table 27. Monthly and annual mean air temperatures for Yap (1951-81)

Source: U.S. National Oceanic and Atmospheric Administration, 1981.

Temperatures converted from °F to °C

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1951	27.3	27.3	27.2	28.0	27.7	27.9	27.6	27.4	28.0	27.9	28.1	27.3	27.6
1952	26.9	26.8	27.4	28.2	28.1	27.4	28.1	27.4	27.4	27.8	28.0	27.7	27.6
1953	27.4	27.1	27.5	27.7	28.4	27.6	28.1	27.1	27.8	27.8	27.3	27.3	27.6
1954	27.2	27.5	27.6	28.4	27.6	27.8	27.8	27.8	27.7	27.6	27.4	26.8	27.6
1955	26.5	27.1	27.4	27.9	27.6	27.6	27.6	27.3	27.8	27.3	27.6	27.4	27.4
1956	26.8	27.3	27.2	27.3	27.6	27.7	27.7	27.6	27.4	27.4	27.4	27.1	27.4
1957	26.8	26.7	27.4	27.7	28.2	28.4	27.3	27.7	27.8	27.9	28.1	27.6	27.6
1958	26.8	26.9	27.4	27.7	28.1	28.1	27.3	28.0	27.4	27.9	27.4	27.9	27.6
1959	27.4	27.2	27.7	27.8	27.8	28.2	27.2	26.9	27.2	27.6	27.9	27.6	27.5
1960	27.4	27.4	27.4	27.8	27.8	27.7	27.7	27.2	27.6	26.8	27.7	27.0	27.4
1961	27.0	27.4	27.3	27.8	27.3	27.1	26.7	26.8	27.0	26.6	26.7	27.1	27.1
1962	27.1	27.1	27.2	27.0	27.4	27.4	27.1	26.8	27.3	27.8	27.6	26.6	27.2
1963	26.8	26.7	27.2	27.6	27.6	27.7	27.2	27.1	27.4	27.1	27.5	27.3	27.3
1964	26.9	26.7	27.1	27.4	27.3	27.2	27.4	27.1	27.6	27.5	27.6	27.1	27.2
1965	27.3	26.9	26.6	27.3	27.8	27.2	26.1	27.1	27.1	27.4	27.2	27.3	27.1
1966	26.4	26.8	26.9	27.8	27.9	27.6	27.3	27.3	27.5	27.9	27.6	26.9	27.3
1967	26.6	26.8	26.7	27.1	27.5	27.2	27.1	27.0	27.6	27.4	27.2	26.9	27.1
1968	26.6	26.7	27.3	27.2	27.7	27.3	27.0	26.9	27.1	26.9	27.3	26.9	27.1
1969	26.7	26.6	26.9	27.6	27.4	27.7	26.9	26.9	26.7	27.2	27.1	27.1	27.1
1970	27.1	27.2	27.5	27.8	27.6	27.7	27.6	27.0	27.2	27.3	27.4	27.3	27.4
1971	26.8	27.1	27.5	27.3	27.2	26.9	26.6	26.8	27.1	26.7	27.0	27.2	27.0
1972	26.8	26.8	26.9	27.3	27.2	27.4	28.3	27.2	27.2	27.4	27.2	27.1	27.2
1973	26.5	27.3	27.6	28.1	27.9	27.6	27.2	27.2	27.0	26.7	27.3	26.9	27.3
1974	26.3	27.2	27.1	27.3	27.1	26.8	27.1	27.3	27.0	26.9	27.1	27.0	27.0
1975	26.7	27.1	27.1	27.1	27.1	26.6	26.8	26.4	26.5	27.0	27.1	26.6	26.8
1976	26.2	26.6	26.6	26.6	27.2	26.7	26.4	26.4	26.4	27.3	27.0	26.7	26.7
1977	26.7	26.9	27.4	27.9	27.3	27.3	26.7	27.1	26.8	27.4	27.3	27.1	27.2
1978	26.8	26.5	27.3	27.6	27.9	27.4	27.4	26.9	26.8	26.6	27.2	27.3	27.1
1979	26.9	26.8	27.0	27.6	27.5	27.4	26.7	26.8	27.4	27.2	27.4	26.9	27.2
1980	27.1	26.8	27.2	27.6	27.6	27.2	27.0	27.4	26.8	27.2	27.1	26.9	27.2
1981	26.5	26.7	27.0	27.7	28.1	27.0	26.7	27.0	27.5	27.3	27.4	27.6	27.2
1922-81:													
Mean	26.9	27.0	27.3	27.7	27.7	27.4	27.3	27.2	27.3	27.3	27.4	27.2	27.3
Maximum	27.8	27.7	27.8	28.4	28.4	28.4	28.3	28.0	28.0	28.6	28.3	27.9	28.6
Year	1950	1950	1950	1954	1953	1957	1972	1958	1951	1930	1949	1949	10/1930
Mininum	26.1	26.0	26.5	26.6	27.0	26.6	26.1	26.0	26.4	26.5	26.7	26.5	26.0
Year	1929	1929	1932	1976	1923	1975	1965	1923	1976	1933	1924	1938	8/1923
		1931			1929						1961		2/1929
					1932								2/1931
					1936								
					1938								

Streamflow records

Gaging stations

Table 28. Streamflow records of Qatliw Stream, Yap (16892000)
(Formerly published as Atelu Stream, Yap)

Location: Lat 9°32'58" N., long 138°06'41" E., 90 ft downstream from confluence with major tributary, 0.4 mi northeast of Bael School and 0.5 mi upstream from mouth.

Drainage area: 0.31 mi^2.

Period of record: Occasional low-flow measurements water years 1980-81. Continuous record February to September 1982.

Gage: Water-stage recorder and concrete control. Altitude of gage is 35 ft (from topographic map).

Remarks: Records good. No diversion above station.

Extremes for period of record: Maximum discharge, 874 ft^3/s June 21, 1982 (gage height, 5.96 ft), from rating curve extended above 9.9 ft^3/s on basis of estimate of peak flow; no flow for several days.

A. Discharge measurements, in cubic feet per second

0.2 mi upstream from mouth		At gaging station, 0.5 mi upstream from mouth	
Date	Discharge	Date	Discharge
Sept. 20, 1980	0.18	July 21, 1981	1.2
Oct. 21, 1980	6.7	Dec. 31, 1981	1/.01
Mar. 25, 1981	0	Jan. 22, 1982	1/.01
Apr. 8, 1981	0	Feb. 12, 1982	.05
July 21, 1981	.90	Mar. 25, 1982	.24
June 18, 1982	3.2	June 18, 1982	2.7
July 14, 1982	.08	July 14, 1982	.05

1/ Estimated.

Table 28. Streamflow records of Qatliw Stream, Yap--Continued

B. Monthly discharges, in cubic feet per second

Year		Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1982	Total	48.20	15.42	0.59	13.67	230.98	50.42	69.71	45.19
	Mean	1.72	.50	.020	.44	7.70	1.63	2.25	1.51
	Max.	15	10	.05	4.3	106	17	15	14
	Min.	.03	.01	0	0	0	.02	.02	.01

Peak discharges above base (200 ft^3/s): Feb. 6 (0800) 385 ft^3/s (4.30 ft); June 21 (0445) 874 ft^3/s (5.96 ft).

Table 29. Streamflow records of Qaringeel Stream, Yap (16892400)
(Formerly published as Aringel Stream, Yap)

Location: Lat 9°31'02" N., long 138°05'31" E., on right bank at Qaringeel and 0.3 mile southwest of Dalipeebinaew School.

Drainage area: 0.24 mi^2.

Period of record: April 1968 to September 1982.

Gage: Water-stage recorder and concrete control. Altitude of gage is 15 ft (from topographic map).

Remarks: Records fair. No diversion above station.

Average discharge: 14 years, 1.12 ft^3/s (811 acre-ft/yr).

Extremes for period of record: Maximum discharge, 674 ft^3/s July 13, 1981 (gage height, 7.82 ft), from rating curve extended above 20 ft^3/s; no flow for many days most years.

Discharge measurement made prior to beginning of continuous discharge record

Oct. 9, 1967 ---------- 0.10 ft^3/s

Table 29. Streamflow records of Qaringeel Stream, Yap--Continued

A. Annual maximum discharge (*) and peak discharges above base (200 ft^3/s)

Date	Time	Discharge (ft^3/s)	Gage height (ft)	Date	Time	Discharge (ft^3/s)	Gage height (ft)
Sept. 22, 1968	0630	*210	5.00	Oct. 9, 1975	+2300	222	a/5.10
				Oct. 17,1975	+1700	*340	a/5.90
July 13, 1969	0030	*376	6.14	May 12, 1976	0700	295	5.60
July 23, 1969	0500	313	5.72	June 16, 1976	1330	292	5.58
July 29, 1969	0630	208	4.98	Aug. 6, 1976	0730	241	5.24
Aug. 5, 1969	0700	325	5.80	Aug. 19, 1976	1300	266	5.41
Sept. 10, 1969	0330	212	5.02				
				Sept. 3, 1977	1030	*195	4.86
Oct. 27, 1969	1130	225	5.12				
Aug. 15, 1970	0800	271	5.44	Aug. 19, 1978	+1730	203	a/4.94
Aug. 21, 1970	0130	*408	6.35	Sept. 14, 1978	+0300	*520	a/7.05
Aug. 26, 1970	1830	265	5.40	Sept. 17, 1978	+1230	--	--
Aug. 31, 1970	1030	247	5.28				
Sept. 19, 1970	1630	250	5.30	June 26, 1979	1300	242	5.25
				Aug. 17, 1979	0830	*334	5.86
Oct. 14, 1970	0200	306	5.67				
Jan. 20, 1971	2230	235	5.20	Oct. 1, 1979	2400	202	4.93
Apr. 24, 1971	0500	*403	6.32	May 22, 1980	1000	240	5.23
July 9, 1971	0030	203	4.94	July 1, 1980	0100	373	6.12
Aug. 6, 1971	0800	250	5.30	July 4, 1980	0400	*374	6.13
Sept. 6, 1971	0600	262	5.38				
				Oct. 18, 1980	1700	201	4.92
Mar. 6, 1972	1130	*290	5.57	Dec. 2, 1980	1800	277	5.48
Sept. 8, 1972	0200	207	4.95	July 13, 1981	2300	*674	7.82
Sept. 16, 1972	1430	204	4.93	July 27, 1981	0230	355	6.00
				Aug. 5, 1981	1830	300	5.63
Sept. 15, 1973	+2200	*457	a/6.68				
				Dec. 23, 1981	0700	358	6.02
June 6, 1974	0100	+210	+5.0	Feb. 6, 1982	0800	260	5.37
June 20, 1974	0100	202	4.93	May 18, 1982	+1600	232	a/5.18
July 2, 1974	1700	*434	a/6.53	June 21, 1982	0500	*445	6.60
				Aug. 30, 1982	0530	304	5.66
Nov. 4, 1974	0930	*277	5.48				
Jan. 21, 1975	0330	206	4.96				

\+ About.
a/ From floodmark.

Table 29. Streamflow records of Qaringeel Stream, Yap--Continued

B. Annual minimum discharge

Water year	Date	Discharge (ft^3/s)	Water year	Date	Discharge (ft^3/s)
1968[a/]	Many days (46)	0	1976	Many days (56)	0
1969	Many days (118)	0	1977	Many days (118)	0
1970	Many days (63)	0	1978	Many days (122)	0
1971	April 18, 19	.01	1979	Many days (97)	0
1972	Many days (36)	0	1980	Many days (58)	0
1973	Many days (135)	0	1981	Many days (61)	0
1974	Many days (19)	0	1982	Many days (52)	0
1975	Many days (76)	0			

[a/] April to September 1968.

Table 29. Streamflow records of Qaringeel Stream, Yap--Continued

C. Monthly and annual discharges, in cubic feet per second

Year		Calendar year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Water year
1968	Total	--				0	0.08	2.88	28.38	37.81	54.66	60.23	2.42	14.92	--
	Mean	--				0	.003	.096	.92	1.22	1.82	1.94	.081	.48	--
	Max.	--				0	.05	.92	8.8	11	13	14	.88	3.3	--
	Min.	--				0	0	0	.03	.08	.05	.01	0	.02	--
1969	Total	397.59	1.37	0	0	.02	11.18	36.42	152.23	57.24	61.49	29.48	31.74	16.42	397.52
	Mean	1.09	.044	0	0	.001	.36	1.21	4.91	1.85	2.05	.95	1.06	.53	1.09
	Max.	32	.50	0	0	.01	1.4	13	32	21	13	9.4	5.6	5.0	32
	Min.	0	0	0	0	0	0	.03	.12	.05	.11	.04	.03	.01	0
1970	Total	369.53	7.46	13.80	6.70	0	8.86	16.77	35.09	119.01	51.43	58.49	29.65	22.27	336.76
	Mean	1.01	.24	.49	.22	0	.29	.56	1.13	3.84	1.71	1.89	.99	.72	.92
	Max.	28	3.1	11	5.9	0	1.8	6.9	8.1	28	11	14	7.7	3.6	28
	Min.	0	0	0	0	0	0	.01	.03	.05	.02	.05	.05	.04	0
1971	Total	533.94	35.94	29.82	36.82	40.12	49.66	58.45	75.17	38.78	56.66	62.80	30.58	19.14	531.83
	Mean	1.46	1.16	1.07	1.19	1.34	1.60	1.95	2.42	1.25	1.89	2.03	1.02	.62	1.46
	Max.	18	11	6.4	11	18	13	9.8	16	11	12	13	11	5.5	18
	Min.	.01	.02	.04	.02	.01	.03	.09	.07	.05	.04	.10	.09	.03	.01
1972	Total	357.68	22.60	46.19	52.79	2.91	2.12	25.96	27.59	47.58	86.77	11.21	24.68	7.28	427.03
	Mean	.98	.73	1.59	1.70	.097	.068	.87	.89	1.53	2.89	.36	.82	.23	1.17
	Max.	27	7.2	20	27	1.3	.60	6.7	7.4	10	21	2.3	7.5	2.5	27
	Min.	0	.01	0	.02	0	0	.03	0	.06	.03	.01	.05	0	0
1973	Total	294.16	0	0	0	0	1.55	30.03	25.98	9.72	71.70	55.98	28.01	26.19	182.15
	Mean	.68	0	0	0	0	.050	1.00	.84	.31	2.39	1.81	.93	.84	.50
	Max.	20	0	0	0	0	.41	4.7	3.6	2.1	20	9.0	9.0	9.8	20
	Min.	0	0	0	0	0	0	.11	.16	.01	.03	.06	.03	.01	0
1974	Total	573.76	44.72	3.25	10.05	42.60	29.82	57.34	68.60	61.83	20.85	102.35	76.71	55.64	449.24
	Mean	1.57	1.44	.12	.32	1.42	.96	1.91	2.21	1.99	.70	3.30	2.56	1.79	1.23
	Max.	23	11	.47	8.0	18	14	20	23	23	4.5	12	19	18	23
	Min.	0	.13	.01	0	.01	0	.04	.17	.04	.07	.21	.02	.01	0

Table 29. Streamflow records of Qaringeel Stream, Yap--Continued

C. Monthly and annual discharges, in cubic feet per second--Continued

Year		Calendar year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Water year
1975	Total	416.63	90.66	.16	.03	19.53	32.14	41.37	39.54	59.64	36.69	58.26	13.05	25.56	554.46
	Mean	1.14	2.92	.006	.001	.65	1.04	1.38	1.28	1.92	1.22	1.88	.44	.82	1.52
	Max.	42	42	.04	.02	15	5.3	9.7	9.2	10	6.0	15	6.0	9.6	42
	Min.	0	.06	0	0	0	.04	.04	.04	.06	.05	.01	0	.01	0
1976	Total	340.27	4.31	2.68	4.33	19.21	44.62	35.11	44.50	72.61	43.98	4.25	26.52	38.15	368.22
	Mean	.93	.14	.092	.14	.64	1.44	1.17	1.44	2.34	1.47	.14	.88	1.23	1.01
	Max.	27	2.0	1.5	2.2	4.7	27	7.8	9.2	20	9.9	2.5	12	7.4	27
	Min.	0	.01	0	0	0	.02	0	.06	.03	.01	0	0	.01	0
1977	Total	339.18	3.89	.04	0	0	16.78	15.92	90.73	51.39	102.79	1.97	5.75	49.92	350.46
	Mean	.93	.13	.001	0	0	.54	.53	2.93	1.66	3.43	.064	.19	1.61	.96
	Max.	52	.65	.01	0	0	6.6	11	22	7.0	52	.56	4.6	15	52
	Min.	0	0	0	0	0	0	.03	.03	.10	.04	0	0	.01	0
1978	Total	409.10	9.62	17.11	.02	0	0	30.69	30.61	107.61	77.46	62.60	34.87	38.51	330.76
	Mean	1.12	.31	.61	.001	0	0	1.02	.99	3.47	2.58	2.02	1.16	1.24	.91
	Max.	40	5.0	8.3	.01	0	0	13	15	14	40	13	4.0	8.1	40
	Min.	0	0	0	0	0	0	0	.02	.07	.04	.06	.05	.01	0
1979	Total	391.81	.20	0	5.55	0	8.22	64.69	63.08	79.13	28.89	58.49	23.83	59.73	385.74
	Mean	1.07	.006	0	.18	0	.27	2.16	2.03	2.55	.96	1.89	.79	1.93	1.06
	Max.	26	.03	0	4.0	0	5.0	12	15	26	7.0	21	9.3	22	26
	Min.	0	0	0	0	0	0	0	.03	.08	.01	.01	0	.01	0
1980	Total	401.56	.40	3.55	17.14	14.45	35.04	30.60	103.81	25.81	56.01	67.12	4.48	43.15	428.86
	Mean	1.10	.013	.12	.55	.48	1.13	1.02	3.35	.83	1.87	2.16	.15	1.39	1.17
	Max.	28	.10	1.1	9.2	11	28	7.9	24	5.1	16	18	1.7	13	28
	Min.	0	0	0	0	0	.01	.02	.04	.01	.07	.04	.01	.03	0
1981	Total	468.56	46.44	23.14	.71	0	1.02	22.55	110.25	62.02	80.20	51.31	23.49	47.43	461.08
	Mean	1.28	1.50	.83	.023	0	.033	.75	3.56	2.00	2.67	1.66	.78	1.53	1.26
	Max.	32	15	14	.33	0	.37	4.6	25	16	17	15	7.6	32	25
	Min.	0	.04	.01	0	0	0	.01	.14	0	.01	.01	.04	.03	0
1982	Total		24.20	31.61	23.43	0	14.45	183.72	4.58	49.79	46.27				537.28
	Mean		.78	1.13	.76	0	.47	6.12	1.34	1.61	1.54				1.47
	Max.		14	12	16	0	4.0	92	11	20	14				92
	Min.		.01	0	0	0	0	.01	.03	.01	.01				0

Table 30. Streamflow records of Daloelaeb Stream, Yap (16892800)
(Formerly published as Dalolab Stream, Yap)

Location: Lat 9°31'05" N., long 138°06'21" E., on left bank 0.17 mi north of Daloelaeb Hill water tank and 1.3 mi northwest of Protestant Mission Church in Colonia.

Drainage area: 0.07 mi^2.

Period of record: April 1968 to December 1981 (discontinued).

Gage: Water-stage recorder and concrete control. Altitude of gage is 110 ft from topographic map).

Remarks: Records good. No diversion above station.

Average discharge: 13 years, 0.366 ft^3/s (265 acre-ft/yr).

Extremes for period of record: Maximum discharge, 180 ft^3/s Sept. 15, 1973 (gage height, 4.80 ft, from floodmark in well), from rating curve extended above 17 ft^3/s; no flow for many days each year.

Discharge measurement made after the end of continuous discharge record

Sept. 15, 1982 ---------- 0.09 ft^3/s

Table 30. Streamflow records of Daloelaeb Stream, Yap--Continued

A. Annual maximum discharge (*) and peak discharges above base (75 ft^3/s)

Date	Time	Discharge (ft^3/s)	Gage height (ft)	Date	Time	Discharge (ft^3/s)	Gage height (ft)
Aug. 2, 1968	1300	*106	3.97	Oct. 9, 1975	2230	96	3.83
				Oct. 17, 1975	1600	*116	4.10
June 24, 1969	1800	88	3.71	May 12, 1976	+0700	91	3.76
July 13, 1969	0100	83	3.64	Aug. 6, 1976	0800	105	3.96
July 23, 1969	0530	*119	4.14	Aug. 19, 1976	+1300	110	4.02
July 28, 1969	0200	78	3.56				
Aug. 5, 1969	0700	98	3.86	Sept. 3, 1977	1145	*68	3.40
Oct. 27, 1969	1100	75	3.51	Dec. 12, 1977	0230	76	3.54
Aug. 8, 1970	2000	91	3.76	June 21, 1978	1900	94	3.80
Aug. 21, 1970	1400	*143	4.42	Aug. 3, 1978	1300	90	3.75
Aug. 26, 1970	+1030	92	3.77	Aug. 19, 1978	1730	76	3.53
Sept. 19, 1970	+1630	135	4.33	Sept. 14, 1978	0300	*152	4.52
				Sept. 17, 1978	1230	146	4.45
Oct. 14, 1970	0200	*111	4.04				
Jan. 20, 1971	+2300	89	3.73	June 26, 1979	1300	110	4.02
Apr. 24, 1971	0600	107	3.98	Aug. 17, 1979	+0900	*116	4.10
Aug. 6, 1971	0800	86	3.68				
Sept. 6, 1971	0700	91	3.76	Oct. 1, 1979	2230	*128	4.24
				Oct. 30, 1979	1600	79	3.55
Jan. 9, 1972	2400	97	3.84	May 22, 1980	0930	89	3.70
Mar. 6, 1972	+1130	--	--	July 1, 1980	0100	114	4.06
Sept. 7, 1972	2400	*106	3.97	July 4, 1980	0430	116	4.08
Sept. 15, 1973	2200	*180	a/4.80	Oct. 18, 1980	1800	87	3.70
				Dec. 2, 1980	1700	109	4.01
July 2, 1974	1600	*76	a/3.54	July 13, 1981	+2300	*151	4.51
				July 27, 1981	0200	125	4.21
Oct. 12, 1974	2200	75	3.52	Aug. 5, 1981	1800	108	4.00
Oct. 25, 1974	1430	83	3.64				
Nov. 4, 1974	0700	*110	4.02				
Dec. 5, 1974	1430	96	3.83				
Jan. 21, 1975	0300	91	3.76				

+ About.
a/ From floodmark.

Table 30. Streamflow records of Daloelaeb Stream, Yap--Continued

B. Annual minimum discharge

Water year	Date	Discharge (ft^3/s)	Water year	Date	Discharge (ft^3/s)
1968[a/]	Many days (94)	0	1975	Many days (108)	0
1969	Many days (197)	0	1976	Many days (116)	0
1970	Many days (136)	0	1977	Many days (163)	0
1971	Many days (23)	0	1978	Many days (220)	0
1972	Many days (73)	0	1979	Many days (147)	0
1973	Many days (190)	0	1980	Many days (143)	0
1974	Many days (74)	0	1981	Many days (135)	0

[a/] April to September 1968.

Table 30. Streamflow records of Daloelaeb Stream, Yap--Continued

C. Monthly and annual discharges, in cubic feet per second

Year		Calendar year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Water year
1968	Total					0	0	0.05	8.61	14.81	14.17				--
		--										21.28	0.53	2.82	
	Mean	--				0	0	.002	.28	.48	.47	.69	.018	.091	--
	Max.	--				0	0	.04	2.1	5.0	3.3	5.3	.35	.88	--
	Min.	--				0	0	0	0	0	.01	0	0	0	--
1969	Total		0.27	0	0	0	2.14	11.05	48.29	20.77	21.89				129.04
		131.84										8.50	13.69	5.24	
	Mean	.36	.009	0	0	0	.069	.37	1.56	.67	.73	.27	.46	.17	.35
	Max.	11	.10	0	0	0	.62	3.4	11	7.0	4.6	2.8	3.0	2.0	11
	Min.	0	0	0	0	0	0	0	.01	0	.01	0	.01	0	0
1970	Total		2.98	3.70	1.72	0	2.56	5.26	11.64	50.95	22.12				128.36
		133.17										17.42	8.32	6.50	
	Mean	.36	.096	.13	.056	0	.083	.18	.38	1.64	.74	.56	.28	.21	.35
	Max.	13	1.5	2.9	1.7	0	.75	2.7	3.2	13	5.0	5.1	2.8	1.2	13
	Min.	0	0	0	0	0	0	0	0	.01	0	0	0	0	0
1971	Total		11.19	8.28	14.65	12.57	19.60	23.17	29.15	10.84	18.44				180.13
		181.80										19.60	9.90	4.41	
	Mean	.50	.36	.30	.47	.42	.63	.77	.94	.35	.61	.63	.33	.14	.49
	Max.	6.1	3.5	2.0	4.1	5.0	3.5	3.7	6.1	3.2	3.9	4.0	4.0	1.3	6.1
	Min.	0	0	0	0	0	0	.01	.01	.01	0	.01	.01	0	0
1972	Total		6.34	16.10	17.41	1.00	.22	9.28	9.61	14.23	28.53				136.63
		116.25										2.45	7.88	3.20	
	Mean	.32	.20	.56	.56	.033	.007	.31	.31	.46	.95	.079	.26	.10	.37
	Max.	10	2.4	7.0	10	.40	.06	2.0	2.5	3.2	5.2	.90	2.0	1.2	10
	Min.	0	0	0	.02	0	0	0	0	0	0	0	.01	0	0
1973	Total		0	0	0	0	0.05	5.96	7.31	7.16	32.37				66.38
		94.55										20.24	11.59	9.87	
	Mean	.26	0	0	0	0	.002	.20	.24	.23	1.08	.65	.39	.32	.18
	Max.	16	0	0	0	0	.02	1.1	1.5	1.9	16	3.9	4.9	4.0	16
	Min.	0	0	0	0	0	0	0	0	0	.01	.01	.01	0	0
1974	Total		13.35	.22	4.34	12.53	9.75	20.04	23.47	14.96	5.67				146.03
		182.12										33.67	28.07	16.05	
	Mean	.50	.43	.008	.14	.42	.31	.67	.76	.48	.19	1.09	.94	.52	.40
	Max.	9.0	3.5	.06	3.5	6.4	5.5	8.0	9.0	7.5	1.5	3.9	5.3	4.4	9.0
	Min.	0	0	0	0	0	0	0	.02	0	.01	.01	.01	0	0

Table 30. Streamflow records of Daloelaeb Stream, Yap--Continued

C. Monthly and annual discharges, in cubic feet per second--Continued

Year		Calendar year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Water year
1975	Total	140.58	30.94	0.03	0	5.39	5.88	15.62	12.37	24.23	12.80	20.29	3.74	9.29	185.05
	Mean	.39	1.00	.001	0	.18	.19	.52	.40	.78	.43	.65	.12	.30	.51
	Max.	15	15	.01	0	4.6	1.2	4.0	3.2	4.4	3.3	5.5	1.5	4.4	15
	Min.	0	0	0	0	0	0	0	0	.01	0	0	0	0	0
1976	Total	121.72	1.69	.89	1.03	6.91	13.57	13.54	13.63	26.88	19.38	1.17	8.84	14.19	130.84
	Mean	.33	.055	.031	.033	.23	.44	.45	.44	.87	.65	.038	.29	.46	.36
	Max.	8.0	.72	.60	.65	1.8	8.0	3.0	3.0	7.0	4.3	.50	4.0	1.8	8.0
	Min.	0	0	0	0	0	0	.01	.01	.01	0	0	0	.01	0
1977	Total	102.98	1.19	0	0	0	3.17	4.15	26.93	23.77	27.44	13.93	34.58	26.23	110.85
	Mean	.28	.038	0	0	0	.10	.14	.87	.77	.91	.45	1.12	.87	.30
	Max.	15	.43	0	0	0	1.2	2.9	6.7	3.9	15	4.9	5.1	12	15
	Min.	0	0	0	0	0	0	0	0	.02	0	0	0	0	0
1978	Total	151.44	3.53	4.15	0	0	0	10.32	13.93	34.58	26.23	35.24	13.05	10.43	109.07
	Mean	.41	.11	.15	0	0	0	.34	.45	1.12	.87	1.14	.44	.34	.30
	Max.	12	2.7	2.0	0	0	0	5.5	4.9	5.1	12	9.7	2.0	2.1	12
	Min.	0	0	0	0	0	0	0	0	0	0	.01	.01	0	0
1979	Total	127.90	0	0	1.86	0	2.24	18.70	20.91	25.63	8.53	21.13	7.10	21.80	136.59
	Mean	.35	0	0	.06	0	.07	.62	.67	.83	.28	.68	.24	.70	.37
	Max.	9.0	0	0	1.7	0	1.5	4.0	5.0	9.0	2.4	5.9	3.2	6.6	9.7
	Min.	0	0	0	0	0	0	0	0	.03	0	0	0	0	0
1980	Total	128.41	.02	.62	6.12	2.94	10.33	11.01	37.11	12.04	13.77	18.44	1.11	14.90	143.99
	Mean	.35	.001	.021	.20	.098	.33	.37	1.20	.39	.46	.59	.04	.48	.39
	Max.	8.7	.01	.18	3.4	2.7	8.1	2.4	8.7	3.8	2.5	4.7	.40	6.0	8.7
	Min.	0	0	0	0	0	0	.01	.01	.01	.01	0	0	0	0
1981	Total	152.28	12.61	9.74	.14	0	.08	7.12	31.03	22.05	26.77	18.32	7.57	16.85	143.99
	Mean	.42	.41	.35	.004	0	.002	.24	1.00	.71	.89	.59	.25	.54	.39
	Max.	10	3.9	6.4	.09	0	.06	2.3	8.8	5.9	6.1	4.8	2.5	10	8.8
	Min.	0	.01	0	0	0	0	0	.01	0	0	.01	.02	.01	0

Table 31. Streamflow records of Peemgoy Stream, Yap (16892900)
(Formerly published as Pemgoy Stream, Yap)

Location: Lat 9°31'07" N., long 138°06'36" E., on right bank at Taalgum, 100 ft upstream from confluence with Taalgum Stream, 0.3 mi southeast of Mount Peemgoy, and 1.0 mi northwest of Protestant Mission Church in Colonia.
Drainage area: 0.14 mi^2.
Period of record: April 1968 to July 1982 (discontinued).
Gage: Water-stage recorder. Concrete control since Mar. 30, 1974. Altitude of gage is 60 ft (from topographic map).
Remarks: Records fair. No diversion above station.
Average discharge: 13 years (water years 1969-81), 0.591 ft^3/s (428 acre-ft/yr).
Extremes for period of record: Maximum discharge, 335 ft^3/s July 13, 1981 (gage height, 5.40 ft), from rating curve extended above 15 ft^3/s; no flow for many days most years.

Discharge measurements, in cubic feet per second, made outside the period of continuous discharge record

Sept. 23, 1965	0.45
Oct. 9, 1967	.10
Aug. 4, 1982	.01
Sept. 15, 1982	.68

Table 31. Streamflow records of Peemgoy Stream, Yap--Continued

A. Annual maximum discharge (*) and peak discharges above base (70 ft^3/s)

Date	Time	Discharge (ft^3/s)	Gage height (ft)	Date	Time	Discharge (ft^3/s)	Gage height (ft)
Aug. 2, 1968	1300	*66	2.94	Sept. 3, 1977	+1100	*87	a/3.24
July 23, 1969	0500	*161	4.06	June 21, 1978	1900	75	3.07
Aug. 5, 1969	0630	104	3.45	Aug. 3, 1978	1300	72	3.03
				Sept. 14, 1978	0230	*314	a/5.26
Aug. 8, 1970	1930	79	3.13	Sept. 17, 1978	1230	192	a/4.34
Aug. 15, 1970	0630	76	3.08	June 26, 1979	1230	86	3.22
Aug. 21, 1970	+1300	198	a/4.39	Aug. 17, 1979	0900	*165	4.10
Aug. 26, 1970	1800	74	3.05				
Sept. 19, 1970	1630	*207	4.47	Oct. 1, 1979	2300	*234	4.68
				Oct. 30, 1979	1500	90	3.28
Oct. 14, 1970	0200	86	3.22	May 22, 1980	0830	88	3.25
Jan. 20, 1971	2230	71	3.02	July 1, 1980	+0100	+150	--
Sept. 6, 1971	0600	*90	3.23	July 4, 1980	+0400	179	4.22
Oct. 3, 1971	+0030	112	3.54	Dec. 2, 1980	1730	96	3.33
Mar. 6, 1972	1100	151	3.96	July 13, 1981	2300	*335	5.40
June 25, 1972	0130	76	3.09	July 27, 1981	0300	228	4.63
Sept. 8, 1972	0030	*173	a/4.17	Aug. 5, 1981	1800	94	3.33
Sept. 15, 1973	2200	*240	4.72	Oct. 31, 1981	0200	71	3.02
				Dec. 23, 1981	0700	117	3.60
Nov. 17, 1973	1900	81	2.86	Feb. 6, 1982	0800	128	a/3.72
June 6, 1974	0030	83	3.18	Mar. 22, 1982	2230	86	3.22
June 20, 1974	0100	88	3.25	June 21, 1982	0600	*303	5.18
July 2, 1974	1700	*156	4.01				
Nov. 4, 1974	+0800	+*150	--				
Jan. 21, 1975	0300	102	3.42				
Oct. 9, 1975	2300	74	3.06				
Oct. 17, 1975	1730	82	3.17				
May 12, 1976	+0700	+100	--				
Aug. 6, 1976	+0700	106	3.47				
Aug. 19, 1976	1300	*110	3.52				
Sept. 4, 1976	0500	75	3.07				

\+ About
a/ From floodmark.

Table 31. Streamflow records of Peemgoy Stream, Yap--Continued

B. Annual minimum discharge

Water year	Date	Discharge (ft^3/s)	Water year	Date	Discharge (ft^3/s)
1968[a/]	Many days (87)	0	1976	Many days (15)	0
1969	Many days (107)	0	1977	Many days (63)	0
1970	Many days (68)	0	1978	Several days (8)	0
1971	Many days	.01	1979	Feb. 16, Mar. 30	0
1972	Many days (86)	0	1980	Feb. 2	0
1973	Many months (165)	0	1981	Many days (59)	0
1974	Many days (16)	0	1982[b/]	Many days	.01
1975	Many days (34)	0			

[a/] April to September 1968.

[b/] October 1981 to July 1982.

Table 31. Streamflow records of Peemgoy Stream, Yap--Continued

C. Monthly and annual discharges, in cubic feet per second

Year		Calendar year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Water year
1968	Total	--				0	0.02	0.33	8.85	14.33	20.33	26.82	.79	4.28	--
	Mean	--				0	.001	.011	.28	.46	.68	.87	.026	.14	--
	Max.	--				0	.02	.16	2.4	5.5	4.6	7.0	.30	1.0	--
	Min.	--				0	0	0	0	0	0	.01	0	0	--
1969	Total	198.44	1.93	.05	0	0	3.46	13.50	75.26	31.68	34.68	11.69	18.91	7.28	192.45
	Mean	.54	.062	.002	0	0	.11	.45	2.43	1.02	1.16	.38	.63	.23	.53
	Max.	17	.50	.01	0	0	.89	3.3	17	10	6.0	3.0	4.0	3.0	17
	Min.	0	0	0	0	0	0	.01	.05	.04	.07	.03	.02	.01	0
1970	Total	185.70	6.70	7.31	3.14	0	7.28	8.46	17.49	56.06	34.02	24.80	9.96	10.47	178.35
	Mean	.51	.22	.26	.10	0	.23	.28	.56	1.81	1.13	.80	.33	.34	.49
	Max.	15	2.5	5.9	2.8	0	2.3	4.2	4.8	15	8.8	7.3	3.0	2.0	15
	Min.	0	0	0	0	0	0	0	.01	.02	.02	.03	.01	.02	0
1971	Total	247.21	16.22	10.94	19.09	12.18	21.77	29.97	37.46	15.13	27.77	35.94	12.76	7.98	235.76
	Mean	.68	.52	.39	.62	.41	.70	1.00	1.21	.49	.93	1.16	.43	.26	.65
	Max.	7.8	4.7	2.7	6.3	4.6	4.2	6.5	7.8	4.2	5.8	7.0	5.4	1.4	7.8
	Min.	.01	.01	.01	.01	.01	.01	.02	.04	.03	.03	.06	.04	.04	.01
1972	Total	164.99	9.31	27.68	23.10	1.41	.50	10.68	17.56	16.97	32.97	8.43	12.85	3.53	196.86
	Mean	.45	.30	.95	.75	.047	.016	.36	.57	.55	1.10	.27	.43	.11	.54
	Max.	13	3.9	13	12	.53	.15	3.6	5.9	4.1	9.5	2.9	4.3	1.0	13
	Min.	0	.01	0	.04	0	0	.02	0	.03	.03	.03	.04	0	0
1973	Total	159.48	0	0	0	0	0	9.64	12.93	10.92	41.85	40.85	24.24	19.05	100.15
	Mean	.44	0	0	0	0	0	.32	.42	.35	1.40	1.32	.81	.61	.27
	Max.	11	0	0	0	0	0	2.0	3.0	4.4	11	7.0	9.6	7.3	11
	Min.	0	0	0	0	0	0	0	0	0	.02	.02	.02	.01	0
1974	Total	328.45	30.62	1.01	5.71	28.52	15.44	36.90	38.83	23.12	9.69	64.39	47.92	26.30	273.98
	Mean	.90	.99	.036	.18	.95	.50	1.23	1.25	.75	.32	2.08	1.60	.85	.75
	Max.	13	8.7	.24	3.5	13	7.5	11	10	10	2.0	7.0	10	6.7	13
	Min.	0	.03	0	0	0	.01	.05	.08	.04	.04	.08	.04	.03	0
1975	Total	224.62	46.57	1.40	0.33	7.25	9.47	23.79	16.91	37.98	26.10	31.38	9.36	14.08	308.41
	Mean	.62	1.50	.050	.011	.24	.31	.79	.55	1.23	.87	1.01	.31	.45	.85
	Max.	20	20	.07	.05	6.2	2.0	6.0	3.3	6.0	4.0	6.4	3.7	4.7	20
	Min.	0	.04	.02	0	0	0	.02	.04	.05	.04	.04	.02	.03	0

Table 31. Streamflow records of Peemgoy Stream, Yap--Continued

C. Monthly and annual discharges, in cubic feet per second--Continued

Year		Calendar year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Water year
1976	Total	223.32	2.83	1.66	2.02	10.54	31.08	28.24	29.86	40.87	33.69	2.31	14.63	25.59	235.61
	Mean	.61	.091	.057	.065	.35	1.00	.94	.96	1.32	1.12	.075	.49	.83	.64
	Max.	18	1.1	.71	.85	2.7	18	5.5	6.1	10	5.7	.69	5.7	4.3	18
	Min.	0	.01	.01	0	0	.01	.03	.07	.06	.04	.01	.01	.01	0
1977	Total	185.04	3.31	.26	.08	0	3.38	7.17	45.54	37.08	66.39	.74	2.80	18.29	205.74
	Mean	.51	.11	.009	.003	0	.11	.24	1.47	1.20	2.21	.024	.093	.59	.56
	Max.	35	.80	.01	.01	0	1.1	4.3	7.4	5.0	35	.15	1.7	6.8	35
	Min.	0	.01	0	0	0	0	.01	.01	.05	.02	.01	.01	.01	0
1978	Total	255.08	7.12	8.52	.36	.31	1.98	15.66	21.22	54.91	44.03	59.00	23.51	18.46	175.94
	Mean	.70	.23	.30	.012	.010	.064	.52	.68	1.77	1.47	1.90	.78	.60	.48
	Max.	22	3.6	3.2	.03	.04	1.0	5.4	5.5	7.1	22	15	3.0	3.8	22
	Min.	0	.01	.01	0	0	0	.01	.01	.05	.03	.03	.04	.02	0
1979	Total	219.42	.43	.28	3.34	.34	6.02	33.67	35.49	48.15	13.55	38.71	12.15	27.29	242.24
	Mean	.60	.014	.010	.11	.011	.19	1.12	1.15	1.55	.45	1.25	.40	.88	.66
	Max.	15	.03	.01	2.3	.02	3.0	6.0	8.7	15	3.4	9.9	4.5	11	15
	Min.	0	.01	0	0	.01	.01	.01	.02	.04	.01	.01	.01	.01	0
1980	Total	199.94	.37	1.06	8.36	3.86	16.66	16.63	58.56	18.49	22.70	28.79	2.55	21.91	224.84
	Mean	.55	.012	.037	.27	.13	.54	.55	1.89	.60	.76	.93	.085	.71	.61
	Max.	14	.02	.29	3.4	3.1	13	3.5	14	4.9	5.6	6.6	.68	7.5	14
	Min.	0	.01	0	.01	.01	.01	.01	.03	.02	.03	.01	.01	.01	0
1981	Total	254.85	21.99	18.05	.50	.05	.46	12.11	52.37	38.78	44.84	32.13	11.34	22.23	242.40
	Mean	.70	.71	.64	.016	.002	.015	.40	1.69	1.25	1.49	1.04	.38	.72	.66
	Max.	12	5.2	9.5	.24	.01	.30	2.7	12	9.0	9.8	6.4	3.1	11	12
	Min.	0	.02	.01	0	0	0	0	.03	.01	.01	.02	.01	.01	0
1982	Total	--	9.33	20.32	15.62	.52	13.40	105.00	27.16						--
	Mean	--	.30	.73	.50	.017	.43	3.50	.88						--
	Max.	--	7.0	6.5	8.0	.07	5.0	51	7.3						--
	Min.	--	.01	.01	.01	.01	.01	.03	.02						--

Table 32. Streamflow records of Taalgum Stream, Yap (16893000)
(Formerly published as Talagu Stream, Yap)

Location: Lat 9°31'09" N., long 138°06'32" E., on left bank at Taalgum, 300 ft upstream from confluence with Pemgoy Stream, and 1.2 mi northwest of Protestant Mission Church in Colonia.

Drainage area: 0.08 mi^2.

Period of record: April 1968 to April 1979 (discontinued).

Gage: Water-stage recorder. Concrete control since Apr. 3, 1975. Altitude of gage is 100 ft (from topographic map).

Remarks: Records fair. No diversion above station.

Average discharge: 10 years (water years 1969-78), 0.341 ft^3/s (247 acre-ft/yr).

Extremes for period of record: Maximum discharge, 330 ft^3/s Sept. 14, 1978 (gage height, 3.98 ft), from rating curve extended above 9.0 ft^3/s; no flow for many days each year.

A. Discharge measurements, in cubic feet per second, made outside the period of continuous discharge record

Date	Discharge	Date	Discharge
9-20-65	0.05	9-19-79	e/0.01
9-23-65	.19	10- 5-79	.03
10- 9-67	.08	10-30-79	e/ .01
6-13-79	.23	11- 9-79	e/ .01
6-29-79	.72	12- 4-79	e/ .01
7-11-79	1.4	12-28-79	.03
7-26-79	.63	1-23-80	0
8- 8-79	.14	2- 1-80	0
8-21-79	.06	9-17-80	.56
9- 5-79	e/.01	9-15-82	.25

e/ Estimated.

Table 32. Streamflow records of Taalgum Stream, Yap--Continued

B. Annual maximum discharge (*) and peak discharges above base (50 ft^3/s)

Date	Time	Discharge (ft^3/s)	Gage height (ft)	Date	Time	Discharge (ft^3/s)	Gage height (ft)
Aug. 2, 1968	1300	*66	2.36	Oct. 12, 1974	2230	54	2.17
				Oct. 25, 1974	1500	55	2.18
July 13, 1969	0100	55	2.18	Nov. 4, 1974	0800	*114	2.97
July 23, 1969	0500	*137	3.22	Jan. 21, 1975	0400	82	2.58
Aug. 5, 1969	0700	85	2.62	Aug. 26, 1975	1330	63	2.36
Feb. 23, 1970	+0700	85	a/2.63	Oct. 9, 1975	2300	85	2.57
Aug. 5, 1970	2000	53	2.15	Oct. 17, 1975	1730	*128	2.91
Aug. 15, 1970	0630	65	2.34	May 12, 1976	0700	127	2.90
Aug. 21, 1970	1300	*145	3.30	Aug. 6, 1976	0700	108	a/2.76
Aug. 26, 1970	1800	63	2.31	Aug. 19, 1976	1300	113	a/2.80
Sept. 19, 1970	1700	138	3.23	Sept. 4, 1976	0500	+55	--
Oct. 14, 1970	0230	72	2.44	Sept. 3, 1977	1000	*79	2.52
Jan. 20, 1971	2300	57	2.22				
Apr. 24, 1971	0500	63	2.32	Nov. 27, 1977	0800	56	a/2.28
July 8, 1971	+2400	57	a/2.21	Dec. 12, 1977	0200	54	2.26
Sept. 6, 1971	0930	*81	2.57	June 21, 1978	1930	65	2.38
				Aug. 3, 1978	1300	61	2.33
Mar. 6, 1972	1100	115	2.98	Sept. 14, 1978	0300	*330	3.98
Sept. 8, 1972	0200	*117	a/3.00	Sept. 17, 1978	1230	255	3.65
Sept. 15, 1973	2300	*213	3.98	July 3, 1979	+1900	61	a/2.33
				Aug. 17, 1979	+0900	*164	a/3.14
Apr. 20, 1974	1200	63	2.31				
June 6, 1974	0130	68	2.38				
June 20, 1974	0130	63	2.32				
July 2, 1974	1730	*141	3.26				

\+ About.
a/ From floodmark.

Table 32. Streamflow records of Taalgum Stream, Yap--Continued

C. Annual minimum discharge

Water year	Date	Discharge (ft^3/s)	Water year	Date	Discharge (ft^3/s)
1968[a/]	Many days (111)	0	1974	Many days (42)	0
1969	Many days (183)	0	1975	Many days (78)	0
1970	Many days (178)	0	1976	Many days (58)	0
1971	April 7, 8	0	1977	Many days (91)	0
1972	Many days (74)	0	1978	Many days (137)	0
1973	Many days (177)	0	1979[b/]	Many days (106)	0

[a/] April to September 1968.

[b/] October 1978 to April 1979.

Table 32. Streamflow records of Taalgum Stream, Yap--Continued

D. Monthly and annual discharges, in cubic feet per second

Year		Calendar year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Water year
1968	Total	--				0	0.01	0	8.23	15.96	15.95	24.41	0.54	6.11	--
	Mean	--				0	.0003	0	.26	.52	.53	.79	.018	.20	--
	Max.	--				0	.01	0	2.2	4.7	3.4	4.7	.29	2.1	--
	Min.	--				0	0	0	0	0	0	0	0	0	--
1969	Total	136.48	1.37	0	0	0	3.84	8.55	48.08	21.13	21.72	8.57	17.03	6.19	135.75
	Mean	.37	.044	0	0	0	.12	.28	1.55	.68	.72	.28	.57	.20	.37
	Max.	12	.48	0	0	0	1.0	2.0	12	7.0	3.9	2.5	3.1	2.5	12
	Min.	0	0	0	0	0	0	0	0	0	.01	0	0	0	0
1970	Total	124.18	4.43	3.46	1.7	0	2.25	5.45	11.37	38.69	22.89	16.20	7.84	9.90	122.03
	Mean	.34	.14	.12	.055	0	.073	.18	.37	1.25	.76	.52	.26	.32	.33
	Max.	12	2.4	3.0	1.7	0	1.3	3.5	3.3	12	5.4	5.3	2.1	2.4	12
	Min.	0	0	0	0	0	0	0	0	0	0	.01	.01	.01	0
1971	Total	179.79	10.13	7.87	16.96	13.54	20.82	22.05	27.95	12.23	21.16	18.19	6.93	1.96	186.65
	Mean	.49	.33	.28	.55	.45	.67	.74	.90	.39	.71	.59	.23	.063	.51
	Max.	5.7	2.6	2.2	4.3	4.0	3.3	5.2	5.7	3.3	4.7	3.5	3.5	.40	5.7
	Min.	.01	.01	.01	.01	.01	.01	.03	.03	.02	.03	.03	.01	.01	.01
1972	Total	95.77	5.04	14.71	15.75	.80	.23	8.31	10.39	10.82	19.47	2.34	6.21	1.70	112.60
	Mean	.26	.16	.51	.51	.027	.007	.28	.34	.35	.65	.076	.21	.055	.31
	Max.	9.6	2.0	6.9	9.6	.30	.08	2.7	2.8	2.4	5.2	.73	1.9	.54	9.6
	Min.	0	0	0	.02	0	0	0	0	0	.02	.01	.02	0	0
1973	Total	76.60	0	0	0	0	0	4.63	7.08	5.89	21.84	18.03	10.77	8.36	49.69
	Mean	.21	0	0	0	0	0	.15	.23	.19	.73	.58	.36	.27	.14
	Max.	6.5	0	0	0	0	0	.94	1.7	2.3	6.5	3.2	5.0	3.6	6.5
	Min.	0	0	0	0	0	0	0	0	.01	0	.01	.01	.01	0
1974	Total	171.09	11.30	.29	5.32	13.19	7.50	19.20	21.33	13.10	4.09	31.36	27.91	16.50	132.48
	Mean	.47	.36	.010	.17	.44	.24	.64	.69	.42	.14	1.01	.93	.53	.36
	Max.	7.6	2.9	.08	4.1	7.0	4.1	7.2	7.6	6.6	1.0	3.6	7.0	4.3	7.6
	Min.	0	.01	0	0	0	0	.02	.03	.01	.01	.03	0	0	0

Table 32. Streamflow records of Taalgum Stream, Yap--Continued

D. Monthly and annual discharges, in cubic feet per second--Continued

Year		Calendar year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Water year
1975	Total		31.29	0.13	0.02	3.80	5.17	13.70	10.45	21.04	13.94				175.31
		133.35										20.66	3.89	9.26	
	Mean	.37	1.01	.005	.001	.13	.17	.46	.34	.68	.46	.67	.13	.30	.48
	Max.	14	14	.04	.01	3.3	.84	2.4	2.0	3.5	2.5	5.3	1.6	3.3	14
	Min.	0	.01	0	0	0	.01	.02	.02	.03	.02	.02	0	.03	0
1976	Total		1.73	.85	.65	5.80	14.11	15.23	14.24	24.20	17.82				128.44
		115.12										1.21	7.34	11.94	
	Mean	.31	.056	.029	.021	.19	.46	.51	.46	.78	.59	.039	.24	.39	.35
	Max.	8.0	.47	.40	.40	1.5	8.0	2.9	3.2	7.3	3.7	.32	3.2	2.1	8.0
	Min.	0	.01	0	0	0	0	.02	.04	.05	.02	.01	.02	.02	0
1977	Total		1.64	.18	0	0	1.44	3.46	29.94	17.43	27.06				101.64
		95.71										1.04	2.15	11.37	
	Mean	.26	.053	.006	0	0	.046	.12	.97	.56	.90	.034	.072	.37	.28
	Max.	16	.40	.01	0	0	.48	2.2	5.9	2.5	16	.17	1.2	4.0	16
	Min.	0	.01	0	0	0	0	0	.02	.02	.01	.01	0	0	0
1978	Total		3.70	4.15	0	0	.26	9.37	10.28	28.10	31.41				101.83
		132.79										25.64	11.10	8.78	
	Mean	.36	.12	.15	0	0	.008	.31	.33	.91	1.05	.83	.37	.28	.28
	Max.	16	2.2	2.0	0	0	.07	4.6	3.1	3.7	16	7.0	1.5	2.0	16
	Min.	0	0	0	0	0	0	0	.01	.01	.01	.02	.02	.01	0
1979	Total		.06	0	1.68	0									
		--													--
	Mean	--	.002	0	.054	0									--
	Max.	--	.01	0	1.4	0									--
	Min.	--	0	0	0	0									--

Table 33. Streamflow records for Burong Stream, Yap, (16893100)

Location: Lat 9°32'05" N., long 138°07'19" E., on left bank at Dugor, 0.25 mi upstream from mouth, and 0.5 mi northeast of Mount Gamuw.

Drainage area: 0.23 mi^2.

Period of record: April 1968 to September 1982.

Gage: Water-stage recorder and concrete control. Altitude of gage is 15 ft (from topographic map).

Remarks: Records good. No diversion above station.

Average discharge: 14 years, 0.973 ft^3/s (705 acre-ft/yr).

Extremes for period of record: Maximum discharge, 550 ft^3/s June 21, 1982 (gage height, 5.45 ft), from rating curve extended above 15 ft^3/s; no flow for many days most years.

Table 33. Streamflow records of Burong Stream, Yap--Continued

A. Annual maximum discharge (*) and peak discharges above base (75 ft^3/s)

Date	Time	Discharge (ft^3s)	Gage height (ft)	Date	Time	Discharge (ft^3/s)	Gage height (ft)
Sept. 22, 1968	0700	* 58	2.96	Oct. 17, 1975	1730	*201	4.08
				May 12, 1976	0700	152	3.79
Oct. 13, 1968	1300	91	3.32	Aug. 19, 1976	1300	194	4.04
July 23, 1969	0500	*220	4.18				
Aug. 5, 1969	0700	133	3.66	Sept. 3, 1977	1130	*240	4.28
Aug. 15, 1970	0700	173	3.92	June 21, 1978	1900	154	a/3.80
Aug. 21, 1970	0130	120	3.56	Sept. 14, 1978	0300	*445	5.10
Aug. 26, 1970	1830	91	3.32	Sept. 17, 1978	1230	201	4.08
Sept. 19, 1970	1630	*250	4.33				
				Aug. 17, 1979	0900	*232	4.24
Oct. 3, 1970	1130	102	3.42				
Oct. 14, 1970	0200	91	3.32	Oct. 1, 1979	2200	256	4.36
July 22, 1971	0300	98	3.38	Dec. 24, 1979	0130	110	3.48
Sept. 6, 1971	0800	136	3.68	July 1, 1980	0100	150	3.77
Sept. 15, 1971	1400	*261	4.38	July 4, 1980	0330	*505	5.30
Sept. 22, 1971	0130	90	3.31				
Sept. 26, 1971	1100	102	3.42	July 13, 1981	2300	*433	5.06
				July 27, 1981	+0200	194	a/4.04
Mar. 6, 1972	1030	236	4.26	Aug. 5, 1981	+1800	157	a/3.82
Sept. 5, 1972	1230	287	4.50				
Sept. 8, 1972	0130	*338	4.71	Dec. 23, 1981	0700	151	3.78
				Feb. 6, 1982	0730	211	4.16
Sept. 15, 1973	2300	*442	5.09	Mar. 22, 1982	2200	112	3.50
				June 21, 1982	0600	*550	5.45
Apr. 20, 1974	1200	*368	4.83	Aug. 30, 1982	0500	128	3.62
Aug. 12, 1974	1800	122	3.58				
Oct. 10, 1974	0030	154	3.80				
Oct. 25, 1974	1600	263	4.39				
Nov. 4, 1974	0900	*285	4.49				
Jan. 21, 1975	0330	191	4.02				

\+ About.
a/ From floodmarks.

Table 33. Streamflow records of Burong Stream, Yap--Continued

B. Annual minimum discharge

Water year	Date	Discharge (ft^3/s)	Water year	Date	Discharge (ft^3/s)
1968[a/]	Many days (100)	0	1976	Many days (65)	0
1969	Many days (179)	0	1977	Many days (131)	0
1970	Many days (91)	0	1978	Many days (126)	0
1971	February 1	.01	1979	Many days (132)	0
1972	Many days (44)	0	1980	Many days (83)	0
1973	Many days (172)	0	1981	Many days (94)	0
1974	Many days (22)	0	1982	Many days (32)	0
1975	Many days (84)	0			

[a/] April to September 1968.

Table 33. Streamflow records of Burong Stream, Yap--Continued

C. Monthly and annual discharges, in cubic feet per second

Year		Calendar year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Water year
1968	Total	--				0	0.05	0.08	13.24	32.27	44.54	53.05	1.00	11.20	--
	Mean	--				0	.002	.003	.43	1.04	1.48	1.71	.033	.36	--
	Max.	--				0	.05	.08	3.2	7.4	7.3	11	.46	3.3	--
	Min.	--				0	0	0	0	0	0	0	0	0	--
1969	Total	302.43	.45	0	0	0	7.29	20.03	109.47	49.72	48.62	14.76	40.82	14.27	297.83
	Mean	.83	.015	0	0	0	.24	.67	3.53	1.60	1.52	.48	1.36	.46	.82
	Max.	25	.13	0	0	0	2.0	3.7	25	17	9.7	4.9	7.5	5.0	25
	Min.	0	0	0	0	0	0	0	.04	.06	.12	.03	.01	.01	0
1970	Total	330.44	9.05	14.95	3.26	0	8.04	14.54	38.03	92.20	59.99	45.67	25.19	19.52	309.91
	Mean	.91	.29	.53	.11	0	.26	.48	1.23	2.97	2.00	1.47	.84	.63	.85
	Max.	20	3.0	7.4	2.9	0	2.6	7.0	8.8	20	14	11	5.8	3.9	20
	Min.	0	0	0	0	0	0	0	0	.04	.01	.04	.03	.03	0
1971	Total	457.67	27.49	19.72	34.94	21.43	28.27	56.08	76.43	38.57	71.17	54.84	21.59	7.14	464.48
	Mean	1.25	.89	.70	1.13	.71	.91	1.87	2.47	1.24	2.37	1.77	.72	.23	1.27
	Max.	15	6.1	4.1	10	4.7	5.6	10	15	8.2	12	10	7.7	1.8	15
	Min.	.01	.02	.01	.03	.03	.02	.05	.10	.04	.03	.12	.10	.03	.01
1972	Total	303.01	17.65	35.58	40.19	2.36	.67	16.04	28.81	38.42	87.89	13.70	18.09	3.61	351.18
	Mean	.83	.57	1.23	1.30	.079	.022	.53	.93	1.24	2.93	.44	.60	.12	.96
	Max.	22	6.1	19	21	.88	.10	4.5	9.3	11	22	4.7	6.2	1.0	22
	Min.	0	.01	0	.03	0	0	.02	0	.03	.05	.02	.03	0	0
1973	Total	232.74	0	0	0	0	0	7.67	24.29	12.36	72.23	64.77	32.18	19.24	151.95
	Mean	.64	0	0	0	0	0	.26	.78	.40	2.41	2.09	1.07	.62	.42
	Max.	20	0	0	0	0	0	1.4	3.3	2.7	20	8.7	8.5	8.5	20
	Min.	0	0	0	0	0	0	0	0	0	.01	.07	.04	.02	0
1974	Total	504.50	49.89	2.64	9.59	41.30	25.87	55.67	55.49	39.64	19.32	99.90	70.86	34.33	415.60
	Mean	1.38	1.61	.094	.31	1.38	.83	1.86	1.79	1.28	.64	3.22	2.36	1.11	1.14
	Max.	20	11	.82	7.5	20	12	17	10	17	5.0	11	17	6.8	20
	Min.	0	.19	.01	0	.01	0	.07	.08	.03	.08	.15	.05	.02	0
1975	Total	336.96	76.39	0.40	0	11.43	6.96	31.11	30.55	53.77	37.80	54.40	13.63	20.52	453.50
	Mean	.92	2.46	.014	0	.38	.22	1.04	.99	1.73	1.26	1.75	.45	.66	1.24
	Max.	33	33	.10	0	10	2.1	7.5	8.0	12	7.7	13	6.5	7.4	33
	Min.	0	.04	0	0	0	0	0	.01	.03	.01	.04	0	.05	0

Table 33. Streamflow records of Burong Stream, Yap--Continued

C. Monthly and annual discharges, in cubic feet per second--Continued

Year		Calendar year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Water year
1976	Total		2.92	1.79	1.60	13.95	39.02	39.30	36.10	57.46	59.22				339.91
		293.01										1.03	12.07	28.55	
	Mean	.80	.094	.062	.052	.47	1.26	1.31	1.16	1.85	1.97	.033	.40	.92	.93
	Max.	21	.82	.74	.90	5.0	21	10	10	15	12	.25	6.8	6.6	21
	Min.	0	0	0	0	0	.02	0	.01	.06	.05	0	0	0	0
1977	Total		3.23	.05	0	0	1.85	8.72	83.39	43.78	71.75				254.42
		267.67										1.74	11.11	42.05	
	Mean	.73	.10	.002	0	0	.060	.29	2.69	1.41	2.39	.056	.37	1.36	.70
	Max.	39	.88	.02	0	0	1.0	4.8	20	6.7	39	.13	2.1	13	39
	Min.	0	0	0	0	0	0	0	.01	.03	.06	0	.02	0	0
1978	Total		8.76	13.87	0	0	.46	28.45	28.82	79.48	64.41				279.15
		349.32										80.22	22.35	22.50	
	Mean	.96	.28	.50	0	0	.015	.95	.93	2.56	2.15	2.59	.74	.72	.76
	Max.	31	3.6	6.2	0	0	.42	8.3	5.3	9.0	31	19	3.8	6.9	31
	Min.	0	0	0	0	0	0	0	0	.06	.01	.06	.06	.02	0
1979	Total		.16	0	3.00	0	3.12	51.08	62.38	71.50	28.64				344.95
		355.09										57.30	14.41	63.50	
	Mean	.97	.005	0	.097	0	.10	1.70	2.01	2.31	.96	1.85	.48	2.05	.94
	Max.	22	.02	0	2.2	0	2.3	10	16	20	7.5	22	4.1	22	20
	Min.	0	0	0	0	0	0	0	.01	.07	0	0	.01	.01	0
1980	Total		.49	.95	17.62	12.92	28.36	26.65	94.24	25.69	41.35				383.48
		335.44										49.15	4.14	33.88	
	Mean	.92	.016	.033	.57	.43	.91	.89	3.04	.83	1.38	1.59	.14	1.09	1.05
	Max.	25	.08	.22	10	11	18	7.6	25	9.3	7.6	10	1.0	12	25
	Min.	0	0	0	0	0	0	.01	.10	.03	.09	.06	.03	.02	0
1981	Total		30.52	32.68	.57	0	.05	15.94	83.35	60.34	75.18				385.80
		409.73										39.46	33.37	38.27	
	Mean	1.12	.98	1.17	.018	0	.002	.53	2.69	1.95	2.51	1.27	1.11	1.23	1.06
	Max.	20	4.8	17	.24	0	11	20	20	15	16	7.4	4.0	12	20
	Min.	0	.04	.01	0	0	0	.01	.01	0	.01	.04	.10	.01	0
1982	Total		14.99	27.78	22.68	.18	11.45	218.35	43.54	49.00	36.79				535.86
	Mean		.48	.99	.73	.006	.37	7.28	1.40	1.58	1.23				1.47
	Max.		12	13	13	.01	4.7	115	14	13	11				115
	Min.		.01	0	0	0	0	0	.03	.02	.02				0

Table 34. Streamflow records of Mukong Stream, Gagil-Tamil (16893200)

Location: Lat 9°32'05" N., long 138°10'18" E., on right bank 0.2 mi upstream from mouth and 0.9 mi south of U.S. Coast Guard LORAN station.

Drainage area: 0.50 mi^2.

Period of record: Occasional low-flow measurements, water years 1972-75. Continuous record December 1974 to June 1978, October 1978 to September 1982 (July to September 1978, stage-discharge relation indefinite due to blocked control).

Gage: Water-stage recorder. Altitude of gage is 5 ft (from topographic map).

Remarks: Records fair. Since 1978, small amount of water is pumped at times from site about 500 ft upstream for domestic use in nearby village.

Average discharge: 6 years (water years, 1976-77, 1979-82), 2.08 ft^3/s (1,510 acre-ft/yr).

Extremes for period of continuous record: Maximum discharge, 153 ft^3/s June 21, 1982 (gage height, 4.10 ft), from rating curve extended above 18 ft^3/s; minimum discharge, 0.07 ft^3/s Apr. 9, 1979, Mar. 15, 1980, May 4, 1981.

Table 34. Streamflow records of Mukong Stream, Gagil-Tamil--Continued

A. Discharge measurements, in cubic feet per second, made outside the periods of continuous discharge record

Date	Discharge	Date	Discharge	Date	Discharge
12- 4-71 ---	0.55	1-29-73 ---	0.21	4-19-74 ---	1.3
1-14-72 ---	.93	2-16-73 ---	.06	5- 7-74 ---	.65
2-24-72 ---	6.9	2-26-73 ---	.12	5-17-74 ---	1.4
3-23-72 ---	3.3	5- 7-73 ---	.18	6- 5-74 ---	8.7
4-21-72 ---	1.7	6-20-73 ---	.35	7-10-74 ---	3.0
5-18-72 ---	.28	7- 2-73 ---	3.7	8-16-74 ---	2.2
6-16-72 ---	1.2	8-15-73 ---	.79	9-12-74 ---	.98
7-15-72 ---	1.2	8-29-73 ---	1.2	10- 3-74 ---	3.1
8-10-72 ---	3.6	12- 4-73 ---	1.1	7-21-78 ---	.86
10-12-72 ---	1.1	1-16-74 ---	2.8	8-30-78 ---	2.4
10-16-72 ---	1.2	2- 4-74 ---	1.2	9-14-78 ---	6.1
12-19-72 ---	1.1	2-14-74 ---	1.5	9-29-78 ---	1.6
1- 9-73 ---	.28	3- 7-74 ---	.34		

Table 34. Streamflow records of Mukong Stream, Gagil-Tamil--Continued

B. Annual maximum discharge (*) and peak discharges above base (25 ft^3/s, 1974-79; 50 ft^3/s, 1980-82)

Date	Time	Discharge (ft^3/s)	Gage height (ft)	Date	Time	Discharge (ft^3/s)	Gage height (ft)
Dec. 5, 1974	0600	26	2.29	Oct. 5, 1978	1530	*41	2.81
Jan. 22, 1975	1000	*37	2.69	Dec. 14, 1978	0700	35	2.62
Apr. 30, 1975	0130	35	2.63				
				Dec. 24, 1979	0500	62	3.27
Oct. 10, 1975	0200	35	2.63	Mar. 20, 1980	2400	69	3.37
May 12, 1976	1030	29	2.42	May 22, 1980	1000	63	3.28
June 17, 1976	2130	25	2.23	July 1, 1980	0430	73	3.43
June 25, 1976	0600	31	2.48	July 4, 1980	0630	*110	3.80
Aug. 19, 1976	1600	*40	2.78				
Sept. 13, 1976	1330	29	2.40	July 14, 1981	0200	*90	3.62
Sept. 18, 1976	1000	32	2.53				
				Nov. 27, 1981	0700	75	3.45
Dec. 21, 1976	0930	24	2.20	Dec. 23, 1981	1000	70	3.38
Aug. 20, 1977	1030	39	2.75	Jan. 24, 1982	0730	85	3.57
Aug. 28, 1977	1830	33	2.56	Feb. 6, 1982	1000	102	3.73
Sept. 3, 1977	+1100	*52	3.08	June 21, 1982	0700	*153	4.10
				July 15, 1982	0930	63	3.28
Dec. 12, 1977	0700	35	2.62	Aug. 16, 1982	1100	67	3.34
Sept. 14, 1978	0500	*71	3.40				
Sept. 17, 1978	1500	41	2.83				

+ About.

C. Annual minimum discharge

Water year	Date	Discharge (ft^3/s)	Water year	Date	Discharge (ft^3/s)
1975[a/]	Several days in April	0.11	1979	April 9	0.07
1976	March 15-17	.12	1980	March 15	.07
1977	Part of each day, April 3-9	.11	1981	May 4	.07
1978	Several days in April, May	.09	1982	March 5, 6	.20

[a/] December 1974 to September 1975.

Table 34. Streamflow records of Mukong Stream, Gagil-Tamil--Continued

D. Monthly and annual discharges, in cubic feet per second

Year		Calendar year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Water year
1974	Total	--												99.2	
	Mean	--												3.20	
	Max.	--												10	
	Min.	--												1.3	
1975	Total	725.36	126.08	19.10	10.07	29.33	44.28	75.63	73.32	83.33	53.95	102.4	47.47	60.40	--
	Mean	1.99	4.07	.68	.32	.98	1.43	2.52	2.37	2.69	1.80	3.30	1.58	1.95	--
	Max.	27	27	1.2	.80	17	5.5	6.1	11	8.2	5.7	14	7.7	8.4	--
	Min.	.11	.73	.33	.20	.11	.58	.63	.60	.89	.49	1.1	.52	.88	--
1976	Total	772.87	32.38	18.87	14.97	49.06	90.20	94.56	85.1	101.5	139.6	26.46	33.12	87.05	836.51
	Mean	2.11	1.04	.65	.48	1.64	2.91	3.15	2.75	3.27	4.65	.85	1.10	2.81	2.29
	Max.	19	3.2	1.9	2.5	9.0	19	15	13	14	17	1.8	8.0	12	19
	Min.	.15	.56	.25	.15	.30	.61	.75	1.0	1.3	1.0	.45	.36	.83	.15
1977	Total	713.03	32.92	13.71	6.86	4.72	26.25	67.88	148.5	126.9	109.03	57.25	41.20	77.81	683.40
	Mean	1.95	1.06	.49	.22	.16	.85	2.26	4.79	4.09	3.63	1.85	1.37	2.51	1.87
	Max.	30	3.5	1.2	.35	.23	3.5	9.2	13	12	30	5.1	3.0	13	30
	Min.	.13	.50	.30	.15	.13	.15	.77	1.5	1.2	.83	.45	.50	.55	.13
1978	Total	--	44.31	46.30	9.14	5.55	9.42	35.74	--	--	--	166.86	56.22	60.67	--
	Mean	--	1.43	1.65	.29	.19	.30	1.19	--	--	--	5.38	1.87	1.96	--
	Max.	--	9.0	8.3	.55	.60	3.4	5.6	--	--	--	17	5.6	11	--
	Min.	--	.40	.32	.15	.09	.09	.13	--	--	--	.83	.65	.77	--
1979	Total	531.26	16.03	8.38	15.90	7.74	9.78	58.17	87.33	103.1	65.49	53.45	38.10	67.79	655.67
	Mean	1.46	.52	.30	.51	.26	.32	1.94	2.82	3.33	2.18	1.72	1.27	2.19	1.80
	Max.	12	.77	.60	2.4	.96	1.7	7.4	10	11	6.0	11	4.7	12	17
	Min.	.09	.40	.15	.15	.11	.09	.13	.67	1.6	.99	.35	.47	.39	.09

Table 34. Streamflow records of Mukong Stream, Gagil-Tamil--Continued

D. Monthly and annual discharges, in cubic feet per second--Continued

Year		Calendar year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Water year
1980	Total	610.38	18.44	14.54	33.58	32.25	31.15	59.83	107.9	66.3	78.7	69.94	20.68	77.07	602.03
	Mean	1.67	.59	.50	1.08	1.08	1.00	1.99	3.48	2.14	2.62	2.26	.69	2.49	1.64
	Max.	18	.93	1.6	8.1	8.4	11	6.9	18	5.0	9.4	6.8	2.5	15	18
	Min.	.18	.35	.22	.18	.39	.20	.47	1.2	1.0	1.1	.59	.43	.63	.18
1981	Total	735.23	95.14	65.66	14.25	5.35	6.30	26.76	93.39	92.3	83.47	105.0	85.20	62.41	650.31
	Mean	2.01	3.07	2.34	.46	.18	.20	.89	3.01	2.98	2.78	3.39	2.84	2.01	1.78
	Max.	25	20	25	1.8	.35	.66	5.9	14	13	16	12	18	20	25
	Min.	.10	.75	.47	.22	.10	.10	.10	.93	1.0	.47	1.3	1.1	.62	.10
1982	Total		55.82	89.03	50.41	14.56	41.66	244.15	130.61	139.09	123.10				1,141.04
	Mean		1.80	3.18	1.63	.49	1.34	8.14	4.21	4.49	4.10				3.13
	Max.		31	30	20	2.4	8.9	79	25	21	18				79
	Min.		.42	.34	.24	.26	.29	.31	.71	.34	1.5				.24

Table 35. Streamflow records of Gilaew Spring, Gagil-Tamil (16893300)
(Formerly published as Bileiy Spring, Gagil-Tomil)

Location: Lat 9°32'16" N., long 138°11'17" E., on right bank at Binaew, 200 ft downstream from main spring and 0.5 mile southwest of Gagil Elementary School.

Period of record: Continuous-record station April 1968 to September 1974 (discontinued). Low-flow partial-record station 1975-82.

Gage: Water-stage recorder until September 1974. Altitude is 60 ft (from topographic map).

Average discharge: 6 years, 0.129 ft^3/s (93.4 acre-ft/yr).

Remarks: Records fair. No diversion above station.

Extremes for period of continuous record: Maximum daily discharge, 1.5 ft^3/s Sept. 8, 1972; no flow for many days in 1968-69, 1973.

A. Discharge measurements, in cubic feet per second, made after the end of continuous discharge record

Date	Discharge	Date	Discharge	Date	Discharge
10- 3-74 ---	0.05	5-19-76 ---	0.42	7-21-78 ---	0.03
11- 9-74 ---	.45	8- 9-76 ---	.09	8-30-78 ---	.02
4- 2-75 ---	e/.01	10-10-76 ---	.07	10-26-78 ---	.02
4-30-75 ---	.10	12- 2-76 ---	.20	11-28-78 ---	.02
7- 8-75 ---	.18	1-20-77 ---	.07	12-28-78 ---	0
8-27-75 ---	.16	11-29-77 ---	.01	12-27-79 ---	.18
10- 7-75 ---	.10	12-29-77 ---	.03	9-16-80 ---	.40
12- 3-75 ---	.04	2- 1-78 ---	.03	10-20-80 ---	.21
1- 8-76 ---	.08	3-15-78 ---	.02	7-18-81 ---	.11
4- 1-76 ---	.05	4-12-78 ---	.01	5-6-82 ----	.02

e/ Estimated.

Table 35. Streamflow records of Gilaew Spring, Gagil-Tamil--Continued

B. Monthly and annual discharges, in cubic feet per second

Year		Calendar year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Water year
1968	Total					1.69	1.07	0	0.37	2.46	6.19				--
		--										9.85	2.18	1.33	
	Mean	--				.056	.035	0	.012	.079	.21	.32	.073	.043	--
	Max.	--				.10	.25	0	.06	.15	.46	.96	.17	.13	--
	Min.	--				.02	0	0	0	.03	.11	.08	.02	.01	--
1969	Total		.05	0	0	0	.16	.62	8.21	11.73	5.92				40.05
		41.09										4.40	5.79	4.21	
	Mean	.11	.002	0	0	0	.005	.021	.26	.38	.20	.14	.19	.14	.11
	Max.	1.4	.01	0	0	0	.03	.05	1.0	1.4	.36	.22	.38	.18	1.4
	Min.	0	0	0	0	0	0	.01	.01	.11	.09	.10	.13	.09	0
1970	Total		3.71	1.27	.56	.30	.45	.55	2.35	7.72	7.52				41.09
		39.56										7.69	4.31	3.13	
	Mean	.11	.12	.045	.018	.010	.015	.018	.076	.25	.25	.25	.14	.10	.11
	Max.	.87	.22	.09	.04	.01	.03	.09	.12	.87	.51	.64	.27	.14	.87
	Min.	.01	.06	.02	.01	.01	.01	.01	.06	.07	.13	.12	.11	.05	.01
1971	Total		2.38	2.35	3.24	2.03	4.00	7.87	12.48	3.92	6.96				60.36
		61.97										12.29	3.29	1.16	
	Mean	.17	.077	.084	.10	.068	.13	.26	.40	.13	.23	.40	.11	.037	.17
	Max.	1.3	.11	.12	.18	.08	1.0	1.3	1.2	.24	1.0	.84	.20	.05	1.3
	Min.	.02	.05	.05	.06	.04	.05	.08	.15	.05	.05	.18	.04	.02	.04
1972	Total		2.90	3.09	10.80	2.85	1.33	.97	2.43	5.97	19.25				66.33
		56.63										4.01	1.87	1.16	
	Mean	.15	.094	.11	.35	.095	.043	.032	.078	.19	.64	.13	.062	.037	.18
	Max.	1.5	20	.70	.80	.19	.07	.06	.17	.51	1.5	.22	.08	.06	1.5
	Min.	.02	.03	.03	.19	.06	.03	.02	.04	.08	.07	.08	.04	.03	.02
1973	Total		.63	.10	0	0	0	0	.01	0	5.15				12.93
		24.87										10.63	5.25	3.10	
	Mean	.068	.020	.004	0	0	0	0	.0003	0	.17	.34	.18	.10	.035
	Max.	.96	.03	.01	0	0	0	0	.01	0	.68	.96	.42	.30	.68
	Min.	0	.01	0	0	0	0	0	0	0	0	.08	.09	.05	0
1974	Total		8.20	1.89	1.11	2.16	4.17	9.52	6.75	8.99	1.73				63.50
		--													
	Mean	--	.26	.068	.036	.072	.13	.32	.22	.29	.058				.17
	Max.	--	.72	.17	.19	.27	.57	1.0	.50	1.1	.08				1.1
	Min.	--	.09	.01	.01	.01	.02	.16	.10	.09	.04				.01

Table 36. Streamflow records of Eyeb Stream, Gagil-Tamil (16893400)

Location: Lat 9°33'11" N., long 138°09'14" E., 0.6 mi southeast of Tagireeng Canal bridge and 1.1 mi northwest of U.S. Coast Guard LORAN station.

Drainage area: 0.22 mi^2.

Period of record: Occasional low-flow measurements water years 1980-81. Continuous record January to September 1982.

Gage: Water-stage recorder and concrete control. Altitude of gage is 15 ft (from topographic map).

Remarks: Records good. No diversion above station.

Extremes for period of record: Maximum discharge, 490 ft^3/s June 21, 1982 (gage height, 6.22 ft), from rating curve extended above 14 ft^3/s on basis of estimate of peak flow; minimum discharge, 0.12 ft^3/s May 8, 9, 14, 15, 1982.

A. Discharge measurements, in cubic feet per second, made outside the period of continuous discharge record

Date	Discharge	Date	Discharge
9-19-80	1.9	7-18-81	2.2
10-20-80	4.6	10-18-82	.97
3-24-81	.20	11-10-82	.77
4- 7-81	19	11-24-82	.58
4-27-81	.04	12-9-82	2.4
5-14-81	.07	12-28-82	.47

Table 36. Streamflow records of Eyeb Stream, Gagil-Tamil--Continued

B. Monthly discharge, in cubic feet per second

Year		Jan.	Feb.	Mar.	Apr.	May
1982	Total	49.71	79.90	37.11	11.44	21.79
	Mean	1.60	2.85	1.20	.38	.70
	Max.	26	23	8.3	1.2	4.4
	Min.	.41	.69	.36	.19	.15

Year		June	July	Aug.	Sept.
1982	Total	291.17	122.77	95.70	80.37
	Mean	9.71	3.96	3.09	2.68
	Max.	130	27	20	15
	Min.	.27	.97	.51	.83

Peak discharges above base (150 ft^3/s): Feb. 6 (0830) 207 ft^3/s (4.66 ft); June 21 (0430) 490 ft^3/s (6.22 ft); Aug. 16 (0900) 153 ft^3/s (4.14 ft).

Low-flow partial-record stations

Table 37. Discharge measurements, in cubic feet per second, of Faraq Swamp outlets, Yap (16892450)

Location: Lat 9°29'08" N., long 138°04'24" E., and lat 9°29'15" N., long 138°04'21" E., 0.9 mi northwest of Lamear and 4.1 mi southwest of Colonia, at altitude 5 ft (from topographic map).

Drainage area: 0.29 mi^2.

Period of record: 1968-73.

Date	Discharge	Date	Discharge	Date	Discharge
10- 9-67 ---	0.25	11-25-70 ---	0.22	10-20-71 ---	0.08
9-25-68 ---	.58	12-18-70 ---	.25	2-24-72 ---	.76
9-20-69 ---	.48	11-12-70 ---	.12	3-23-72 ---	.12
10-16-69 ---	.26	1- 5-71 ---	.03	4-20-72 ---	.04
6- 4-70 ---	.07	7- 1-71 ---	.09	7-16-72 ---	.04
7-30-70 ---	.30	7- 7-71 ---	.20	8-10-72 ---	.16
9- 1-70 ---	4.4	7-20-71 ---	.24	9-20-72 ---	.30
10- 5-70 ---	.49	7-27-71 ---	.08	10-12-72 ---	.06
10-30-70 ---	.14	8- 4-71 ---	.04		

Table 38. Discharge measurements, in cubic feet per second, of Galngun Swamp outlet, Yap (16892460)

Location: Lat 9°29'04" N., long 138°04'40" E., 0.5 mi northwest of Lamear and 3.9 mi southwest of Colonia, at altitude 30 ft (from topographic map).

Drainage area: 0.16 mi^2.

Period of record: 1968-73.

Date	Discharge	Date	Discharge	Date	Discharge
10- 9-67 ---	0.23	11-13-70 ---	0.25	10-20-71 ---	0.16
9-25-68 ---	.50	11-25-70 ---	.34	1-13-72 ---	.26
10-15-68 ---	1.2	12-22-70 ---	.23	2-24-72 ---	.25
9-20-69 ---	.40	1- 5-71 ---	.14	3-23-72 ---	.29
7-14-70 ---	.15	1-28-71 ---	.30	4-20-72 ---	.17
7-30-70 ---	.24	6-30-71 ---	.05	5-18-72 ---	.16
9- 1-70 ---	2.8	7- 7-71 ---	.35	7-15-72 ---	.20
9-18-70 ---	.15	7-20-71 ---	.42	8-10-72 ---	.21
10- 5-70 ---	.23	7-27-71 ---	.31	9-19-72 ---	.50
10-29-70 ---	.40	8- 4-71 ---	.17	10-12-72 ---	.23

Table 39. Discharge measurements, in cubic feet per second, of Tamaney Stream, Yap (16892500)

Location: Lat 9°29'49" N., long 138°05'52" E., at abandoned German dam, 0.2 mi upstream from mouth and 1.1 mi southwest of U.S. Weather Bureau Station at airport, at altitude 30 ft (from topographic map).

Drainage area: 0.17 mi^2.

Period of record: 1968-82.

Date	Discharge	Date	Discharge	Date	Discharge	Date	Discharge
8-22-68	0.97	12-22-70	0.04	5-24-74	1.6	12-30-77	0
9- 4-68	.53	1- 5-71	.13	6-14-74	.25	2- 1-78	.05
10-17-68	3.2	1-27-71	.04	7-14-74	.26	3-16-78	0
9-19-69	.45	6-30-71	1.1	9-13-74	.27	6-29-78	.09
9-30-69	.38	7- 7-71	.07	4- 4-75	0	7-25-78	0
10-14-69	.15	7-20-71	.06	5- 2-75	.25	8-31-78	.07
11- 6-69	.24	7-27-71	.03	6-20-75	1.6	10-30-78	.10
11-20-69	.06	8- 4-71	.06	7-15-75	.52	11-30-78	.10
3-11-70	0	9-17-71	.07	8-29-75	.23	12-28-78	0
3-24-70	0	10-20-71	.74	10- 9-75	.14	6-29-79	.81
4- 7-70	0	1-13-72	.06	12- 5-75	.12	8-21-79	.05
4-29-70	0	2-24-72	11	1- 9-76	.04	12-27-79	.16
5-12-70	.39	3-23-72	.04	2-18-76	e/.01	2- 1-80	0
7-14-70	.07	4-20-72	.08	4- 2-76	.32	9-17-80	1.4
7-30-70	.39	7-15-72	.06	5-21-76	.15	10-20-80	1.1
9- 2-70	3.8	8-10-72	.08	7- 6-76	.09	7-17-81	.46
9-22-70	.38	9-20-72	.09	8-11-76	.74	5- 5-82	.05
10- 6-70	.10	10-12-72	.02	10-10-76	0	6-17-82	.52
10-29-70	.07	2-19-74	.18	12- 3-76	.23		
11-13-70	.14	3-11-74	.20	1-21-77	.26		
11-25-70	.38	4-21-74	1.9	11-30-77	.07		

e/ Estimated.

Table 40. Discharge measurements, in cubic feet per second, of Ripu Stream, Yap (16892600)

Location: Lat 9°30'10" N., long 138°06'24" E., 300 ft upstream from mouth and 0.3 mi southwest of Gitaem water-treatment plant at altitude 10 ft (from topographic map).

Drainage area: 0.29 mi^2.

Period of record: 1968-82.

Date	Discharge	Date	Discharge	Date	Discharge	Date	Discharge
3- 7-68	0.63	9-22-70	0.21	9-20-72	0.16	8-11-76	0.86
7-29-68	3.5	10- 7-70	.16	10-12-72	.04	10-10-76	0
8- 8-68	.88	10-30-70	.06	7-16-73	.10	12- 3-76	.43
9- 4-68	.61	11-13-70	.16	2-17-74	.39	1-21-77	.16
9-17-68	.07	11-27-70	.62	3-11-74	.20	11-30-77	.08
10-17-68	3.3	12-22-70	.09	4-21-74	1.8	12-30-77	0
12- 6-68	.25	1- 5-71	.06	5-23-74	1.7	2- 1-78	.01
6-14-69	.50	1-26-71	.12	6-14-74	.19	3-16-78	0
6-28-69	.15	6-30-71	.09	7-14-74	.20	6-29-78	.09
9-19-69	.43	7- 6-71	.10	9-13-74	.21	7-25-78	.01
9-29-69	3.8	7-20-71	.07	4- 4-75	0	8-31-78	.13
10-16-69	.19	7-27-71	.13	5- 2-75	.22	10-30-78	.11
11- 4-69	.15	8- 3-71	.08	6-20-75	1.6	11-30-78	.11
11-20-69	.07	9-17-71	.40	7-15-75	.85	12-28-78	0
3-11-70	0	10-20-71	.57	8-29-75	.33	6-29-79	1.2
3-24-70	0	12- 3-71	.04	10- 9-75	.17	8-21-79	.14
4- 7-70	0	1-13-72	.11	12- 5-75	.93	12-27-79	.09
4-29-70	0	3-23-72	.34	1- 9-76	.07	9-17-80	1.5
5-26-70	0	4-20-72	.09	2-18-76	e/.01	10-21-80	.62
7-14-70	.10	5-18-72	.004	4- 2-76	.84	7-17-81	.43
7-31-70	.05	7-15-72	.08	5-21-76	.12	5- 5-82	.03
9- 2-70	3.3	8-10-72	.22	7- 2-76	.09	6-17-82	.73

e/ Estimated.

Table 41. Discharge measurements, in cubic feet per second, of Dinaey Stream, Yap (16892650)

Location: Lat 9°30'32" N., long 138°06'15" E., at upper Gitaem Reservoir, 0.4 mi northwest of water-treatment plant and 1.5 mi southwest of Colonia, at altitude 75 ft (from topographic map).

Drainage area: 0.04 mi^2.

Period of record: 1980-82.

Date	Discharge
9-18-80	0.14
10-21-80	.19
3-25-81	0
4- 8-81	0
7-17-81	.06
5- 5-82	.01 (estimated)
6-17-82	.08

Table 42. Discharge measurements, in cubic feet per second, of Tholomar Stream, Yap (16892700)

Location: Lat 9°30'34" N., long 138°06'21" E., 5 ft upstream from confluence with Dinaey Stream and 1.4 mi southwest of Colonia, at altitude 70 ft (from topographic map). Site covered by water from new Gitaem dam since 1975. Reestablished in 1980 as station 16892680 at site 800 ft upstream, at lat 9°30'37" N., long 138°06'18" E., drainage area 0.10 mi^2, and altitude 75 ft (from topographic map).

Drainage area: 0.13 mi^2.

Period of record: 1965, 1968-74, 1980-82.

Date	Discharge	Date	Discharge	Date	Discharge	Date	Discharge
9-23-65	0.29	4-29-70	0	7- 6-71	0.15	2-17-74	0.27
3-23-68	.04	7-14-70	.08	7-20-71	.10	3-11-74	.23
8- 8-68	1.0	7-30-70	.74	7-21-71	.15	4-21-74	2.6
9- 4-68	1.2	9- 2-70	3.8	8- 3-71	.40		
10-17-68	5.6	9-23-70	.26	10-21-71	.27	9-18-80	.43
6-14-69	.36	10- 6-70	.28	1-13-72	.11	10-21-80	.32
6-27-69	.12	10-29-70	.11	4-20-72	.09	3-25-81	0
9-19-69	.52	11-13-70	.22	5-18-72	.01	4- 8-81	0
9-30-69	.64	11-27-70	.70	7-15-72	.06	7-23-81	.07
10-14-69	.32	12-22-70	.16	8-11-72	.21	5- 5-82	[1] .01
11- 4-69	.25	1- 6-71	.18	9-20-72	.14	6-17-82	.22
3-24-70	0	1-27-71	.10	10-13-72	.03		
4- 8-70	0	7- 1-71	1.0	1-11-73	.02		

[1] Estimated.

Table 43. Discharge measurements, in cubic feet per second, of Mabuuq Stream, Yap (16893050)

Location: Lat 9°31'14" N., long 138°07'00" E., at Mabuuq, 0.4 mi upstream from mouth and 0.9 mi northwest of Ganiir bridge in Colonia, at altitude 45 ft (from topographic map).

Drainage area: 0.30 mi^2.

Period of record: 1968-72.

Date	Discharge	Date	Discharge	Date	Discharge
9-26-68 ---	0.14	5-26-70 ---	0	7- 1-71 ---	0.59
10-16-68 ---	27	7-14-70 ---	.03	7- 6-71 ---	.20
6-14-69 ---	.20	7-30-70 ---	.08	7-19-71 ---	.22
9-18-69 ---	.14	9- 2-70 ---	7.2	8- 3-71 ---	.58
10- 8-69 ---	.14	9-24-70 ---	1.6	10-21-71 ---	.11
11- 4-69 ---	.37	10- 7-70 ---	.12	1-14-72 ---	.08
11-20-69 ---	.11	10-29-70 ---	.36	3-25-72 ---	.17
1-21-70 ---	.42	11-13-70 ---	.16	4-21-72 ---	.01
3-11-70 ---	0	11-27-70 ---	.60	6-16-72 ---	.51
4- 8-70 ---	0	12-22-70 ---	.18	8-11-72 ---	.16
4-29-70 ---	0	1- 6-71 ---	.07	9-20-72 ---	.13

Table 44. Discharge measurements, in cubic feet per second, of Monguch Stream, Gagil-Tamil (16893180)

Location: Lat 9°31'59" N., long 138°09'57" E., 0.7 mi northeast of Tamilang Elementary School and 1.0 mi south of Coast Guard LORAN station, at altitude 20 ft (from topographic map).

Drainage area: 0.18 mi^2.

Period of record: 1979-82.

Date	Discharge	Date	Discharge
5- 3-79	a/0.02	10-20-80	2.0
5- 5-79	a/.03	3-24-81	.16
5- 7-79	a/.02	4- 7-81	.08
5-11-79	a/.35	4-27-81	.26
5-15-79	a/.30	5-14-81	.12
5-29-79	a/.08	7-22-81	1.6
5-30-79	a/.06	5-6-82	b/.08
6- 4-79	a/.05	6-15-82	b/.20
7-25-79	a/.43	9-16-82	1.3
9-16-80	1.3		

a/ Measurements from Lyon Associates, 1980, made by V-notch weir and reported in gallons per minute.

b/ Measurements made near mouth at lat 9°32'03" N., long 138°10'09" E., altitude 5 ft:

5-6-82 ---------- 0.24 ft^3/s

6-15-82 ---------- .48 ft^3/s

Table 45. Discharge measurements, in cubic feet per second, of Gilaew Stream, Gagil-Tamil (16893310)

Location: Lat 9°32'12" N., long 138°11'29" E., at road culvert, 0.3 mile downstream from Gilaew Spring, 0.4 mi upstream from mouth, and 0.45 mi south of Gagil Elementary School, at altitude 15 ft (from topographic map).

Drainage area: 0.15 mi^2.

Period of record: 1968-80.

Date	Discharge	Date	Discharge	Date	Discharge	Date	Discharge
3-20-68	0.12	11-12-70	0.45	7-11-43	e/0.02	1- 8-76	0.19
8-19-68	.27	11-25-70	.54	3- 7-74	.13	2-18-76	.10
10- 4-68	.10	12-28-70	.14	4-19-74	.16	4- 1-76	.11
10-23-68	.25	1- 6-71	.15	5- 7-74	.16	5-19-76	1.7
10-31-68	.24	6-30-71	1.1	5-17-74	.24	7- 7-76	.42
11-19-68	.16	7- 8-71	.27	6- 5-74	.78	8- 9-76	.71
12- 3-68	.31	7-19-71	.33	7-10-74	.46	10-10-76	.41
1- 7-69	.10	7-27-71	.73	8-16-74	1.2	12- 2-76	.26
2-10-69	0	8- 3-71	.30	9-12-74	.27	1-20-77	.10
6-13-69	e/.02	10-19-71	.17	10- 3-74	.32	11-29-77	.13
9-19-69	.36	1-14-72	.24	11- 9-74	1.4	12-29-77	.13
9-29-69	.46	2-24-72	.17	12- 3-74	.69	2- 1-78	.07
11- 6-69	.88	3-23-72	.42	1- 2-75	.40	3-15-78	.06
11-18-69	.32	4-21-72	.10	2-13-75	.36	4-12-78	.02
1-14-70	.24	5-18-72	.06	4- 2-75	.06	6-28-78	.05
1-29-70	.20	6-16-72	.08	4-30-75	.29	7-21-78	.13
8-31-70	1.2	7-15-72	.13	5-20-75	.19	8-30-78	.11
9-15-70	.15	8-10-72	.48	7- 8-75	.80	10-26-78	.06
9-29-70	.19	9-18-72	2.0	8-27-75	.36	11-28-78	.14
10- 5-70	.35	10-12-72	.39	10- 7-75	.64	12-27-78	.30
10-30-70	.38	1- 9-73	.04	12- 3-75	.20	12-27-79	.18

e/ Estimated.

Table 46. Discharge measurements, in cubic feet per second, of Yanbilang Stream, Gagil-Tamil (16893350)

Location: Lat 9°32'45" N., long 138°11'48" E., 250 ft upstream from mouth and 0.3 mi northeast of Gagil School, at altitude 5 ft (from topographic map).

Drainage area: 0.03 mi^2.

Period of record: 1968-72.

Date	Discharge	Date	Discharge	Date	Discharge
10-10-67 ---	0.04	3-23-70 ---	0	12-24-70 ---	0.02
10-14-68 ---	1.6	4- 6-70 ---	0	1- 6-71 ---	.21
11-19-68 ---	0	4-21-70 ---	0	1-26-71 ---	.01
12- 3-68 ---	.51	5-11-70 ---	0	6-30-71 ---	.85
1- 7-69 ---	0	8-31-70 ---	.71	7- 8-71 ---	.28
2-10-69 ---	0	9-29-70 ---	.07	7-19-71 ---	.05
4-18-69 ---	0	10- 7-70 ---	.04	7-27-71 ---	.80
6-13-69 ---	e/.01	10-30-70 ---	.09	8- 3-71 ---	.12
10-15-69 ---	.02	11-12-70 ---	.12	10-19-71 ---	.38
11- 6-69 ---	.12	11-25-70 ---	.05	2-25-72 ---	.71

e/ Estimated.

Table 47. Discharge measurements, in cubic feet per second, of Qamin Stream, Maap (16893500)

Location: Lat 9°35'57" N., long 138°10'15" E., 0.25 mi southeast of Qamin and 0.8 mile upstream from mouth at altitude 45 ft (from topographic map).

Drainage area: 0.19 mi^2.

Period of record: 1980-81.

Date	Discharge
9-19-80	0.49
10-20-80	1.2
3-24-81	.03
4- 8-81	0
7-18-81	.28

Miscellaneous measurements

Table 48. Discharge measurements, in cubic feet per second, made at miscellaneous sites

Stream	Tributary to	Location	Measurement Date	Measurement Discharge
Dalibaech Stream, Yap	Pacific Ocean	Lat 9°30'32" N., long 138°06'21" E., at inflow to reservoir, 20 ft below confluence of Tholomar and Dinaey Streams, and 1.4 mi southwest of Colonia (Confluence covered by water from new Gitaem dam since 1975).	9-21-65	0.19
			9-23-65	.46
Dorfay Stream, Gagil-Tamil (16893190)	Mukong Stream	Lat 9°32'08" N., long 138°10'13" E., at altitude 10 ft, 0.2 mi upstream from mouth and 0.9 mi northeast of Tamilang School.	7-22-81	.93
			5-6-82	.12
			6-15-82	.22
			9-16-82	.82

Table 49. Chemical analyses of water from Qatliw (Atelu) Stream, Yap

Constituents	Unit	9-20-80	7-21-81	9-14-82
Time	--	1230	1200	0930
Discharge, instantaneous	ft^3/s	0.18	1.0	8.4
Specific conductance	µmho	125	83	70
pH	--	7.4	7.9	7.6
Temperature, water	°C	26.5	26.0	26.0
Turbidity	NTU	5.4	--	--
Oxygen, dissolved	mg/L	7.0	7.8	--
Hardness as $CaCO_3$	mg/L	47	35	32
Noncarbonate hardness	mg/L	0	--	5
Calcium, dissolved (Ca)	mg/L	5.6	5.1	4.6
Magnesium, dissolved (Mg)	mg/L	8.1	5.5	4.9
Sodium, dissolved (Na)	mg/L	6.8	6.2	5.3
Percent sodium	percent	24	28	27
Sodium adsorption ratio	--	.4	.5	.5
Potassium, dissolved (K)	mg/L	.3	.1	.2
Alkalinity, total as $CaCO_3$	mg/L	51	24	27
Sulfate, dissolved (SO_4)	mg/L	.7	3.9	--
Chloride, dissolved (Cl)	mg/L	11	12	9.5
Fluoride, dissolved (F)	mg/L	0	0	< .1
Silica, dissolved (SiO_2)	mg/L	23	20	16
Solids, dissolved, sum of constituents	mg/L	86	67	68
Solids, dissolved, ton per acre foot	ton/ac-ft	.12	--	--
Nitrite plus nitrate, as dissolved N	mg/L	.03	.05	< .1
Iron, dissolved (Fe)	µg/L	360	270	350
Manganese, dissolved (Mn)	µg/L	6	9	6

Table 50. Chemical analyses of water from Qaringeel (Aringel) Stream, Yap

Constituent	Unit	4-6-79	1-31-80	9-15-80	7-16-81	9-14-82
Time	--	1530	0900	1430	0920	1230
Discharge, instantaneous	ft^3/s	1/ 0	1/ 0	0.47	0.17	20
Specific conductance	µmho	260	220	95	68	45
pH	--	7.2	6.8	7.8	7.7	7.2
Temperature, water	°C	27.5	24.5	27.0	24.5	26.0
Turbidity	NTU	--	--	9.3	--	--
Oxygen, dissolved	mg/L	2.8	5.0	7.3	7.9	--
Hardness as $CaCO_3$	mg/L	91	74	34	28	20
Noncarbonate hardness	mg/L	10	8	0	7	0
Calcium, dissolved (Ca)	mg/L	10	8.0	4.0	3.8	3.6
Magnesium, dissolved (Mg)	mg/L	16	13	5.9	4.5	3.0
Sodium, dissolved (Na)	mg/L	13	17	5.1	4.3	3.7
Percent sodium	percent	23	33	24	25	29
Sodium adsorption ratio	--	.6	.9	.4	.4	.4
Potassium, dissolved (K)	mg/L	1.2	.6	.2	.1	.2
Alkalinity, total as $CaCO_3$	mg/L	81	66	36	21	20
Sulfate, dissolved (SO_4)	mg/L	3.3	2.9	.3	2.2	--
Chloride, dissolved (Cl)	mg/L	25	23	7.7	6.2	6.0
Fluoride, dissolved (F)	mg/L	.1	0	0	0	< .1
Silica, dissolved (SiO_2)	mg/L	35	25	19	18	9.5
Solids, dissolved, sum of constituents	mg/L	153	147	64	52	48
Solids, dissolved, ton per acre foot	ton/ac-ft	.21	< .20	.09	--	--
Nitrite plus nitrate, as dissolved N	mg/L	0	3.9	0	.03	< .1
Iron, dissolved (Fe)	µg/L	170	90	190	190	190
Manganese, dissolved (Mn)	µg/L	16	3	7	5	5

1/ Water sample taken from gage pool.

Table 51. Chemical analyses of water from Daloelaeb (Dalolab) Stream, Yap

Constituent	Unit	1-31-80	9-17-80	7-16-81	9-15-82
Time	--	1015	1400	1035	1300
Discharge, instantaneous	ft^3/s	1/ 0	0.56	0.03	0.09
Specific conductance	µmho	210	112	99	--
pH	--	7.0	7.6	7.2	6.9
Temperature, water	°C	25.5	26.0	25.5	27.5
Turbidity	NTU	--	30	--	--
Oxygen, dissolved	mg/L	1.6	7.5	3.8	--
Hardness as $CaCO_3$	mg/L	81	39	38	43
Noncarbonate hardness	mg/L	1	5	9	3
Calcium, dissolved (Ca)	mg/L	9.2	4.7	4.5	5.9
Magnesium, dissolved (Mg)	mg/L	14	6.7	6.6	6.9
Sodium, dissolved (Na)	mg/L	10	6.1	7.0	6.1
Percent sodium	percent	21	25	28	23
Sodium adsorption ratio	--	.5	.4	.5	.5
Potassium, dissolved (K)	mg/L	.2	.3	.1	.1
Alkalinity, total as $CaCO_3$	mg/L	80	34	29	40
Sulfate, dissolved (SO_4)	mg/L	.7	1.3	2.6	--
Chloride, dissolved (Cl)	mg/L	16	13	20	10
Fluoride, dissolved (F)	mg/L	0	0	0	< .1
Silica, dissolved (SiO_2)	mg/L	28	16	19	18
Solids, dissolved, sum of constituents	mg/L	127	69	78	81
Solids, dissolved, ton per acre foot	ton/ac-ft	.17	.09	--	--
Nitrite plus nitrate, as dissolved N	mg/L	.13	.11	.04	< .1
Iron, dissolved (Fe)	µg/L	150	370	170	260
Manganese, dissolved (Mn)	µg/L	20	10	7	6

1/ Water sample taken from gage pool.

Table 52. Chemical analyses of water from Peemgoy (Pemgoy) Stream, Yap

Constituent	Unit	4-7-79	2-1-80	9-17-80	7-16-81	9-15-82
Time	--	1100	0915	1000	1235	0930
Discharge, instantaneous	ft^3/s	0.01	0.01	0.27	0.08	0.68
Specific conductance	µmho	370	345	118	100	--
pH	--	7.5	7.5	7.5	7.6	7.4
Temperature, water	°C	26.5	25.5	26.5	25.5	26.0
Turbidity	NTU	--	--	8.4	--	--
Oxygen, dissolved	mg/L	3.2	4.6	7.9	6.0	--
Hardness as $CaCO_3$	mg/L	170	140	41	38	33
Noncarbonate hardness	mg/L	0	0	0	9	13
Calcium, dissolved (Ca)	mg/L	17	15	5.2	4.3	4.0
Magnesium, dissolved (Mg)	mg/L	30	25	6.9	6.5	5.7
Sodium, dissolved (Na)	mg/L	14	13	6.3	6.8	5.6
Percent sodium	percent	15	17	25	28	27
Sodium adsorption ratio	--	.5	.5	.4	.5	.5
Potassium, dissolved (K)	mg/L	.4	.5	.4	.1	.1
Alkalinity, total as $CaCO_3$	mg/L	170	150	54	29	20
Sulfate, dissolved (SO_4)	mg/L	3.3	.4	.2	2.0	10
Chloride, dissolved (Cl)	mg/L	12	14	10	17	8.7
Fluoride, dissolved (F)	mg/L	.1	0	0	0	< .1
Silica, dissolved (SiO_2)	mg/L	61	51	18	22	20
Solids, dissolved, sum of constituents	mg/L	241	210	79	77	69
Solids, dissolved, ton per acre foot	ton/ac-ft	.33	.29	.11	--	--
Nitrite plus nitrate, as dissolved N	mg/L	.11	.29	0	.08	.47
Iron, dissolved (Fe)	µg/L	130	260	150	130	350
Manganese, dissolved (Mn)	µg/L	50	30	10	4	5

Table 53. Chemical analyses of water from Taalgum (Talagu) Stream, Yap

Constituent	Unit	2-1-80	9-17-80	9-15-82
Time	--	0830	1100	1000
Discharge, instantaneous	ft^3/s	0 [1/]	0.56	0.25
Specific conductance	µmho	134	112	--
pH	--	6.6	7.1	7.0
Temperature, water	°C	25.5	26.5	26.0
Turbidity	NTU	--	6.9	--
Oxygen, dissolved	mg/L	1.6	7.4	--
Hardness as $CaCO_3$	mg/L	46	40	35
Noncarbonate hardness	mg/L	3	0	6
Calcium, dissolved (Ca)	mg/L	5.4	4.4	5.3
Magnesium, dissolved (Mg)	mg/L	7.8	7.0	5.4
Sodium, dissolved (Na)	mg/L	7.0	5.8	5.2
Percent sodium	percent	25	24	24
Sodium adsorption ratio	--	.5	.4	.4
Potassium, dissolved (K)	mg/L	.1	.4	.1
Alkalinity, total as $CaCO_3$	mg/L	43	43	29
Sulfate, dissolved (SO_4)	mg/L	.3	.6	--
Chloride, dissolved (Cl)	mg/L	14	11	8.5
Fluoride, dissolved (F)	mg/L	0	0	< .1
Silica, dissolved (SiO_2)	mg/L	21	20	17
Solids, dissolved, sum of 69 constituents	mg/L	82	75	69
Solids, dissolved, ton per acre foot	ton/ac-ft	.11	.10	--
Nitrite plus nitrate, as dissolved N	mg/L	.16	.01	< .1
Iron, dissolved (Fe)	µg/L	30	140	270
Manganese, dissolved (Mn)	µg/L	4	10	6

[1/] Water sample taken from gage pool.

Table 54. Chemical analyses of water from Burong Stream, Yap

Constituent	Unit	2-1-80	9-18-80	7-17-81	9-17-82
Time	--	1645	1030	1520	0830
Discharge, instantaneous	ft^3/s	1/ 0	2.0	1.3	0.14
Specific conductance	µmho	154	105	92	101
pH	--	7.0	7.1	7.3	7.0
Temperature, water	°C	26.5	26.0	26.0	26.5
Turbidity	NTU	--	26	--	--
Oxygen, dissolved	mg/L	--	7.4	6.5	--
Hardness as $CaCO_3$	mg/L	55	39	37	43
Noncarbonate hardness	mg/L	3	0	7	3
Calcium, dissolved (Ca)	mg/L	8.0	5.2	5.1	5.8
Magnesium, dissolved (Mg)	mg/L	8.4	6.2	6.0	7.0
Sodium, dissolved (Na)	mg/L	7.3	5.6	6.3	5.4
Percent sodium	percent	22	24	27	21
Sodium adsorption ratio	--	.4	.4	.4	.4
Potassium, dissolved (K)	mg/L	.5	.3	.1	.1
Alkalinity, total as $CaCO_3$	mg/L	52	43	30	40
Sulfate, dissolved (SO_4)	mg/L	.4	1.1	3.1	< 5
Chloride, dissolved (Cl)	mg/L	13	8.2	9.0	8.1
Fluoride, dissolved (F)	mg/L	0	0	0	< .1
Silica, dissolved (SiO_2)	mg/L	20	--	21	21
Solids, dissolved, sum of constituents	mg/L	94	60	69	--
Solids, dissolved, ton per acre foot	ton/ac-ft	.13	.08	--	--
Nitrite plus nitrate, as dissolved N	mg/L	1.2	.36	.03	.21
Iron, dissolved (Fe)	µg/L	60	380	260	81
Manganese, dissolved (Mn)	µg/L	20	10	6	16

1/ Water sample taken from gage pool.

Table 55. Chemical analyses of water from Mukong Stream, Gagil-Tamil

Constituent	Unit	4-7-79	2-1-80	9-16-80	7-19-81	9-16-82
Time	--	1400	1510	0930	1000	1200
Discharge, instantaneous	ft^3s	0.09	0.33	2.5	1.7	2.7
Specific conductance	µmho	94	81	72	53	59
pH	--	6.9	6.7	6.8	6.5	6.8
Temperature, water	°C	27.5	28.5	26.5	26.0	27.5
Turbidity	NTU	--	--	3.6	--	--
Oxygen, dissolved	mg/L	5.4	5.6	6.3	--	--
Hardness as $CaCO_3$	mg/L	32	25	29	15	23
Noncarbonate hardness	mg/L	0	0	0	1	0
Calcium, dissolved (Ca)	mg/L	5.1	4.1	4.2	2.2	4.0
Magnesium, dissolved (Mg)	mg/L	4.6	3.6	4.4	2.4	3.1
Sodium, dissolved (Na)	mg/L	6.3	5.2	4.6	4.0	3.8
Percent sodium	percent	30	31	26	36	27
Sodium adsorption ratio	--	.5	.5	.4	.4	.4
Potassium, dissolved (K)	mg/L	.1	.1	.3	.1	.1
Alkalinity, total as $CaCO_3$	mg/L	35	30	28	14	27
Sulfate, dissolved (SO_4)	mg/L	2.2	.4	4.0	1.2	< 5
Chloride, dissolved (Cl)	mg/L	7.9	6.6	6.1	5.6	5.3
Fluoride, dissolved (F)	mg/L	.1	0	.1	--	< .1
Silica, dissolved (SiO_2)	mg/L	11	9.3	9.3	8.6	7.6
Solids, dissolved, sum of constituents	mg/L	59	48	50	33	--
Solids, dissolved, ton per acre foot	ton/ac-ft	.08	.07	.07	--	--
Nitrite plus nitrate, as dissolved N	mg/L	.01	.06	.23	.02	< .1
Iron, dissolved (Fe)	µg/L	140	290	950	100	430
Manganese, dissolved (Mn)	µg/L	80	560	200	90	100

Table 56. Chemical analyses of water from Eyeb Stream, Gagil-Tamil

Constituent	Unit	9-16-80	7-18-81	9-16-82
Time	--	1130	1010	0915
Discharge, instantaneous	ft^3s	1.9	2.2	2.5
Specific conductance	µmho	69	36	41
pH	--	6.8	6.8	6.9
Temperature, water	°C	26.5	26.0	26.5
Turbidity	NTU	1.4	--	--
Oxygen, dissolved	mg/L	6.9	7.2	--
Hardness as $CaCO_3$	mg/L	21	10	13
Noncarbonate hardness	mg/L	5	0	0
Calcium, dissolved (Ca)	mg/L	5.6	2.1	2.7
Magnesium, dissolved (Mg)	mg/L	1.7	1.2	1.4
Sodium, dissolved (Na)	mg/L	4.1	4.0	3.6
Percent sodium	percent	29	46	38
Sodium adsorption ratio	--	.4	.5	.5
Potassium, dissolved (K)	mg/L	.3	.1	.1
Alkalinity, total as $CaCO_3$	mg/L	16	12	16
Sulfate, dissolved (SO_4)	mg/L	6.9	.6	< 5
Chloride, dissolved (Cl)	mg/L	6.0	5.2	5.3
Fluoride, dissolved (F)	mg/L	0	0	< .1
Silica, dissolved (SiO_2)	mg/L	7.2	7.6	6.0
Solids, dissolved, sum of constituents	mg/L	44	28	--
Solids, dissolved, ton per acre foot	ton/ac-ft	.06	--	--
Nitrite plus nitrate, as dissolved N	mg/L	.43	.02	< .1
Iron, dissolved (Fe)	µg/L	390	160	120
Manganese, dissolved (Mn)	µg/L	40	20	9

Table 57. Chemical analyses of water from low-flow partial-record stations on Yap

Constituent	Unit	Tamaney Stream		Ripu Stream		Dinaey Stream		Tholomar Stream	
		9-17-80	7-17-81	9-17-80	7-17-81	9-18-80	7-17-81	9-18-80	7-23-81
Time	--	1630	0945	1530	1045	1630	1135	1500	0920
Discharge, instantaneous	ft^3/s	1.4	0.47	1.5	0.43	0.14	0.06	0.43	0.08
Specific conductance	µmho	138	161	112	152	92	81	130	116
pH	--	7.3	7.9	7.4	8.1	7.2	7.3	7.1	7.3
Temperature, water	°C	27.0	26.5	27.0	26.5	26.0	26.0	26.5	26.5
Turbidity	NTU	12	--	19	--	22	--	27	--
Oxygen, dissolved	mg/L	6.4	7.4	7.7	7.2	7.5	6.5	7.6	6.5
Hardness as $CaCO_3$	mg/L	62	72	48	67	35	31	44	47
Noncarbonate hardness	mg/L	0	4	0	14	2	3	0	3
Calcium, dissolved (Ca)	mg/L	13	15	6.9	11	4.1	3.2	6.4	6.5
Magnesium, dissolved (Mg)	mg/L	7.2	8.3	7.4	9.6	6.1	5.5	6.9	7.5
Sodium, dissolved (Na)	mg/L	4.3	5.3	5.2	7.7	4.8	5.7	6.2	6.9
Percent sodium	percent	13	14	19	20	23	29	23	24
Sodium adsorption ratio	--	.2	.3	.3	.4	.4	.4	.4	.4
Potassium, dissolved (K)	mg/L	.1	.1	.4	.1	.2	.3	.3	.2
Alkalinity, total as $CaCO_3$	mg/L	66	68	51	53	33	28	50	44
Sulfate, dissolved (SO_4)	mg/L	.6	1.3	.9	1.9	.9	2.0	.2	2.0
Chloride, dissolved (Cl)	mg/L	5.4	5.5	6.7	20	6.7	7.6	8.7	10
Fluoride, dissolved (F)	mg/L	0	0	0	0	.1	0	0	0
Silica, dissolved (SiO_2)	mg/L	18	16	20	22	20	20	19	22
Solids, dissolved, sum of constituents	mg/L	89	93	79	104	64	61	78	82
Solids, dissolved, ton per acre foot	ton/ac-ft	.12	--	.11	--	.09	--	.11	--
Nitrite plus nitrate, as dissolved N	mg/L	.12	.03	.22	.03	.07	.02	.07	.04
Iron, dissolved (Fe)	µg/L	330	160	250	150	450	100	240	140
Manganese, dissolved (Mn)	µg/L	20	40	20	20	30	9	10	10

Table 58. Chemical analyses of water at low-flow partial-record stations and miscellaneous site on Gagil-Tamil and Maap

Constituent	Unit	[1/] Monguch Stream, Gagil-Tamil			Dorfay Stream, Gagil-Tamil		Gilaew Spring, Gagil-Tamil		Qamin Stream, Maap	
		9-16-80	7-22-81	9-16-82	7-22-81	9-16-82	9-16-80	7-18-81	9-19-80	7-18-81
Time	--	1430	1045	1500	1500	1300	1130	1540	1600	1250
Discharge, instantaneous	ft^3s	1.3	1.6	1.3	0.93	0.82	0.40	0.25	0.49	0.29
Specific conductance	µmho	33	34	29	29	33	105	111	131	120
pH	--	5.9	6.4	5.8	6.0	6.5	6.6	7.0	7.1	7.4
Temperature, water	°C	28.0	27.5	27.5	27.5	27.5	27.0	27.5	27.0	27.5
Turbidity	NTU	2.3	--	--	--	--	.50	--	15	--
Oxygen, dissolved	mg/L	5.2	6.6	--	6.8	--	6.2	5.4	6.4	7.2
Hardness as $CaCO_3$	mg/L	7	6	7	4	6	34	40	42	40
Noncarbonate hardness	mg/L	0	0	0	0	0	5	8	0	8
Calcium, dissolved (Ca)	mg/L	.8	.8	1.5	.5	.2	3.1	2.3	6.8	6.1
Magnesium, dissolved (Mg)	mg/L	1.1	.9	.7	.6	1.3	6.3	8.3	6.1	6.1
Sodium, dissolved (Na)	mg/L	3.7	4.3	3.4	4.1	4.2	6.3	9.0	9.5	10
Percent sodium	percent	53	61	51	70	60	29	33	33	35
Sodium adsorption ratio	--	.6	.8	.6	.9	.9	.5	.6	.4	.7
Potassium, dissolved (K)	mg/L	.6	.2	.2	.1	.2	.4	.2	.3	.2
Alkalinity, total as $CaCO_3$	mg/L	8	8	9	6	10	29	32	43	32
Sulfate, dissolved (SO_4)	mg/L	1.8	1.0	< 5	1.0	< 5	.4	.5	5.0	2.0
Chloride, dissolved (Cl)	mg/L	6.3	5.9	5.7	5.8	5.4	9.7	20	15	18
Fluoride, dissolved (F)	mg/L	0	0	< .1	0	< .1	0	0	0	0
Silica, dissolved (SiO_2)	mg/L	6.7	10	4.4	6.7	6.0	15	18	19	20
Solids, dissolved, sum of constituents	mg/L	26	28	--	23	--	63	78	83	82
Solids, dissolved, ton per acre foot	ton/ac-ft	.04	--	--	--	--	.09	--	.11	--
Nitrite plus nitrate, as dissolved N	mg/L	0	.02	< .1	.01	< .1	.88	.07	.12	.04
Iron, dissolved (Fe)	µg/L	1,000	120	580	200	320	100	80	320	420
Manganese, dissolved (Mn)	µg/L	110	20	44	30	34	20	7	20	50

[1/] For Lyon Associates analyses, see table 14.

Table 59. Chemical analyses of water from Airport Swamp and Water Treatment Plant, Yap

Constituent	Unit	[1/] Airport Swamp				[2/] Water treatment plant
		2-2-80	9-20-80	7-20-81	9-15-82	9-20-82
Time	--	0930	1030	1615	1520	1500
Specific conductance	µmho	125	110	88	--	145
pH	--	7.7	7.3	8.5	7.6	7.2
Temperature, water	°C	26.0	33.0	32.0	30.0	--
Turbidity	NTU	--	15	--	--	60
Oxygen, dissolved	mg/L	--	6.3	5.7	--	--
Hardness as $CaCO_3$	mg/L	41	43	36	41	56
Noncarbonate hardness	mg/L	1	2	8	1	13
Calcium, dissolved (Ca)	mg/L	13	14	12	13	14
Magnesium, dissolved (Mg)	mg/L	2.1	2.0	1.4	2.0	5.0
Sodium, dissolved (Na)	mg/L	5.5	4.5	2.3	3.9	5.6
Percent sodium	percent	22	18	16	17	18
Sodium adsorption ratio	--	.4	.3	.2	.3	.3
Potassium, dissolved (K)	mg/L	.5	.7	.8	.5	.5
Alkalinity, total as $CaCO_3$	mg/L	40	41	28	40	43
Sulfate, dissolved (SO_4)	mg/L	4.7	3.3	< 5	6	--
Chloride, dissolved (Cl)	mg/L	9.2	7.8	4.7	6.7	10
Fluoride, dissolved (F)	mg/L	0	.1	0	< .1	.1
Silica, dissolved (SiO_2)	mg/L	2.3	2.3	2.3	1.9	11
Solids, dissolved, sum of constituents	mg/L	61	61	--	58	88
Solids, dissolved, ton per acre foot	ton/ac-ft	.08	.08	--	--	.12
Nitrite plus nitrate, as dissolved N	mg/L	.01	.36	.02	< .1	.12
Iron, dissolved (Fe)	µg/L	50	70	60	49	160
Manganese, dissolved (Mn)	µg/L	9	10	40	11	30

[1/] Location: Lat 9°29'14" N., long 138°05'06" E., altitude 33.6 ft, at old Yap airport. For 1967 analyses, see table 13.

[2/] Finished water collected from rubber hose at plant.

Table 60. Chemical analyses of water from wells on Yap and Gagil-Tamil

Constituent	Unit	[1] Timlang 3 well, Yap	[2] Lamaer well, Yap	[3] Communication Station well, Yap			[4] Mitsui well, Yap		[5] Monguch 1 well, Gagil-Tamil
		9-15-82	7-20-81	2-2-80	7-20-81	9-15-82	7-20-81	9-15-82	9-16-82
Time	--	1510	1550	1100	1400	1600	1440	1630	1530
Depth	ft	--	91	--	82	--	85	--	--
Specific conductance	µmho	62	177	81	119	--	125	--	75
pH	--	7.0	6.7	7.7	6.9	7.0	7.3	7.5	7.1
Temperature, water	°C	--	--	26.0	29.0	--	29.4	--	29.0
Hardness as $CaCO_3$	mg/L	16	62	25	40	40	48	45	24
Noncarbonate hardness	mg/L	0	0	0	0	0	0	0	0
Calcium, dissolved (Ca)	mg/L	4.5	10	4.4	7.3	7.2	12	11	4.3
Magnesium, dissolved (Mg)	mg/L	1.2	9.1	3.4	5.4	5.3	4.3	4.3	3.1
Sodium, dissolved (Na)	mg/L	7.0	12	6.3	8.0	7.8	8.9	7.8	8.1
Percent sodium	percent	48	29	35	30	30	29	41	41
Sodium adsorption ratio	--	.8	.7	.5	.5	.6	.6	.6	.8
Potassium, dissolved (K)	mg/L	.2	.4	.4	.3	.6	.4	.5	1.8
Alkalinity, total as $CaCO_3$	mg/L	20	70	30	44	49	56	49	30
Sulfate, dissolved (SO_4)	mg/L	< 5	1.0	1.2	.3	< 5	1.0	< 5	< 5
Chloride, dissolved (Cl)	mg/L	9.4	12	8.2	7.4	8.0	7.9	8.4	6.9
Fluoride, dissolved (F)	mg/L	< .1	0	0	< .1	0	0	< .1	< .1
Silica, dissolved (SiO_2)	mg/L	5.1	63	29	58	57	42	41	80
Solids, dissolved, sum of constituents	mg/L	--	150	72	114	--	--	--	--
Nitrite plus nitrate, as dissolved N	mg/L	.69	.11	.11	.19	.25	.13	.12	.31
Iron, dissolved (Fe)	µg/L	340	60	60	160	23	30	4	8
Manganese, dissolved (Mn)	µg/L	22	0	10	10	11	0	3	2

[1] Latitude 9°29'16" N., longitude 138°05'04" E., altitude 44 ft.
[2] Latitude 9°29'03" N., longitude 138°05'11" E., altitude 35 ft.
[3] Latitude 9°29'25" N., longitude 138°05'03" E., altitude 38 ft.
[4] Latitude 9°29'27" N., longitude 138°05'02 E., altitude 30 ft.
[5] Latitude 9°31'59" N., longitude 138°09'57" E., altitude 21 ft.

Table 61. Chemical analyses of water from Airport and Tamil aquifers (1982)

[Source: Nance, 1982. Samples analyzed by Brewer Analytical Laboratories, Honolulu, March 15-31, 1982]

Constituent	Unit	Timlang 1 well, Yap 2-20-82	Mukong Stream well, Gagil-Tamil 1-26-82	Monguch 2 well, Gagil-Tamil 1-30-82
pH	--	6.6	7.3	7.0
Turbidity	NTU	.2	3.9	.5
Calcium	mg/L	2.4	1.2	2.1
Magnesium	mg/L	4.3	1.3	3.2
Sodium	mg/L	1.9	66.5	2.5
Potassium	mg/L	.39	4.0	1.3
Chloride	mg/L	24	89	20
Fluoride	mg/L	.35	.64	.35
Silica	mg/L	19	26	49
Total dissolved solids	mg/L	90	346	123
Nitrate	mg/L	< .19	< .01	< .01
Arsenic	mg/L	< .002	< .002	< .002
Barium	mg/L	< .1	< .1	< .1
Cadmium	mg/L	< .005	< .005	< .005
Chromium	mg/L	< .05	< .05	< .05
Lead	mg/L	< .05	< .05	< .05
Mercury	mg/L	.086	.158	.400
Selenium	mg/L	< .002	< .002	< .002
Silver	mg/L	< .01	< .01	< .01

Note: For chemical analyses of Timlang 3 well, Yap, and Monguch 1 well, Gagil-Tamil, by U.S. Geological Survey, see table 60.

Table 62. Water and air temperatures and instantaneous discharge at Qatliw (Atelu) Stream, Yap

Date	Time	Instantaneous discharge (ft^3/s)	Temperature water (^oC)	Temperature air (^oC)
Sept. 20, 1980	1235	0.18	26.5	
Oct. 21, 1980	1210	1.7	26.0	27.5
July 21, 1981	1200	1.0	26.0	
Feb. 12, 1982	1140	.05	25.5	27.0
Mar. 25, 1982	1115	.24	25.5	26.5
July 14, 1982	1305	.05	26.0	27.5
Sept. 14, 1982	0940	9.9	26.0	27.5

Table 63. Water and air temperatures and instantaneous discharge at Qaringeel (Aringel) Stream, Yap

Date	Time	Instantaneous discharge (ft^3/s)	Temperature water (^oC)	Temperature air (^oC)
Sept. 18, 1969	0850	0.11	24.0	
Oct. 14, 1969	0930	.58	26.0	
Oct. 30, 1969	1230	.52	25.5	
Nov. 13, 1969	1400	.04	25.5	
Nov. 25, 1969	0920	.87	25.5	
Dec. 2, 1969	1550	.11	25.5	
Dec. 18, 1969	1045	.09	26.0	
Jan. 6, 1970	0935	.05	24.0	
Jan. 22, 1970	1330	.06	25.0	
Feb. 3, 1970	1310	.06	26.0	
Feb. 24, 1970	0935	.42	26.0	
May 11, 1970	0955	2.0	26.0	
July 14, 1970	1400	.09	26.0	
Oct. 2, 1970	1405	.23	27.0	
Oct. 13, 1970	1100	1.7	26.0	
Oct. 29, 1970	1400	.05	26.0	
Nov. 9, 1970	1415	1.1	26.0	
Nov. 24, 1970	1015	1.6	26.0	
Dec. 16, 1970	1410	.39	26.0	
Dec. 18, 1970	1510	.24	27.0	
Jan. 8, 1971	1115	3.2	25.0	
Jan. 26, 1971	1400	.12	25.0	
Feb. 8, 1971	1345	1.4	25.0	

Table 63. Water and air temperatures and instantaneous discharge at Qaringeel (Aringel) Stream, Yap--Continued

Date	Time	Instantaneous discharge (ft^3/s)	Temperature water (^oC)	Temperature air (^oC)
Feb. 25, 1971	1000	0.89	25.0	
Mar. 25, 1971	0930	.19	25.0	
Apr. 28, 1971	1415	.47	26.0	
Dec. 3, 1971	1450	.03	27.0	
Jan. 13. 1972	1455	.09	25.0	
Mar. 24, 1972	0835	.64	25.0	
Apr. 21, 1972	1200	.03	25.0	
June 15, 1972	1445	.09	25.0	
July 16, 1972	1320	.02	26.0	
Aug. 11, 1972	0850	.46	25.0	
Sept. 19, 1972	1435	.36	26.0	
Oct. 13, 1972	0930	.02	25.0	
Nov. 10, 1972	1450	.14	29.0	28.0
Dec. 21, 1972	1420	.06	26.0	
Dec. 22, 1972	1400	.03	27.0	
June 4, 1973	1020	.16	27.0	
July 5, 1973	1415	.12	27.0	
Aug. 1, 1973	1440	.37	27.0	
Aug. 31, 1973	1435	.07	27.0	
Sept. 20, 1973	1355	.45	27.0	
Oct. 19, 1973	1440	.10	27.0	
Dec. 26, 1973	1500	.47	26.5	
July 14, 1974	1516	.25	25.5	
July 30, 1974	1435	.71	26.5	30.0
Sept. 13, 1974	1400	.26	26.5	30.0
Oct. 9, 1974	1453	1.6	26.0	28.0
Nov. 5, 1974	1050	2.9	26.0	29.0
Dec. 6, 1974	1414	.69	26.0	27.5
Dec. 30, 1974	1044	.94	25.5	26.5
Jan. 14, 1975	1354	.10	26.0	31.0
May 2, 1975	0945	.13	25.0	29.0
May 15, 1975	1040	.99	26.0	29.0
June 17, 1975	0810	.34	26.0	29.0
July 14,1975	0920	5.6	25.0	27.0
Aug. 14, 1975	1400	.77	27.0	30.0
Aug. 28, 1975	1015	.28	25.0	26.0
Sept. 22, 1975	0940	.51	25.0	28.0
Oct. 7. 1975	1440	.87	26.0	29.0
Dec. 4, 1975	1040	.87	25.0	27.0
Dec. 22, 1975	1230	.58	27.0	32.0
Jan. 5, 1976	1405	.06	26.0	34.0
Feb. 3, 1976	1630	.25	25.5	27.0
June 16, 1976	1010	.17	25.0	28.0
July 6, 1976	0940	.10	24.5	28.0

Table 63. Water and air temperatures and instantaneous discharge at Qaringeel (Aringel) Stream, Yap--Continued

Date	Time	Instantaneous discharge (ft^3/s)	Temperature water (^oC)	Temperature air (^oC)
July 26, 1976	1400	0.73	26.0	27.0
Aug. 10, 1976	1520	.20	26.0	27.5
Aug. 26, 1976	1415	.76	25.0	27.5
Sept. 16, 1976	1320	.48	26.0	30.0
Nov. 2, 1976	1500	.13	27.0	29.5
Dec. 2, 1976	1235	.51	25.0	27.5
Dec. 29, 1976	1510	1.7	27.0	29.0
Jan. 21, 1977	0950	.36	24.0	25.5
May 31, 1977	1500	.08	26.0	28.0
June 30, 1977	1515	.06	26.0	30.0
Aug. 12, 1977	1350	.07	28.0	31.0
Nov. 1, 1977	1350	.01	26.0	32.5
Nov. 29, 1977	1400	.09	26.0	30.5
Dec. 15, 1977	1450	1.8	26.0	28.5
Dec. 30, 1977	0930	.01	25.0	27.0
Feb. 1, 1978	1350	.04	25.5	27.0
June 15, 1978	1415	.06	26.5	30.0
June 28, 1978	1430	.05	26.5	30.5
July 21, 1978	1355	.03	27.0	30.5
Aug. 30, 1978	1515	.07	28.0	30.0
Sept. 19, 1978	0935	.31	25.5	28.0
Sept. 29, 1978	0910	.30	26.0	28.0
Oct. 26, 1978	1505	.17	26.5	32.0
Nov. 9, 1978	1440	.49	26.0	30.0
Nov. 28, 1978	1410	.07	26.0	30.5
Dec. 13, 1978	0935	3.7	25.5	26.5
Mar. 15, 1979	1330	.29	26.5	35.0
May 15, 1979	1505	.16	27.0	32.0
June 13, 1979	0855	.53	25.5	26.5
June 27, 1979	0915	1.1	26.0	26.5
July 11, 1979	1200	2.3	26.5	29.0
July 26, 1979	1020	1.7	25.5	26.5
Aug. 8, 1979	0915	.54	25.5	27.5
Aug. 21, 1979	0945	.16	25.5	28.5
Oct. 15, 1979	1445	.12	27.0	29.0
Oct. 30, 1979	1400	.12	26.0	29.0
Dec. 26, 1979	1010	.21	25.0	27.0
May 19, 1980	1025	.07	26.0	27.5
June 3, 1980	1405	.17	26.5	30.0
June 30, 1980	1030	.35	25.5	27.5
July 24, 1980	0900	.26	25.0	25.5
July 31, 1980	1055	.06	25.5	30.0
Sept. 2, 1980	0940	.07	25.5	27.0
Sept. 15, 1980	1430	.47	27.0	30.0

Table 64. Water temperature and instantaneous discharge at Faraq (Fara) Swamp outlets, Yap

Date	Time	Instantaneous discharge (ft^3/s)	Temperature water (^oC)
Oct. 16, 1969	0920	0.26	25.5
July 14, 1970	0900	.07	26.0
Oct. 5, 1970	1510	.49	28.0
Oct. 30, 1970	1415	.14	26.0
Nov. 12, 1970	1520	.12	27.0
Nov. 25, 1970	1415	.22	26.0
Jan. 5, 1971	1300	.03	26.0
Mar. 23, 1972	1010	.12	26.0
Apr. 20, 1972	1010	.04	26.0
July 16, 1972	1535	.04	29.0
Aug. 10, 1972	1555	.16	28.0
Sept. 20, 1972	1450	.30	28.0
Oct. 12, 1972	1455	.06	28.0

Table 65. Water temperature and instantaneous discharge at Galngun Swamp outlet, Yap

Date	Time	Instantaneous discharge (ft^3/s)	Temperature water (^oC)
Sept. 18, 1970	1415	0.15	26.5
Oct. 5, 1970	1335	.23	27.0
Oct. 29, 1970	0945	.40	26.0
Nov. 13, 1970	0855	.25	25.0
Nov. 25, 1970	1340	.34	26.0
Dec. 22, 1970	1330	.23	26.0
Jan. 5, 1971	1450	.14	26.0
Jan. 28, 1971	0845	.30	25.0
Jan 13, 1972	1030	.26	25.5
Mar 23, 1972	0930	.29	25.0
Apr. 20, 1972	0935	.17	25.0
May 18, 1972	1317	.16	25.0
July 15, 1972	1003	.20	26.0
Aug. 10, 1972	1522	.21	25.0
Sept. 19, 1972	1610	.50	26.0
Oct. 12, 1972	1420	.23	26.0

Table 66. Water and air temperatures and instantaneous discharge at Tamaney Stream, Yap

Date	Time	Instantaneous discharge (ft^3/s)	Temperature water (^oC)	Temperature air (^oC)
Sept. 19, 1969	1605	0.45	26.5	28.0
Oct. 14, 1969	1610	.15	25.5	
Nov. 6, 1969	1535	.24	25.5	
Nov. 20, 1969	0840	.06	25.5	
July 14, 1970	0935	.07	26.0	
Sept. 2, 1970	0855	3.8	26.0	
Sept. 22, 1970	1050	.38	26.5	
Oct. 6, 1970	0930	.10	26.0	
Oct. 29, 1970	1100	.07	27.0	
Nov. 13, 1970	1010	.14	25.0	
Nov. 25, 1970	1455	.38	26.0	
Dec. 23, 1970	1400	.04	26.0	
Jan. 5, 1971	1600	.13	27.0	
Jan. 27, 1971	1600	.04	26.0	
Jan. 13, 1972	1310	.06	25.5	
Apr. 20, 1972	1100	.08	25.0	
July 15, 1972	1107	.06	26.0	
Aug. 10, 1972	1637	.08	26.0	
Sept. 20, 1972	1530	.09	26.0	
Oct. 12, 1972	1540	.02	26.0	
Mar. 11, 1974	1355	.20	26.5	
July 14, 1974	1722	.26	25.5	
Sept. 13, 1974	1151	.27	26.0	29.0
May 2, 1975	1325	.25	27.0	28.0
June 20, 1975	0835	1.5	27.0	28.0
July 15, 1975	1020	.52	27.0	29.0
Aug. 29, 1975	0920	.23	26.0	32.0
Oct. 9, 1975	1310	.14	25.0	27.0
Dec. 5, 1975	1515	.12	34.0	36.0
Jan. 9, 1976	1445	.04	27.0	30.0
Apr. 2, 1976	1515	.32	27.5	29.5
May 21, 1976	1025	.15	26.0	32.0
July 6, 1976	1500	.09	27.0	32.0
Aug. 11, 1976	1345	.74	26.0	28.0
Dec. 3, 1976	1205	.23	25.0	26.5
Jan. 21, 1977	1440	.26	26.0	27.5
Nov. 30, 1977	1325	.07	26.0	27.5
Feb. 1, 1978	1535	.05	26.5	30.0
June 29, 1978	1056	.09	29.0	30.5
Oct. 30, 1978	0950	.10	26.0	27.5
Nov. 30, 1978	1415	.10	28.0	30.0
June 29, 1979	1550	.81	27.0	30.0
Aug. 21, 1979	1531	.05	27.0	30.0
Dec. 27, 1979	1330	.16	25.5	30.0
Sept. 17, 1980	1630	1.4	27.0	
Oct. 20, 1980	1530	1.1	27.0	29.0

Table 67. Water and air temperatures and instantaneous discharge at Ripu Stream, Yap

Date	Time	Instantaneous discharge (ft^3/s)	Temperature water (^oC)	Temperature air (^oC)
Mar. 7, 1968	1630	0.63	26.0	28.0
Sept. 19, 1969	1540	.43	25.5	28.0
Oct. 16, 1969	1110	.19	25.5	
Nov. 4, 1969	1015	.15	25.5	
Nov. 20, 1969	0925	.07	25.5	
July 14, 1970	1015	.10	26.0	
Sept. 2, 1970	0925	3.3	25.5	
Sept. 22, 1970	1500	.21	25.5	
Oct. 7, 1970	1500	.16	27.0	
Oct. 30, 1970	1525	.06	27.0	
Nov. 13, 1970	1110	.16	25.0	
Nov. 27, 1970	0900	.62	26.0	
Dec. 22, 1970	1425	.09	26.0	
Jan. 5, 1971	1510	.06	27.0	
Jan. 26, 1971	1500	.12	26.0	
Jan. 13, 1972	1332	.11	25.0	
Mar. 23, 1972	1245	.34	25.0	
Apr. 20, 1972	1135	.09	25.0	
May 18, 1972	1435	.004	27.0	
July 15, 1972	1136	.08	26.0	
Aug. 10, 1972	1720	.22	26.0	
Sept. 20, 1972	1600	.16	26.0	
Sept. 20, 1973	1440	.27	28.0	
Oct. 12, 1973	1610	.04	26.0	
Mar. 11, 1974	1425	.20	26.5	
July 14, 1974	1617	.20	25.5	
Sept. 13, 1974	1523	.21	26.5	28.5
May 2, 1975	1258	.22	27.0	32.0
June 20, 1975	1110	1.6	27.0	29.0
July 15, 1975	0940	.85	26.0	29.0
Aug. 29, 1975	0900	.33	26.5	29.0
Oct. 9, 1975	1355	.17	27.0	29.0
Dec. 5, 1975	1415	.93	29.0	32.0
Jan. 9, 1976	1510	.07	26.0	29.0
Apr. 2, 1976	1420	.84	25.0	26.5
May 21, 1976	1050	.12	26.0	29.0
July 2, 1976	1440	.09	25.5	32.0
Aug. 11, 1976	1326	.86	25.5	28.0
Dec. 3, 1976	1130	.43	24.0	25.5
Jan 21, 1977	1405	.16	26.0	27.0
Nov. 30, 1977	1410	.08	26.0	27.0
Feb. 1, 1978	1515	.01	26.0	30.0
Aug. 31, 1978	0910	.13	26.5	28.0
Oct. 30, 1978	0935	.11	26.0	27.5

Table 67. Water and air temperatures and instantaneous discharge at Ripu Stream, Yap--Continued

Date	Time	Instantaneous discharge (ft^3/s)	Temperature water (^oC)	Temperature air (^oC)
Nov. 30, 1978	1345	0.11	27.5	30.5
June 29, 1979	1525	1.2	27.0	32.0
Aug. 21, 1979	1515	.14	27.0	28.0
Dec. 27, 1979	1355	.09	26.0	31.5
Sept. 17, 1980	1530	1.5	27.0	
Oct. 21, 1980	1045	.62	26.0	27.5

Table 68. Water and air temperatures and instantaneous discharge at Dinaey (Dinay) Stream, Yap

Date	Time	Instantaneous discharge (ft^3/s)	Temperature water (^oC)	Temperature air (^oC)
Sept. 18, 1980	1615	0.14	26.0	
Oct. 21, 1980	1010	.19	26.5	27.5
July 17, 1981	1140	.06	26.5	27.5

Table 69. Water temperature and instantaneous discharge at Tholomar (Thalomar) Stream, Yap

Date	Time	Instantaneous discharge (ft^3/s)	Temperature water (^oC)
Sept. 30, 1969	1010	0.64	26.0
Oct. 14, 1969	1245	.32	26.0
Nov. 4, 1969	0920	.25	26.0
July 14, 1970	1045	.08	26.0
Sept. 2, 1970	0950	3.8	26.0
Sept. 23, 1970	1330	.26	26.0
Oct. 6, 1970	1330	.28	26.0
Oct. 29, 1970	1600	.11	26.0
Nov. 13, 1970	1410	.22	26.0
Nov. 27, 1970	0920	.70	26.0
Dec. 22, 1970	1450	.16	26.0
Jan. 6, 1971	1020	.18	26.0
Jan. 27, 1971	1420	.10	25.0
Jan. 13, 1972	1400	.11	25.0
Apr. 20, 1972	1215	.09	25.0
May 18, 1972	1507	.01	26.0
July 15, 1972	1213	.06	26.0
Aug. 11, 1972	1006	.21	25.0
Sept. 20, 1972	1645	.14	26.0
Oct. 13, 1972	1126	.03	25.0
Jan. 11, 1973	1017	.02	28.0
Mar. 11, 1973	1512	.23	26.5
Sept. 18, 1980	1450	.43	26.5
Oct. 21, 1980	0915	.32	26.5
July 23, 1981	0940	.07	26.5

Table 70. Water and air temperatures and instantaneous discharge at Daloelaeb (Dalolab) Stream, Yap

Date	Time	Instantaneous discharge (ft^3/s)	Temperature water (^oC)	Temperature air (^oC)
Sept. 30, 1969	1330	0.08	26.0	
Oct. 27, 1969	0855	.40	25.5	
Nov. 13, 1969	1020	e/.01	25.5	
Nov. 25, 1969	1110	.28	25.5	
Oct. 3, 1970	1045	.02	26.0	
Oct. 14, 1970	0930	2.2	24.0	
Oct. 28, 1970	1030	.02	25.0	
Nov. 10, 1970	1415	.56	26.0	
Nov. 24, 1970	1315	.23	26.0	
Dec. 17, 1970	1050	.16	26.0	
Dec. 19, 1970	1025	.02	26.0	
Jan. 11, 1971	1350	.07	26.0	
Feb. 12, 1971	1045	.16	25.0	
Feb. 26, 1971	1405	.03	25.0	
May 11, 1971	1110	.02	25.0	
Mar. 24, 1972	1210	.12	25.0	
June 16, 1972	0910	.04	25.0	
Aug. 11, 1972	1240	.03	25.0	
Sept. 20, 1972	1110	.04	25.0	
Oct. 13, 1972	1345	.003	25.0	
Nov. 10, 1972	1030	.06	29.0	27.0
Aug. 3, 1973	1330	.15	27.0	
Sept. 21, 1973	1510	1.4	26.0	
Oct. 16, 1973	1500	.25	27.0	
July 11, 1974	1456	.08	26.0	
July 30, 1974	1015	.31	25.5	27.0
Oct. 9, 1974	1621	.27	26.0	28.0
Nov. 6, 1974	1525	.29	26.5	28.0
Dec. 11, 1974	1403	.01	26.0	29.5
Dec. 31, 1974	1518	.77	25.0	29.0
Jan. 14, 1975	1455	.01	25.5	30.0
May 20, 1975	1515	.25	27.0	29.0
June 17, 1975	1035	.20	26.0	29.0
July 14, 1975	1040	2.2	26.0	29.0
Aug. 14, 1975	1032	.23	26.0	28.0
Aug. 28, 1975	1150	.25	25.0	30.0
Sept. 22, 1975	1045	.17	26.0	29.0
Oct. 8, 1975	1440	.04	26.0	29.0
Dec. 5, 1975	1020	.78	25.0	27.0
Dec. 23, 1975	1250	.14	26.0	29.0
Feb. 3, 1976	1110	.05	25.5	26.0
Apr. 2, 1976	1325	.07	25.0	26.5
May 20, 1976	1435	.08	27.5	30.0
July 27, 1976	1435	.07	25.0	27.0

Table 70. Water and air temperatures and instantaneous discharge at Daloelaeb (Dalolab) Stream, Yap--Continued

Date	Time	Instantaneous discharge (ft^3/s)	Temperature water (^oC)	Temperature air (^oC)
Aug. 11, 1976	1250	0.10	26.0	27.5
Aug. 26, 1976	1510	.28	26.0	27.5
Sept. 16, 1976	1420	.17	26.0	28.5
Dec. 2, 1976	1330	.16	26.0	27.0
Dec. 30, 1976	1030	.07	25.5	27.5
Jan. 21, 1977	1025	.14	25.0	26.5
Aug. 12, 1977	1450	.07	26.0	28.5
Sept. 29, 1977	1015	.01	26.0	29.0
Nov. 29, 1977	1440	.01	26.0	29.0
Dec. 16, 1977	1205	.10	26.5	28.0
Sept. 19, 1978	1030	.09	25.5	27.0
Sept. 29, 1978	1010	.08	27.0	29.0
Oct. 30, 1978	0905	.02	26.0	27.5
Nov. 15, 1978	0900	.13	25.5	28.0
Dec. 13, 1978	1125	1.0	25.5	26.5
Mar. 15, 1979	1450	.02	26.0	29.5
June 13, 1979	0940	.12	25.5	27.0
June 29, 1979	1005	.61	26.0	29.0
July 11, 1979	1055	.84	26.0	28.0
July 26, 1979	1115	1.1	25.5	26.5
Aug. 8, 1979	1110	.08	25.5	26.0
Aug. 21, 1979	1135	.02	26.0	32.0
Oct. 10, 1979	0925	.12	26.5	27.5
Dec. 26, 1979	1055	.02	25.0	26.5
June 3, 1980	1500	.03	27.0	30.5
June 30, 1980	1020	.07	26.0	29.0
July 23, 1980	1040	.08	26.0	29.0
July 31, 1980	1020	.02	26.0	29.0
Sept. 2, 1980	1025	.03	25.5	26.0
Sept. 17, 1980	1400	.56	26.0	
Oct. 8, 1980	1155	.13	25.0	27.0

e/ Estimated.

Table 71. Water and air temperatures and instantaneous discharge at Peemgoy (Pemgoy) Stream, Yap

Date	Time	Instantaneous discharge (ft^3/s)	Temperature water (^oC)	Temperature air (^oC)
Oct. 9, 1969	1400	0.08	26.0	
Oct. 27, 1969	1020	.38	26.0	
Nov. 18, 1969	1020	.30	26.0	
Dec. 30, 1969	1115	.06	25.0	
Jan. 22, 1970	1025	2.0	25.0	
Oct. 15, 1970	1045	.59	25.0	
Nov. 10, 1970	1600	.68	26.0	
Nov. 24, 1970	1450	.29	26.0	
Dec. 17, 1970	1225	.67	25.0	
Dec. 19, 1970	1200	.06	26.0	
Jan. 11, 1971	1500	.06	26.0	
Jan. 27, 1971	1120	.03	25.0	
Feb. 12, 1971	1200	.29	25.0	
Feb. 26, 1971	1530	.06	26.0	
Mar. 26, 1971	1645	.03	26.0	
May 11, 1971	1245	.03	26.0	
Dec. 4, 1971	1100	.04	25.0	
Jan. 13, 1972	1210	.10	25.0	
Mar. 24, 1972	1410	.20	25.0	
June 16, 1972	1120	.18	25.0	
Aug. 11, 1972	1420	.11	25.0	
Sept. 20, 1972	1335	.08	26.0	
Nov. 10, 1972	1230	.13	28.0	
Aug. 3, 1973	1505	.16	26.0	
Sept. 21, 1973	1655	3.0	26.0	
Nov. 20, 1973	1435	.73	28.0	
Mar. 11, 1974	1005	.01	25.5	
Apr. 5, 1974	1206	.08	26.5	
July 11, 1974	1709	.20	25.5	
July 30, 1974	1240	.52	25.5	27.0
Sept. 11, 1974	1557	.05	25.5	26.5
Nov. 7, 1974	1627	.14	26.0	27.0
Dec. 12, 1974	1533	.54	25.5	28.0
Jan. 14, 1975	0954	.05	25.0	29.5
May 14, 1975	1400	.02	27.0	32.0
June 17, 1975	1410	.26	26.0	28.0
July 14, 1975	1440	1.4	26.0	28.0
Aug. 14, 1975	0955	.50	25.0	27.0
Aug. 28, 1975	1505	.20	26.0	28.0
Sept. 22, 1975	1445	.16	26.0	29.0
Oct. 9, 1975	0850	.33	25.0	29.0
Dec. 4, 1975	1350	.40	26.0	29.0
Dec. 23, 1975	1040	.08	25.0	28.0

Table 71. Water and air temperatures and instantaneous discharge at Peemgoy (Pemgoy) Stream, Yap--Continued

Date	Time	Instantaneous discharge (ft^3/s)	Temperature water (^oC)	Temperature air (^oC)
Jan. 27, 1976	1340	0.20	25.0	28.0
Feb. 3, 1976	1015	.11	24.5	--
Feb. 17, 1976	1055	.03	25.0	29.0
Mar. 2, 1976	1445	.07	25.5	26.5
Apr. 2, 1976	1205	.10	25.0	29.0
May 3, 1976	1445	.09	25.0	27.0
May 20, 1976	1110	.10	26.0	28.5
June 16, 1976	1400	14	23.0	25.0
July 6, 1976	1045	.08	25.0	28.0
July 27, 1976	----	.54	25.0	26.0
Aug. 11, 1976	1110	.16	25.0	27.0
Sept. 17, 1976	0930	.16	26.0	28.0
Nov. 2, 1976	1245	.52	27.0	28.5
Dec. 3, 1976	0945	.43	25.0	26.0
Dec. 30, 1976	1120	.22	--	28.0
Jan. 21, 1977	1225	.36	25.0	26.5
Aug. 5, 1977	1320	2.8	26.0	30.5
Sept. 28, 1977	1515	.06	27.0	29.0
Sept. 29, 1977	0945	.05	25.0	28.0
Nov. 3, 1977	0915	.01	25.0	28.0
Nov. 18, 1977	0920	.005	25.5	29.5
Nov. 30, 1977	1515	.02	26.5	32.0
Dec. 16, 1977	0935	.29	26.0	29.0
Dec. 29, 1977	1405	.01	26.0	29.0
Jan. 18, 1978	1250	.01	26.0	29.0
Feb. 3, 1978	0920	.02	24.5	26.5
Feb. 23, 1978	1455	.01	28.0	30.0
Mar. 16, 1978	0955	.01	25.0	27.5
Apr. 12, 1978	1335	.01	29.5	32.0
May 26, 1978	0920	1.5	25.5	27.0
June 16, 1978	0900	.02	25.0	26.0
Aug. 30, 1978	1335	.02	27.0	31.0
Sept. 29, 1978	1050	.16	25.5	28.0
Oct. 31, 1978	0935	.03	25.5	27.0
Nov. 15, 1978	0955	.34	25.5	28.0
Nov. 30, 1978	0905	.04	25.0	27.5
Dec. 13, 1978	1245	3.2	25.5	27.0
Mar. 16, 1979	0910	.03	25.0	28.0
June 13, 1979	1440	.27	25.5	25.5
June 29, 1979	1140	.68	26.0	27.5
July 11, 1979	0920	4.6	25.5	27.0
July 26, 1979	1240	2.0	25.5	27.0
Aug. 8, 1979	1315	.16	25.5	27.0

Table 71. Water and air temperatures and instantaneous discharge at Peemgoy (Pemgoy) Stream, Yap--Continued

Date	Time	Instantaneous discharge (ft^3/s)	Temperature water (^oC)	Temperature air (^oC)
Aug. 21, 1979	1235	0.11	26.0	28.0
Sept. 5, 1979	0915	e/.01	25.5	29.0
Oct. 5, 1979	1130	.08	26.5	28.0
Oct. 30, 1979	1000	.05	25.5	27.0
Dec. 28, 1979	0955	.03	25.0	27.0
Feb. 1, 1980	0925	e/.01	25.0	
June 4, 1980	0955	.02	25.5	26.5
June 30, 1980	1225	.30	26.0	30.5
July 24, 1980	1000	.12	25.0	27.0
July 31, 1980	0845	.05	25.0	31.0
Sept. 2, 1980	1145	.04	25.5	26.5
Sept. 17, 1980	1000	.27	26.5	
Nov. 5, 1980	1000	.02	27.0	26.0

e/ Estimated.

Table 72. Water and air temperatures and instantaneous discharge at Taalgum (Talagu) Stream, Yap

Date	Time	Instantaneous discharge (ft^3/s)	Temperature water (^oC)	Temperature air (^oC)
Oct. 8, 1969	1345	0.05	25.5	
Oct. 27, 1969	0930	.16	25.5	
Nov. 18, 1969	0920	.33	25.5	
Dec. 30, 1969	0935	.03	25.0	
Jan. 22, 1970	1010	1.5	25.0	
Oct. 15, 1970	0940	.40	25.0	
Oct. 28, 1970	1425	.02	26.0	
Nov. 10, 1970	1520	.82	26.0	
Nov. 24, 1970	1415	.18	26.0	
Dec. 17, 1970	1200	.53	26.0	
Dec. 19, 1970	1115	.04	27.0	
Jan. 27, 1971	1055	.01	25.0	
Feb. 12, 1971	1115	.11	25.0	
Feb. 26, 1971	1505	.04	25.0	
Mar. 26, 1971	1620	.03	27.0	
May 11, 1971	1215	.02	26.0	
Mar. 24, 1972	1325	.08	25.0	
June 16, 1972	1025	.07	25.0	
Aug. 11, 1972	1340	.05	25.0	
Sept. 20, 1972	1245	.03	25.0	
Oct. 13, 1972	1500	.02	25.0	
Oct. 17, 1972	1000	.01	25.0	
Nov. 10, 1972	1130	.14	27.0	25.0
Aug. 3, 1973	1425	.29	26.0	
Sept. 21, 1973	1610	1.2	26.0	
July 11, 1974	1626	.13	25.5	00.0
July 30, 1974	1138	.29	25.5	28.5
Sept. 11, 1974	1502	.02	25.5	28.0
Oct. 10, 1974	1510	.48	26.0	30.0
Nov. 7, 1974	1528	.09	26.0	29.0
Dec. 12, 1974	1440	.39	25.5	28.5
Dec. 31, 1974	1232	.40	25.0	29.5
Jan. 14, 1975	0857	.02	25.5	29.0
June 17, 1975	1410	.29	26.0	29.0
July 14, 1975	1410	1.1	27.0	29.0
Aug. 14, 1975	0850	.37	25.0	27.0
Aug. 28, 1975	1420	.08	26.0	30.0
Sept. 22, 1975	1525	.20	27.0	30.0
Oct. 9, 1975	0940	.07	25.0	27.0
Dec. 4, 1975	1435	.21	26.0	28.0
Dec. 23, 1975	1125	.08	25.0	28.0
Jan. 27, 1976	1415	.14	25.0	27.0
Feb. 3, 1976	0935	.06	25.0	27.0
Apr. 2, 1976	1225	.08	25.0	26.0

Table 72. Water and air temperatures and instantaneous discharge at Taalgum (Talagu) Stream, Yap--Continued

Date	Time	Instantaneous discharge (ft^3/s)	Temperature water (^oC)	Temperature air (^oC)
May 20, 1976	1220	0.13	26.0	27.0
June 16, 1976	1515	8.2	23.5	25.0
July 27, 1976	----	.24	25.0	26.5
Aug. 11, 1976	1200	.23	25.0	27.5
Sept. 17, 1976	1015	.12	27.0	28.5
Nov. 2, 1976	1320	.15	26.5	28.5
Dec. 3, 1976	1045	.26	24.0	25.5
Dec. 30, 1976	1310	.10	25.5	28.0
Jan. 21, 1977	1310	.15	25.5	26.5
Aug. 16, 1977	1415	.89	26.0	28.5
Sept. 28, 1977	1100	.03	27.0	29.0
Sept. 29, 1977	1030	.02	27.0	29.0
Nov. 3, 1977	1030	.01	25.5	28.0
Nov. 30, 1977	1550	.01	26.0	29.5
Dec. 16, 1977	1020	.13	26.0	27.0
May 26, 1978	0950	.11	25.5	26.0
Sept. 19, 1978	1515	.09	25.0	26.0
Sept. 29, 1978	1130	.06	25.5	27.5
Oct. 31, 1978	1015	.03	25.5	27.5
Nov. 15, 1978	1040	.13	26.0	30.5
Dec. 13, 1978	1315	1.2	--	26.5
Mar. 16, 1979	0955	.02	25.0	25.5
June 13, 1979	1520	.23	26.0	27.0
June 29, 1979	1100	.72	26.0	28.0
July 11, 1979	1000	1.3	25.0	26.0
July 26, 1979	1210	.63	25.5	26.5
Aug. 8, 1979	1350	.14	25.5	27.0
Aug. 21, 1979	1315	.06	26.0	32.0
Oct. 5, 1979	1050	.03	26.0	31.0
Dec. 28, 1979	0920	.03	25.0	26.0

Table 73. Water temperature and instantaneous discharge at Mabuuq (Mabu) Stream, Yap

Date	Time	Instantaneous discharge (ft^3/s)	Temperature water (^oC)
Sept. 18, 1969	1110	0.14	25.5
Oct. 8, 1969	1610	.14	26.0
Nov. 4, 1969	0835	.37	25.5
Nov. 20, 1969	1005	.11	25.5
Jan. 21, 1970	0946	.42	25.0
July 14, 1970	1115	.03	26.0
Sept. 24, 1970	1025	1.6	25.5
Oct. 7, 1970	1100	.12	25.0
Oct. 29, 1970	1110	.36	25.0
Nov. 13, 1970	1320	.16	26.0
Nov. 27, 1970	1030	.60	27.0
Dec. 22, 1970	1530	.18	26.0
Jan. 6, 1971	1100	.07	26.0
Jan. 14, 1972	1550	.08	25.0
Apr. 21, 1972	1535	.01	25.0
June 16, 1972	1600	.51	25.0
Aug. 11, 1972	1510	.16	25.0
Sept. 20, 1972	1730	.13	26.0

Table 74. Water and air temperatures and instantaneous discharge at Burong Stream, Yap

Date	Time	Instantaneous discharge (ft^3/s)	Temperature water (^oC)	Temperature air (^oC)
Sept. 18, 1969	1020	0.10	25.5	
Oct. 16, 1969	1310	.06	26.0	
Oct. 30, 1969	1045	.28	25.5	
Nov. 13, 1969	1310	.04	25.5	
Dec. 18, 1969	0915	.09	25.0	
Jan. 21, 1970	1125	.64	25.0	
Feb. 3, 1970	1010	.06	26.0	
May 11, 1970	1110	.63	26.0	
July 13, 1970	1305	.04	26.0	
Oct. 2, 1970	1600	.26	26.0	
Oct. 12, 1970	1000	1.3	26.0	
Oct. 27, 1970	0920	.10	25.0	
Nov. 9, 1970	1315	.89	25.0	
Nov. 23, 1970	1100	1.4	26.0	
Dec. 16, 1970	0955	.48	26.0	
Dec. 28, 1970	1625	.04	26.0	
Jan. 11, 1971	1020	.33	25.0	
Jan. 26, 1971	1135	.09	25.0	
Feb. 8, 1971	1530	1.0	25.0	
Feb. 25, 1971	1610	.97	27.0	
Mar. 25, 1971	1505	.14	26.0	
Apr. 28, 1971	0955	.31	25.0	
May 26, 1971	1405	.49	26.0	
Dec. 4, 1971	1745	.06	26.0	
Jan. 14, 1972	0935	.09	24.0	
Mar. 23, 1972	1830	.20	25.0	
Apr. 21, 1972	1040	.02	25.0	
June 15, 1972	1250	.09	25.0	
July 16, 1972	1125	.02	25.0	
Aug. 10, 1972	1345	1.9	25.0	
Sept. 19, 1972	1245	.44	25.0	
Oct. 12, 1972	1230	.04	25.0	
Oct. 16, 1972	1630	.63	26.0	
Nov. 9, 1972	1625	.18	26.0	23.0
Dec. 22, 1972	1525	.01	28.0	
June 20, 1973	1100	.12	27.0	
July 2, 1973	1510	.70	25.0	
Aug. 1, 1973	0920	.35	26.0	
Aug. 15, 1973	1400	.03	28.0	
Sept. 19, 1973	1410	.67	27.0	
Oct. 5, 1973	1025	.66	26.0	
Nov. 1, 1973	1355	.15	27.0	
Nov. 19, 1973	1025	5.9	26.0	
Dec. 28, 1973	1500	.11	26.0	

Table 74. Water and air temperatures and instantaneous discharge at Burong Stream, Yap--Continued

Date	Time	Instantaneous discharge (ft^3/s)	Temperature water (^oC)	Temperature air (^oC)
July 11, 1974	1028	0.50	25.5	
Sept. 21, 1974	1510	.24	27.0	32.5
Oct. 7, 1974	1410	1.3	26.0	28.5
Nov. 5, 1974	1508	8.5	25.5	29.0
Dec. 3, 1974	1015	.03	25.0	28.5
Dec. 30, 1974	1514	.43	26.5	29.5
Jan. 14, 1975	1555	.05	26.0	30.0
May 20, 1975	1345	.32	27.0	30.0
June 16, 1975	1435	.22	27.0	28.0
July 8, 1975	1320	.91	26.0	29.0
Aug. 25, 1975	1010	.40	26.0	28.0
Sept. 18, 1975	1402	2.4	26.0	32.0
Oct. 7, 1975	1230	1.2	26.0	30.0
Nov. 5, 1975	1110	.07	26.0	28.0
Dec. 3, 1975	1337	.36	29.0	32.0
Dec. 22, 1975	1050	.87	24.0	27.0
Jan. 9, 1976	0940	.06	25.0	28.0
Jan. 27, 1976	1115	.33	26.0	29.0
Feb. 3, 1976	1502	.14	26.0	27.5
Apr. 1, 1976	1330	.98	26.5	32.0
May 3, 1976	1230	.06	26.0	29.0
May 19, 1976	1410	.43	26.5	30.0
June 15, 1976	1330	.29	26.0	29.0
July 6, 1976	1250	.06	28.0	34.5
July 26, 1976	1135	.62	25.5	28.0
Aug. 10, 1976	1450	.27	25.5	27.0
Aug. 26, 1976	1300	.84	26.0	28.5
Sept. 16, 1976	1120	.57	26.0	28.0
Nov. 2, 1976	1120	.11	25.0	26.0
Dec. 2, 1976	1100	.29	23.0	25.0
Dec. 29, 1976	1345	1.2	26.0	29.0
Jan. 20, 1977	1240	.16	26.0	28.5
June 30, 1977	1430	.06	28.0	31.5
Aug. 9, 1977	1530	.09	28.0	30.0
Sept. 26, 1977	1600	.16	26.0	29.0
Sept. 29, 1977	1630	.32	27.0	29.0
Nov. 16, 1977	1515	.01	27.5	31.5
Nov. 30, 1977	1030	.10	26.5	30.0
Dec. 14, 1977	1330	2.1	27.0	30.0
Dec. 30, 1977	1345	.01	28.0	30.5
Jan. 12, 1978	1020	.01	26.0	28.5
Feb. 1, 1978	1130	.03	27.0	29.0
June 28, 1978	1055	.14	25.5	28.5
Aug. 30, 1978	1110	.08	26.5	31.0

Table 74. Water and air temperatures and instantaneous discharge at Burong Stream, Yap--Continued

Date	Time	Instantaneous discharge (ft^3/s)	Temperature water (^oC)	Temperature air (^oC)
Sept. 15, 1978	1445	1.5	26.5	29.5
Sept. 29, 1978	1440	.17	28.5	30.5
Oct. 26, 1978	1050	.11	26.0	28.5
Nov. 9, 1978	0910	2.9	26.0	28.5
Nov. 28, 1978	1320	.06	26.5	30.0
Dec. 12, 1978	1030	1.0	26.0	27.5
Dec. 27, 1978	1340	.04	26.5	30.5
Mar. 15, 1979	1055	.21	25.0	24.0
May 15, 1979	1015	.61	--	28.5
June 12, 1979	1340	2.5	25.5	28.0
June 27, 1979	1045	1.2	26.0	28.0
July 11, 1979	1350	2.4	26.5	32.0
July 30, 1979	1040	.12	25.5	28.0
Aug. 9, 1979	1200	3.6	25.5	27.0
Aug. 21, 1979	1235	.21	26.5	32.0
Sept. 5, 1979	1200	.02	27.0	30.0
Sept. 20, 1979	1235	.07	27.0	30.0
Oct. 10, 1979	1520	.18	--	26.0
Oct. 30, 1979	1520	.10	25.0	27.5
Dec. 27, 1979	1135	.07	26.0	32.0
Mar. 26, 1980	1010	.04	25.5	28.5
May 20, 1980	1445	.03	27.5	35.0
June 3, 1980	1050	.06	--	28.5
June 30, 1980	0905	.44	25.5	27.5
July 23, 1980	0925	.42	26.0	28.5
July 30, 1980	1345	.19	27.0	32.0
Aug. 30, 1980	1310	2.1	25.0	27.0

Table 75. Water and air temperatures and instantaneous discharge at Monguch Stream, Gagil-Tamil

Date	Time	Instantaneous discharge (ft^3/s)	Temperature water (^oC)	Temperature air (^oC)
Sept. 16, 1980	1440	1.3	28.0	29.0
Oct. 20, 1980	1210	.44	26.0	28.5
Mar. 24, 1981	1335	.16	27.5	28.5
Apr. 7, 1981	1250	.08	29.0	30.5
Apr. 27, 1981	1300	.26	27.5	28.0
May 14, 1981	1150	.12	28.0	28.5
July 22, 1981	1040	1.6	27.5	30.5

Table 76. Water and air temperatures and instantaneous discharge at Mukong Stream, Gagil-Tamil

Date	Time	Instantaneous discharge (ft^3/s)	Temperature water (^oC)	Temperature air (^oC)
Mar. 23, 1972	1642	3.3	26.0	
Apr. 21, 1972	0925	1.7	25.0	
May 18, 1972	1035	.28	25.0	
June 16, 1972	1450	1.2	26.0	
July 15, 1972	0928	1.2	26.0	
Aug. 10, 1972	1147	3.6	25.0	
Oct. 12, 1972	1110	1.1	26.0	
Oct. 16, 1972	1520	1.2	27.0	
Dec. 19, 1972	1530	1.1	28.0	30.0
Jan. 9, 1973	1100	.28	26.0	
Jan. 29, 1973	1005	.21	26.0	
Feb. 16, 1973	1100	.06	26.0	
Feb. 26, 1973	1410	.12	26.0	
May 7, 1973	1350	.18	27.0	
July 2, 1973	1020	3.7	25.0	
Aug. 15, 1973	1050	.79	28.0	
Aug. 29, 1973	1045	1.2	27.0	
Dec. 4, 1973	1100	1.1	28.0	
Mar. 7, 1974	1550	.34	28.0	
July 10, 1974	1553	3.0	26.5	
Aug. 16, 1974	1553	2.2	27.5	30.0
Sept. 12, 1974	1555	.98	26.5	28.0
Oct. 3, 1974	1605	3.1	27.0	31.0

Table 76. Water and air temperatures and instantaneous discharge at Mukong Stream, Gagil-Tamil--Continued

Date	Time	Instantaneous discharge (ft^3/s)	Temperature water (^oC)	Temperature air (^oC)
Apr. 1, 1975	1530	0.17	28.0	31.0
Apr. 2, 1975	1350	.17	28.0	32.0
Apr. 16, 1975	0955	.03	26.0	28.0
Apr. 30, 1975	1030	14	26.0	28.0
May 20, 1975	0945	4.7	27.0	29.5
June 18, 1975	1425	11	27.0	29.0
July 8, 1975	1025	3.1	26.0	28.0
July 28, 1975	1020	.89	26.0	29.0
Aug. 6, 1975	0945	3.0	26.0	29.0
Aug. 14, 1975	1552	3.2	27.0	32.0
Aug. 27, 1975	1045	1.4	26.0	28.0
Sept. 18, 1975	1010	6.9	26.0	29.0
Oct. 7, 1975	0940	3.9	26.0	27.0
Nov. 5, 1975	0945	.86	26.0	29.0
Dec. 3, 1975	1000	2.9	25.0	27.0
Dec. 22, 1975	0915	3.6	25.0	27.0
Jan. 8, 1976	1415	.77	25.0	29.0
Jan. 27, 1976	0935	1.9	25.0	26.0
Feb. 3, 1976	1335	1.4	26.0	27.5
Feb. 18, 1976	1410	.45	27.0	33.0
Mar. 3, 1976	0935	.33	26.0	28.5
Mar. 12, 1976	0920	.31	26.0	28.0
Apr. 1, 1976	1100	2.4	25.5	28.0
Apr. 15, 1976	1030	.67	26.0	28.0
May 3, 1976	1120	.80	27.0	32.0
May 19, 1976	1020	4.8	26.0	28.5
June 15, 1976	1030	1.5	27.0	29.0
July 7, 1976	1010	1.8	26.0	28.0
July 26, 1976	1030	2.0	26.0	29.5
Aug. 9, 1976	1430	4.0	27.0	30.0
Aug. 26, 1976	1130	3.5	26.0	27.0
Sept. 16, 1976	0950	3.5	25.5	28.0
Oct. 10, 1976	0845	.71	26.5	28.0
Nov. 2, 1976	1015	.77	26.0	27.5
Dec. 2, 1976	1000	2.0	23.0	25.0
Dec. 29, 1976	1040	2.3	26.0	27.0
Jan. 20, 1977	1115	.60	26.5	29.0
Feb. 3, 1977	0945	.80	27.5	29.0
Mar. 10, 1977	1040	.24	26.0	30.0
Mar. 22, 1977	1010	.17	26.0	29.0
June 30, 1977	1110	1.6	27.0	29.0
Aug. 10, 1977	1420	1.2	28.0	30.0
Sept. 29, 1977	1520	1.1	26.0	30.0
Nov. 1, 1977	0930	.59	26.0	29.5

Table 76. Water and air temperatures and instantaneous discharge at Mukong Stream, Gagil-Tamil--Continued

Date	Time	Instantaneous discharge (ft^3/s)	Temperature water (^oC)	Temperature air (^oC)
Nov. 16, 1977	1415	0.69	28.0	34.0
Nov. 29, 1977	0950	.82	26.0	30.0
Dec. 15, 1977	0940	3.9	26.0	28.0
Dec. 29, 1977	0925	.58	26.0	27.5
Jan. 12, 1978	0915	.65	25.0	27.0
Feb. 1, 1978	0940	.67	26.0	28.0
Feb. 23, 1978	0945	.46	27.0	29.0
Mar. 15, 1978	1500	.32	28.0	31.0
Mar. 30, 1978	1400	.18	27.0	32.5
Apr. 12, 1978	0940	.10	26.0	28.0
Apr. 18, 1978	1640	.58	28.0	32.0
May 4, 1978	1010	.11	27.5	28.0
May 25, 1978	1355	.19	27.5	31.0
June 15, 1978	0940	.32	26.5	28.5
June 28, 1978	0950	.80	27.0	28.5
July 21, 1978	1000	.86	26.0	29.0
Aug. 30, 1978	1000	2.4	26.5	28.5
Sept. 15, 1978	1005	6.1	26.0	26.5
Sept. 29, 1978	1345	1.6	29.0	32.0
Oct. 26, 1978	1000	1.2	27.0	27.5
Nov. 8, 1978	0940	.98	26.0	29.5
Nov. 28, 1978	0930	1.1	25.5	28.5
Dec. 12, 1978	0920	2.4	26.0	28.0
Dec. 27, 1978	0930	1.1	25.0	28.0
Jan. 12, 1979	1410	.48	26.5	31.0
Jan. 31, 1979	0935	.37	25.5	28.0
Feb. 13, 1979	0930	.22	25.5	27.5
Feb. 27, 1979	1355	.20	27.0	32.0
Mar. 15, 1979	0855	1.0	26.0	28.0
Mar. 30, 1979	1535	.18	28.0	32.5
Apr. 7, 1979	1355	.09	27.5	31.0
Apr. 25, 1979	0900	.13	26.5	29.0
May 17, 1979	1710	.18	27.0	33.0
May 31, 1979	1620	.15	28.5	35.5
June 14, 1979	1400	1.7	27.0	30.0
June 29, 1979	1420	3.7	28.0	30.0
July 13, 1979	0925	2.2	26.0	32.0
July 30, 1979	0910	1.1	--	28.0
Aug. 9, 1979	1025	6.2	25.5	27.5
Aug. 22, 1979	0915	1.6	26.0	29.0
Sept. 6, 1979	1410	.90	28.0	34.5
Sept. 20, 1979	1135	1.2	26.5	33.0
Oct. 10, 1979	1415	1.5	26.0	27.0
Oct. 31, 1979	1030	1.3	27.5	28.5

Table 76. Water and air temperatures and instantaneous discharge at Mukong Stream, Gagil-Tamil--Continued

Date	Time	Instantaneous discharge (ft^3/s)	Temperature water (^oC)	Temperature air (^oC)
Nov. 19, 1979	1410	0.60	28.0	33.0
Dec. 5, 1979	1010	.56	26.0	29.5
Dec. 27, 1979	1040	.99	27.0	30.0
Jan. 22, 1980	1420	.51	27.0	32.5
Feb. 1, 1980	1510	.32	28.0	28.0
Feb. 23, 1980	1215	1.8	25.5	26.5
Mar. 12, 1980	0955	.24	26.5	28.5
Mar. 28, 1980	1110	.58	26.0	29.5
Apr. 11, 1980	0905	.57	26.5	30.0
Apr. 23, 1980	0930	.46	26.5	30.0
May 16, 1980	1430	1.2	27.5	31.0
June 3, 1980	0920	.83	27.0	30.5
June 19, 1980	1015	.52	27.5	32.5
July 24, 1980	1305	1.5	28.0	32.0
July 31, 1980	1430	1.7	25.0	31.0
Aug. 30, 1980	1130	7.1	26.0	27.0
Sept. 16, 1980	0930	2.5	26.0	28.0
Nov. 4, 1980	1140	.50	27.5	29.0

Table 77. Water and air temperatures and instantaneous discharge at Gilaew (Bileiy) Spring, Gagil-Tamil

Date	Time	Instantaneous discharge (ft^3/s)	Temperature water (^oC)	Temperature air (^oC)
July 30, 1969	1350	0.80	26.0	
Oct. 15, 1969	1005	.12	26.0	
Oct. 30, 1969	0900	.11	26.0	
Nov. 12, 1969	0910	.19	26.0	
Nov. 25, 1969	1345	.19	26.0	
Dec. 18, 1969	1405	.11	28.0	
Jan. 14, 1970	0925	.10	26.0	
Jan. 22, 1970	1445	.07	26.0	
Feb. 3, 1970	0900	.05	26.0	
Feb. 19, 1970	1020	.03	26.0	
Mar. 10, 1970	0915	.02	27.0	
July 13, 1970	1510	.08	27.0	
Oct. 3, 1970	1425	.18	28.0	
Oct. 12, 1970	1430	.37	26.0	
Oct. 22, 1970	1105	.17	27.0	
Nov. 9, 1970	1045	.11	26.0	
Nov. 23, 1970	1400	.25	27.0	
Dec. 16, 1970	1115	.09	27.0	
Dec. 28, 1970	1320	.06	27.0	
Jan. 6, 1971	1515	.02	27.0	
Jan. 26, 1971	1010	.10	26.0	
Feb. 8, 1971	1630	.05	26.0	
Feb. 25, 1971	1405	.08	27.0	
Mar. 23, 1971	1515	.14	27.0	
Apr. 22, 1971	1015	.05	27.0	
May 26, 1971	1050	.30	25.0	
Mar. 23, 1972	1515	.18	26.0	
Apr. 20, 1972	1430	.06	28.0	
May 18, 1972	0850	.03	25.0	
June 16, 1972	1305	.02	29.0	
July 15, 1972	1405	.07	28.0	
Aug. 10, 1972	1015	.25	25.0	
Sept. 18, 1972	1025	.81	26.0	
Oct. 12, 1972	0940	.20	26.0	
Oct. 16, 1972	1410	.11	27.0	
Nov. 9, 1972	1400	.04	29.0	27.0
Dec. 19, 1972	1415	.03	28.0	31.0
Jan. 9, 1973	0926	.02	26.0	
Jan. 29, 1973	0905	.01	26.0	
Oct. 3, 1973	1005	.31	26.0	
Dec. 28, 1973	1005	.10	26.0	
Mar. 7, 1974	1508	.01	27.5	
July 10, 1974	1450	.11	27.0	
July 29, 1974	1355	.24	26.0	

Table 77. Water and air temperatures and instantaneous discharge at Gilaew (Bileiy) Spring, Gagil-Tamil--Continued

Date	Time	Instantaneous discharge (ft^3/s)	Temperature water (^oC)	Temperature air (^oC)
Aug. 16, 1974	1512	0.45	27.0	31.5
Sept. 12, 1974	1506	.06	27.0	29.5
Oct. 3, 1974	1525	.05	25.5	32.0
Nov. 9, 1974	1640	.45	26.0	29.0
Apr. 30, 1975	1135	.10	26.0	31.0
July 8, 1975	1100	.18	26.0	29.0
Aug. 27, 1975	1220	.16	30.0	34.0
Oct. 7, 1975	1055	.10	27.0	35.0
Dec. 3, 1975	1105	.04	26.0	29.0
Jan. 8, 1976	1550	.08	24.0	28.0
Apr. 1, 1976	1230	.05	27.5	29.5
May 19, 1976	1150	.42	27.0	30.0
Aug. 9, 1976	1545	.09	26.0	28.0
Oct. 10, 1976	0950	.07	27.0	29.5
Dec. 2, 1976	0915	.20	24.5	26.5
Jan. 20, 1977	0945	.07	27.0	29.0
Nov. 29, 1977	1105	.01	29.0	30.5
Dec. 29, 1977	1030	.03	26.5	30.5
Feb. 1, 1978	1040	.03	27.0	30.0
Mar. 15, 1978	1435	.02	29.0	32.0
Apr. 12, 1978	0855	.01	26.0	28.0
Aug. 30, 1978	0855	.02	26.0	27.5
Oct. 26, 1978	0850	.02	26.0	27.0
Nov. 28, 1978	1035	.02	26.0	30.0
Dec. 27, 1980	0905	.18	25.0	27.0
Sept. 16, 1980	1130	.40	27.0	28.0
Oct. 20, 1980	1100	.21	27.0	29.0

Table 78. Water and air temperatures and instantaneous discharge at Gilaew (Bileiy) Stream, Gagil-Tamil

Date	Time	Instantaneous discharge (ft^3/s)	Temperature water (^oC)	Temperature air (^oC)
Sept. 19, 1969	1420	0.46	82.0	
Nov. 6, 1969	0940	.88	78.0	
Nov. 18, 1969	1340	.32	78.0	
Jan. 14, 1970	1023	.24	26.0	
Jan. 29, 1970	0945	.20	26.0	
Sept. 15, 1970	1100	.15	80.0	
Sept. 29, 1970	1055	.19	78.0	
Oct. 5, 1970	1100	.35	27.0	
Oct. 30, 1970	0930	.38	26.0	
Nov. 12, 1970	1400	.45	27.0	
Nov. 25, 1970	0955	.54	26.0	
Dec. 28, 1970	1455	.14	26.0	
Jan. 6, 1971	1400	.15	26.0	
Mar. 23, 1972	1600	.42	26.0	
Apr. 21, 1972	0840	.10	25.0	
May 18, 1972	0950	.06	25.0	
June 16, 1972	1320	.08	26.0	
July 15, 1972	1445	.13	27.0	
Aug. 10, 1972	1103	.48	25.0	
Sept. 18, 1972	1125	2.0	26.0	
Oct. 12, 1972	1025	.39	26.0	
Jan. 9, 1973	1015	.04	26.0	
July 10, 1974	1346	.46	27.0	
Aug. 16, 1974	1426	1.2	27.5	30.5
Sept. 12, 1974	1410	.27	28.0	33.5
Oct. 3, 1974	1439	.32	27.0	31.5
Nov. 9, 1974	1543	1.4	27.0	31.0
Dec. 3, 1974	1348	.67	28.0	35.0
Jan. 2, 1975	1413	.40	28.0	32.0
Apr. 30, 1975	1150	.29	26.0	29.0
May 20, 1975	1045	.19	28.0	32.0
July 8, 1975	1150	.81	25.0	27.0
Aug. 27, 1975	1140	.36	26.0	30.0
Oct. 7, 1975	1020	.64	27.0	30.0
Dec. 3, 1975	1030	.20	27.0	29.0
Feb. 18, 1976	1450	.10	28.0	32.5
Apr. 15, 1976	1210	.11	28.0	30.0
May 19, 1976	1115	1.7	27.0	29.0
July 7, 1976	1045	.42	27.0	29.0
Aug. 9, 1976	1510	.71	27.0	29.5
Oct. 10, 1976	0930	.41	27.0	29.0
Dec. 2, 1976	0835	.26	25.0	26.0
Jan. 20, 1977	1030	.10	26.0	29.0
Nov. 29, 1977	1030	.13	27.5	32.5

Table 78. Water and air temperatures and instantaneous discharge at Gilaew (Bileiy) Stream, Gagil-Tamil--Continued

Date	Time	Instantaneous discharge (ft^3/s)	Temperature water (^oC)	Temperature air (^oC)
Dec. 29, 1977	1000	0.13	26.0	28.0
Feb. 1, 1978	1010	.07	26.0	29.0
Mar. 15, 1978	1420	.06	29.5	32.5
Apr. 12, 1978	0840	.02	25.0	26.5
June 8, 1978	0820	.05	26.0	27.0
July 21, 1978	0915	.13	25.5	32.0
Aug. 30, 1978	0830	.11	25.0	27.0
Oct. 26, 1978	0825	.06	25.5	27.0
Nov. 28, 1978	1010	.14	25.0	28.5
Dec. 27, 1978	1005	.30	25.0	25.5
Dec. 27, 1979	0935	.18	27.0	30.0

Table 79. Water temperature and instantaneous discharge at Yanbilang Stream, Gagil-Tamil

Date	Time	Instantaneous discharge (ft^3/s)	Temperature water (^oC)
Oct. 15, 1969	0905	0.02	25.5
Nov. 6, 1969	1040	.12	25.5
Sept. 29, 1970	1025	.07	26.0
Oct. 7, 1970	1755	.04	28.0
Oct. 30, 1970	1325	.09	27.0
Nov. 12, 1970	1335	.12	27.0
Nov. 25, 1970	0920	.05	26.0
Dec. 24, 1970	1530	.02	27.0
Jan. 6, 1971	1325	.21	26.0
Jan. 26, 1971	0835	.01	26.0

Table 80. Water and air temperatures and instantaneous discharge at Eyeb Stream, Gagil-Tamil

Date	Time	Instantaneous discharge (ft^3/s)	Temperature water (^oC)	Temperature air (^oC)
Sept. 19, 1980	1140	1.9	26.5	
Oct. 20, 1980	1300	4.7	26.0	27.0
Mar. 24, 1981	1420	.20	28.0	29.5
Apr. 7, 1981	1320	.19	28.0	29.5
Apr. 27, 1981	1325	.04	27.5	28.0
May 14, 1981	1230	.07	28.5	29.5
July 18, 1981	1010	2.2	26.0	
Jan. 20, 1982	1305	.49	26.5	28.0
Feb. 9, 1982	1215	1.6	26.5	28.0
Mar. 24, 1982	0935	2.2	25.5	26.5
Apr. 8, 1982	1200	.31	26.0	27.5
Apr. 26, 1982	1255	.19	28.5	27.5
May 7, 1982	1020	.40	27.0	
May 28, 1982	1115	.54	28.0	29.5
June 15, 1982	1455	.36	27.5	28.5
July 7, 1982	1320	1.3	27.5	29.0
Aug. 2, 1982	1300	1.0	27.0	28.0
Aug. 18, 1982	1130	1.4	26.0	27.5
Sept. 13, 1982	1230	14	26.5	27.0
Sept. 29, 1982	1405	.85	26.5	28.0
Oct. 18, 1982	1111	.77	26.0	27.0
Nov. 10, 1982	1010	.77	26.0	27.5
Nov. 24, 1982	1120	.58	26.0	27.0
Dec. 9, 1982	1250	2.4	26.5	27.5

Table 81. Water and air temperatures and instantaneous discharge at Qamin (Amin) Stream, Maap

Date	Time	Instantaneous discharge (ft^3/s)	Temperature water (^oC)	Temperature air (^oC)
Sept. 19, 1980	1550	0.49	27.0	
Oct. 20, 1980	0950	1.2	26.0	29.0
Mar. 24, 1981	1230	.03	27.0	29.5
July 18, 1981	1330	.28	26.5	

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