WATER RESOURCES OF THE TRUK ISLANDS

By Otto van der Brug

U.S. GEOLOGICAL SURVEY

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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)
nautical mile (nmi)	1.852	kilometer (km)
Area		
acre	4047	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)	1233	cubic meter (m^3)
cubic foot (ft^3)	0.02832	cubic meter (m^3)
gallon (gal)	3.785	liter (L)
million gallons (Mgal)	3785	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)
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 [$(m^3/s)/km^2$]
foot per day (ft/d)	0.3048	meter per day (m/d)
micromho per centimeter at 25° Celsius (µmho/cm at 25°C)	1.000	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.

Cfs-day (ft^3/s)-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.

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.

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 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 relationship 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 elevation 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 as Nephelometric Turbidity Units (NTU).

Geology

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

Andesite: A volcanic rock of fine-grained texture, consisting chiefly of plagioclase feldspar and ferromagnesian minerals, without olivine.

Basalt: Dark-colored, fine-grained igneous dike or flow rock of relatively high specific gravity, composed primarily of plagioclase feldspar and pyroxene, with or without olivine.

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.

Conglomerate: A rock made up of water-worn and rounded pebbles of other rocks cemented together.

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

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

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

Peat: Unconsolidated soil material consisting largely of undecomposed or slightly decomposed organic matter accumulated under conditions of excessive moisture.

Pyroclastic rock: A general term applied to detrital volcanic materials that have been explosively or aerially ejected from a volcanic vent.

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

Talus: An accumulated heap of rock fragments derived from and lying at the base of a cliff or very steep slope.

Trachyte: Light-colored, fine grained, igneous flow or dike rocks differing from andesites chiefly in having more alkalic feldspar and less dark minerals in the fine ground mass.

Tuff: Indurated pyroclastic rocks of grain generally finer than 4 mm, the indurated equivalent of volcanic ash or dust.

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ABSTRACT

The Truk Islands consist of 19 volcanic islands and about 65 coral islets. The volcanic islands and some of the coral islets are scattered in an 820-square-mile lagoon enclosed by a 125-mile long barrier reef. Moen, although not the largest, is by far the most developed island and is the administrative, commercial, educational, and transportation center of the islands.

This report summarizes all hydrologic data collected and provides interpretations that can be used for development and management of the water resources.

Monthly rainfall records are available for most years since 1903, although they were not collected on the same island. On Moen, the average annual rainfall is 144 inches and runoff-rainfall comparisons show that about half of this rainfall runs off as surface water into Truk Lagoon.

Flow characteristics of the major streams, based on more than 11 years of record, are provided and the application of data for possible use in the design of reservoirs and rain catchments is included.

Historical and present development of all water sources are given. Virtually all water produced in the Truk Islands comes from the Administration area on Moen, where a 90-acre catchment area and the only known large aquifer in the islands are located. Runoff from the catchment area ranges from 15,000 to 150,000 gallons per day depending on the amount of rainfall, and production of ground water ranges from 500,000 to 800,000 gallons per day depending on the number of wells in operation and their pumping rates. The chemical analyses of surface and ground water on Moen, with the exception of water from well 9, indicate that the quality of the water is good.

INTRODUCTION

Cooperation

In 1968, the U.S. Geological Survey and the Trust Territory of the Pacific Islands entered into a joint funding agreement to 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 advise on exploratory drilling and ground-water development. Water quality was introduced into the program in 1979 with the collection of biannual samples from surface and ground water for chemical analyses.

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

After 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 purpose of this report is two-fold. First, it seeks to provide a summary of available water-resources data for the Truk Islands and second, it provides interpretations that can be used by planning and public works officials.

The bulk of the hydrologic data collected since 1954 on the Truk Islands consists of surface-water records for most of the principal streams. More recently, the data base has been expanded to include information on ground-water resources, on water quality, and on rainfall. Data collected prior to mid-1960 were published by the U.S. Geological Survey in "Surface Water Supply of Mariana, Caroline and Samoa Islands through June 1960" and in "Military Geology of the Truk Islands," (Valenciano and Takasaki, 1959).

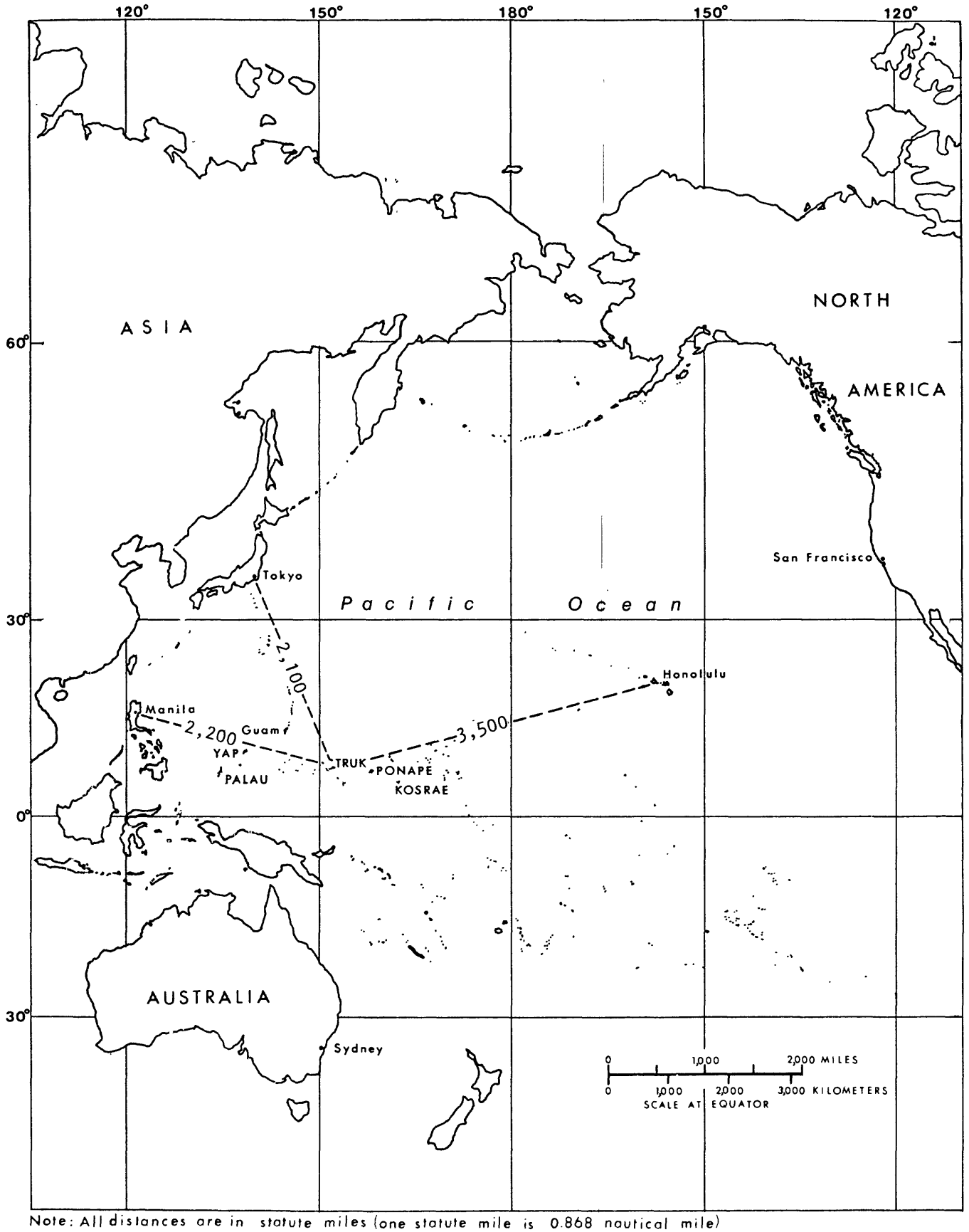
Most of the data collected since 1968 have been published by the Geological Survey in the annual release "Water Resources Data for Hawaii and other Pacific Areas." For 1968-70, the information also was published in Water-Supply Paper 2137: "Surface Water Supply of the United States, 1966-70; Part 16. Hawaii and other Pacific Areas."

Geographic Setting

The Truk Islands, located about 2,100 miles southeast of Tokyo, 2,200 miles east-southeast of Manila and 3,500 miles west-southwest of Honolulu, consist of 19 high volcanic islands and at least 65 low coral islets (fig. 1).

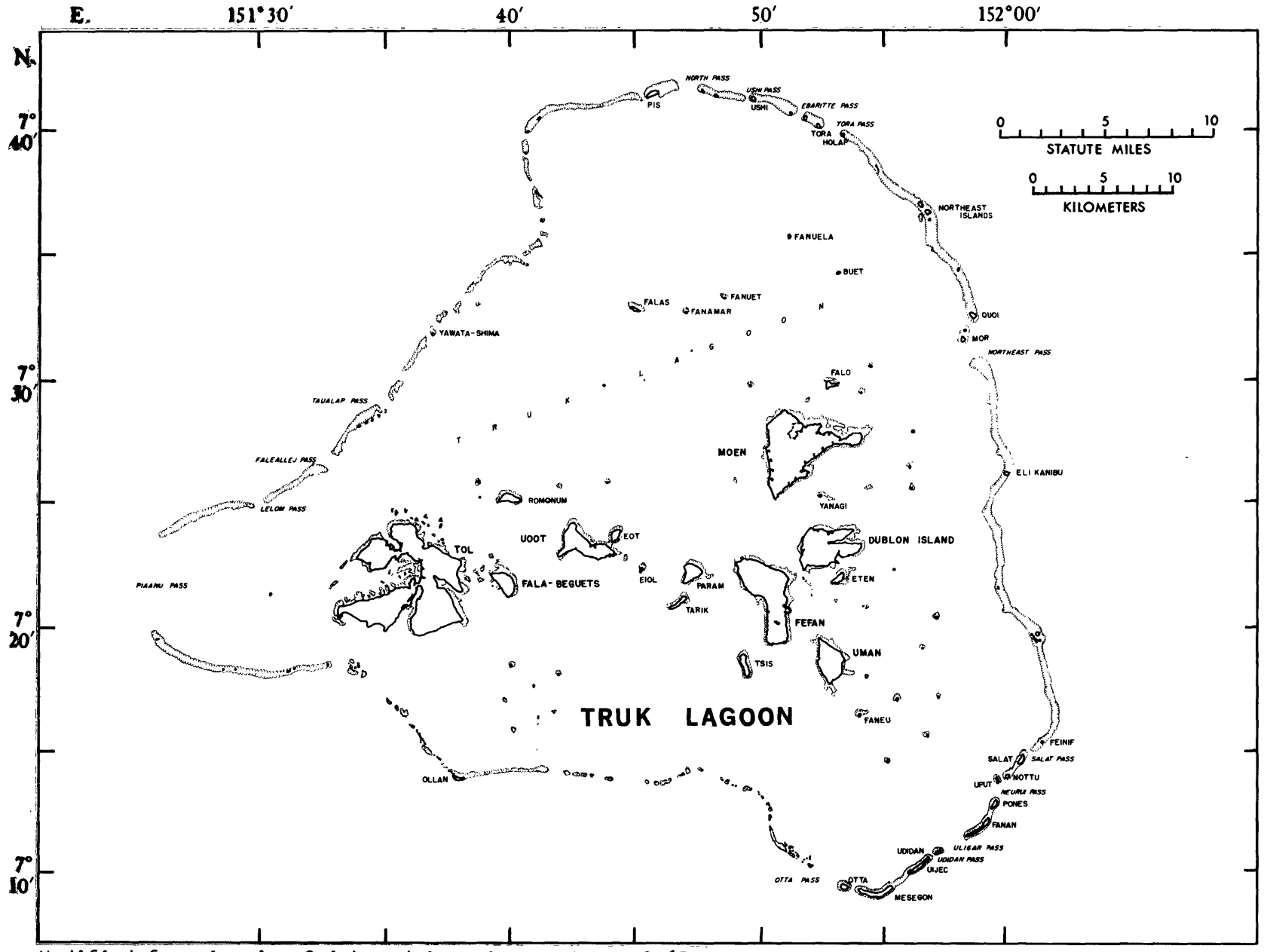
Many of the coral islands are a part of the 125-mile-long barrier reef that encloses an 820-square-mile lagoon in which the volcanic islands and remaining coral islets are scattered (fig. 2). The volcanic islands are the erosive remnants of a partly submerged large shield volcano, which has long been inactive.

The volcanic islands comprise about 97 percent of the total land area of 35 square miles and range in altitude from 30 to 1,460 feet above sea level. Many have sloping sides which end in narrow coastal flats where the inhabitants live. Frequently, the flats are poorly drained and, in some places, are bordered by mangrove swamps. The volcanic islands are drained by streams, most of them short with small drainage areas. Vegetation is tropical and lush, except on some high ridges where it is sparse because of rocky soil.



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

Figure 1. Location of the Truk Islands.



Modified from Austin, Smith and Associates, Inc., 1967.

Figure 2. Truk Lagoon.

The climate is uniformly warm and humid. Temperatures average 27.3°C, relative humidity 82 percent, and rainfall 144 inches per year. From November to June, northeasterly trade winds are prevalent and for the remainder of the year, the islands experience moist southerly winds as they are influenced by the Intertropical Convergence Zone.

Tol, the largest and historically the most populous island, has an area of 13 mi^2 (square miles) and consists of four volcanic areas separated by deep bays. Mangrove swamps fringe the coast. Mount Winipot (called Mount Tumuital on the Army Map Service map, 1957), the highest point of the Truk Islands, stands 1,460 feet above mean sea level.

Moen, with a land area of 7.2 mi^2, is the second largest island; like Tol, much of the area consists of steep and rugged terrain, with Mount Tonoken being the highest point (1,212 ft). Moen is the administrative, commercial, educational, and transportation center of the islands. Continuing migration to Moen from the other islands occurs because of employment opportunities, educational facilities, and the attractions of urban life. The population has increased fourfold during the last two decades reaching 9,077 in the 1976 census (Austin, Tsutsumi and Associates, 1977) with nearly 70 percent of the increase due to migration from the other islands (Hawaii Architects and Engineers, 1968).

Fefan, 4.7 mi^2 in area, is a continuous mountain ridge. Coastal areas consist partly of mangrove swamps, freshwater marshes, and beaches, while inland areas support agriculture.

Dublon Island, 3 miles south of Moen with an area of 3.4 mi^2, was the administrative and military center during the Japanese Administration (1914-1945) and the most developed island during that period. Two volcanic mountains, Mount Tonomwan and Mount Foukenau, with altitudes of 1,129 and 811 feet respectively, form the main mass of the island, with two eastward projecting peninsulas. The slopes of the island are steep, except in the saddle between the mountains and at the base of the peninsulas.

Udot, 1.8 mi^2, consists of three volcanic highlands connected by narrow necks and Uman, 1.6 mi^2, is a conical-shaped volcanic rock.

The remaining islands are much less than one square mile in area and have few inhabitants.

The economic base of the islands is narrow, as the government is almost the sole employer. Only a small amount of income is derived from tourism, fishing, and copra production.

Historical Development

The first Westerner to view the Truk Islands was the Spanish explorer, Alonso de Arellano, aboard the "San Lucas" on January 17, 1565. Natives in canoes invited him into the Truk Lagoon to the large island of Tonowas (Dublon Island) where he was attacked, but he managed to escape. This was the only recorded contact with Truk until the 19th century. Truk did appear on maps in the 18th century, but only through information from native sources and was marked as "Torres" or Hogoleu" (Hezel, 1973).

Rudimentary maps were drawn by the French explorer Manuel Dublon, who visited the islands on December 10, 1814, and by Louis Duperry, who talked to the natives on June 24, 1824, but did not enter the lagoon.

In 1881, the captain of the missionary ship "Morning Star" wrote: "There is but one white man in all of Ruk (Truk) Lagoon and worldly influences have not been felt" (Hezel, 1973).

When the Spanish interests in the Pacific were challenged by Germany in 1885, Pope Leo XIII mediated the dispute in favor of Spain, and, in 1887, the first Spanish governor of the Eastern Caroline Islands arrived on Ponape (Pompey 1969). The people in the Truk Islands were left alone until Germany purchased the Caroline Islands from Spain in 1899. Early in 1901, the Germans sent a Ponapean, Henry Nanpei, to Truk to mediate the warfare between the islands (Bernard, 1977). All warfare ended after two German warships arrived in 1904 and confiscated the weapons sold by Japanese traders (Dolan, 1974). The Germans encouraged copra production by requiring every household to plant a number of coconut trees each year (Coulter, 1957). They surveyed the land and gave title to its owners.

At the outbreak of World War I, in 1914, the Japanese occupied the islands and after the War, Japan was given a mandate to administer the islands by the League of Nations. The Japanese built roads and began to develop the water resources. Large Naval and Air Force installations were in operation on the Truk Islands, until they were neutralized by intensive American bombing during 1944.

The Americans occupied the islands on September 3, 1945. The islands remain under American Administration until their impending independence as one of the Federated States of Micronesia.

Population

In 1827, the number of people in the Truk Islands was estimated to be 35,000 (Austin, Smith and Associates, 1967). The population was decimated by imported diseases, but began to increase again at the beginning of the 20th century. In 1920, the estimated population was 9,800, and in 1935, the population had increased to 10,344, according to Japanese figures (Great Britain Naval Intelligence Div., 1945).

Before World War II, there were few Japanese civilians in the islands and Truk was used mainly as an anchorage for the Japanese 4th Fleet. Between November 15, 1940, when the Japanese 4th Defense Unit was organized, and February 17 and 18, 1944, when successful raids on Truk were made by an American task force, the Japanese military presence rapidly escalated. In 1945, at the end of the war, the Japanese forces numbered 38,360, of which 14,220 were civilians working for the Navy (Stark and others, 1958). All Japanese were repatriated shortly after the end of the war, and in 1946, there were 14,032 people left in the islands (Coulter, 1957).

In 1957, the population of the Truk Islands had increased to 18,605, of which 2,694 or 14.5 percent lived on Moen (U.S. Dept. of State, 1957 Annual report to the United Nations), and by 1967, the population had grown to 25,107, with 5,687 or 22.7 percent residing on Moen (Hawaii Architects and Engineers, 1968).

The 1976 Trust Territory census information shows a population of 9,077 on Moen. This indicates an average annual growth rate of more than 5 percent, which is very high even by the Southeast Asian standard of 3 percent (Austin, Tsutsumi and Associates, 1977). Preliminary figures of the 1980 U.S. census show 37,383 people residing in the Truk Islands (The New Pacific Magazine, 1981).

The growth is expected to continue and the population of the Truk Islands could reach 50,000 by 1995, with 18,000 people living on Moen.

Previous Investigations

No water-resources information is available from the Spanish and German periods, except for some rainfall records collected during the latter administration. Although the Japanese accomplished substantial development of the water resources, few data are available.

Since the end of World War II, a number of studies have been made by the U.S. Geological Survey. Piper (1946-47) was the first to make an appraisal of ground water in the islands as well as surface-water sources on Moen. He described some of the Japanese water systems on Moen and the potential for development of the Wichen River. Arnow (written communications, 1953 and 1954) collected information on surface-water sources and supply facilities on Moen and Dublon Islands.

Carson (Stark and others, 1958) visited 12 volcanic and 16 coral islands in 1955 and established staff gages, read twice daily, on streams on Moen, Dublon Island, and Tol. Stark described the geology, Paseur the soils and vegetation, and Hay and May the terrain features in "Military Geology of Truk Islands" (Stark and others, 1958).

Valenciano and Takasaki (1959) made a reconnaissance of the ground water on seven volcanic islands and one coral island. They also made many miscellaneous streamflow measurements on the seven volcanic islands (tables 44-49). In their "Military Geology of Truk Islands, Water Resources Supplement," they listed most water sources in use during 1957.

Stark and Hay (1963) made a structural, stratigraphic, and petrographic study of the rocks of the Truk Islands.

Acknowledgments

Throughout the years, cooperation from the Headquarters Staff of the Trust Territory of the Pacific Islands in Saipan and officials in the Truk District has been outstanding.

Special commendation is made to Koichi L. Wong, who was involved in all phases of the work since 1965; to Louis F. Irving, who acted as our liaison with the Trust Territory Headquarters; and to those listed below who did most of the data collection:

Bernard Y. Pillimon (1968-69)
Nehpoad Ben (1969-74)
Misaro Phares (1974)
Kinchiro Small (1974)
Carmelo Sam (1974-78)
Siongau Ezra (1981-present).

DESCRIPTIVE GEOLOGY

The volcanic islands of Truk are the erosive remnants of a partly submerged large shield volcano, which has long been inactive. The Truk volcano rises 16,000 feet from the ocean floor to 1,460 feet above sea level. At one time, it was at least several thousand feet higher (Stark and Hay, 1963). This volcano was built by basalt, andesite, and trachyte lava flows, and is interspersed with dikes and interbedded with pyroclastic rock and conglomerates (Stark and others, 1958). These volcanic rocks make up the bulk of each of the high islands. Younger sediments lying on them consist of slope-wash talus at the base of steep slopes, alluvium in valley bottoms and coastal lowlands, calcareous sands and minor amounts of limestone along the shores, with muck and peat found in coastal marshes and swamps.

Quoting from "Military Geology of the Truk Islands," (Stark and others, 1958):

> The volcanic rocks are thoroughly and deeply weathered in each island, except on the steepest slopes. In places they are weathered to depths of 30 or more meters. The permeability of weathered rock is low; however, it appears generally higher than that of most fresh volcanic rock.
>
> Surficial sediments make up only a small part of the total bulk of the high islands. The slope wash consists of disintegrated and decomposed volcanic rock which forms a discontinuous mantle of variable thickness on the mountain slopes. Its permeability is low but generally is higher than that of undecomposed volcanic rock. The talus is composed of generally coarse debris derived from the volcanic rocks in which varying amounts of fine material are mixed. Alluvial deposits underlying valley flats and coastal lowlands consist mostly of poorly sorted gravel, sand, and clay. The talus and alluvium generally are more permeable than the volcanic rocks.
>
> Calcareous sand and limestone on the high islands are confined to generally narrow discontinuous bands along the shore. The calcareous sand consists of beach deposits of unconsolidated, wave-worn coral and shell fragments, and the limestone of slightly cemented fragments of coral and shell. Both have relatively high permeabilities. The swamp and marsh deposits in the coastal lowlands consist of muck and peat which interfinger on the seaward edges with calcareous sands.
>
> The low islands consist mostly of unconsolidated calcareous debris ranging in size from sand to boulders. The material is generally poorly sorted except in the beaches. Sand is predominant in the beaches of the lagoon islands and in the lagoon-facing beaches of the barrier-reef islands. Wave-worn coarse detritus forms the ocean-facing beaches of the barrier-reef islands. Coralline limestone, formed by the growing reef, occurs locally, and consolidated beach deposits, or beach rock, is present in narrow bands along the shore of some islands. Depressions in the interiors of some larger islands contain a few feet of organic muck.

CLIMATE

General

Because the Truk Islands lie near the equator in an immense ocean, the climate is invariably warm and moist.

Temperatures are uniform; the mean monthly long-term average varies only 0.3°C throughout the year. Relative humidity is high and averages 82 percent; it is lowest during January to March (79 percent).

From November to June, the northeasterly trade winds are predominant, with an average velocity of 8-12 miles per hour. Southerly winds prevail from June to November and tropical disturbances are more frequent during this time of the year.

Typhoons are not common to the islands as they normally pass well to the north or west of the islands. In recent years, typhoon "Lola" (November 1957) and "Ophelia" (January 1958) passed north of Truk bringing 70 miles-per-hour winds to the islands. Typhoon "Amy" moved directly over the Truk Lagoon on May 1, 1971 with a peak wind speed of 113 miles per hour, and typhoon "Pamela" caused ten deaths on Moen on May 18, 1976.

Rainfall

Records of rainfall are available for most years since 1903 and were collected on several islands. German records, collected on Eten for 1903-11, were published in millimeters in "Strategic Bulletins of Oceania," No. 7 (Inst. Human Relations, 1943); for 1903-12, in millimeters in the annual publication "Mitt(h)eilungen von Forschungreisenden und Gelehrten aus den deutschen Schutzgebieten"; and for 1903-13, converted to inches in "Climatology of Truk". For the months with small differences between the publications, values published in millimeters were used after conversion to inches (table 21).

Rainfall records, collected on Dublon Island by the Japanese during 1927-40, were converted from millimeters to inches in "Climatology of Truk". For 1935-40, they were reported in millimeters in "World Weather Records, 1941-50" (U.S. Weather Bureau, 1959). Many values in the two publications differ slightly; for 1935-40, the values, converted to inches from "World Weather Records", were preferred, as errors in the totals of the other publication were noticed (table 22).

During 1932-34, the Japanese also collected weather records on several other islands: Udot, Tol, Moen and Uman (Bryan, 1946). For 1933 and 1934, rainfall records for these stations were published in inches in "Climatology of Truk" (table 23).

A weather station was operated at Moen Airport by the U.S. Navy from December 18, 1945 to July 1, 1951, and by the National Weather Service thereafter. Climatological data from Moen Airport station are published monthly by the National Oceanic and Atmospheric Administration (table 24).

During 1955-57, daily rainfall readings were made for the U.S. Geological Survey on four islands (table 25). Here, the only complete record for a full calendar year is for 1956 for the small island of Eot, located in the center of the Truk lagoon. This total is within 3 percent of the 1956 total for Moen Airport.

Cumulative rainfall readings were made by the U.S. Geological Survey during part of 1973-77 on Moen, Dublon Island, and Tol (tables 26-30). Because of vandalism and other mishaps, these records are not complete. Values suspected to be in error in excess of 10 percent have been omitted.

All rain gages, which have been in operation in the Truk Islands, are listed in table 1 and their locations are shown in figure 3.

In the Truk Islands, there is a clear distinction between the short dry season and a much longer wet season. During January to March, only 16 percent of the annual rainfall was recorded. Thus, the average percentage of annual rainfall for the first 3 months of the year is 5.4 percent compared with a monthly average of 9.3 percent during the remaining 9 months (table 2).

The highest monthly rainfall total during the periods of record was 34.89 inches, recorded for December 1959 and the lowest monthly total was 0.07 inches for February 1931.

Table 1. Rain gages in the Truk Islands

Period of record	Location	Latitude north	Longitude east	Altitude (ft)	Remarks	Frequency of reading	Size can (in.)
1903-11	Eten Island	7°21"	151°53'	--	German station	At least daily	--
1927-40	Dublon Island	7°23'	151°54'	360	Japanese station	4 x hourly	4
1933-34	Udot	7°23'	151°44'	--	do.[1/]	--	--
Do.	Tol	7°21'	151°38'	--	do.[1/]	--	--
Do.	Moen	7°28'	151°51'	--	do.[1/]	--	--
Do.	Uman	7°18'	151°53'	--	do.[1/]	--	--
1946-53	Moen Airport	7°27'22"	151°50'17"	8	U.S. Navy	Hourly	4
1954-present	do.	7°27'22"	151°50'17"	5	U.S. Weather Service	do.	8
1955-56	Pis	7°40'34"	151°45'52"	10	USGS	Daily	8
1955-57	Eot	7°23'03"	151°44'08"	5	USGS	do.	8
Do.	Dublon Island	7°22'27"	151°53'26"	300	USGS	do.	8
Do.	Moen	7°26'30"	151°51'04"	450	USGS, at Pou Stream	Biweekly	8
1974-77	do.	7°26'38"	151°51'38"	200	USGS, at Wichen River	Monthly	6
1973-76	do.	7°25'39"	151°51'07"	30	USGS, at Nachiponong Stream	do.	6
1973	Tol	7°20'49"	151°37'04"	20	USGS, at Echapachik Stream	do.	6
1974-76	Dublon Island	7°22'30"	151°51'43"	25	USGS, at Chun Stream	do.	6
1973-76	do.	7°22'34"	151°52'27"	25	USGS, at Tumunu Stream	do.	6

[1/] Exact location not known.

Note: Locations of U.S. rain gages based on 1981 U.S. Geological Survey maps, scale 1:10,000.

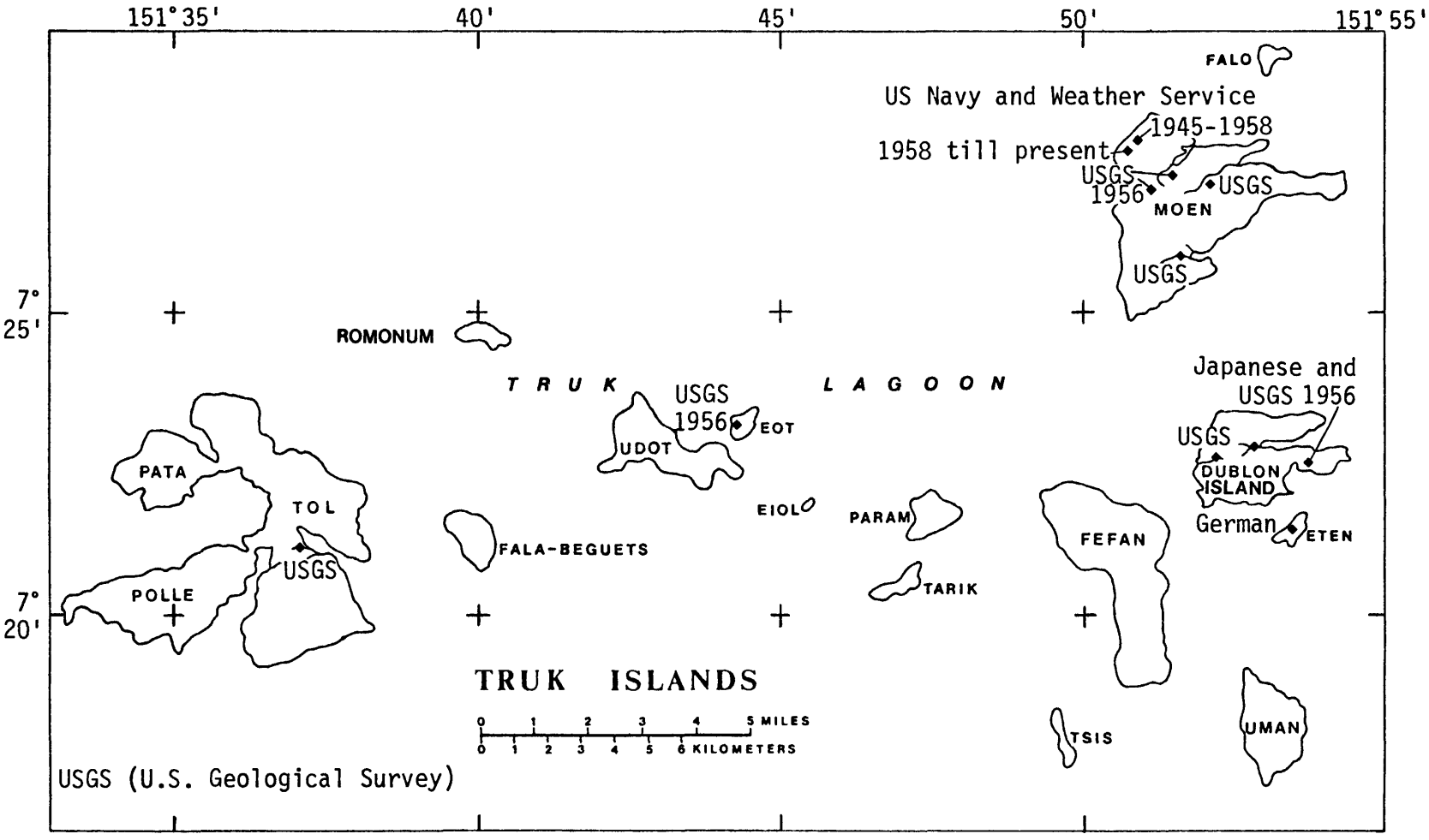


Figure 3. Location of rain gages.

Table 2. Monthly and annual long-term means of rainfall, in inches

	German data for Eten 1903-13			Japanese data for Dublon Island 1927-31, 1933-40			U.S. Weather Service data for Moen 1948, 1950, 1952-82		
	Number of years	Monthly means	Percent	Number of years	Monthly means	Percent	Number of years	Monthly means	Percent
January	7	5.71	4.6	13	7.08	6.0	33	8.35	5.8
February	9	8.10	6.4	13	4.67	4.0	33	6.24	4.3
March	9	7.28	5.8	13	6.87	5.8	33	8.80	6.1
April	8	11.40	9.1	13	10.08	8.6	33	12.29	8.5
May	8	12.23	9.7	13	11.48	9.8	33	15.44	10.7
June	8	11.25	9.0	13	11.58	9.9	33	12.78	8.9
July	8	13.46	10.7	13	10.76	9.2	33	14.12	9.8
August	7	12.31	9.8	13	11.02	9.4	33	13.64	9.5
September	8	12.03	9.6	13	10.84	9.2	33	13.31	9.3
October	7	9.91	7.9	13	11.60	9.9	33	14.20	9.9
November	8	11.21	8.9	13	11.37	9.7	33	11.59	8.1
December	8	10.74	8.5	13	10.05	8.5	33	13.15	9.1
Total	7-9	125.65	100	13	117.40	100	33	143.91	100

Although the mean annual rainfall total on Eten for 1903-13 was 126 inches, and on Dublon Island during 1927-40 and on Moen during 1948-82, 117 and 144 inches respectively, the distribution throughout the year was fairly uniform (fig. 4). Rainfall for the periods during which cumulative rainfall data are available for a number of consecutive months on Dublon Island and Tol, was compared with rainfall on Moen during the same periods. Rainfall on Dublon Island at Chun Stream was within one percent and at Tumunu Stream within 10 percent of the Moen airport rainfall. Rainfall on Tol at Echapachik Stream was within 3 percent of Moen rainfall. These comparisons involve only relatively short periods and give only an indication that the areal distribution of rainfall in the Truk Islands generally does not vary much.

Air Temperatures

In tables 31 and 32, air temperatures are shown for 1935-40 on Dublon Island (Japanese records) and for 1949-81 at Moen Airport (U.S. National Oceanic and Atmospheric Adm., 1981). These tables show how little mean temperatures vary--the monthly long-term means (1950-81) by only 0.3°C and the annual mean by only 1.0°C. The maximum recorded temperature between 1946 and 1981 was 34.4°C in May 1946, the minimum was 20°C in September 1973.

Readings of air temperatures have been made in conjunction with surface-water temperature readings during streamflow measurements and can be found in tables 50, 51, 53, 55-57, 59 in the Hydrologic Data section.

National Weather Service data were published in degrees Fahrenheit and have been converted to degrees Celsius.

Evaporation

No evaporation data are available for the Truk Islands. The National Weather Service collects and publishes pan-evaporation data for the islands of Yap and Guam (see figure 1). The mean annual rainfall for Yap is 122 inches and for Guam 102 inches. For the period for which data are available for both islands (July 1978 to December 1982), the total evaporation differs only 8 percent.

Although annual rainfall for Truk is more than for Yap or Guam, evaporation in the Truk Islands is probably similar to that on Yap and Guam; therefore, these data are presented in table 3.

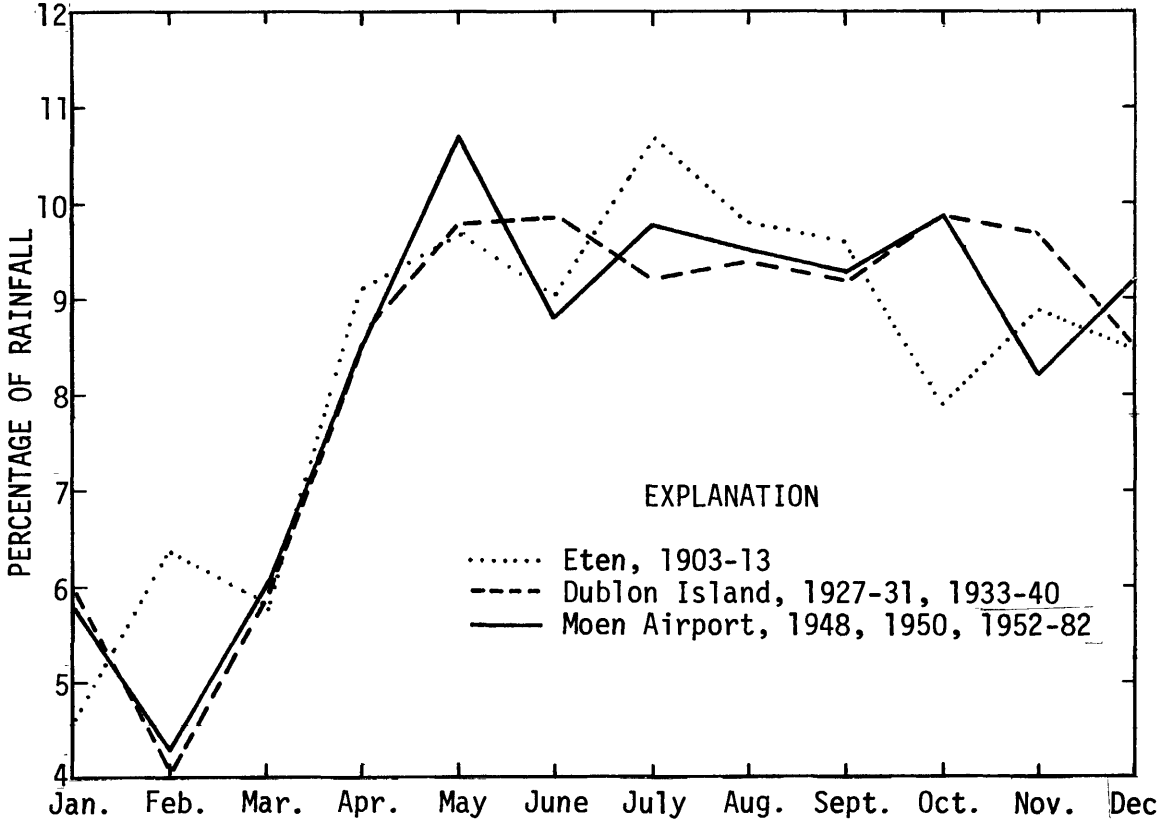


Figure 4. Average monthly mean rainfall in percentage of mean annual total.

Table 3. Monthly and annual evaporation data for Guam and Yap

Source: U.S. National Oceanic and Atmospheric Administration, 1956-76, 1973-82.

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
							Evaporation data for Guam in inches						
							(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

Total of monthly means: Guam 76.98, Yap 75.15.

WATER RESOURCES

General

Water-resources records collected on Truk Islands include data on surface water, ground water, and quality of both surface and ground water. Surface-water data consist of daily discharges from continuous stream-gaging stations, systematic measurements of discharge at partial-record stations, and measurements of discharge at miscellaneous sites. Ground-water data are continuous records of ground-water levels from two wells, pumpage rates, water levels and results of a test-drilling program that includes drillers' logs and records of construction and testing of the wells (Davis, 1977). Water-quality data include water-temperatures readings and results of chemical analyses from samples collected from Wichen River, miscellaneous surface-water sources, and most of the production wells on Moen.

Surface Water

General

Table 4 lists all sites in the Truk Islands where surface-water data were collected and figure 5 shows the location of the sites. For the 2-year period 1955-57, daily discharge records are available on four streams. Two of the streams were located on Tol and one each on Moen and Dublon Island. In 1968, collection of surface-water data was started with the establishment of three stream-gaging stations on Moen, two on Dublon Island, and one on Tol. At these sites water-stage recorders were operated which record a continuous graph of the stream fluctuations. Stream discharge measurements are made with a current meter, and together with the stage records were used to develop a stage-discharge relation. The relation is used to compute daily discharges from which monthly and yearly mean discharges are determined.

Daily discharges are not given in this report but are published in the U.S. Geological Survey annual reports, "Water Resources Data for Hawaii and other Pacific Areas" for water years 1968 to 1980 (for 1979, 1980 in Volume 2) and "Water Resources Data Hawaii - other Pacific Areas," Volume 2 for water year 1981. Information also may be obtained at the U.S. Geological Survey District Office in Honolulu or the Subdistrict Office on Guam.

Table 4. Summary of surface-water stations

Station No.	Station name	Drain. area[1] (mi^2)	Location[1] Latitude north	Location[1] Longitude east	Location[1] Altitude (ft)	Period of record	Remarks
Moen							
16893700	Wichen River at altitude 55 m.	0.21	7°26'07"	151°51'39"	180	June 1968 to Sept. 1978, June 1979, Sept. 1979 to Jan. 1980, May to Dec. 1980.	Continuous record.
16893800	Wichen River at altitude 18 m.	.57	7°27'01"	151°51'56"	60	April 1955 to March 1956	Published as "at Peniesence" Read twice daily.
						June 1968 to Jan. 1980, May to Dec. 1981.	Continuous record.
16893900	Pou Stream	.20	7°26'47"	151°50'56"	65	1968-70, 1972, 1977	Low-flow partial record.
16894200	Nachiponong Stream	.14	7°25'39"	151°51'07"	33	June 1968 to Dec. 1976	Continuous record.
16894300	Nefounumas Spring	--	7°25'43"	151°51'08"	60	1969-70	Low-flow partial record.
Tol							
16895000	Echapachik Stream	.11	7°20'49"	151°37'04"	20	April 1955 to March 1957	Published as "at Fasan". Read twice daily.
						June 1968 to Sept. 1975	Continuous record.
16895100	Afeibung Stream	.09	7°20'49"	151°36'59"	20	1968-71, 1973-76	Low-flow partial record.
16895600	Imor Stream	.02	7°20'45"	151°36'43"	35	March 1955 to May 1957	Published as "at Fasan". Read twice daily.
Dublon Island							
16896800	Chun Stream	.12	7°22'30"	151°51'43"	25	June 1968 to Feb. 1978	Continuous record.
16897000	Fansinifo Stream	.08	7°22'32"	151°52'20"	80	March 1955 to May 1957	Published as "at Roro". Read twice daily.
						1969-71	Low-flow partial record.
16897200	Tumunu Stream	.28	7°22'34"	151°52'27"	25	June 1968 to Jan. 1978	Continuous record.

[1] Drainage areas and locations for most stations differ from those used in "Water Resources Data for Hawaii and other Pacific Areas" 1968-80. These had been based on 1957 Army Map Service 1:25,000-scale maps (International spheroid) whereas the revised figures were based on the 1981 USGS maps with 1:10,000 scale (Clarke spheroid of 1866).

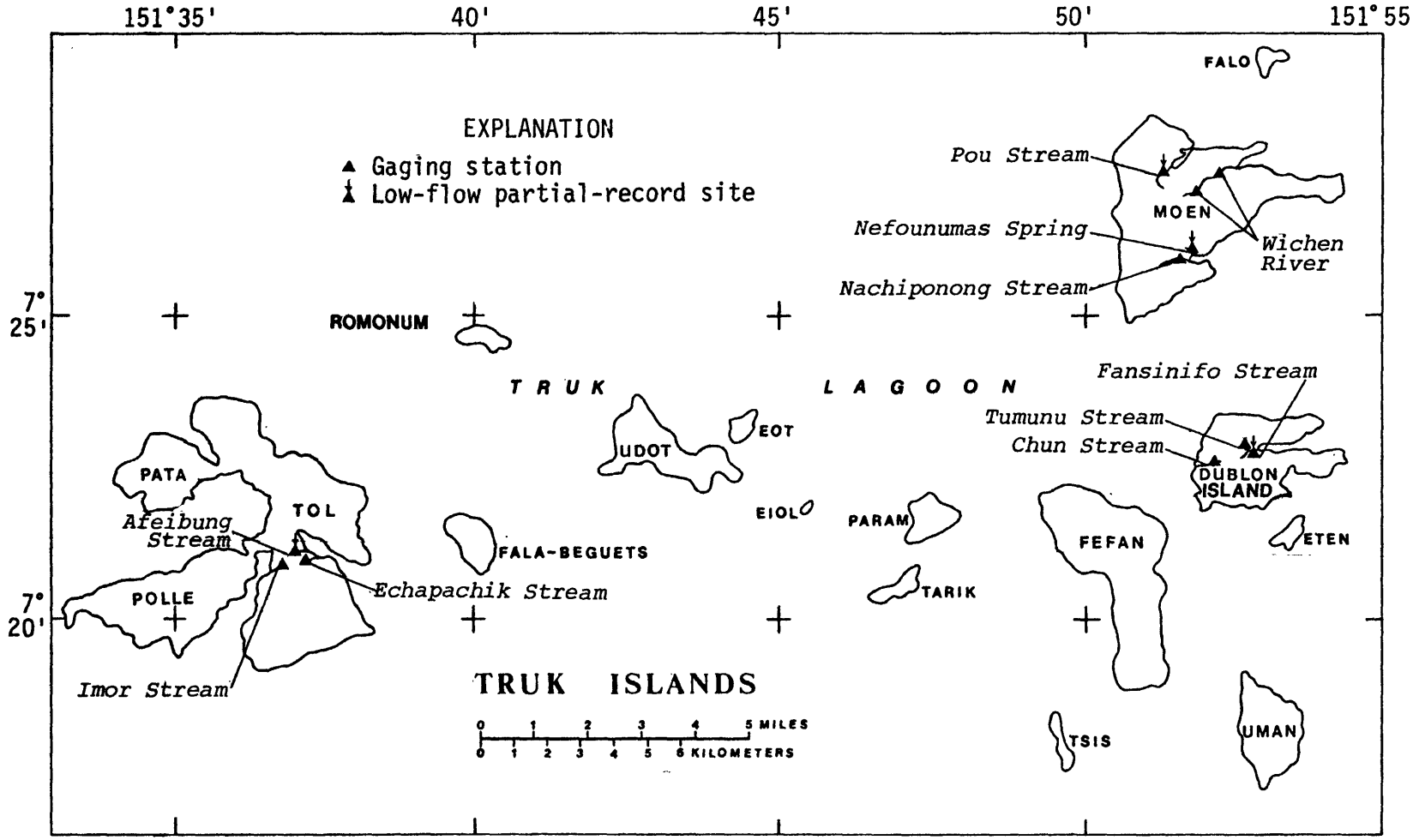


Figure 5. Location of surface-water stations.

Partial-record stations are sites where discharge measurements are made on a systematic basis over a period of years, usually during a period of base flow when streamflow is primarily from ground-water storage. When these measurements are correlated with the simultaneous discharge of a nearby station for which continuous record is available, the low-flow potential of the stream can be estimated. Discharge measurements made at sites not included in the partial-record program are called measurements at miscellaneous sites. A large number of these measurements were made on all major islands in the Truk lagoon during 1955-57.

The Hydrologic Data section presents tables of monthly and annual totals, maximums, minimums, and means for the continuous stream-gaging stations in tables 33-40. Also presented in tables 33-40 are peak discharges above a selected base discharge. Time is expressed in 24-hour local standard time. All records are published in the inch-pound system of units of length, area, and volume. The data are published by water year, the year beginning on October 1 and ending on September 30. Results of discharge measurements made at partial-record stations and at miscellaneous sites are listed in tables 41-43 and tables 44-49.

The locations (latitude, longitude, and altitude) of the miscellaneous measurement sites of 1955 and 1957 were obtained from the 1957 U.S. Army Map Service series W856 maps with a scale of 1:25,000 (International spheroid). The drainage areas and locations of gaging stations and low-flow partial-record stations were based on the 1981 U.S. Geological Survey maps with 1:10,000 scale (Clarke spheroid of 1866).

Streamflow characteristics

Runoff/rainfall comparison.--Rainfall records for Truk show substantial similarity in rainfall distribution throughout the Truk Islands. Although there is a distance of up to 15 miles between the islands and rain showers are often localized, the relatively low profile of the islands will cause the showers to occur at random while large rainstorms will blanket all islands. Yearly rainfall totals, therefore, will not vary significantly, although at times there may be noticeable differences in monthly totals.

Table 5 compares the runoff at the gaging stations on Moen to rainfall records for Moen Airport, and table 6 compares the runoff at gaging stations on other Truk Islands to the Moen rainfall records. A comparison of the two tables shows a similarity between Nachiponong Stream, Moen, and Echapachik Stream, Tol, as both have a mean yield of 4.6 ft^3/s (cubic feet per second) per square mile. (Using the same 6-year period of record for both streams, there is an 8-percent difference). As the drainage areas and their location on the individual islands are comparable, this further indicates that annual rainfall does not vary significantly in the Truk Islands.

Overall, the runoff/rainfall rates vary from about 40 percent for the Dublon Island stations to about 50 percent for the Wichen River stations on Moen.

Figure 6 shows the correlation between the annual rainfall at Moen Airport, and the mean annual discharge in inches for Wichen River at altitude 55 m, Moen, during 1969-77. From this correlation, the runoff of the Wichen River for years outside the period of discharge record can be estimated.

Flow-duration curves.--A flow-duration curve is a cumulative frequency curve that shows 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.

The curve is plotted from a flow-duration table, which shows the distribution of daily discharges in different class limits in increasing order of magnitude. Discharges in cubic feet per second are plotted on the ordinate and percent-of-time equaled or exceeded is plotted on the abscissa. The information is essential for the planning of stream diversions for water supply or for assessing hydroelectric potential.

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

Table 5. Runoff/rainfall ratio for gaging stations on Moen

Station ---------		Wichen River at altitude 55 m		Wichen River at altitude 18 m		Nachiponong Stream	
Drainage area ---		0.21 mi^2		0.57 mi^2		0.14 mi^2	
Calendar year	Rainfall (in.)	Runoff (in.)	Runoff/ rainfall (percent)	Runoff (in.)	Runoff/ rainfall (percent)	Runoff (in.)	Runoff/ rainfall (percent)
1969	131.63	60.11	45.7	42.63	32.4	31.03	23.6
1970	144.28	62.70	43.5	52.39	36.3	39.75	27.6
1971	134.17	69.16	51.6	66.44	49.5	65.93	49.1
1972	148.95	89.85	60.3	82.16	55.2	83.38	56.0
1973	122.00	46.54	38.1	53.82	44.1	45.57	37.4
1974	164.74	80.15	48.7	99.78	60.6	83.38	50.6
1975	120.78	52.36	43.4	63.58	52.6	54.30	45.0
1976	163.24	89.20	54.6	107.40	65.8	96.96	59.4
1977	116.09	54.30	46.8	65.96	56.8	--	--
1978	128.81	--	--	65.73	51.0	--	--
Mean - 137.47							
Mean 1969-74 ----------			48.0		46.4		40.7
1969-76 ----------			48.2		49.6		43.6
1969-77 ----------			48.1		50.4		--
1969-78 ----------			--		51.9		--
Annual mean (ft^3/s) ----		1.06		2.94		0.645	
Mean runoff [(ft^3/s)/mi^2] --------		5.05		5.16		4.61	

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

Table 6. Runoff/rainfall ratio for gaging stations on Dublon Island and on Tol

Station ---------		Chun Stream, Dublon Island		Tumunu Stream, Dublon Island		Echapachik Stream, Tol	
Drainage area ---		0.12 mi^2		0.28 mi^2		0.11 mi^2	
Calendar year	Rainfall (in.)	Runoff (in.)	Runoff/ rainfall (percent)	Runoff (in.)	Runoff/ rainfall (percent)	Runoff (in.)	Runoff/ rainfall (percent)
1969	131.63	35.07	26.6	31.51	23.9	43.19	32.8
1970	144.28	52.03	36.1	43.63	30.2	56.76	39.3
1971	134.17	61.08	45.5	53.33	39.7	49.36	36.8
1972	148.95	65.61	44.0	56.24	37.8	85.15	57.2
1973	122.00	44.12	36.2	43.63	35.8	58.00	47.5
1974	164.74	78.05	47.4	85.81	52.1	83.91	50.9
1975	120.78	56.56	46.8	58.18	48.2	--	--
1976	163.24	69.00	42.3	77.57	47.5	--	--
1977	116.09	42.98	37.0	40.72	35.1	--	--
Mean - 138.43							
Mean 1969-74 ----------			39.3		36.7		44.1
1969-77 ----------			40.2		38.9		
Annual mean (ft^3/s) ---		0.496		1.12		0.508	
Mean runoff [$(ft^3/s)/mi^2$] -------		4.13		4.00		4.62	

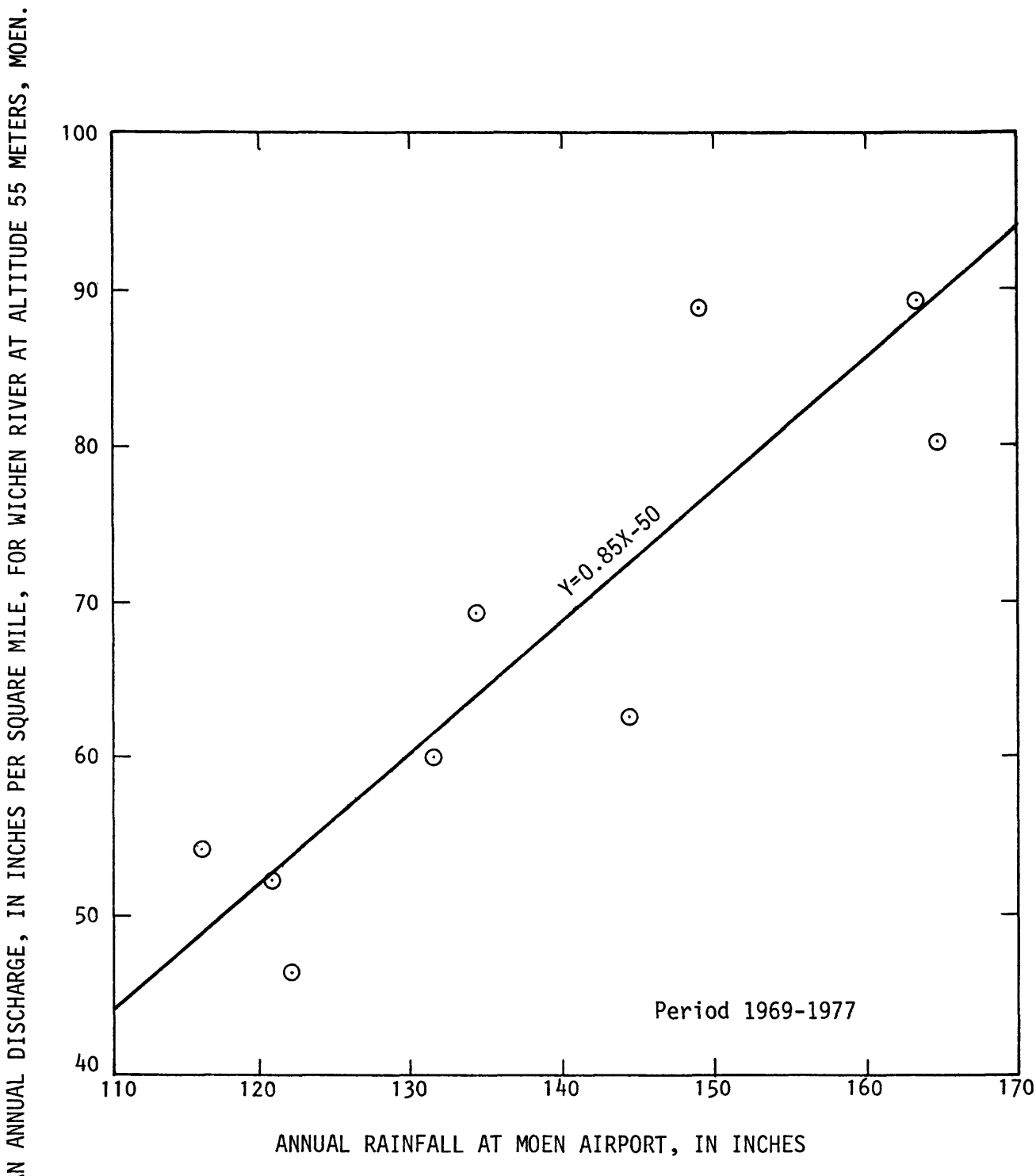


Figure 6. Correlation between rainfall at Moen Airport and discharge at Wichen River at altitude 55 meters, Moen.

Table 7 summarizes the records of gaging stations used in the construction of flow-duration curves plotted on figure 7. Although a longer period of record is available for the Wichen River stations, only records for the period 1969-77 were used to correspond with records available for the Dublon Island stations. Curves drawn from the total available record for the Wichen River stations proved to be almost identical to those for 1969-77. The curves show that although there is a substantial difference in drainage areas, periods of low flow do not vary greatly in duration and in discharge. The similarity in the slope of the curves indicate a similarity in basin characteristics except that Chun Stream (16896800) appears to have a somewhat larger retention of rainfall in the watershed.

No duration curve for Echapachik Stream, Tol, was included because the period of record was too short to compare with records of the other streams.

The homogeneity of the drainage areas is also demonstrated by the good correlation between drainage areas and mean annual discharges of the gaging stations in the Truk Islands (figure 8).

Low-flow frequency curves.--Low-flow frequency curves were prepared for the six continuous-record gaging stations using the log-Pearson Type III distribution. In figures 9-14, the individual curves represent the lowest mean discharge for indicated periods of consecutive days and the likelihood of their occurrence.

The values represented by the curves are given in the low-flow frequency table (table 8).

The curves show the small amount of flow in the streams during low-flow periods. Development of these streams as dependable sources of water supply does not appear feasible, with the possible exception of Wichen River at altitude 18m.

High-flow frequency curves.--High-flow frequency curves show the instantaneous annual peak discharge or the maximum mean discharge for selected periods of consecutive days and the likelihood of occurrence.

Figure 15 shows the magnitude and frequency of annual and instantaneous peak flows for four continuous-record stations. The curve for Echapachik Stream, Tol, is not shown because of insufficient length of record and for Nachiponong Stream, Moen, because the curve was not clearly defined. The curve for Chun Stream (16896800) is flat because the small stream channel overflows during heavy rains.

Table 7. Summary of gaging-station record used for flow-duration curves

Station No.	Gaging station	Drainage area (mi^2)	Period of record
16893700	Wichen River at altitude 55 m, Moen ---	0.21	1969-1977
16893800	Wichen River at altitude 18 m, Moen ---	.57	1969-1977
16894200	Nachiponong Stream, Moen ----------	.14	1969-1976
16896800	Chun Stream, Dublon Island ----------	.12	1969-1977
16897200	Tumunu Stream, Dublon Island ----------	.28	1969-1977

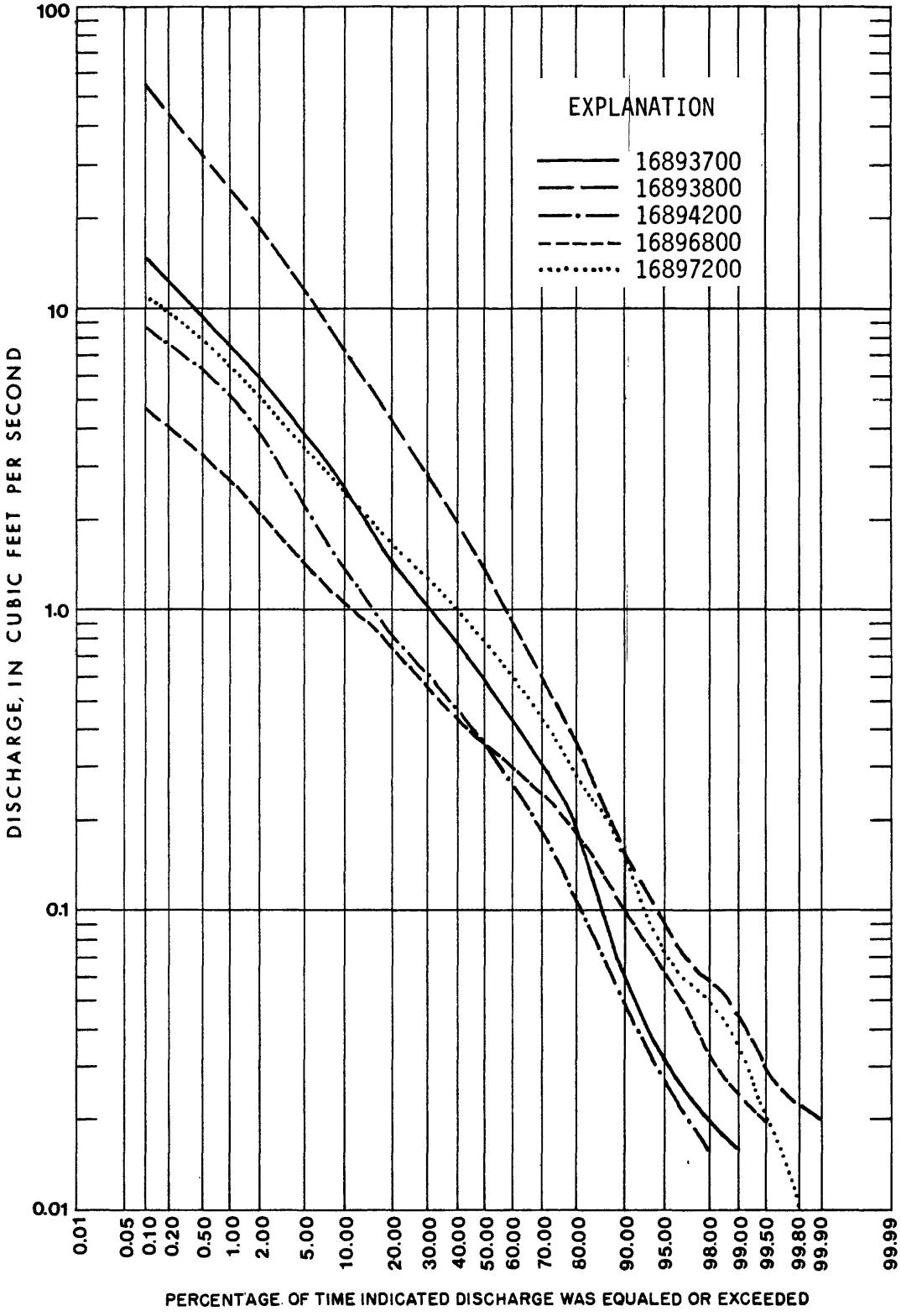


Figure 7. Flow-duration curves of continuous-record stations on Moen and on Dublon Island.

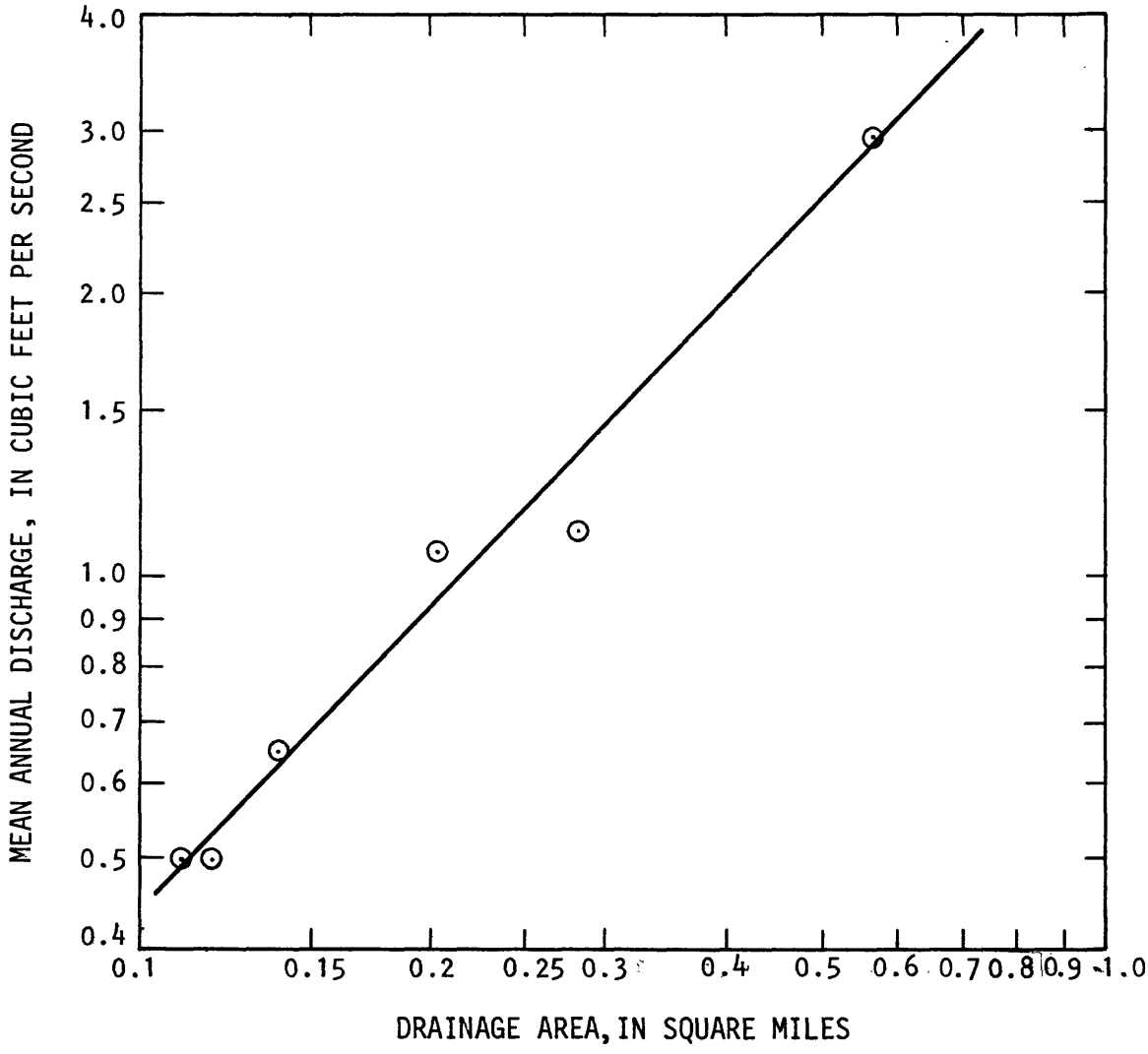


Figure 8. Correlation between drainage areas and mean annual discharges.

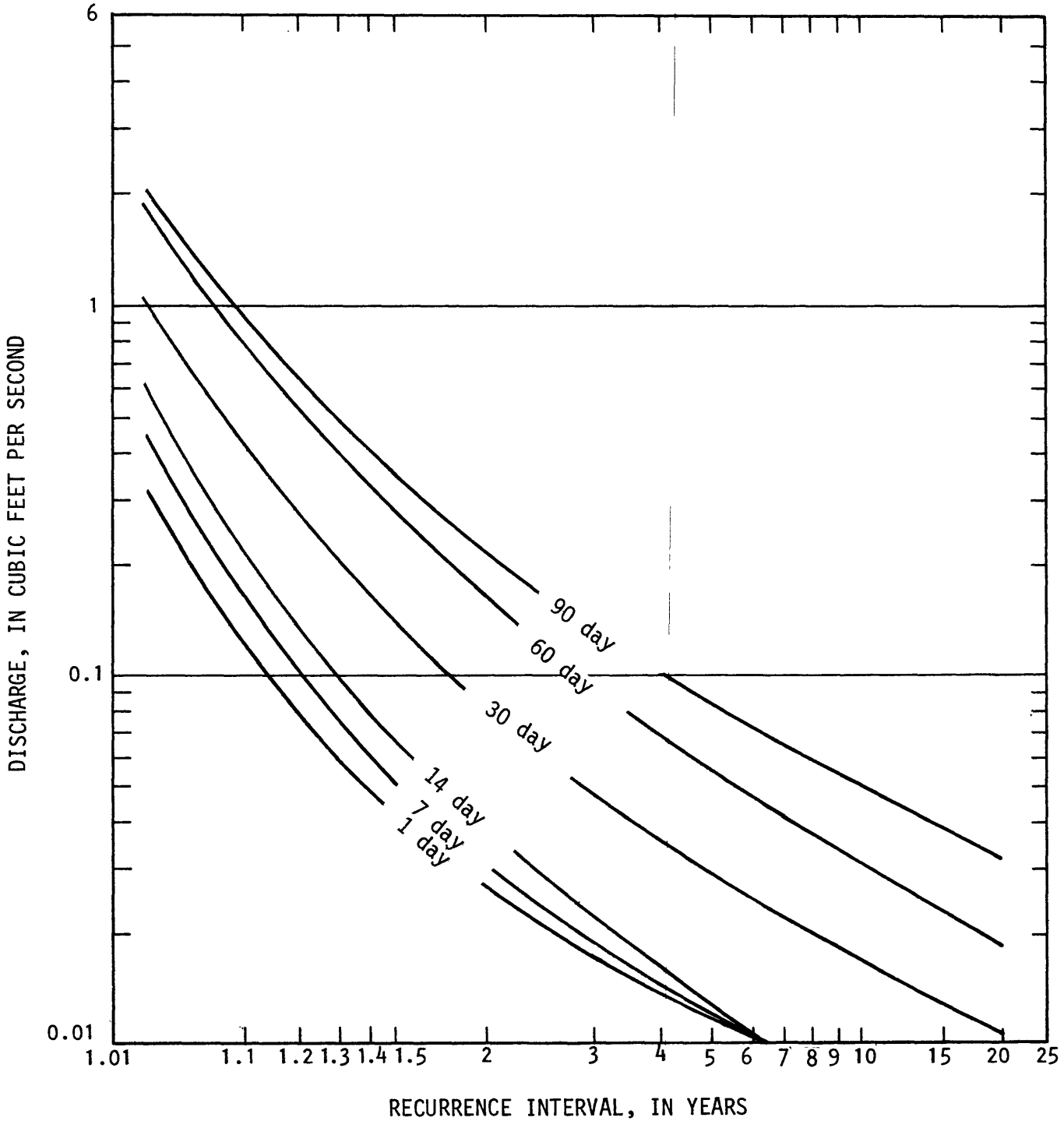


Figure 9. Low-flow frequency curves for Wichen River at altitude 55 meters, Moen, for period 1969-78.

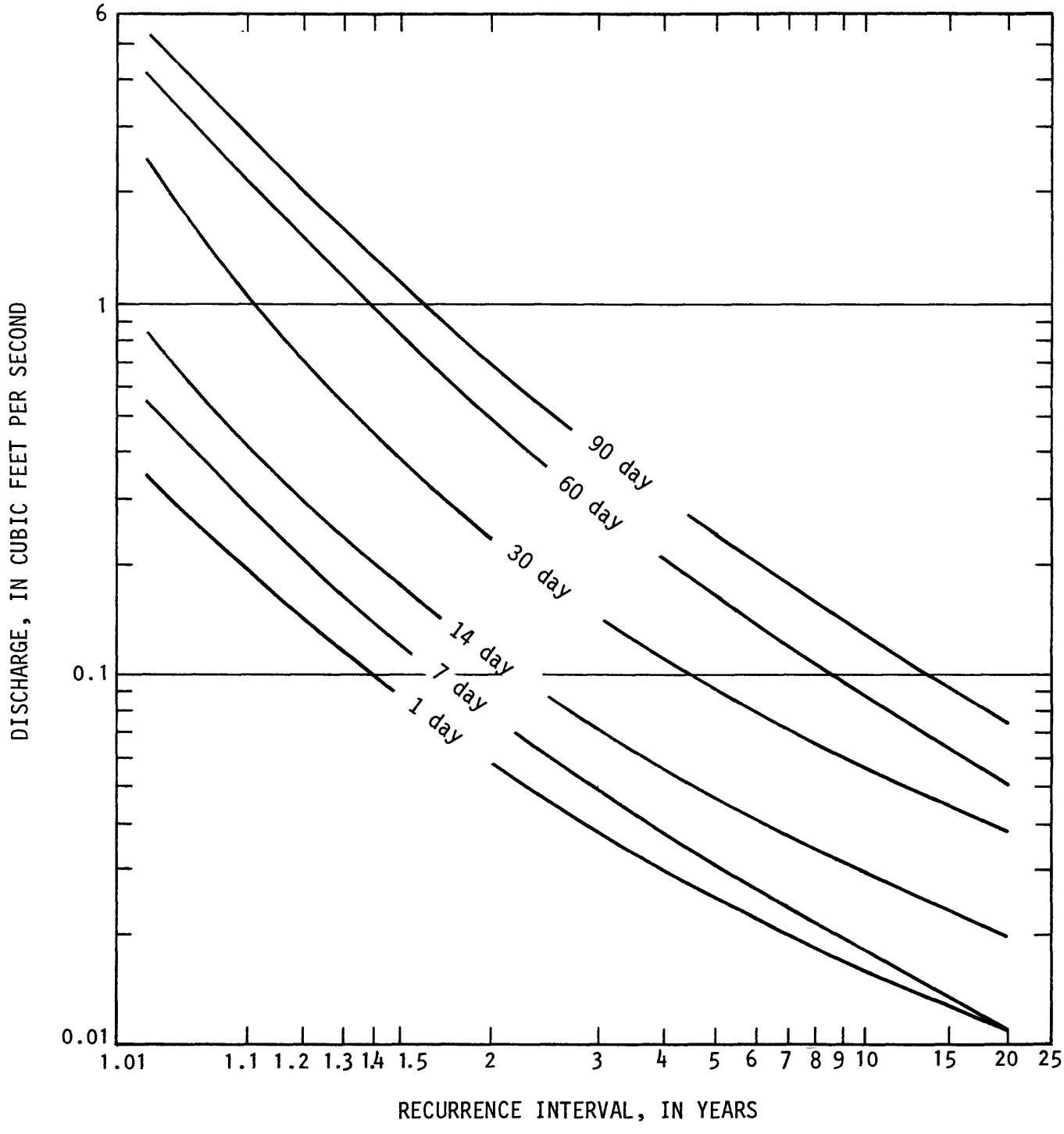


Figure 10. Low-flow frequency curves for Wichen River at altitude 18 meters, Moen, for period 1969-79.

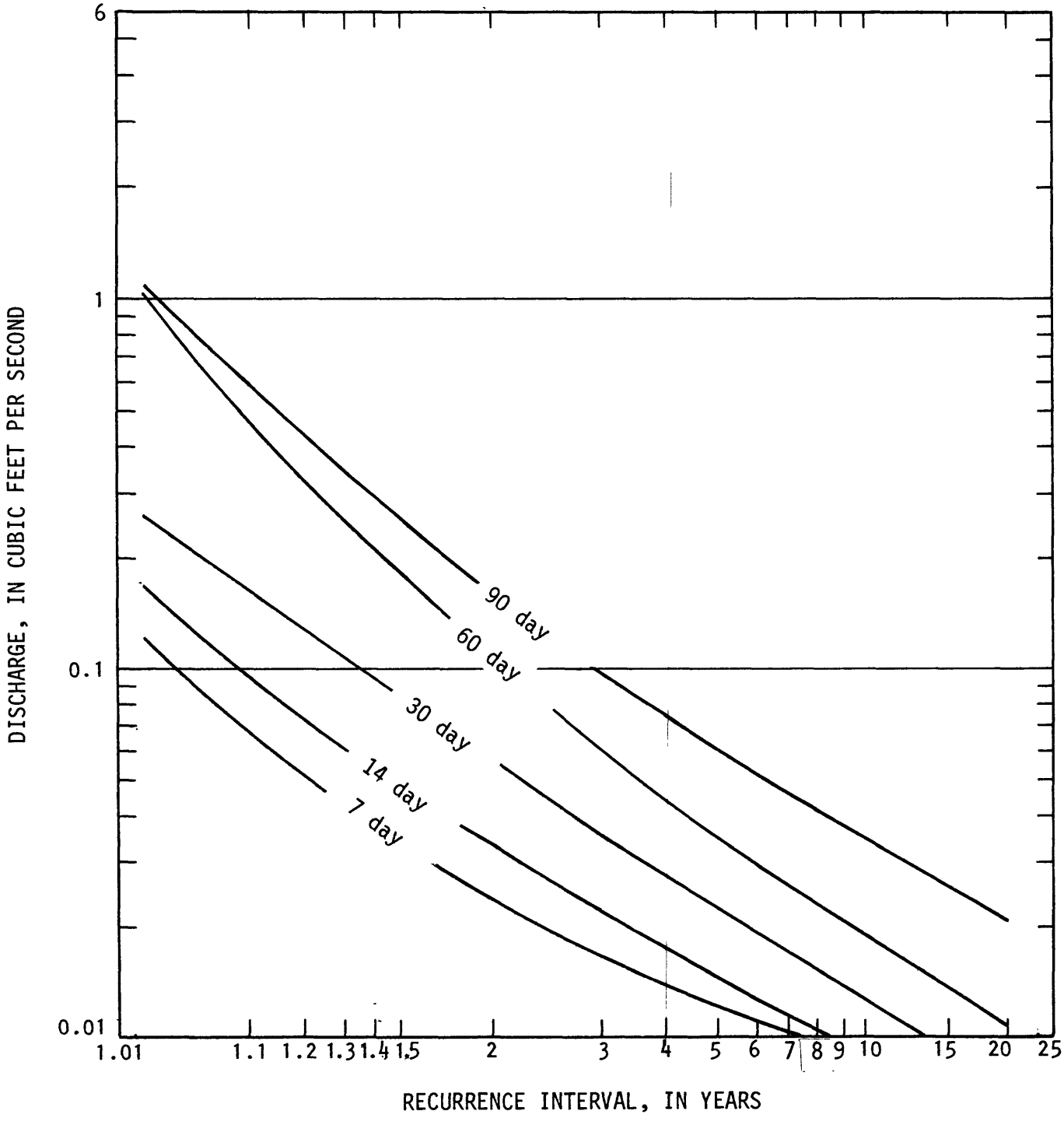


Figure 11. Low-flow frequency curves for Nachiponong Stream, Moen, for period 1969-76.

(Note: The 1 day curve not plotted because of zero-flow day.)

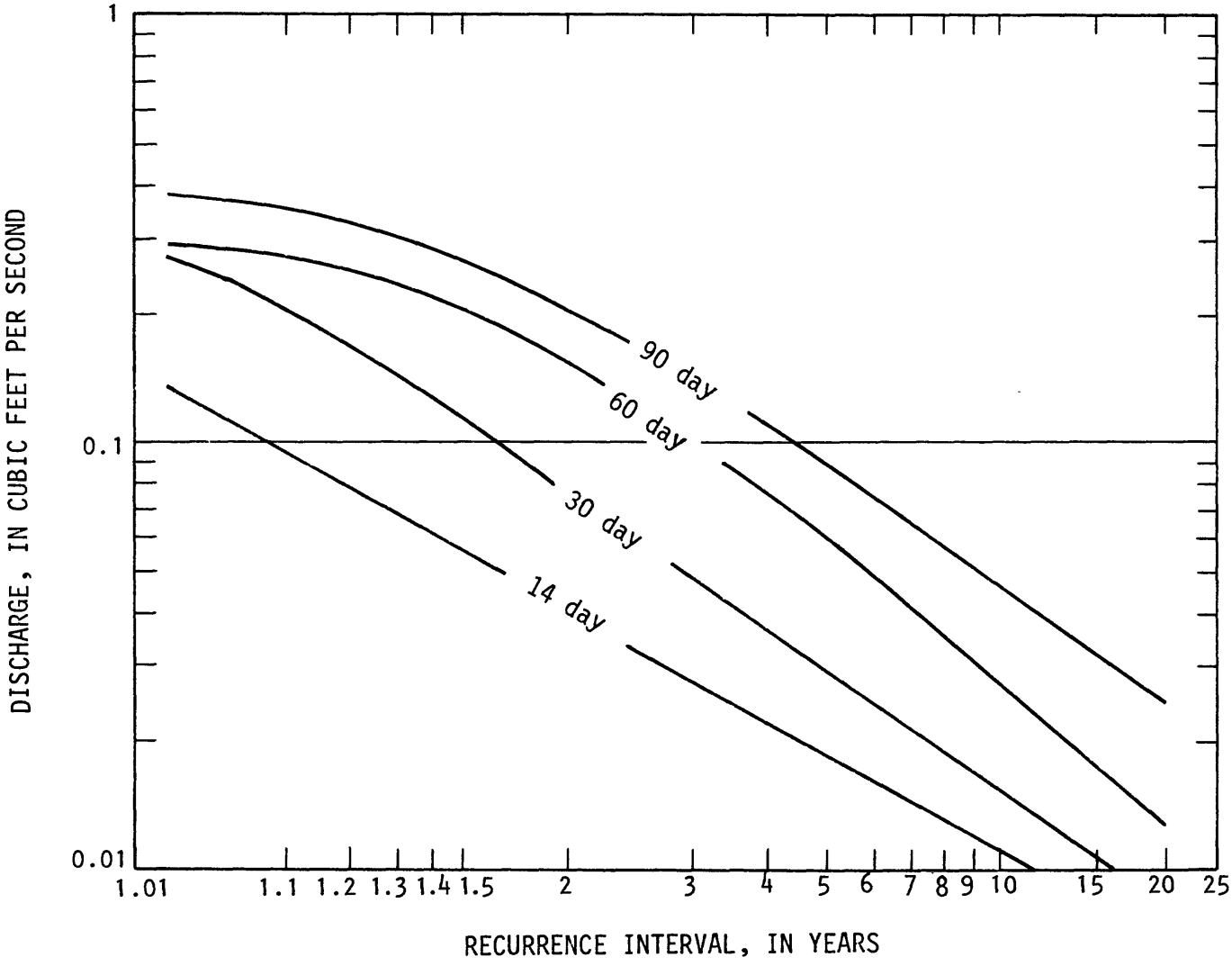


Figure 12. Low-flow frequency curves for Echapachik Stream, Tol, for periods 1956-57, 1969-75.

(Note: Curves for lowest flow for 1 day and 7 consecutive days not plotted because of zero-flow days.)

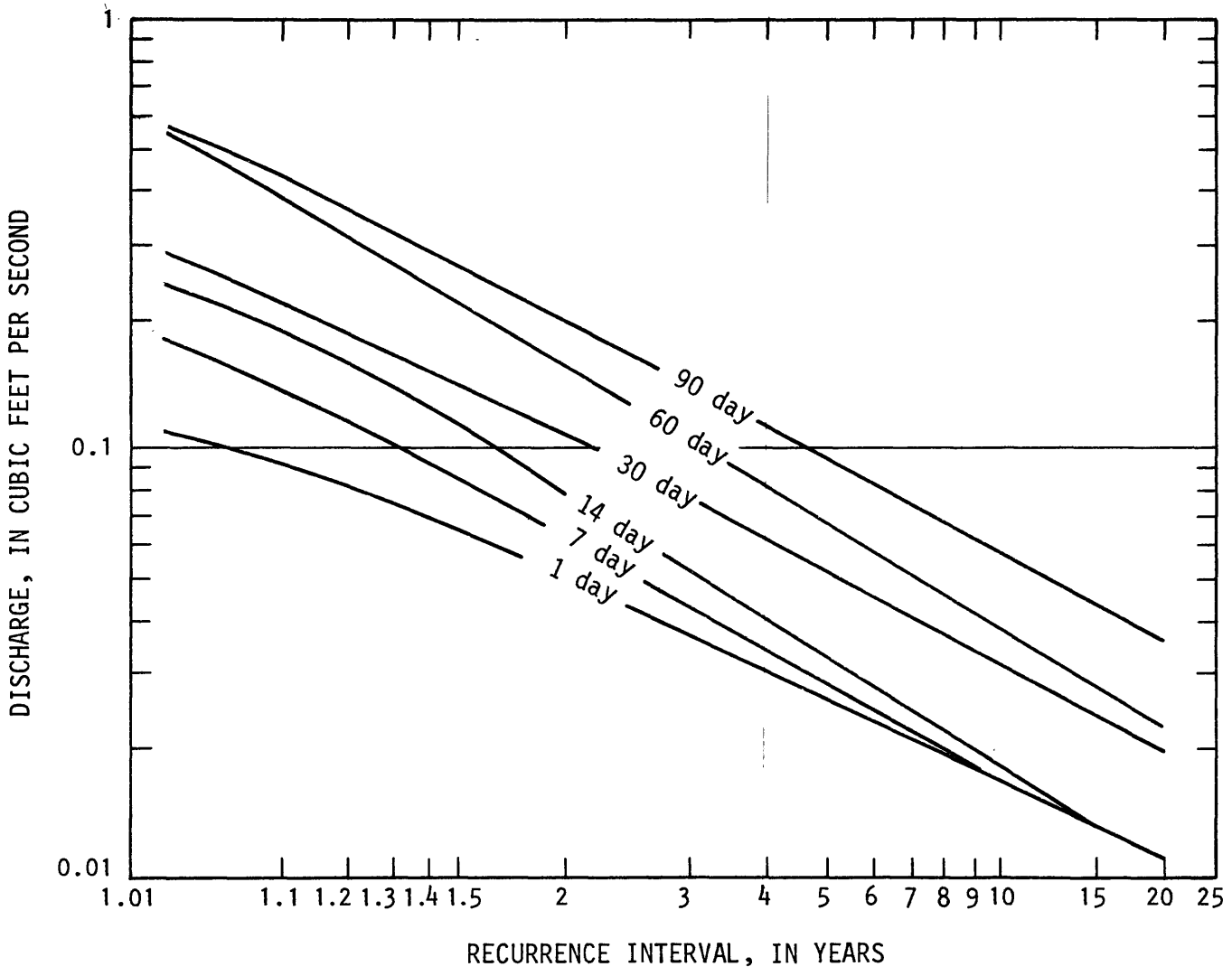


Figure 13. Low-flow frequency curves for Chun Stream, Dublon Island, for period 1969-77.

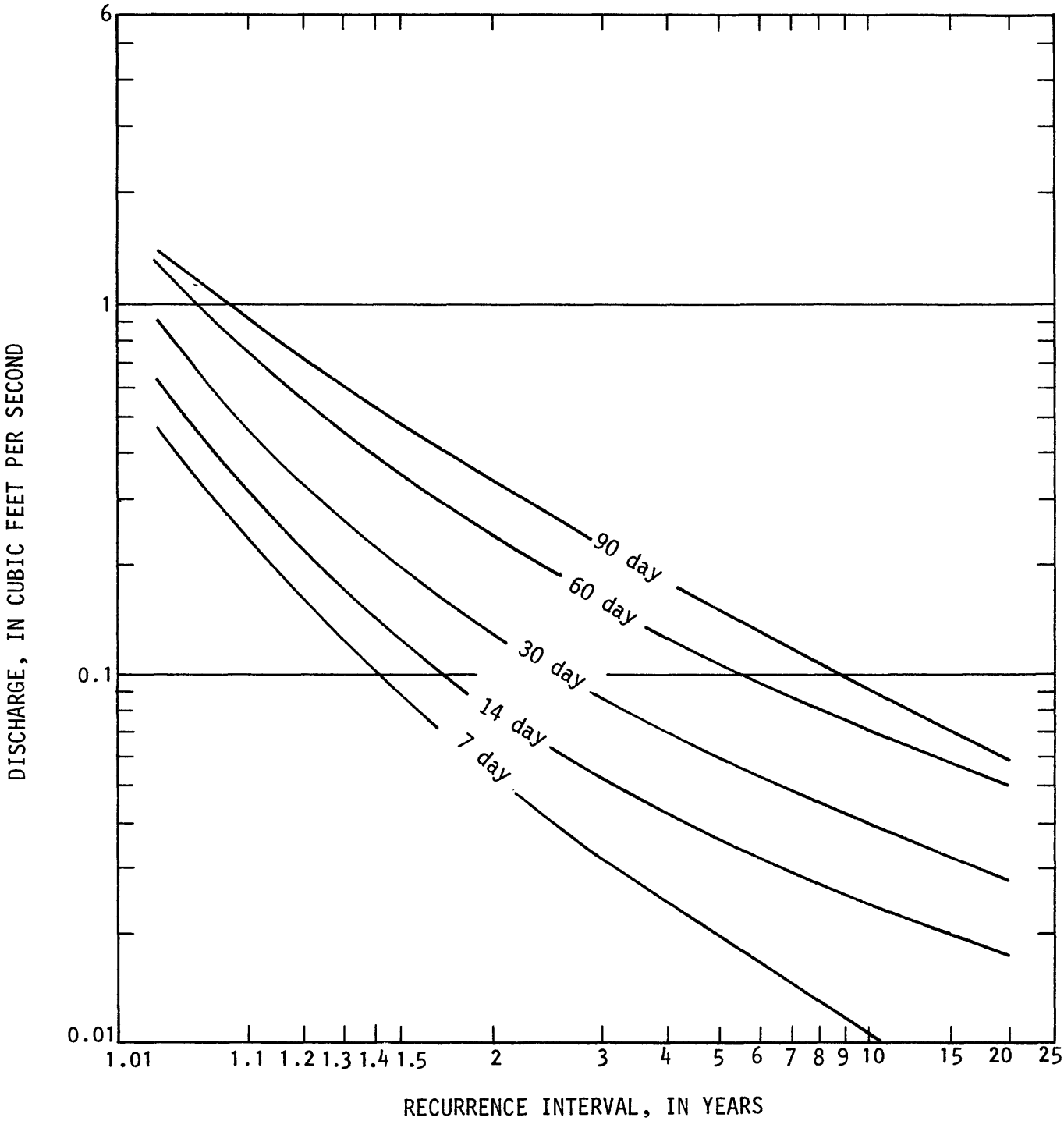


Figure 14. Low-flow frequency curves for Tumunu Stream, Dublon Island, for period 1969-77.

(Note: Curve for lowest flow for 1 day not plotted because of zero-flow days.)

Table 8. Magnitude and frequency of annual low flow for various consecutive days

Station No.	Station name	Consecutive days	Lowest flow, in cubic feet per second, for indicated recurrence intervals, in years			
			2	5	10	20
16893700	Wichen R. at altitude 55 m, Moen, 1969-78	1	0.027	0.012	0.008	0.006
		7	.031	.012	.007	.005
		14	.039	.013	.007	.005
		30	.084	.030	.017	.011
		60	.164	.056	.031	.019
		90	.218	.083	.050	.033
16893800	Wichen R. at altitude 18 m, Moen, 1969-79	1	.059	.026	.016	.011
		7	.079	.030	.018	.011
		14	.112	.047	.029	.020
		30	.241	.094	.057	.037
		60	.502	.167	.088	.051
		90	.696	.239	.129	.075
16894200	Nachiponong Stream, Moen, 1969-76	7	.024	.012	.009	.007
		14	.033	.015	.009	.006
		30	.056	.023	.013	.008
		60	.104	.035	.019	.011
		90	.160	.060	.034	.021
16895000	Echapachik Stream, Tol, 1956, 1969-75	14	.041	.018	.011	.007
		30	.077	.029	.015	.008
		60	.152	.059	.028	.013
		90	.206	.089	.047	.025
16896800	Chun Stream, Dublon Island, 1969-77	1	.050	.026	.017	.011
		7	.062	.028	.017	.011
		14	.079	.033	.018	.011
		30	.108	.051	.031	.020
		60	.151	.065	.038	.024
		90	.196	.092	.057	.036
16897200	Tumunu Stream, Dublon Island, 1969-77	7	.053	.019	.011	.007
		14	.082	.036	.024	.017
		30	.131	.060	.040	.028
		60	.238	.110	.073	.052
		90	.340	.151	.093	.060

Note: Lowest flow for 1 day at Nachiponong and Tumunu Streams and for 1 day and 7 consecutive days at Echapachik Stream omitted because of zero flow days.

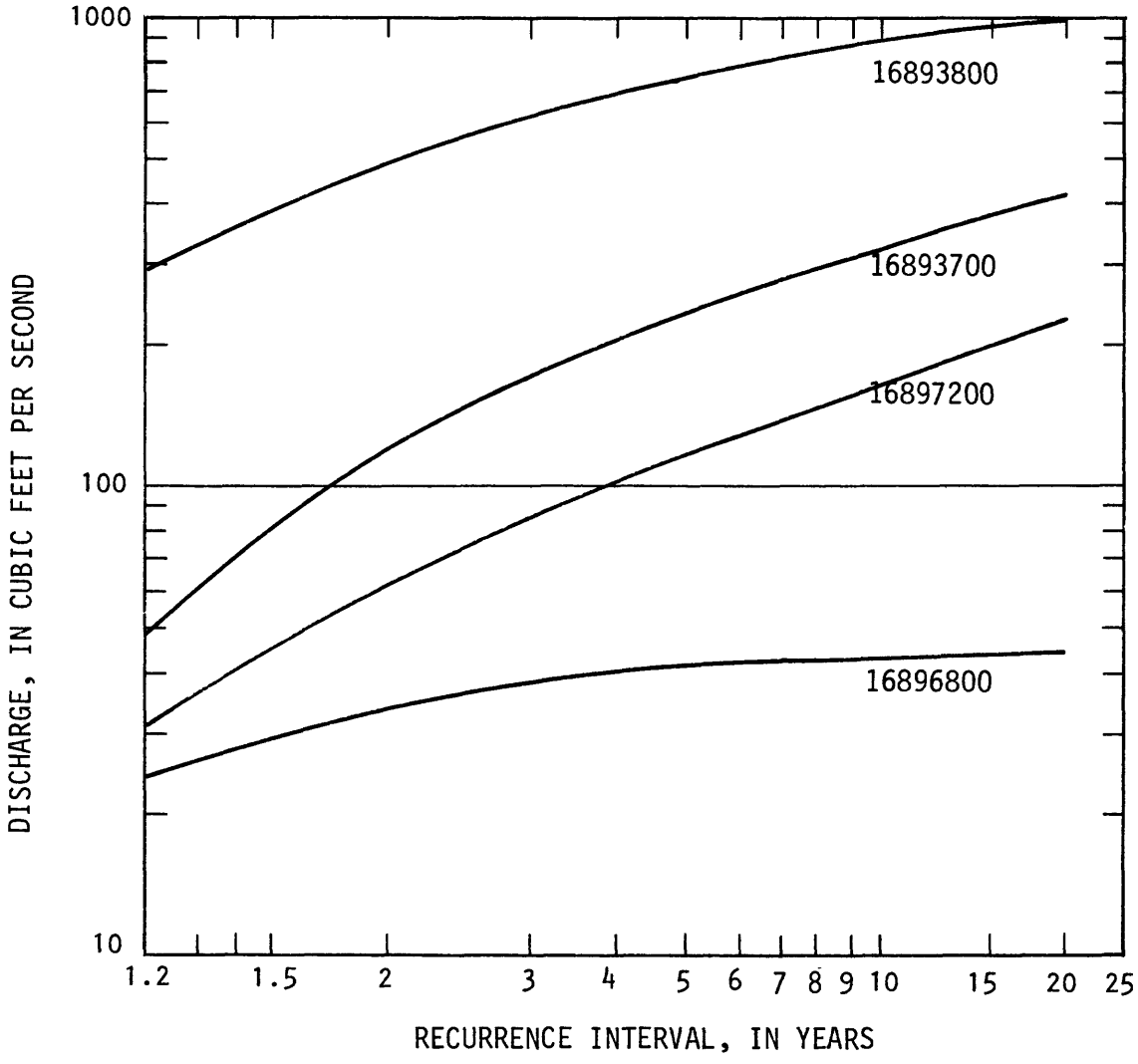


Figure 15. Magnitude and frequency of annual instantaneous peak flows for four gaging stations.

Figures 16-21 present the high-flow frequency curves for all six gaging stations showing the maximum mean discharge for indicated periods of consecutive days. 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 provide information to determine the size and design storm drainage systems, culverts and bridge openings.

Correlation between partial record and continuous record.--The purpose of operating a low-flow partial-record station is to determine the low-flow characteristics of the stream through correlation with concurrent discharges at continuous-record stations. Table 9 shows the correlations made on Moen (between Nefounumas Spring and nearby Nachiponong Stream), on Tol (between Afeibung Stream and nearby Echapachik Stream), and on Dublon Island (between Fansinifo Stream and nearby Tumunu Stream). Low-flow measurements made on Pou Stream, Moen, were not used for correlation as part of the flow was diverted from the Pou Stream catchment upstream.

By use of the relationships derived in figures 22-24, reliable estimates of low-flow discharge at the partial-record stations can be derived from the known discharge at the nearby gaging station.

Ground Water

Ground water in the Truk Islands is available only in limited amounts. The volcanic islands consist mainly of rock with very low permeability and discharge from the rocks is mostly at seeps discharging at ground surface or into overlying surficial deposits. Water moves through these deposits but the supply in any one spot is small. Much of the water consumed on Moen comes from wells drilled into weathered volcanics. The calcareous beach deposits along the shore contain freshwater but are subject to saltwater encroachment.

The low coral islands have brackish to fresh ground-water lenses, some of which can provide small amounts of potable water (Valenciano and Takasaki, 1959).

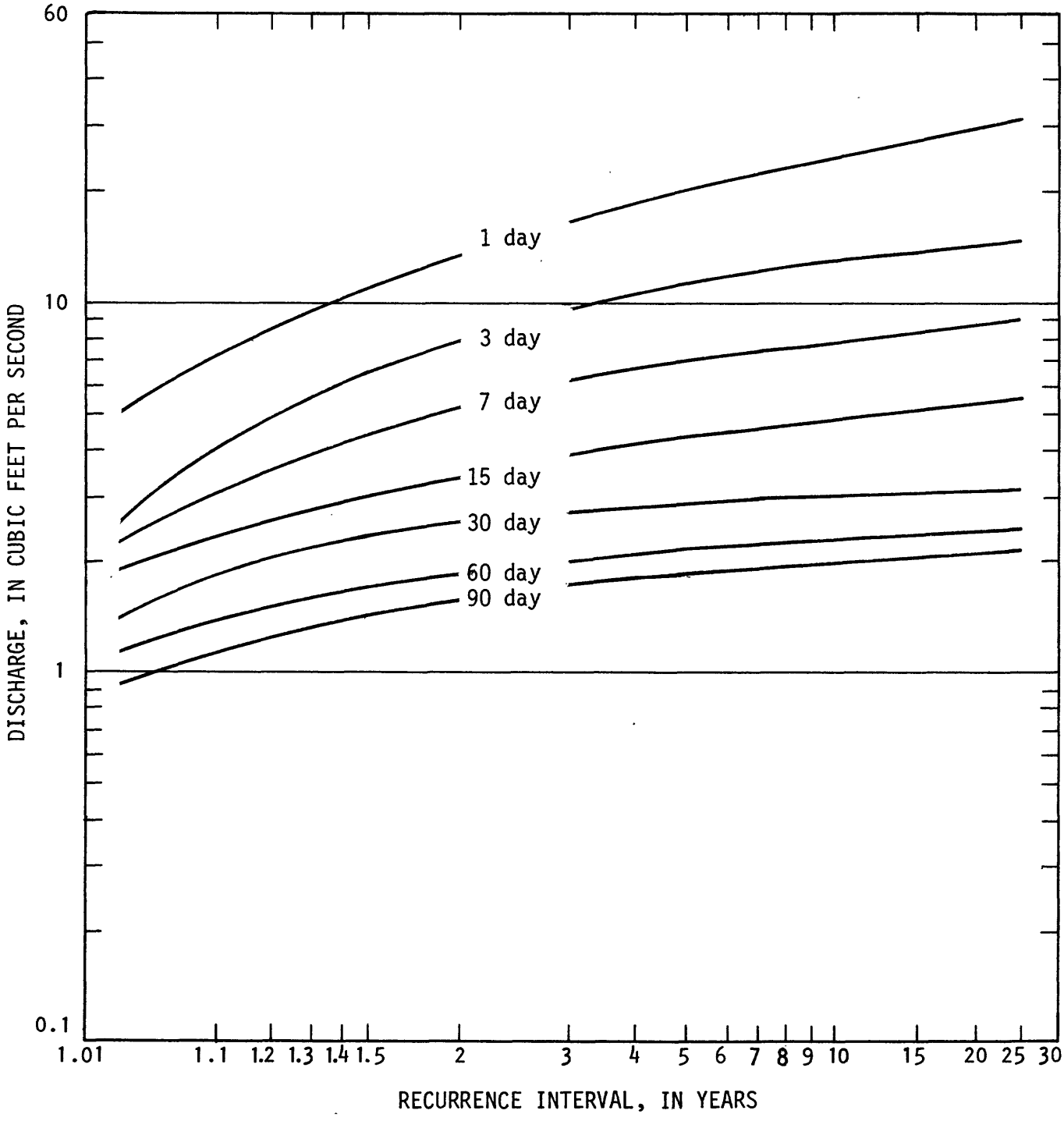


Figure 16. High-flow frequency curves for Wichen River at altitude 55 meters, Moen, for period 1969-78.

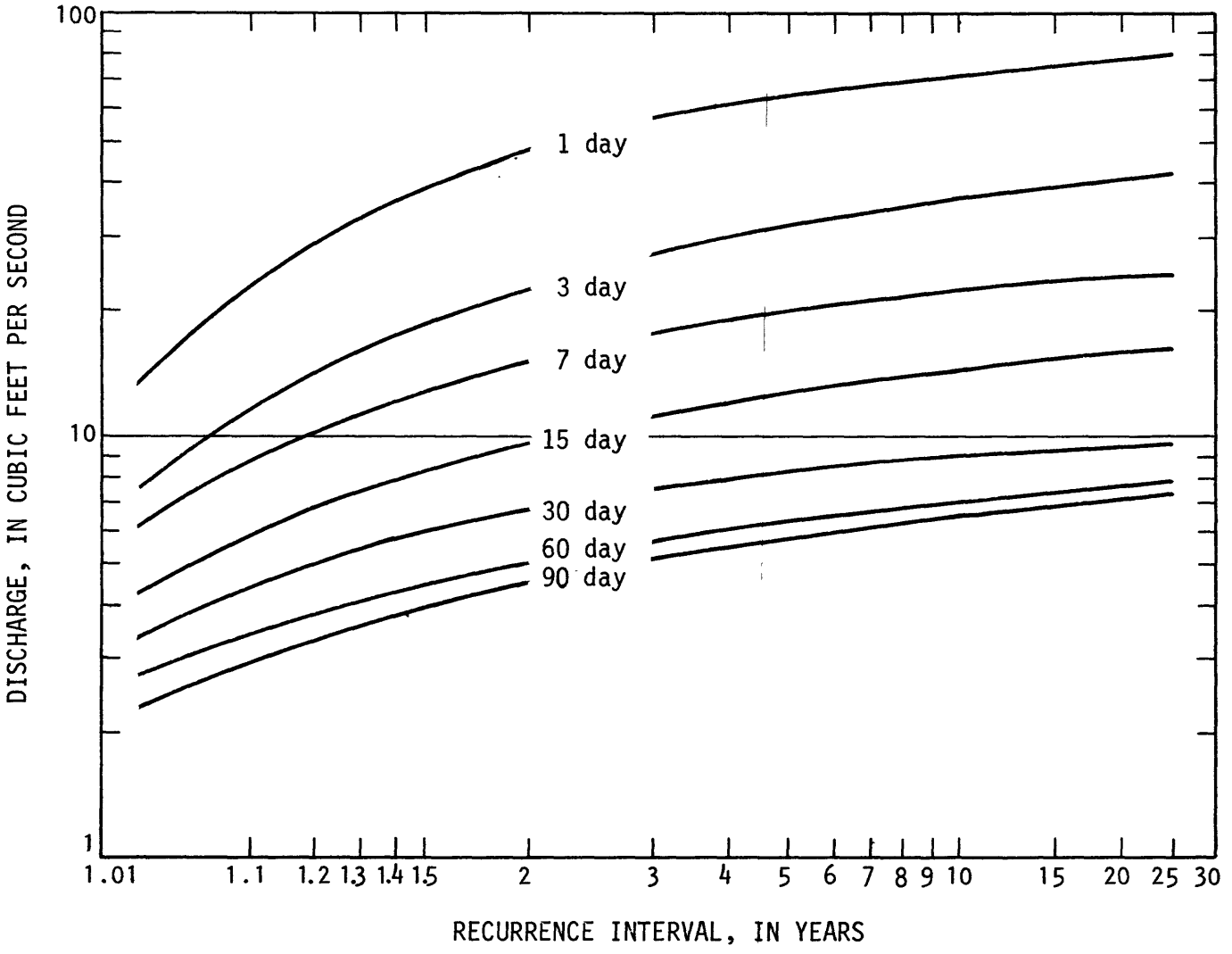


Figure 17. High-flow frequency curves for Wichen River at altitude 18 meters, Moen, for period 1969-79.

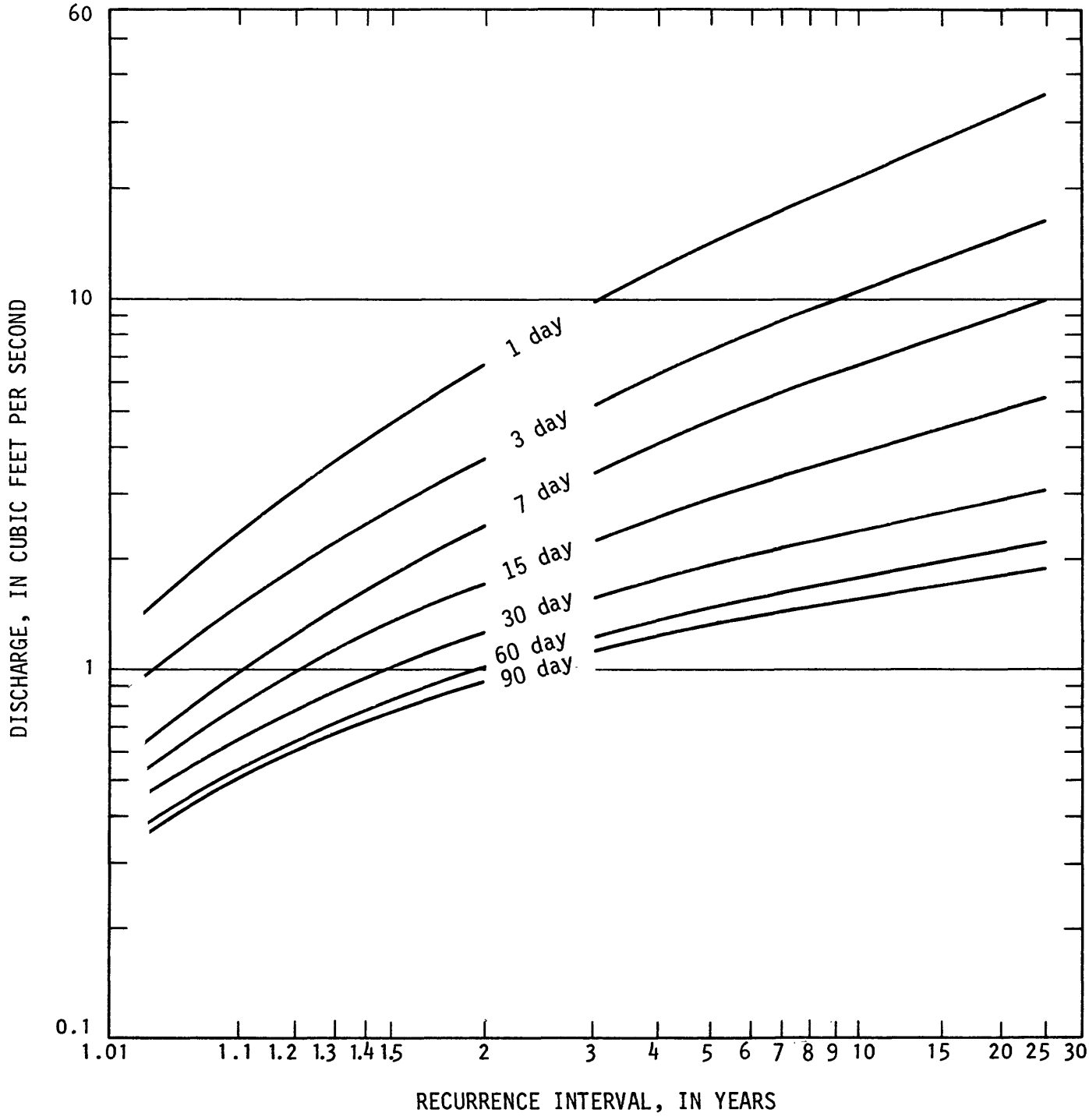


Figure 18. High-flow frequency curves for Nachiponong Stream, Moen, for period 1969-76.

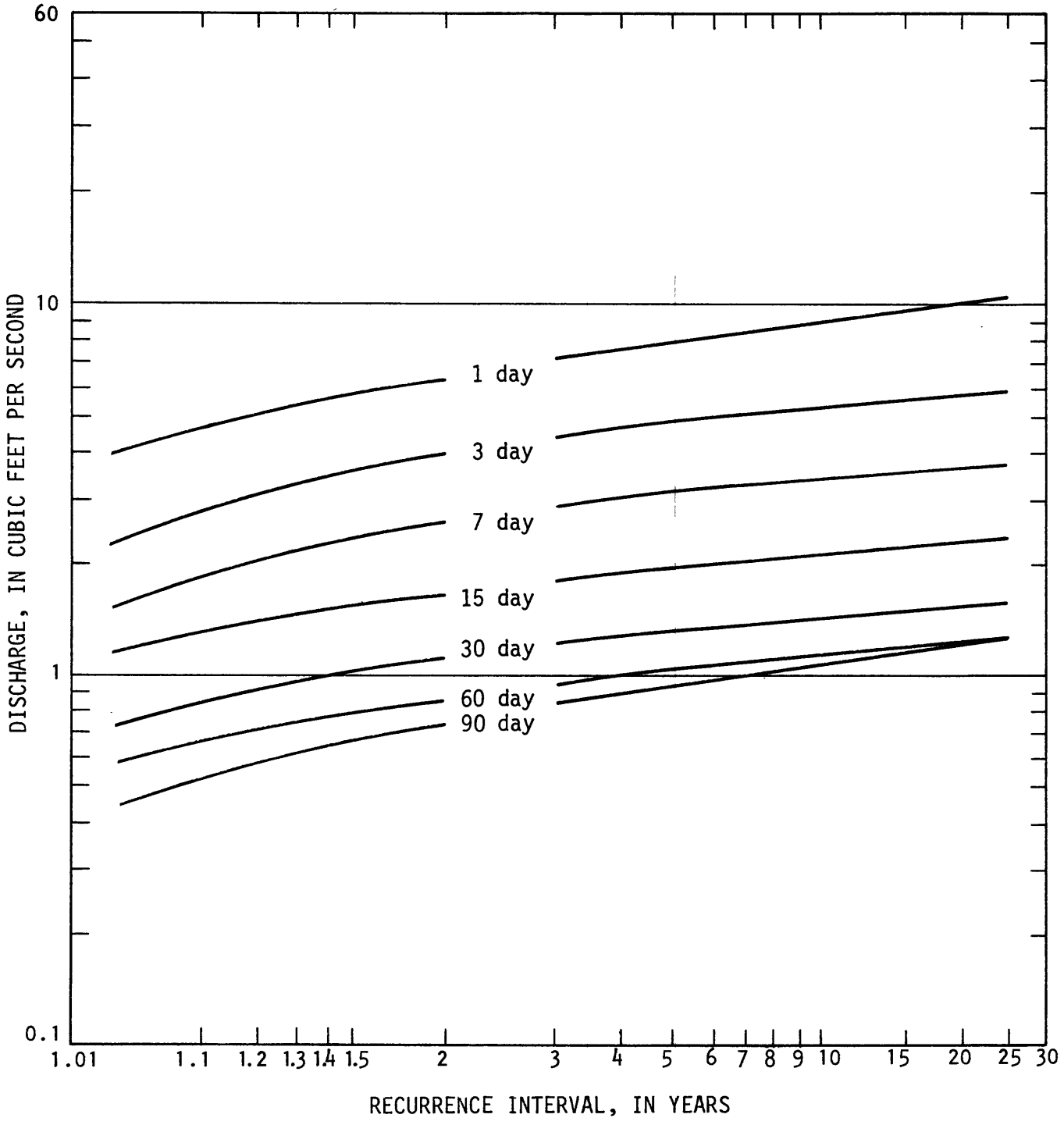


Figure 19. High-flow frequency curves for Echapachik Stream, Tol, for periods 1956-57, 1969-75.

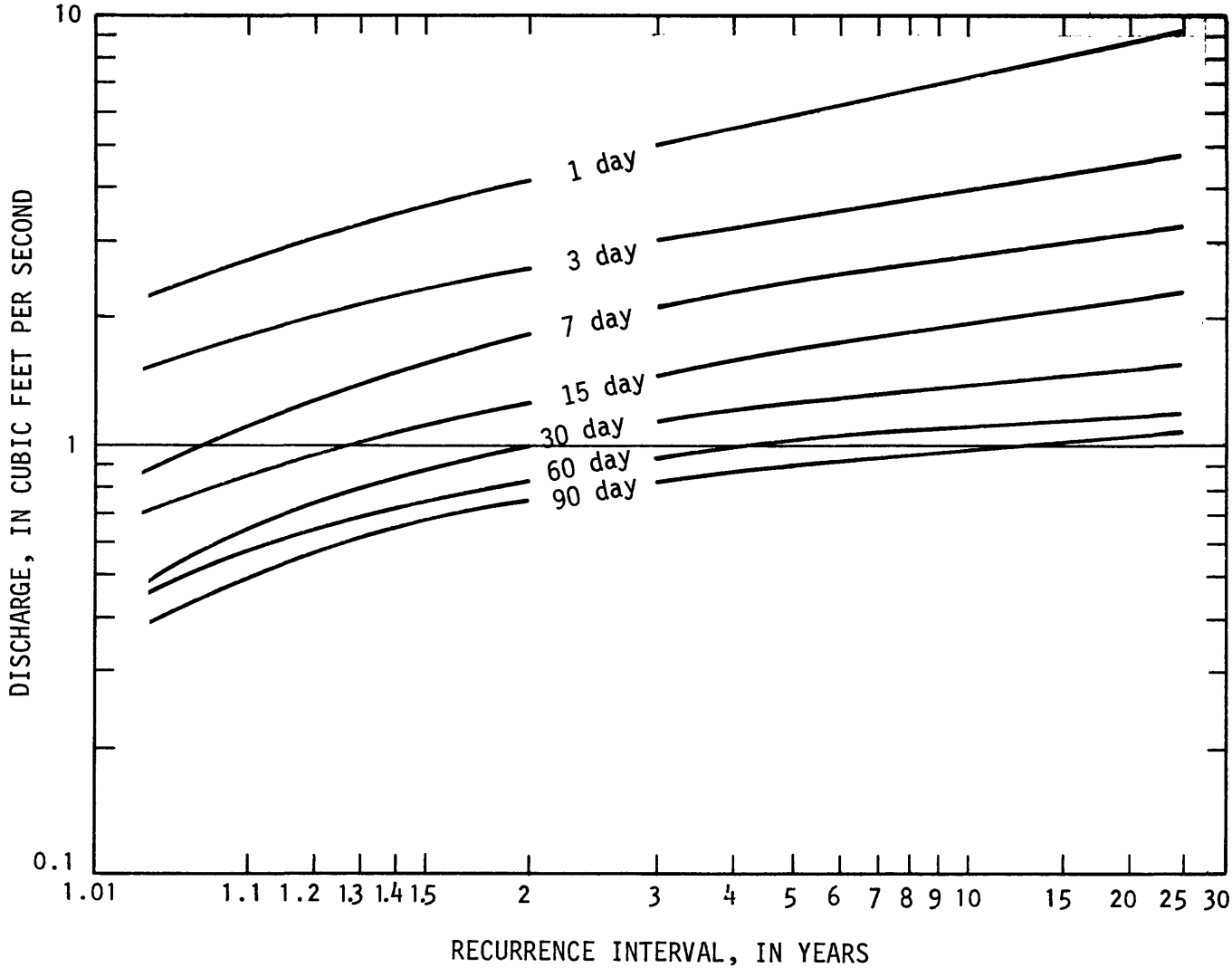


Figure 20. High-flow frequency curves for Chun Stream, Dublon Island, for period 1969-77.

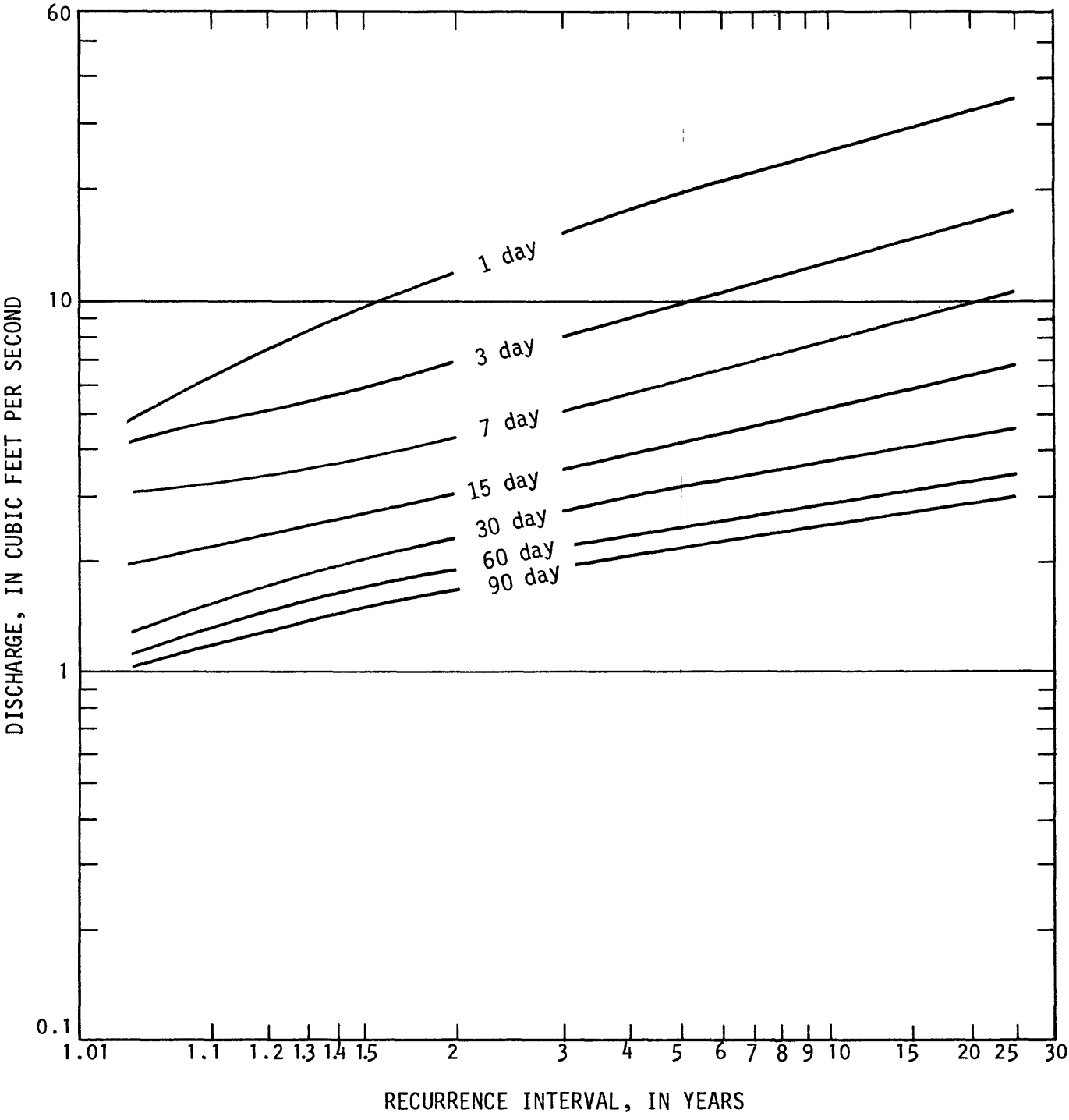


Figure 21. High-flow frequency curves for Tumunu Stream, Dublon Island, for period 1969-77.

Table 9. Correlation between discharge at low-flow partial-record and continuous-record stations

Partial-record station	Drainage area (mi^2)	Continuous-record station	Drainage area (mi^2)	Number of observations	Correlation coefficient	Standard error in percent	Regression
Nefounumas Spring, Moen	--	Nachiponong Stream, Moen	0.14	7	0.95	0.30	$Y = 0.286X^{0.838}$
Afeibung Stream, Tol	0.09	Echapachik Stream, Tol	.11	29	.95	.13	$Y = .596X^{0.917}$
Fansinifo Stream, Dublon Island	.08	Tumunu Stream, Dublon Island	.28	18	.96	.17	$Y = .329X^{1.066}$

Y is discharge at partial-record station.
X is discharge at continuous-record station.

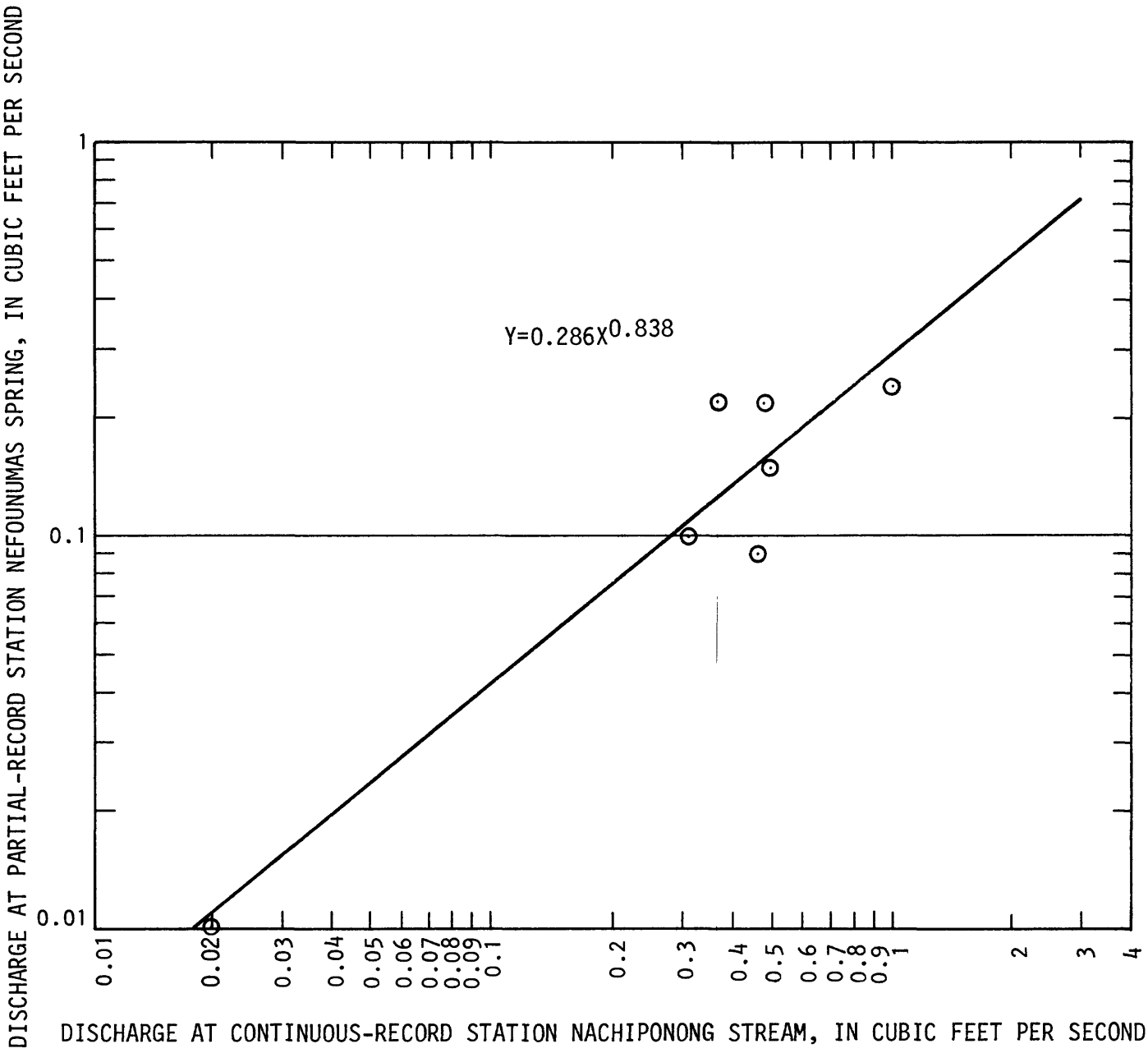


Figure 22. Correlation between discharges of Nefounumas Spring and Nachiponong Stream, Moen.

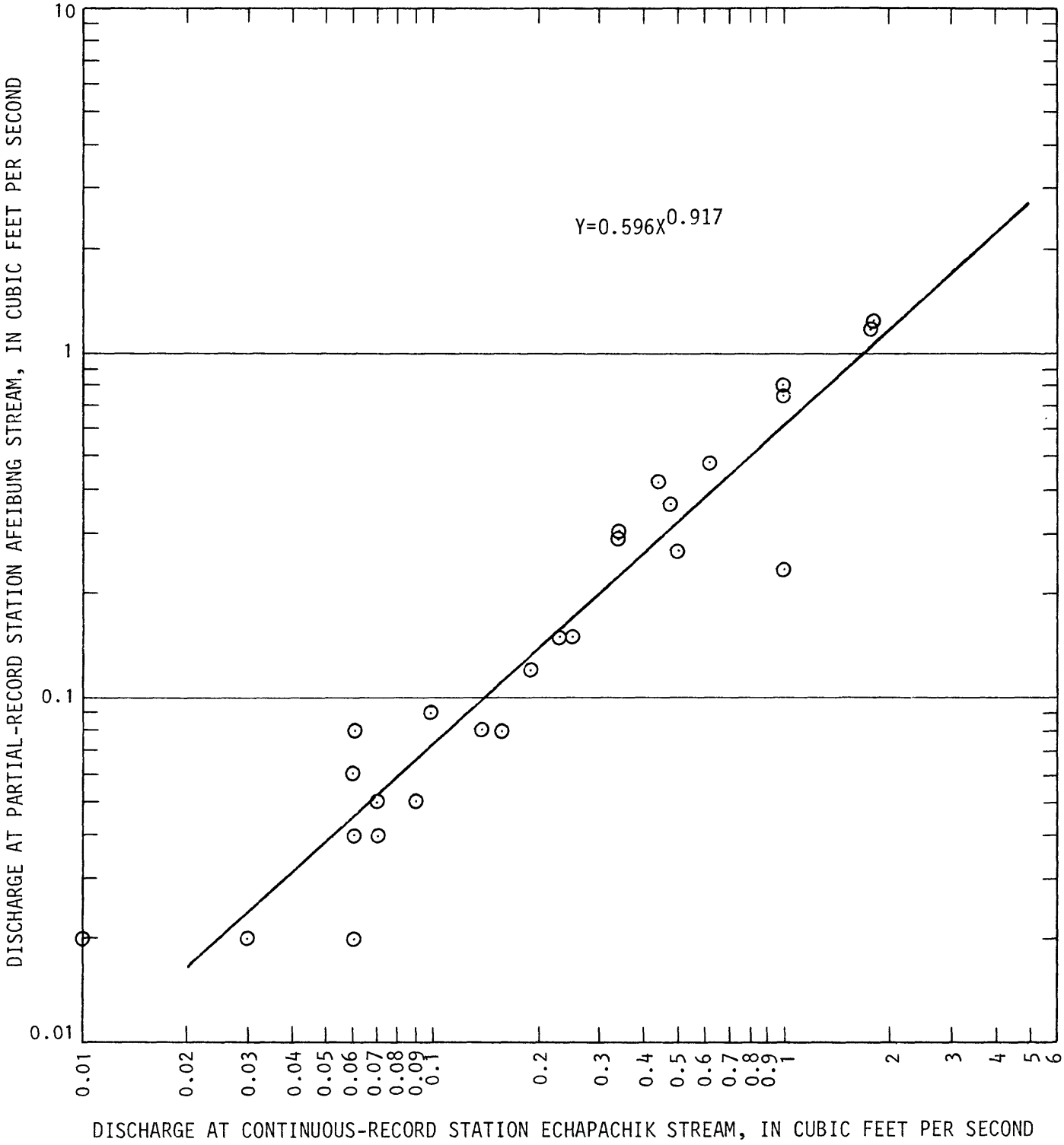


Figure 23. Correlation between discharges of Afeibung and Echapachik Streams, Tol.

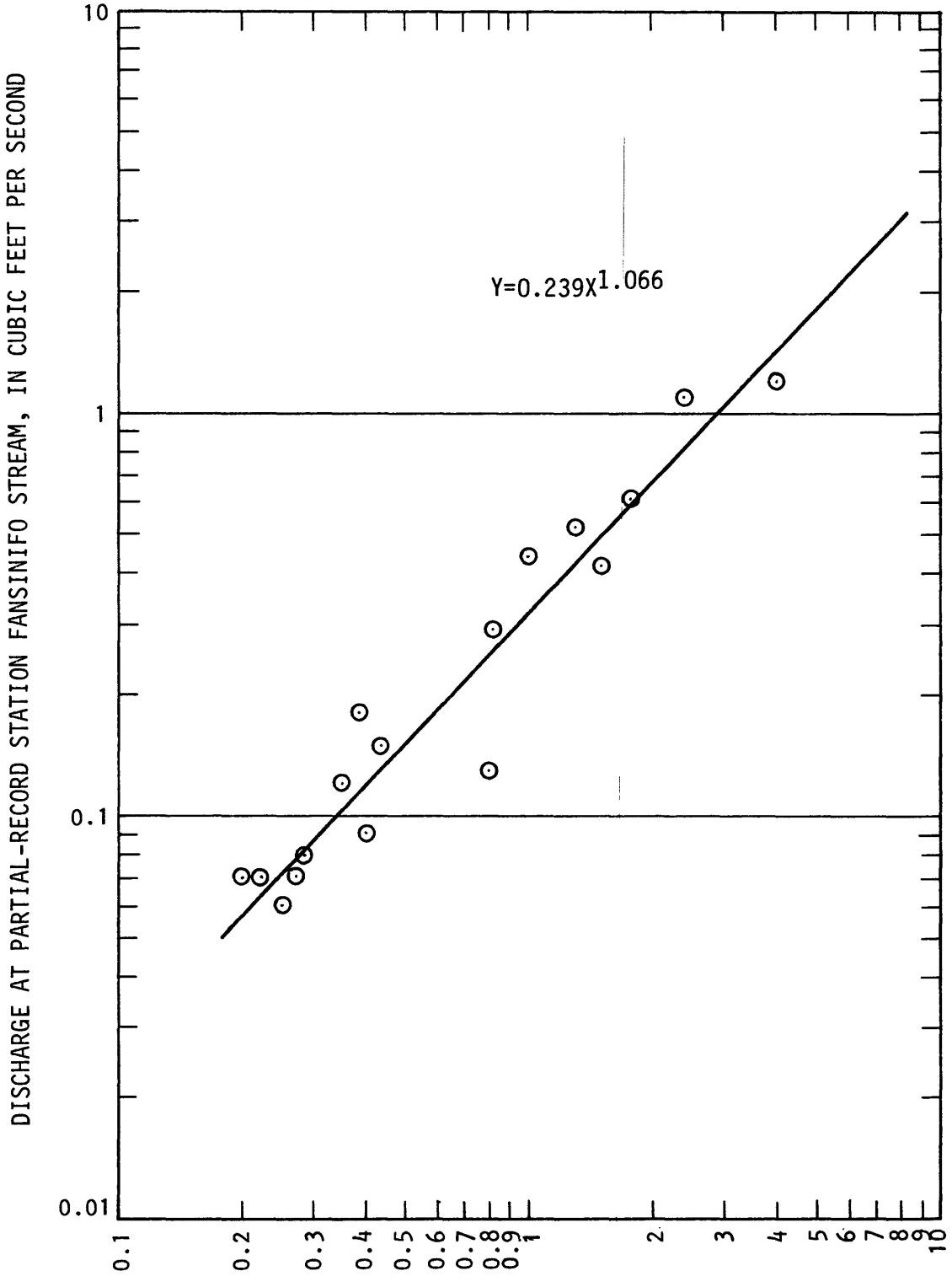


Figure 24. Correlation between discharges of Fansinifo and Tumunu Streams, Dublon Island.

Piper (1946-47) describes the character and water-bearing properties of the rocks in the Truk Islands as follows:

In succession generally downward, the lagoon islands of the Truk group seem to be composed by the following:

1. Deposits of the 5- to 10-foot raised beach--specifically, a veneer of coralline sand mingled at some places with earthy detritus from the higher inland terrane, probably underlain by young reef limestone. Characteristically these deposits are highly permeable, receive the infiltrate from rain on the raised beach, and probably contain some fresh water in hydraulic balance with the ocean. So far as is known, this potential source of fresh water in small quantity has not been tapped by wells, probably because more copious sources are numerous.

2. Talus fans at the base of escarpments and bluffs, as along the east and south flanks of Mt. Tumuital on Tol Island, along either flank of Mt. Teroken on Moen Island, and locally about Mt. Tolomen on Dublon Island. These coarse but unassorted deposits are moderately to highly permeable; through them a considerable amount of fresh water drains to numerous dispersed springs, of which most probably are intermittent. Such springs, also shallow wells dug into the talus fans, are the chief source of water at several native villages and numerous out-lying dwellings.

3. A discontinuous mantle of slope wash and decomposed rock derived from the underlying volcanics to be described, especially from the tuffs. This mantle exists over most of the land area except the escarpments and the steepest slopes, and at some places is at least several tens of feet thick. As on other volcanic terranes of the Caroline Islands, it sheds a very large part of torrential rainfall by over-land flow, but its coarser facies are slightly permeable and probably a source material for some dispersed ground-water runoff.

4. Non-fragmental volcanic rocks, probably of basaltic composition, commonly in thick massive layers separated at some places by beds of tuff and other fragmental materials of volcanic origin. At least in part the fragmental materials are distinctly stratified. Three non-fragmental layers, with intervening tuff, make up most of Moen Islands; several such layers, with little intervening tuff, compose the upper half of Mt. Tumuital on Tol Island. With respect to the occurrence of water, the unweathered non-fragmental volcanics function chiefly as an essentially water-tight basement under the more permeable materials previously described. Among the intercalated beds of fragmental volcanics, the coarsest are judged to be appreciably permeable and so locally to constitute a potential source of fresh water if tapped by deep wells. By inference, such fresh water as exists in the unweathered volcanics probably is not in hydraulic balance with the ocean, so that wells penetrating far below sea level might yield fresh water perennially; however, this latter possibility can be verified only as deep wells may be constructed in the future.

The past and present development of ground water on Moen is presented in the chapter "Water production and distribution". Pumpage rates and water levels of wells are given in the Hydrologic Data section with the water-quality data. Records of drilling and testing of 22 testholes on Moen in 1975-76 have been published in U.S. Geological Survey Open-File Report 77-739 (Davis, 1977).

Water Quality

General

The first record of an analysis of water from the Truk Islands is found in the report by Piper (1946-47) measuring chloride concentration (15 mg/L) and hardness (85 mg/L) of water from (old) well 3. Valenciano and Takasaki (1959) measured the chloride concentration of water from dug wells on all major islands. They found the chloride concentration to be low except from those wells very near the shore (table 10).

Between 1946 and 1979, only a few chemical analyses of water were made. Although the units are now normally given in milligrams per liter, for these analyses they are presented in parts per million as reported. When the density of water is 1.000, parts per million can be considered to be the same as milligrams per liter and most waters in the Truk Islands have a density of 1.000.

Since 1979, the U.S. Geological Survey and the Water Resources Research Center of the University of Guam have analyzed a number of ground-water samples, while the Geological Survey has taken streamflow samples at some miscellaneous sites, and has sampled the Wichen River water biannually. Tables 11 and 12 list the chemical analyses of surface water and ground water that have been made. Results of the analyses are given in the Hydrologic Data section.

All water samples collected by the Geological Survey since 1979 were analyzed in the Geological Survey Central Laboratory in Denver, Colorado. Discharge, water temperature, specific conductance, pH, and dissolved oxygen were determined at the site.

During many of the discharge measurements made on Truk, water temperatures were obtained and these are listed in the Hydrologic Data section (tables 50-59).

Samples are collected once a month from the Moen water system and analyzed for both fecal and total coliform by the Department of Environmental Health Services. Table 13 shows the chemical and microbiological analyses of the Moen Central Water System on November 1, 1976 (Young and others, 1977).

Table 10. Chloride concentrations of water from dug wells (1955, 1957)

[Modified from Valenciano and Takasaki, 1959]

Location	Number of wells	Concentration in milligrams per liter		
		Maximum	Minimum	Mean
Moen	5	76	10	24
Dublon Island	5	10	10	10
Eten	3	36	16	25
Fefan	7	18	5	9
Udot	5	800	10	302
Uman	6	30	15	23
Fala Beguets	8	400	8	94
Tol	15	56	6	13

Table 11. Summary of chemical analyses of surface water

Stream	Date	Collected by/ analyzed by	Table
Tumunu Stream, Dublon Island.	Feb. 23, 1953	USGS/USGS Salt Lake City.	60
Pou Stream catchment, Moen	June 14, 1957	USGS/Navy PW Guam.	60
Echapachik Stream, Tol ----	June 23, 1957	do.	60
Wichen River at altitude 18 m, Moen.	Dec. 15, 1966	Austin, Smith and Assoc., 1967	61
Nachiponong Stream, Moen --	do.	do.	61
Nefounumas Spring, Moen ---	do.	do.	61
Pou Stream catchment, Moen	do.	do.	61
Principal's Spring, Tol ---	Dec. 15, 1971	USGS/USGS Honolulu.	62
Wichen River at altitude 55 m, Moen.	May 13, 1979 Oct. 31, 1979 May 5, 1980 Nov. 18, 1980	USGS/USGS Denver.	63
Wichen River at altitude 18 m, Moen.	May 13, 1979 Oct. 31, 1979 May 5, 1980 Nov. 18, 1980 Apr. 16, 1981 Nov. 11, 1981	do.	64
Nachiponong Stream, Moen --	Sept. 16, 1982	do.	65
Pou Stream catchment, Moen	May 7, 1980 Apr. 14, 1981	do.	66
Pou Stream, Moen ----------	May 7, 1980	do.	66
Faichia Stream, Moen ------	do.	do.	66
Million gallon tank, Intellectual Hill, Moen[1/].	Apr. 17, 1981 June 23, 1981 Nov. 13, 1981 Mar. 3, 1982	do. do. do. do.	76 76 76 76
Pou reservoir, Moen -------	Mar. 3, 1982	do.	84

[1/] Surface water from Pou Stream catchment and ground water from wells in the Administration area.

Table 12. Summary of chemical analyses of Moen ground water

Well No.	Date	Collected by/ analyzed by	Table	Remarks
Old well 3	May 31, 1946	Piper (1946-47)	--	Chloride 15 mg/L. Hardness 85 mg/L.
Old well 3	June 14, 1957	USGS/Navy PW, Guam	67	
Old well 2	Dec. 15, 1966	Austin, Smith and Assoc. (1967).	67	
1, 3, 4, 6	Feb. 28, 1971	Layne International, Guam.	68	
2	Mar. 11, 1971	USGS/USGS Honolulu	68	
1, 7, 11, 16	Nov. 1, 1976	Young, Wong, Univ. of Hawaii.	69	Source: Young and others, 1977.
1, 7, 9, 10, 13, 15.	June 1979 to March 1980.	WRRC, University of Guam.	70-75	Source: Austin, Tsutsumi, 1980.[1/]
10, 12-15, 17, 18.	Mar. 25-29, 1980	USGS	77	Chloride only.
1, 2, 4, 7, 9-15, 17.	May 6, 8, 1980	USGS/USGS Denver	78	
1-4, 7-10, 12, 14, 15.	Nov. 19-25, 1980	do.	79	
1, 2, 7, 9, 12, 13.	Apr. 17, 18, 1981	do.	80	Specific conductance and chloride.
1, 2, 7-10, 12, 13, 15, powerplant.	June 23, 1981	do.	81	
1, 2, 7, 9, 10, 13-15, 17.	Nov. 11-12, 1981	USGS/USGS Honolulu	82	
18	Nov. 12, 1981	USGS/USGS Denver	83	
10	Apr. 13, 1983	do.	83	Includes metals.
1, 4, 7, 9, 10, 12-15, powerplant.	Mar. 2, 3, 1982	do.	84	Specific conductance and chloride.
9	June 4, 1982	USGS/USGS Honolulu	85	Do.
1, 2, 4, 7, 9, 10, 12-15, 17, 18.	Sept. 15, 16, 1982	do.	86	Specific conductance, chloride, and bacteria.
1, 2, 4, 7, 9, 10, 12-15, 17.	Mar. 11, 1983	do.	87	Do.
1, 2, 4, 7, 9, 10, 12-15, 17, 18.	April 1983	do.	88	Specific conductance and chloride.

[1/] Compiled from monthly analyses listed in WRRC Technical Report No. 13 (Clayshulte and Zolan, 1980).

Table 13. Chemical and microbiological analyses of water from Moen central water system

[Collected and analyzed in the field by Young and Wong, University of Hawaii, Nov. 1, 1976 (Young and others, 1977)].

Constituents	Units	Five grab samples from distribution system			Sample from 700,000-gallon concrete tank
		Low	High	Mean	
Specific conductance ---	(µmho)	110	430	240	70
pH ----------	--	6.3	7.3	6.9	6.7
Temperature ----------	(°C)	28	31	29	25.5
Turbidity ----------	(NTU)	--	--	1/ 2.4	14
Total coliform per 100 mL ----------	--	12	2,800	920	--
Total alkalinity -------	(mg/L)	--	--	--	26
Hardness as $CaCo_3$ ----	(mg/L)	86	188	123	--
Sulfate (SO_4) --------	(mg/L)	--	--	--	1.0
Chloride (Cl) ----------	(mg/L)	18	68	40	12.8
Fluoride (F) ----------	(mg/L)	.2	.2	.2	--
Nitrate as N ----------	(mg/L)	1	3	2	.03

NTU - Nephelometric Turbidity Units.

1/ One sample only.

Surface-water quality, Moen.--Water-quality data were collected by the U.S. Geological Survey in 1979-82 to determine the baseline chemical and physical characteristics of surface water on Moen. Toxic chemicals and bacteriological determinations were not part of this basic inventory.

The quality of the surface water on Moen is excellent, as the concentrations of all chemicals analyzed are well within the maximum permissible level recommended for domestic use by the World Health Organization (1971).

The dissolved-solids content of the surface water of Wichen River was less than 50 mg/L (milligrams per liter) and that of the other streams less than 60 mg/L (maximum permissible level is 1,500 mg/L). About one-third of the dissolved solids of the surface water in Moen was due to dissolved silica. Silica concentrations, which ranged from 9.0 to 18 mg/L, are characteristic of rainwater flowing over tropical volcanic terrain. Other constituents, in decreasing order of concentration, were alkalinity, chloride, sodium, calcium, magnesium, sulfate, potassium, nitrite plus nitrate, nitrogen, and fluoride.

The surface water on Moen can be classified as soft in terms of hardness concentration expressed as calcium carbonate. Hardness values were less than 28 mg/L for all sources analyzed. Water hardness is classified as:

Class	Hardness as $CaCO_3$
Soft	Less than 60 mg/L
Moderately hard	60 - 120 mg/L
Hard	120 - 180 mg/L
Very hard	More than 180 mg/L.

Iron concentrations ranged from 70-310 µg/L (micrograms per liter) with a mean of 150 µg/L. Normally a minor element in water, iron, can cause undesirable effects when the concentration exceeds 300 µg/L. It causes problems with taste, discoloration, turbidity, and growth of iron bacteria. The World Health Organization recommends a desirable level of 100 µg/L but allows a maximum level of 1,000 µg/L.

Tropical-storm runoff is flashy and causes turbidity problems in streams. However, storm duration normally is 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 listed in tables 60-66 as an integral part of the baseline information.

Specific conductance is expressed in terms of micromhos per centimeter at 25°C. It is a measure of the ability of water to transmit electrical current. Specific conductance is used as an indicator of the amount of dissolved solids in water: e.g., the more dissolved solids, the greater the conductance. The specific conductance of stream water on Moen did not exceed 89 µmhos (micromhos).

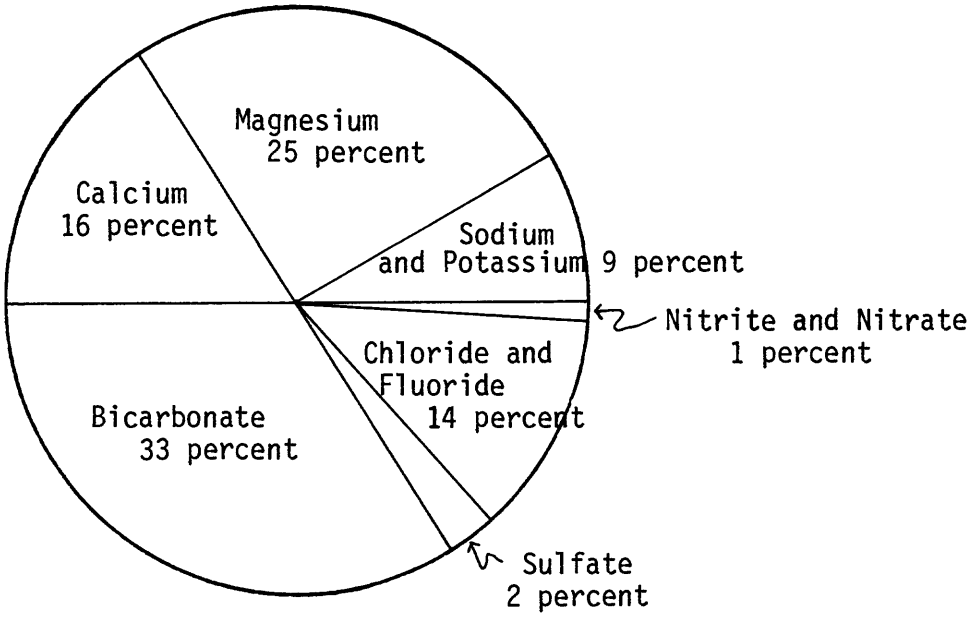
A measure of the acidity or basicity of water is pH. In natural water, pH is a function of chemical and biological processes. The water in Moen streams had pH values ranging from 6.7 to 7.5 units, which are close to the neutral 7.0 units.

Stream temperatures do not vary significantly on Moen. They fluctuate with ambient conditions and are generally highest in midafternoon. Water temperatures of the ten samples on Wichen River, taken between 0900 and 1530 hours, varied only from 25.0° to 27.5°C. Temperature is an important consideration because of its effect on chemical reactions and biological activities.

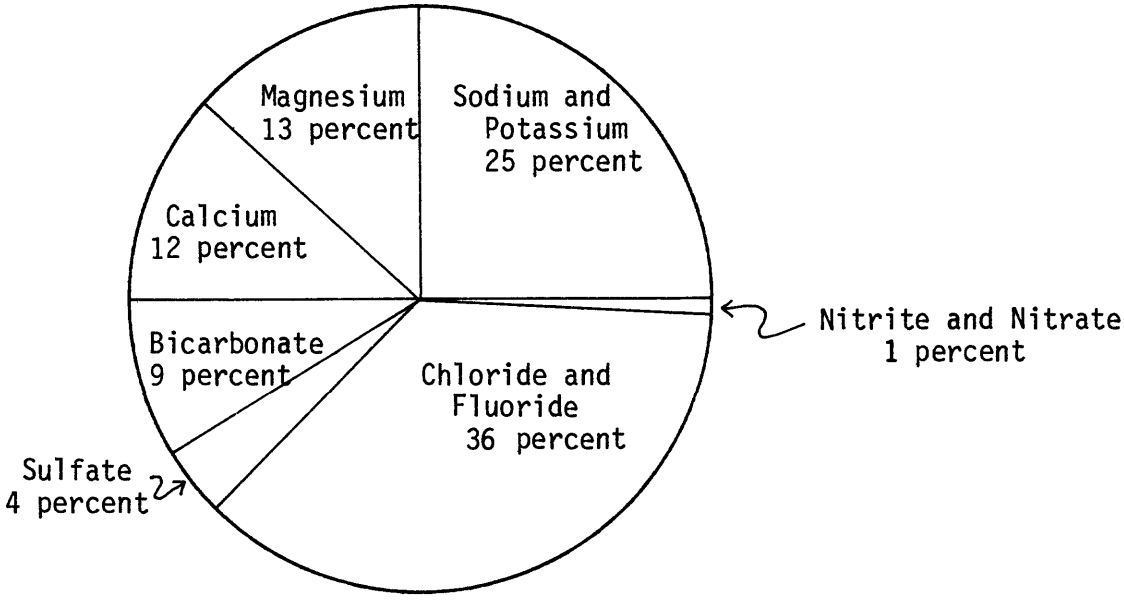
Ground-water quality, Moen.--In general, the ground-water quality on Moen is good. Except for water from well 9, all other ground water developed is chemically suitable for domestic consumption. Water from well 9 had a dissolved-solids content that exceeded the maximum level of 500 mg/L recommended for drinking water by the World Health Organization. The water, however, is being diluted with better-quality water to meet present drinking-water standards.

Moen's ground water is predominantly the magnesium bicarbonate type, where magnesium and bicarbonate ions constitute more than 50 percent of the ions dissolved in the water. The exception is well 9, where ocean water has intruded into the aquifer. The water from well 9 is sodium chloride type water. Figure 25 shows the difference in the two types of ground water in percentages. (See table 78.)

Incidences of high turbidity and total coliform values have been detected in Moen's ground water. Data from the University of Guam showed high turbidity values for wells 7, 9, 13, and 15, and local analyses showed positive coliform colonies for most well samples collected between October 1979 and February 1980 (tables 70-75). Consistent treatment of the water is needed to meet safe drinking-water standards (World Health Organization, 1971).



Average of 10 wells
May 6, 1980



Well 9
May 6, 1980

Figure 25. Major-ion percentage plot for Moen ground water.

WATER PRODUCTION AND DISTRIBUTION

Historical Development

General

No record exists of any water-resources development taking place during the Spanish and German Administrations and, although the Japanese civil and naval personnel were numerous and outnumbered the local population, their water development was modest compared to modern standards. Even on Dublon Island, the headquarters during the Japanese Administration, apparently no water was piped to residences, not even to those of senior officials and officers, but rain catchments were commonly used.

Water resources were developed to a lesser extent on nearby Moen, where most of the subsidiary facilities were located. On all other islands, only some springs and shallow boulder-lined wells were developed.

Surface water on Moen

On Moen, the Japanese built dams across Nachiponong Stream, Wichen River, and Pou Stream. The Nachiponong dam (fig. 26) was situated below the confluence of two branches of the stream at altitude 75 ft (latitude 7°25'38" N., longitude 151°51'02" E.). It was about 150 feet long, 17 feet high, with a 10-foot wide, 3-foot deep rubble masonry spillway. An 8-inch pipe carried the water from the dam about 700 feet and connected with a 4-inch pipe from Nefounumas Spring, the combined flow was piped more than half a mile to a collection basin, filter plant, and distribution reservoir. From there, the water was piped a quarter of a mile to the Epinup pier to supply ships. The Japanese claimed daily production ranging from 50,000 to 200,000 gal/d (gallons per day) (Austin, Smith and Associates, 1967). The filtration plant was destroyed by bombs; the dam was breached, and the system was abandoned after World War II.

On the upper reach of the Wichen River, at altitude 230 ft (latitude 7°26'04" N., longitude 151°51'33" E.), the Japanese built a concrete and stone dam, 7.5 feet high and about 17 feet wide at the top with an 11.5 x 1.6-foot spillway. This dam still exists but has not been used since the end of the Japanese Administration.

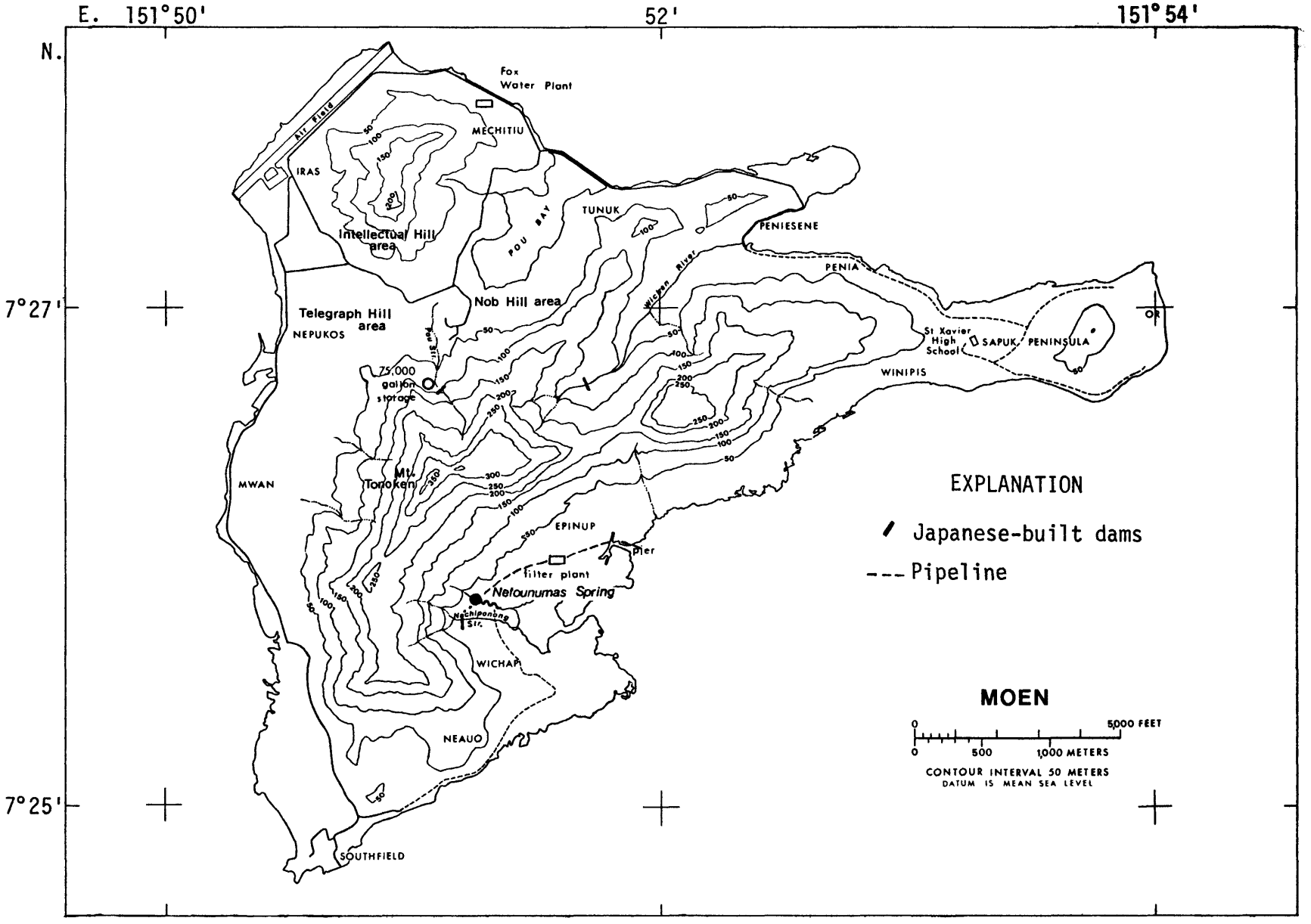


Figure 26. Location of surface-water development on Moen during the Japanese Administration (1914-45).

Water from Pou Stream was impounded by a Japanese-built masonry and steel-plate dam with a storage of about 75,000 gallons at an altitude of about 160 feet. This reservoir was used after the war when water was pumped from it to a filtration plant and two 20,000-gallon steel tanks. The water was then distributed by gravity flow to military and governmental areas (Piper, 1946-47).

In 1953, Ted Arnow (written communication to the High Commissioner, Mar. 11, 1953) mentioned three water systems. The No. 1 system was the Pou catchment area, where water was piped from the head of the falls to the treatment plant and three 20,000-gallon steel tanks. (The masonry and steel-plate dam was leaking and not in use at that time.) During the wet season, the system supplied water to the entire administration area, but during the dry season only the housing areas on Telegraph and Nob Hills were served (fig. 27).

The No. 2 water system consisted of one 20,000-gallon steel tank and two 4,200-gallon steel tanks. This system served the dock, hotel, administration building, school, hospital, and refrigeration plant. During the rainy season, the water for this system was supplied from surplus flow of the No. 1 system. During the dry season, the water would be supplied from (old) well 2, pumped 24 hours per day at a rate of 30 gal/min (gallons per minute), and from a 14,000-gallon concrete reservoir of Japanese construction. This reservoir received water from flow bypassing the masonry and steel-plate dam on Pou Stream.

System No. 3 consisted of one 20,000-gallon steel tank and one 4,200-gallon steel tank, which served the housing area at Intellectual Hill and nearby prison. During the wet season, the water for the system was also supplied from surplus flow of the No. 1 system; during the dry season, water for this plant was supplied from (old) well 3, which also was pumped 24 hours per day at a rate of 30 gal/min (fig. 27).

In December 1956, a 700,000-gallon concrete reservoir was completed near the Japanese masonry and steel-plate dam on Pou Stream. The water from an earthen dam at the head of the waterfall on Pou Stream was piped through a 4-inch pipeline directly to this reservoir and then to the treatment plant with the three 20,000-gallon pure-water tanks. Surplus flow of Pou Stream, bypassing the intake, was impounded in the still-leaking, 75,000-gallon Japanese reservoir. At that time, water systems 2 and 3 were still in use.

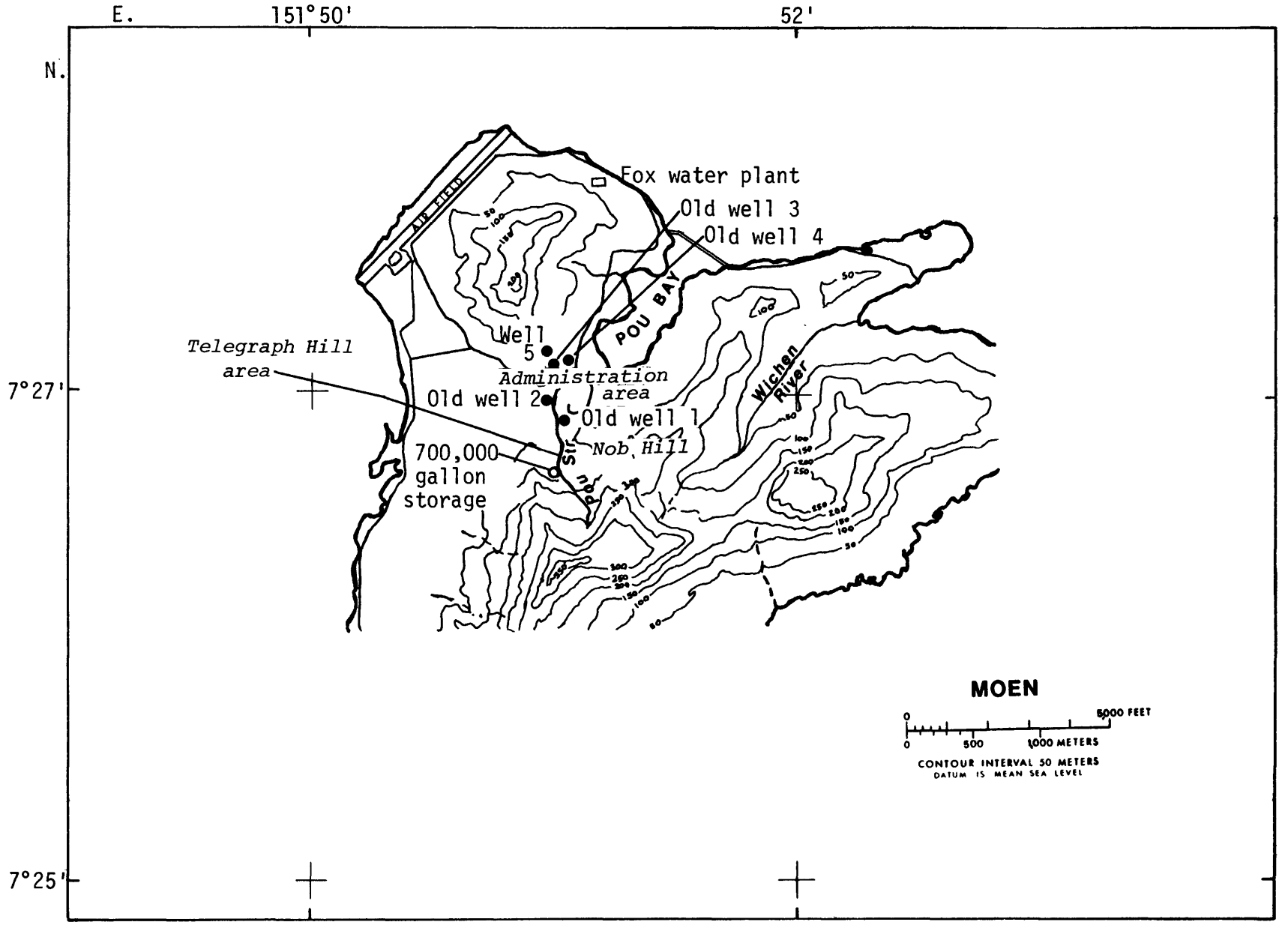


Figure 27. Location of surface- and ground-water development on Moen, 1945-70.

Between 1958 and 1980, the yield of the Pou catchment area was improved by the construction of two more dams and new pipelines. A large number of wells were drilled and three 1-Mgal (million gallon) steel storage tanks were constructed. During those years, the 75,000-gallon masonry and steel-plate reservoir was destroyed by floods, water systems 2 and 3 were abandoned, and the filter plant ceased operation.

At the quarry on the north coast of Moen, the Japanese utilized a spring to provide water to the quarry and the power plant. They constructed a masonry catch basin and sand filter and several concrete 25 x 15 x 15-foot storage tanks. This installation was called Fox Water Plant (Piper, 1946-47). In 1946, the water was used only to serve motorized equipment. In June 1957, when the plant was no longer used, the yield was measured at 3 gal/min (Valenciano and Takasaki, 1959).

Ground water on Moen

Shortly after the end of World War II, four wells were drilled in the Administration area. Apparently, well 1 was never used and well 2 was abandoned shortly after construction. Piper (1946-47) mentions only the 3 wells he called 1, 2, and 3, but his well 1 is now known as old well 2 and his well 2, as old well 4 (fig. 27).

Piper tested (old) well 3 for 4 hours with a yield of 131-147 gal/min, while chloride remained constant at 15 and hardness at 85 ppm (parts per million). He estimated that (old) wells 3 and 4 probably would sustain a draft of about 50,000 gal/d. For chemical analyses of water from (old) wells 2 and 3, see table 67.

During 1971-75, the U.S. Geological Survey operated continuous water-level recorders on old well 2 and well 5 (drilled in 1970-71 and abandoned).

Surface water on Dublon Island

On Dublon Island, the Japanese constructed a filtration plant on the northeast side of Mount Tonomwan consisting of four 30 x 30 x 9-foot concrete settling tanks and a concrete 20 x 20 x 14-foot reservoir. The water was pumped to two concrete 40 x 40 x 12-foot tanks on the east flank of Mount Tonomwan at an altitude of about 300 feet.

Storage potential of the filtration plant was 250,000 gallons and of the storage tanks, 240,000 gallons (Ted Arnow, written communication to D. A. Davis, Feb. 18, 1954). The sources of water for the filtration plant were four springs. Two of these, Fansinifo Spring and a lesser one, form the Tumunu Stream. The system was constructed to supply ships and military needs.

The Japanese started to build a 90-foot concrete dam across the Tumunu Stream valley but stopped, midway, because of World War II. To supply water to the town of Nukuno (Nukura) on the south side of Dublon Island, the Japanese used Fanis Spring at an altitude of 300 feet. On February 25, 1953, flow from this spring was measured by Arnow at 2.5 gal/min with a chloride concentration of 12.5 mg/L. The Japanese also used at least two large (6- to 8-ft diameter) wells, and a number of 12,000-gallon concrete cisterns (Ted Arnow, written communication to D. A. Davis, Feb. 18, 1954). Behind the cisterns, at an altitude of about 50 feet, some water-development tunnels were found, probably the source of much of the water for the cisterns.

After the end of the war all developments were abandoned, and only recently have some been restored to use. A buried Japanese 3-Mgal oil-storage tank on the east coast has been converted into a water reservoir.

Present Moen Water Supply

The Moen Water System depends on two sources for potable water:

1. The 90-acre rainwater catchment area at the head of Pou Stream, which is located on the hillside above the Government headquarters area on the north slope of Mount Tonoken.
2. Sixteen deep wells, most of which are located in the headquarters area (fig. 28).

1. Pou Stream rain-catchment area

Runoff from the catchment area flows into small valleys where three concrete dams divert the water through one 6-inch and two 4-inch steel transmission pipes to a 700,000-gallon concrete storage tank about 2,000 feet downstream from the diversion dams (altitude top of tank, 234 feet). The water is chlorinated by adding calcium hypochloride, but it is not filtered.

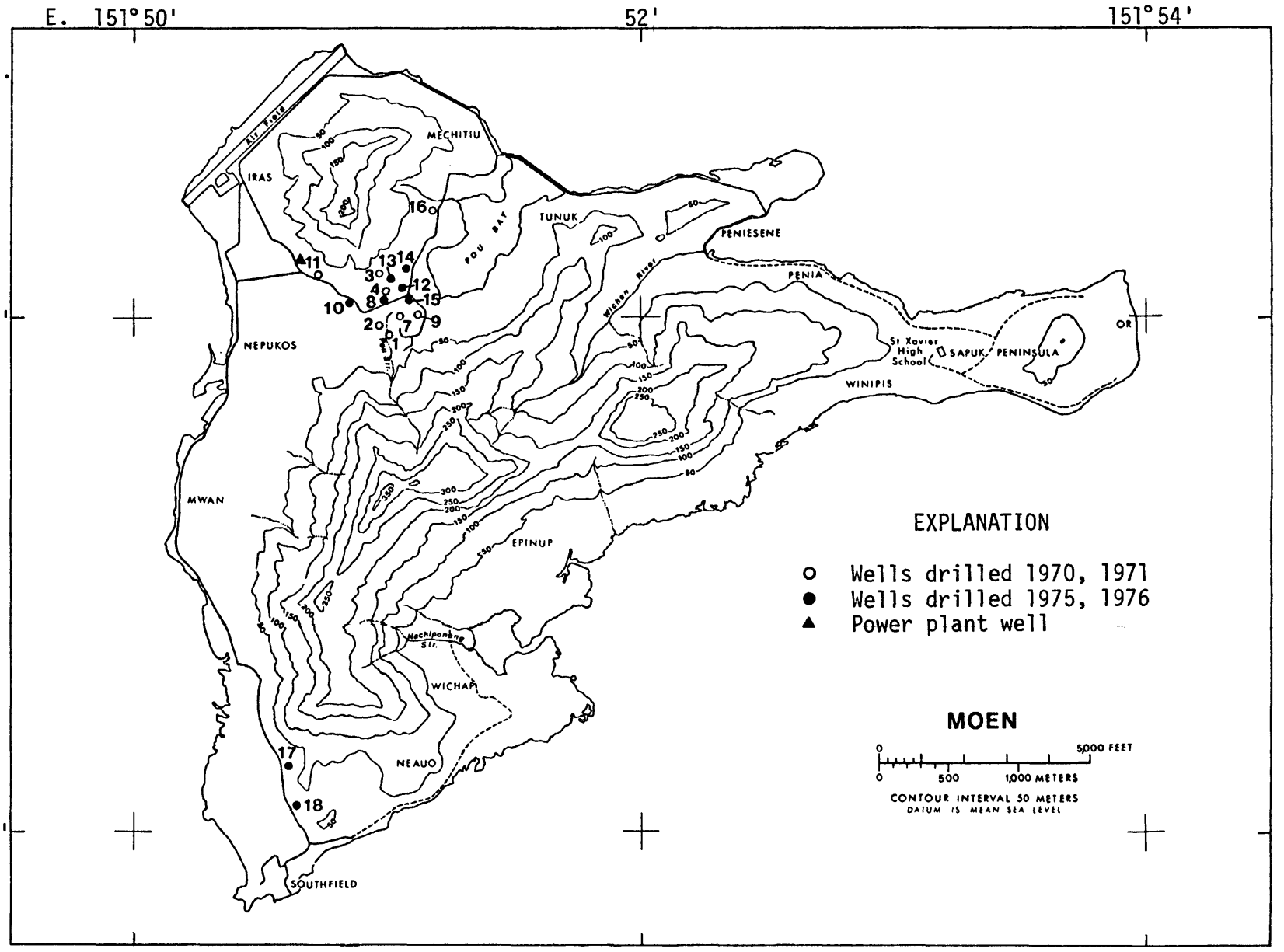


Figure 28. Location of Moen water production wells.

The storage tank is 100 feet long, 80 feet wide (outside) and 12 feet deep (inside) and is divided into eight compartments which are interconnected by 4-inch valves. Water from the compartments flows via 4-inch valved discharge pipes into a 12-inch steel pipe for distribution and, mixed with well water, for storage in the 1-Mgal steel tank on Intellectual Hill and, when connected, to similar tanks at the Wichen River and at Xavier High School (Irving, 1976 b) (fig. 29). Recently, a 1-Mgal steel tank with a top altitude of 259 feet was completed at Pou Stream to replace the 700,000-gallon tank. A new treatment plant was constructed between the two tanks.

The tank on Intellectual Hill above the Community Club was constructed in 1970 and has a top altitude of 190 feet. It is 40 feet high with a rounded steel cover. The tank at the Wichen River has a top altitude of 186 feet, and is 33 feet high, and also has a rounded steel cover. This tank was constructed in 1974 but is not yet in use because of a right-of-way controversy.

The Xavier tank, completed in 1978, has a top altitude of 247 feet and is 29.5 feet high (Irving, 1976a). As this tank is higher than the storage reservoir, a booster pump is necessary. This pump is located on the 12-inch water line on the road below Xavier High School at an altitude of 90 feet. At present, this tank is used only to store rainfall runoff from the high school roof.

A 1-Mgal steel tank with a top altitude of 190 feet is to be constructed for Wichap to provide water for the Southfield area.

No accurate figures for water production from the Pou Stream catchment area are available. Austin, Tsutsumi (1980) estimated the yield as 150,000 gal/d based on a U.S. Geological Survey flow measurement of the three pipes (table 41) and on estimates of basin yield by D. A. Davis and by Austin, Smith (1967). However, the yield depends on the amount of rainfall, and during the extremely dry month of February 1966 the yield was calculated by D. A. Davis to be only about 15,000 gal/d.

Using an average yearly rainfall of 144 inches (table 24), the average rainfall on the 90-acre catchment area would amount to about 1,000 ac-ft (acre-feet) or 325 Mgal/yr (million gallons per year).

The runoff-rainfall ratio at the Wichen River gaging station is almost 50 percent (table 5) and, assuming the same ratio for the Pou Stream, the discharge from the catchment area would average about 160 Mgal/yr (440,000 gal/d). Of course, only part of this flow can be diverted and stored.

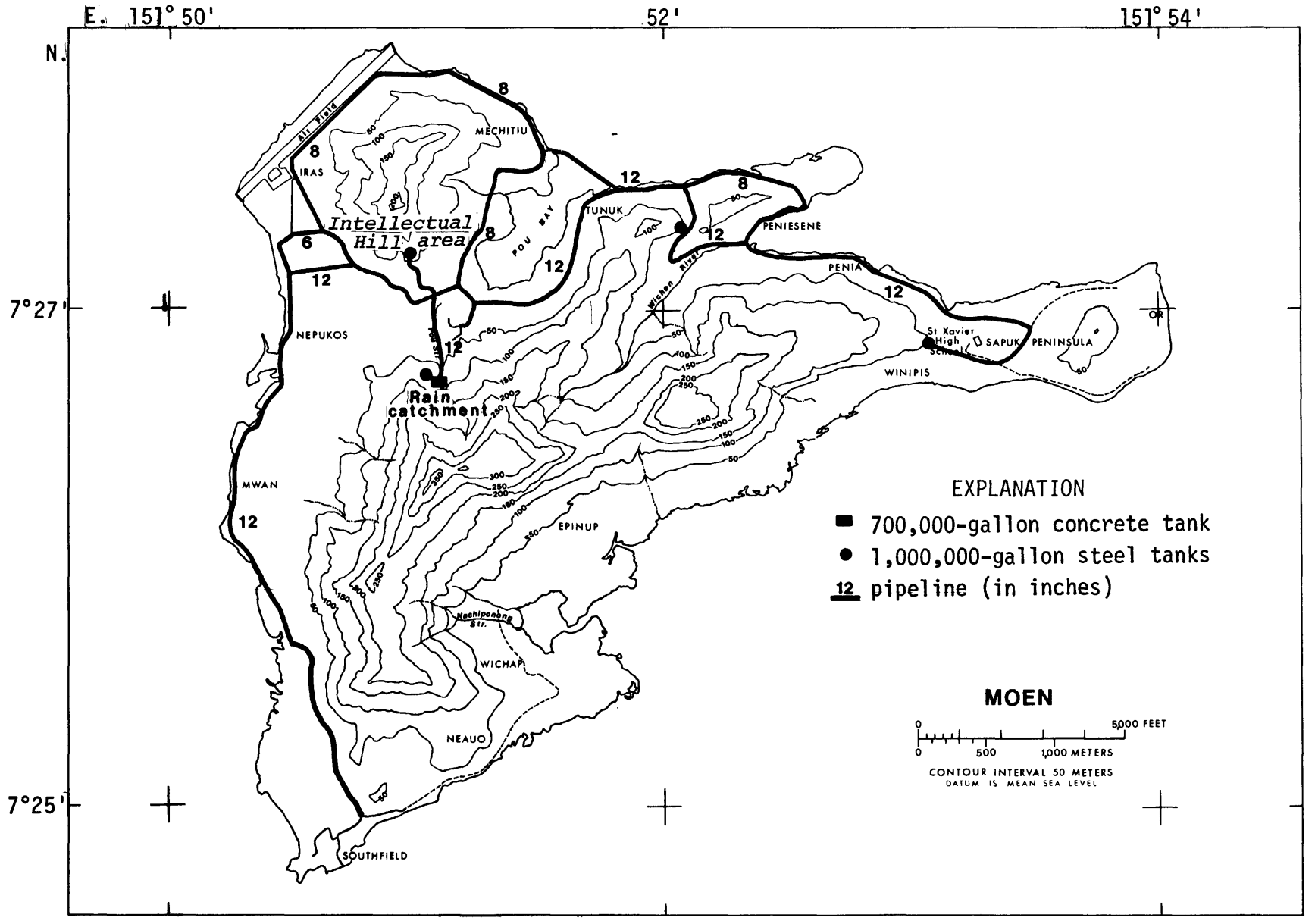


Figure 29. Moen water-distribution system.

2. Deep wells

During 1970-71, 16 deep wells were drilled on Moen. Eight of these wells (now numbered 1 through 4, 7, 9, 11, and 16) were incorporated into the Moen distribution system. Of the other eight, five were abandoned, two were retained for water-level measurements, and well "D" at Peniesene might be hooked up when power becomes available there.

The average depth of the eight production wells is about 100 feet; they were drilled 18 to 82 feet below sea level. Production was expected to average 30 gal/min per well. To illustrate the yield of the eight wells for a 1-year period, table 14 shows their total production for March 1976 to February 1977, and table 15, their individual production for parts of that period. Well 16 was abandoned in 1978 because of low yield. At present, only wells 1, 2, 4, and 9 remain in use.

During November 1975 to July 1976, 22 exploratory wells were drilled and tested on Moen (table 16). Of these, eight were developed and integrated with the central water system. These wells were numbered 8, 10, 12 through 15, 17, and 18.

Well 11 was abandoned in 1980 because of low yield.

Well 18, reportedly developed to supply water to the Continental Hotel, is hardly used because of low yield and high salinity when pumped for any length of time (see table 83).

A description of all Moen production wells can be found in table 17.

D. A. Davis of the Geological Survey assisted in site selection and the preparation of specifications, observed the drilling, and collected the records. Davis (1977) summarized these records as follows:

> Depths of test holes ranged from 53 to 200 feet. Yields of water from the holes ranged from zero to about 60 gal/min. Typically, drawdown of water level during pumping was large in the holes. In most, the specific capacities were 1 gal/min/ft (gallons per minute per foot) or less. The highest specific capacity was 8 gal/min/ft at a pumping rate of 48 gal/min.
>
> Pumping-test rates among the completed wells ranged from 15 to 60 gal/min, and specific capacities from 3/4 gal/min/ft at a rate of 35 gal/min to 6 gal/min/ft at 60 gal/min. The chloride concentration in water from one well was 120 milligrams per liter and less than 50 milligrams per liter in the other seven wells.

Table 14. Total monthly production of Moen wells, March 1976 to February 1977

Source: Public Works, Truk.

Month	Production (gallon)
March 1976	13,024,417
April	13,726,875
May	12,343,850
June	25,144,300
July	25,144,300
August	16,102,725
September	14,647,000
October	14,812,050
November	13,449,825
December	13,235,975
January 1977	12,848,100
February	9,399,874
Total	158,734,991 gal/yr
	= 13,228,000 gal/mo
	or 441,000 gal/d

Table 15. Monthly production of Moen wells during 6 months of 1976

Source: Public Works, Truk.

Well Number	March production (gallon)	April production (gallon)	May production (gallon)	Total production (gallon)
	Production during March to May 1976			
1 -----	1,919,455	3,022,900	1,325,000	6,267,355
2 -----	1,452,800	1,801,200	1,733,000	4,987,000
3 -----	1,716,791	1,974,750	2,276,550	5,968,091
4 -----	1,465,864	1,353,650	1,335,375	4,154,889
7 -----	3,960,900	3,578,500	3,178,100	10,717,502
9 -----	1,152,454	1,120,275	952,500	3,225,229
11 -----	1,020,376	875,600	986,300	2,882,276
16 -----	335,775	--	557,025	892,800
Total -	13,024,417	13,726,875	12,343,850	39,095,142

Average daily production, 425,000 gallons.

	August		September		October		
Well Number	Production (gallon)	Average water level (ft)	Production (gallon)	Average water level (ft)	Production (gallon)	Average water level (ft)	Total Production (gallon)
	Production during August to October 1976						
1 ----	3,125,000	38.7	2,959,400	39.2	2,805,600	38.9	8,890,000
2 ----	2,045,000	--	1,928,000	--	1,746,800	--	5,719,800
3 ----	2,694,950	56.12	2,160,300	54.6	2,053,800	54.1	6,909,050
4 ----	1,305,450	50.72	1,882,800	65	1,676,775	71.8	4,865,025
7 ----	3,864,000	51.34	3,593,600	45.12	3,700,800	41.2	11,158,400
9 ----	1,428,225	59.0	675,075	70.87	1,284,975	75.2	3,388,275
11 ----	957,300	54.45	859,000	33.95	901,300	31.8	2,717,600
16 ----	682,800	43.2	588,825	36.5	642,000	33.0	1,913,625
Total -	16,102,725		14,647,000		14,812,050		45,561,775

Average daily production, 495,000 gallons.

Table 16. Summary of records of test holes drilled on Moen, 1975-76

Source: D. A. Davis, 1977.

Altitudes given are approximate heights above mean sea level of ground surface at the test holes.
All depths are measured below the ground surface. Date of completion is date of completion of pumping test.

Test hole No.	Date completed	Altitude (ft)	Depth (ft)	Depth to water (ft)		Pumping rate (gal/min)	Drawdown (ft)	Specific capacity (gal/min/ft)	Chloride concentration (mg/L)	Remarks
				Static level	Pumping level					
TH-1	11-14-75	35	100	10	81	3	71	0.04	30	
TH-2	11-21-75	21	125	13	82	8	69	.1	25	
TH-3	11-24-75	60	74	--	--	1	--	--	--	Abandoned before testing because of low yield.
TH-4	11-30-75	23	67	10	22	37	12	3	12	Converted to well 17.
TH-5	12-4-75	9	110	5	40	55	35	1	260	Chloride concentration increased from 50 to 260 mg/L in 2 hrs of pumping. Hole was backfilled with neat cement to depth of 75 ft.
	12-6-75	9	75	5	34	34	29	1	20	Converted to well 18.
TH-6	12-8-75	30	79	7	--	--	--	--	--	Hole abandoned before testing because of low yield.
TH-7	1-25-76	77	172	24	74	17	50	.3	17	
TH-8	2-1-76	70	163	32	109	14	77	.2	12	
	2-4-76	70	200	35	137	12	102	.1	12	Hole deepened to 200 ft for further testing.
TH-9	2-11-76	22	80	9	23	56	14	4	50	Converted to well 12.
TH-10	2-13-76	39	66	12	39	23	27	.9	140	Converted to well 8.
TH-11	2-17-76	12	67	5	20	50	15	3	15	Converted to well 10.
TH-12B	2-19-76	13	80	7	45	23	38	.6	14	
TH-13	2-22-76	7	65	4	--	--	--	--	--	
TH-14	2-24-76	25	70	3	55	1	52	.02	20	Hole abandoned without testing.
TH-15	2-26-76	33	137	29	93	13	64	.2	10	
TH-16	3-2-76	22	75	8	25	50	17	3	21	Converted to well 14.
TH-17	3-3-76	10	53	--	--	1	--	--	--	Abandoned before testing because of low yield.
TH-18	3-5-76	40	90	6	69	3	63	.04	15	
TH-19	3-7-76	50	85	28	52	15	24	.6	35	
TH-20	3-9-76	38	85	24	30	48	6	8	16	Converted to well 13.
TH-21	7-21-76	38	66	15	--	--	--	--	--	Abandoned before testing because of low yield.
TH-22	7-23-76	15	70	7	32	32	25	1	33	Converted to well 15.

Table 17. Summary of Moen production wells

Well No.	Date completed	Location Lat. North 7°	Location Long. East 151°	Altitude (ft)	Depth (ft)	Depth intervals of casing, screen, gravel pack, and seal (ft): 8-in. casing	8-in. screen	Open hole	Gravel pack	Grout seal	Depth to static water level (ft)	Pumping test at completion: Pumping rate (gal/min)	Drawdown (ft)	Specific capacity (gal/min/ft)	Chloride concentration (mg/L)
Wells constructed on Moen, 1970-71 (Source: Austin, Tsutsumi and Associates, 1980)															
1	8-22-70	26'46"	50'56"	78.35	127	0-38	38-68	68-127	31-67	0-31	11	80	10	8	--
2	8-4-70	26'50"	50'55"	62.20	127	0-72	72-92	92-127	20-87	0-20	12	60	13	5	--
												83	47	2	--
3	9-26-70	27'02"	50'54"	61.68	110	0-35 65-85 90-95	35-65 85-90	95-110	26-90	0-26	28	75	24	3	--
4	7-16-70	26'59"	50'56"	38.17	108	0-68 88-98	68-88 98-108	0	45-113	0-45	18	45	16	3	15
												73	66	1	15
7	12-4-70	26'54"	51'01"	28.33	105	0-35	35-70	70-105	25-68	0-25	5	80	26	3	--
9	3-12-71	26'55"	51'03"	28.42	110	0-60	60-80	80-110	15-80	0-15	16	29	48	1	--
11	5-23-71	27'01"	50'46"	34.95	70	0-10	10-50	50-70	10-50	0-10	15	60	14	4	--
16	3-19-71	27'19"	51'07"	36	54	0-20	20-40	40-54	15-39	0-15	16	15	--	--	--
Wells constructed on Moen, June-July 1976 (Source: Davis, 1977)															
8	6-26-76	26'54"	50'56"	39	65	0-31	31-55	55-65	16-50	0-16	11	15	17	1	120
10	6-16-76	26'57"	50'47"	12	57	0-23 47-52	23-47	52-57	17-51	0-17	4	50	27	2	16
12	7-2-76	26'58"	51'00"	22	74	0-48 72-74	48-72	None	23-72	0-23	9	60	10	6	45
13	7-12-76	27'01"	50'56"	38	80	0-39 47-60 76-79	39-47 60-76	79-80	23-74	0-23	21	60	13	5	17
14	7-6-76	26'58"	51'02"	15	74	0-38 62-64	38-62	64-74	16-55	0-16	7	60	19	3	20
15	7-27-76	27'03"	51'01"	22	68	0-27 34-43 67-67-1/2	27-34 43-67	None	14-66	0-14	7	37	26	1	33
17	7-19-76	25'10"	50'33"	23	47	0-22 45-47	22-45	None	14-47	0-14	14	37	10	4	14
18	6-18-76	25'04"	50'33"	9	75	0-24 48-53	24-48	53-75	16-50	0-16	5	35	48	3/4	20

Altitudes given to hundredths of a foot are from stadia survey run by Public Works (Dan Patterson) in January 1975 to measuring point. All other altitudes are approximate heights above mean sea level of ground surface at the well sites. All depths are measured below the ground surface. All figures are rounded. Date of completion is date of completion of pumping test on the well.

Table 18 shows the production of all wells in use during the period December 21, 1978 to April 18, 1981, with the mean daily production and the mean pumpage rate. The average daily production with all 15 wells in operation was 700,000 gallons. As some of the wells were not producing at times, the actual average production during the 849 days of the period was 568,500 gallons.

Pumpage rates obtained by the U.S. Geological Survey for 13 days in 1978 and for 14 days are given in table 19. These figures show that up to 800,000 gal/d can be obtained from the present wells on Moen (assuming that the well meters were registering correctly). However, pumpage is normally much lower during the dry months in the beginning of the calendar year. Because rainfall for October 1982 to March 1983 has been only one third of the norm, the production of ground water dropped to about 360,000 gal/d and the chloride concentration of the water increased from a mean weighted average of about 50 mg/L during 1981-82 to more than 400 mg/L in April 1983. This increase was mainly due to the sharp rise in chloride concentration of water from wells 12 and 14 near Pou Bay. (See tables 98 and 100).

In 1966, the distribution system on Moen was restricted to the headquarters area and consisted of 2-, 2-1/2-, and 4-inch lines, mostly laid on the surface. Ten years later the lines had been replaced by 8- and 12-inch and some 6-inch lines (fig. 29) with 50 percent of Moen's population being served. Because of easement problems and sections in need of repair, portions of the system are not used at present. Extensions of the system in Wichap and Sapuk are planned.

Calculating the amount of water used on Moen is not feasible. Much of the water is not metered and there is no accurate count of the number of people making use of the system. In any system, a certain percentage of the water is unaccounted for, but on Moen this percentage may easily be in excess of 50 percent. The unaccounted-for water is chiefly water lost through leakage in the system and through waste. The amount of lost water is illustrated by data for the month of February 1977 during a severe drought. Water was restricted to 4 hours a day during the first 3 weeks and to 2 hours a day for the last week of the month. The estimated 12 Mgal withdrawn from the system in that month served about 3,000 people averaging 3-1/2 hours a day. This would give a daily per-capita consumption of 133 gallons while current engineering designs in southeast Asia allow for 60 gallons per day per capita, one third of which is allowed for losses (Austin, Tsutsumi, 1977).

Table 18. Mean pumpage rates of Moen wells, December 21, 1978 to April 18, 1981

[From readings by U.S. Geological Survey]

Well No.	Period	Number of days	Production (gal)	Mean daily production (gal)	Mean pumpage rate (gal/min)
1	12/21/78-4/18/81	849	64,037,200	75,400	52
2	2/9/79-4/18/81	799	35,283,300	44,200	31
3	5/7/80-11/19/80	196	8,821,400	45,000	31
4	12/21/78-4/15/81	846	18,361,800	21,700	15
7	12/21/78-4/18/81	849	47,206,400	96,500	67
8	12/21/78-4/15/81	846	8,796,900	10,400	7
9	12/21/78-4/18/81	849	29,770,000	35,100	24
10	12/21/78-11/19/81	699	48,637,300	69,600	48
11	2/9/79-11/19/80	649	6,653,400	10,300	7
12	2/9/79-4/18/81	799	49,081,000	61,500	43
13	12/21/78-4/17/81	848	59,745,600	70,500	49
14	12/21/78-4/17/81	848	39,842,100	47,000	33
15	12/21/78-4/15/81	846	36,238,400	42,800	30
17	2/9/79-5/7/80	453	25,553,500	56,400	39
18	11/1/79-11/26/80	390	4,631,100	11,900	8
	Total ----------		482,659,400	698,300	

Average daily production during period, $\frac{482,659,400}{849}$ = 568,500 gallons

Table 19. Pumpage rates of Moen wells for some days during 1978-83

[U.S. Geological Survey. Values in gallons per minute]

Date	Well 1	Well 2	Well 3	Well 4	Well 5	Well 7	Well 8	Well 9	Well 10	Well 11	Well 12	Well 13	Well 14	Well 15	Well 16	Well 17	Well 18	Total (gal/min)	Total (gal/d)
1978																			
4- 7	25	13	8	0	--	67	0	19	52	0	77	29	--	39	19	37	0	385	554,400
7-24	41	20	--	--	47	68	--	22	45	19	56	--	51	40	--	--	--	409	588,960
7-31	47	26	--	--	58	75	--	27	52	19	67	--	47	42	--	44	--	504	725,760
8- 1	47	25	--	--	57	75	--	27	--	20	66	--	55	37	--	53	66	528	760,320
8- 9	47	25	--	--	57	77	--	26	--	--	--	--	--	--	--	--	--	232	334,080
8-10	46	23	--	--	57	77	--	26	63	--	65	--	--	--	--	50	33	440	633,600
8-11	45	24	--	--	57	77	--	26	60	--	65	--	--	--	--	53	60	467	672,480
8-14	48	24	--	--	58	76	--	28	60	--	--	--	--	--	--	53	33	380	547,200
8-16	46	25	--	--	57	78	--	28	58	--	66	--	--	48	--	58	65	529	761,760
8-18	47	24	--	--	57	77	--	27	60	--	65	--	--	38	--	55	--	450	648,000
8-21	47	24	--	--	54	75	--	26	61	--	66	--	--	38	--	57	--	448	645,120
8-28	45	24	0	0	0	75	0	27	58	20	66	0	--	37	0	58	32	442	636,480
12-21	46	--	0	0	0	76	0	27	60	--	--	0	50	64	0	--	--	323	465,120
1979																			
2- 9	48	--	0	19	0	71	8	26	46	--	61	57	37	38	0	36	0	447	643,680
10-29	65	35	0	36	0	13	15	27	57	--	60	40	--	20	0	0	0	368	529,920
1980																			
1-21	63	35	0	33	0	0	0	29	48	0	61	42	--	0	0	40	0	351	505,440
3-25	50	38	44	23	0	54	0	28	48	31	70	53	35	40	0	45	0	559	804,960
3-27	51	39	39	23	0	52	0	29	46	28	70	52	35	41	0	45	0	550	792,000
5-6	55	31	--	13	0	53	0	28	60	27	68	45	34	35	0	38	--	487	701,000
11-19	43	37	40	24	0	50	10	27	48	0	66	--	35	51	0	1/40	30	501	721,000
1981																			
4-18	32	24	0	0	0	55	0	31	1/40	0	58	43	0	0	0	--	0	283	408,000
6-23	54	36	0	--	0	53	27	26	40	0	26	51	0	33	0	--	--	346	498,000
1982																			
3-2	40	0	0	12	0	45	0	31	43	0	61	37	30	31	0	0	0	330	475,000
6-4	51	36	0	23	0	43	0	27	47	0	71	47	16	36	0	34	--	431	621,000
9-15/16	38	34	0	80	0	52	0	27	47	0	71	49	30	36	0	34	9	507	730,000
1983																			
3-11	15	1/39	0	10	0	40	0	16	37	0	43	1/14	25	13	0	20	0	1/272	392,000
4-20	15	0	0	--	0	40	0	18	34	0	40	1/46	28	17	0	19	0	1/250	360,000

1/ About.

2/ Pumping intermittently.

During 1979-82, the combined daily production from ground- and surface-water sources have ranged from about 500,000 gal/d to 1 Mgal/d and have averaged about 750,000 gal/d. In 1982, the Moen water system served about 6,000 people for an average daily per capita consumption of 125 gallons. However, water could only be provided during the hours of greatest demand.

APPLICATION OF DATA FOR FUTURE WATER DEVELOPMENT

Reservoirs

Population growth and higher per-capita water consumption will continue to increase the demand for potable water in the population centers. In 1968, the population growth on Moen was estimated at 7 percent per year, two thirds from immigration from other islands (Hawaii Architects and Engineers, 1968). Between 1967 and 1976, the annual growth rate exceeded 5 percent. More water for the central distribution system which serves most of Moen will be needed and this will have to be supplied either by additional ground-water development, or by surface water. Except for the Wichen River and the existing Pou Stream development, surface-water sources on Moen are small and suitable only for local use or for augmenting a water supply.

A dam on the Wichen River, at altitude 82 ft (25 m) above sea level, was suggested by Piper (1946-47) and has been advocated often since then. In "Water resources development plan for Moen Island" (Austin, Tsutsumi 1980), the authors discuss several locations and dam sizes, but predict that land acquisition will prove to be a major obstacle.

Figure 30 shows that the storage required of a reservoir near the U.S. Geological Survey gaging station at Wichen River at altitude 18 m, Moen, would be 330 Mgal for a maximum sustained yield of 1.7 Mgal. At this draft rate, however, the reservoir would have been full only once during the period January 1969 to June 1974. At the much smaller draft rate of 1.0 Mgal, a storage of 120 Mgal would be required. The longest period the reservoir would be less than full would then be 9 months. These values are based on streamflow records for the period June 1968 to June 1979. Because of land-acquisition problems and the cost of a reservoir, a small diversion dam and some off-river storage might be preferable. At one time, the Truk Public Works Department considered building a new causeway across a narrow part of Pou Bay where surface runoff would gradually freshen the water in the Bay, but this could result in the creation of a swamp.

In most areas, insufficient streamflow precludes construction of large reservoirs.

Rain Catchments

The principal source of freshwater has been the catching of rainwater, except where a perennial stream, spring, or seep is nearby. The simplest rain catchment is the coconut tree with the rainwater running down the trunk. For storage, any impervious receptacle can be used, but steel gasoline drums are preferred. Under Japanese rule, catching rainwater from the roofs of dwellings in concrete cisterns was encouraged, and roofs were inspected monthly for cleanliness. Most cisterns are no longer in use.

To project a water supply derived from a roof catchment, mass curves were drawn for the dry period of a year with average rainfall (1970), for the dry period of an extremely dry year (1973), and for a dry period during 1976-77.

On figures 31-33 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. The draft rate for a drought, such as the one in 1973, is about 30 percent less than for the dry period of a year with a more normal amount of rainfall. The storage size needed depends on the draft rate and the rainfall distribution.

Similar determinations were made for catchment areas of 200 and 300 ft^2, and the results are given in table 20.

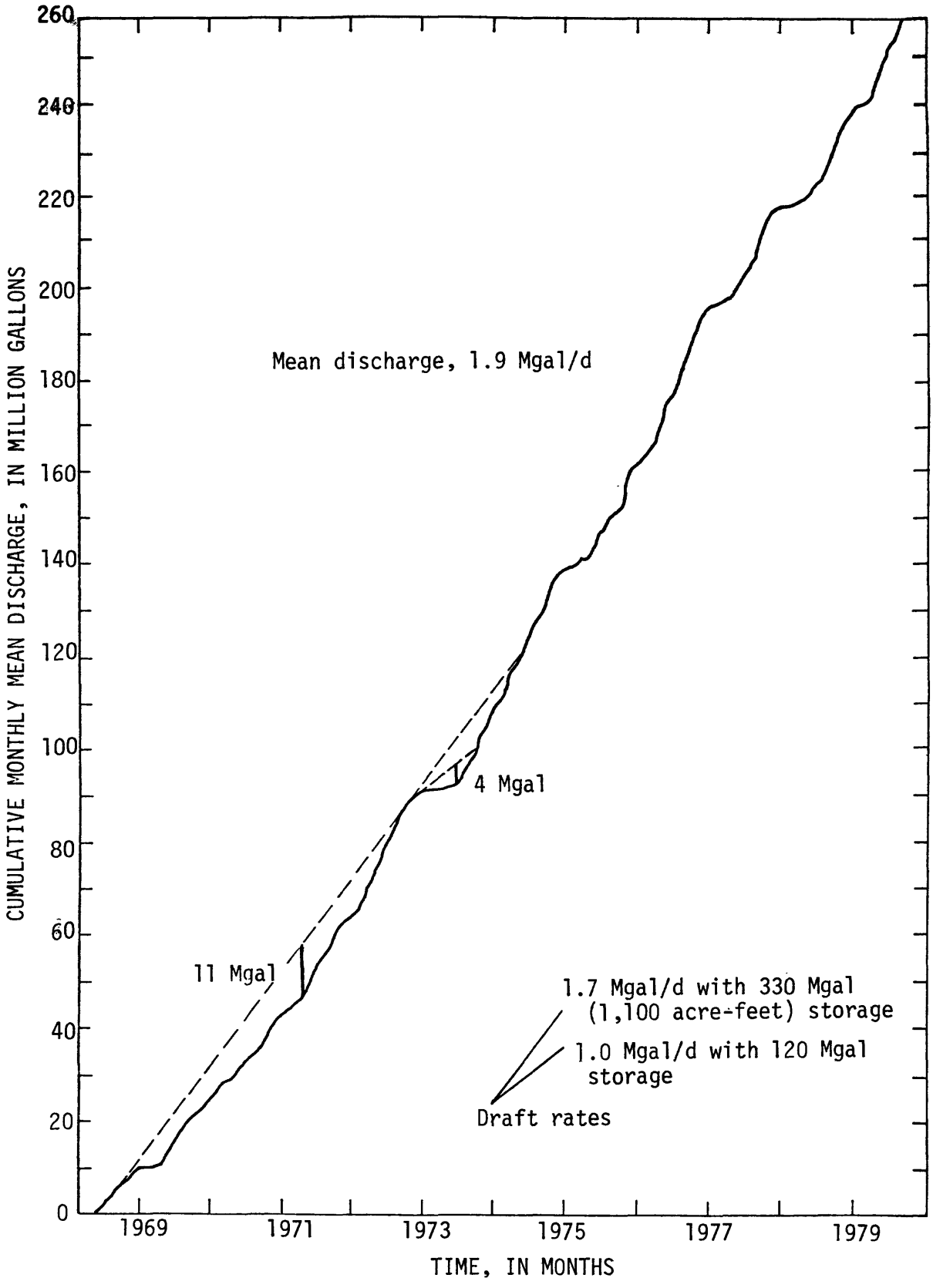


Figure 30. Mass curve of mean monthly discharge for Wichen River at altitude 18 meters, Moen.

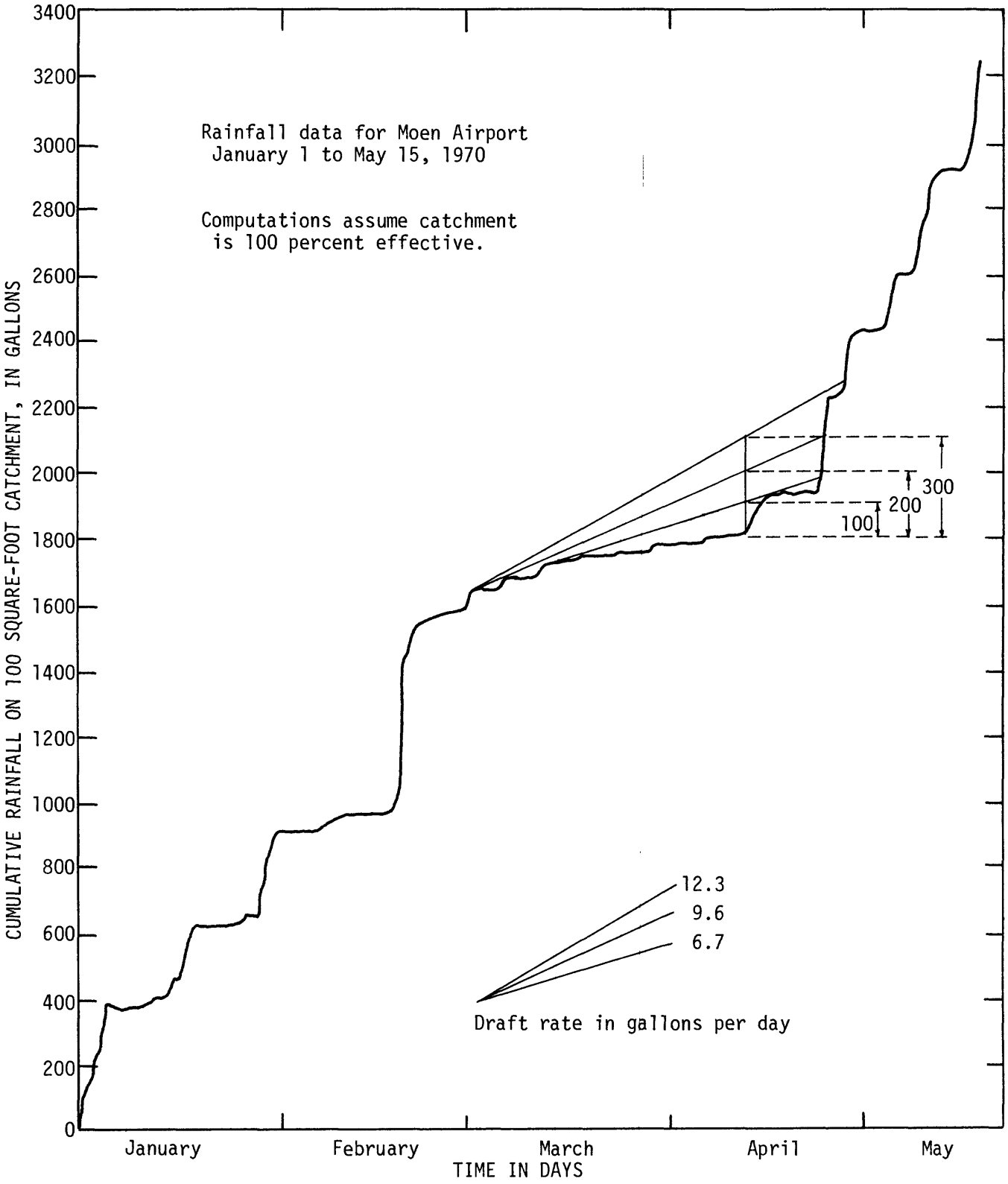


Figure 31. Determinations of daily draft rates and storage requirements for rainfall catchment in Truk Islands for the dry period in a year with average rainfall (1970).

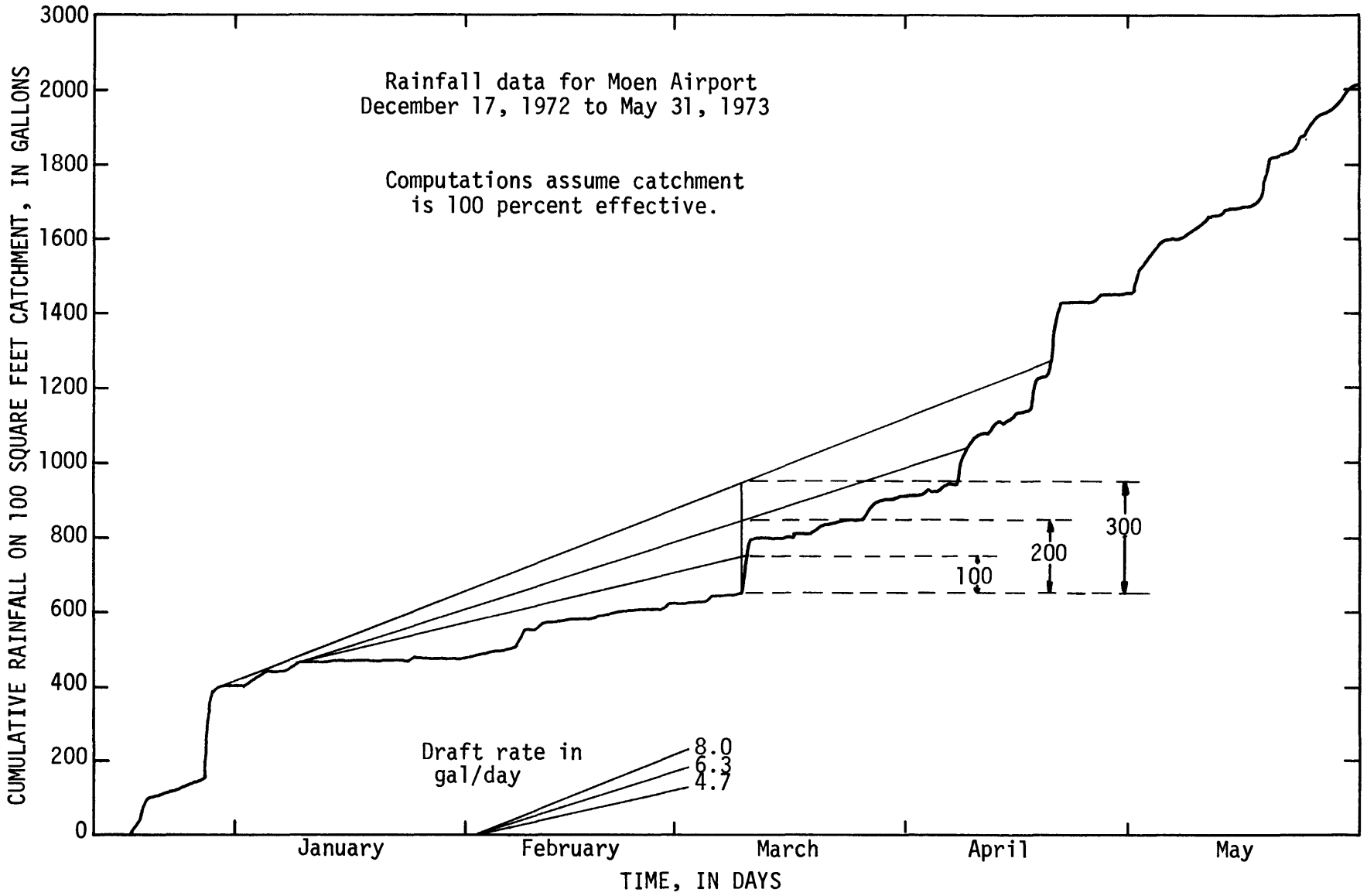


Figure 32. Determinations of daily draft rates and storage requirements for rainfall catchment in Truk Islands for an unusually dry period (1973).

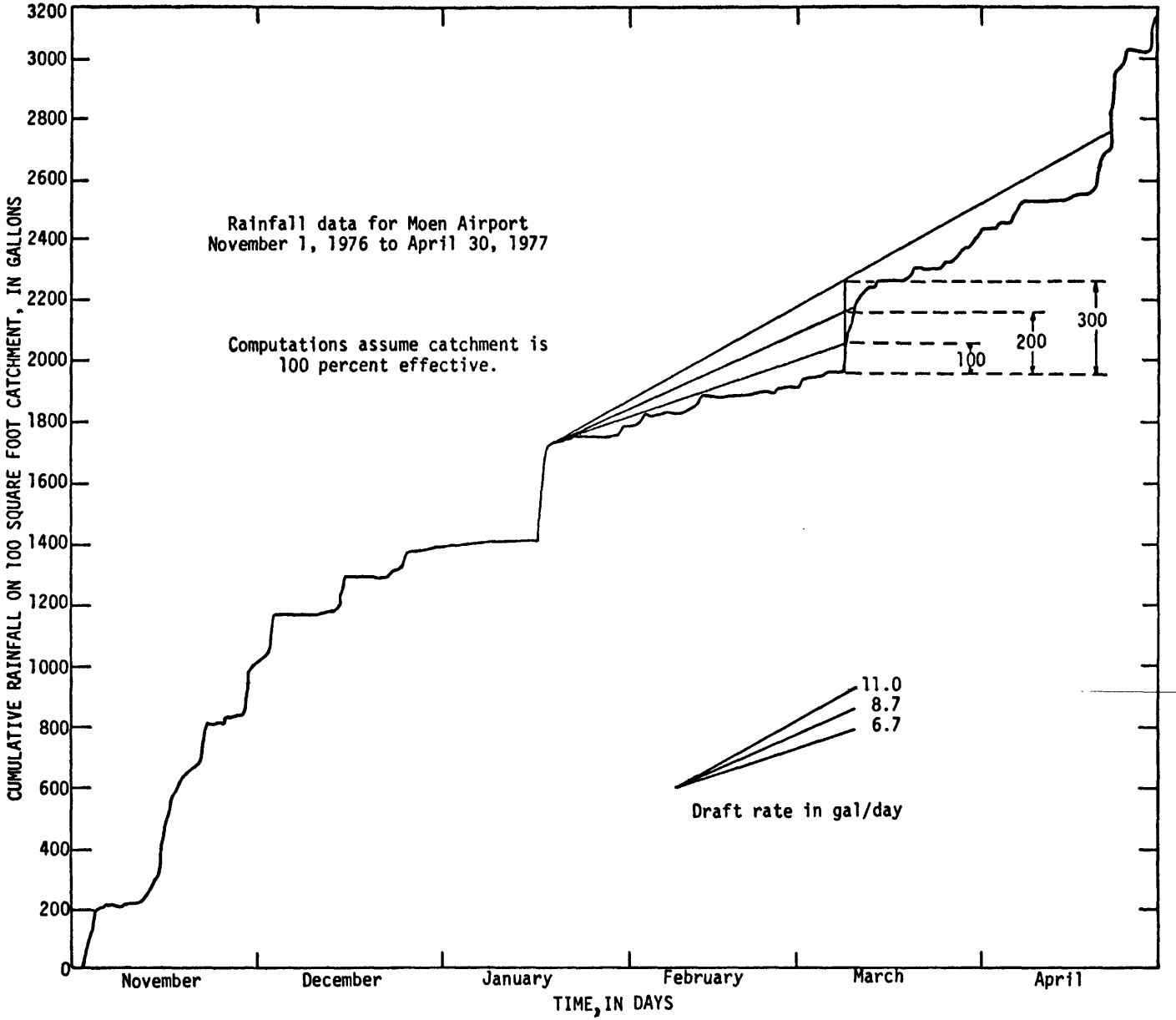


Figure 33. Determinations of daily draft rates and storage requirements for rainfall catchment in Truk Islands for a dry period during 1976-77.

Table 20. Draft rate for available storage for several catchment sizes

Year	Storage (gal)	Catchment (ft^2) 100	200	300
		(Draft rate in gal/d)		
1970	100	6.7	9.6	12.3
	200	11.0	13.5	16.0
	300	12.0	16.0	20.0
1977	100	6.7	8.7	11.0
	200	9.4	13.5	15.0
	300	12.0	16.0	20.0
1972-73	100	4.7	6.3	8.0
	200	7.8	9.5	11.3
	300	10.8	12.5	14.0

SUMMARY

From other islands in the Truk Lagoon people migrate to Moen for better job opportunities, educational facilities, and the attractions of urban life. Because of this rapid growth in population and the increased demand for water, the need for additional sources of water is most urgent on Moen.

At present, the water production of 13 wells on Moen ranges from 360,000 to 730,000 gal/d and the average yield from the Pou catchment is about 150,000 gal/d. However, the yield of the Pou catchment depends on the amount of rainfall and has been as low as about 15,000 gal/d. To increase the production of ground water, new wells are being drilled but the amount of ground water that can be produced is limited. A source of additional water could be the Wichen River, the only significant stream on Moen. Continuous discharge record, collected since 1968, shows the river not to go dry and to have a mean daily discharge of 3 ft^3/s. A large number of chemical analyses made during the last few years show the excellent quality of the surface water and the generally good quality of the ground water.

As the demand for water probably always will exceed the supply, it will be necessary to combine the search for more water with conservation measures such as the elimination of leaks in the distribution system and the reduction of waste by consumers.

For islands other than Moen, there is not as great a demand for more water because of small increases in population, slow development, and the reliance on traditional water sources such as rainwater catchments, springs, and seeps. In contrast, on Moen the people increasingly rely on the central water system for their water needs.

HYDROLOGIC DATA

Rainfall Records

Air Temperatures

Surface-Water Records

Gaging stations

Peak discharges, annual minimum discharge, and monthly and annual total discharges for the following stations:

Water and Air Temperatures and Instantaneous Discharges

Chemical Analyses

Table 21. Monthly and annual rainfall, in inches, for Eten during the German Administration (1903-13)

Sources: "Strategic Bulletins of Oceania, No. 7", publication of Institute of Human Relations, 1943; "Mitteilungen von Forschungsreisenden und Gelehrten aus den deutschen Schutzgebieten, 1904-13"; and "Climatology of Truk" (author not known).

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1903	--	--	--	--	--	--	17.52	7.01	12.32	10.00	6.26	18.58	--
1904	7.13	7.05	10.87	10.47	12.84	17.66	11.97	13.31	16.85	4.33	7.68	3.35	123.51
1905	--	8.11	3.86	8.39	9.25	10.75	15.28	12.01	5.71	6.30	11.34	6.18	--
1906	2.83	3.62	7.09	17.52	13.27	6.42	10.59	8.43	12.64	6.34	12.72	[1] 19.80	121.27
1907	11.97	8.35	12.64	5.71	[2] 13.11	[3] 10.32	[4] (6.93)	--	[5] 7.60	--	[5] 11.50	[6] 11.34	--
1908	--	--	--	--	--	--	--	--	--	--	--	--	--
1909	11.89	7.95	7.24	5.79	9.49	16.02	11.69	11.10	12.80	(*)	(*)	(*)	--
1910	(*)	12.64	4.80	15.20	14.69	16.02	15.12	12.36	13.27	11.34	18.35	9.45	--
1911	2.13	13.90	11.97	--	--	--	--	--	--	14.41	6.97	4.25	--
1912	3.82	5.67	.91	14.17	9.96	4.53	11.38	--	15.04	16.68	14.84	12.95	--
1913	.20	5.59	6.14	13.94	15.24	8.27	14.25	21.93	--	--	--	--	--
Mean	5.71	~~8.10~~	7.28	11.40	12.23	~~11.25~~	13.48	12.31	~~12.03~~	9.91	11.21	~~10.74~~	[7] 125.65
Number of years	7	9	9	8	8	8	8	7	8	7	8	8	7-9

(*) October 4, 1909 to January 14, 1910: 31.93 inches.

[1] November 28-30 included in December total.

[2] May 26-31 missing.

[3] June 1, 27-30 missing.

[4] July 1-16 only.

[5] 4 days missing.

[6] 3 days missing.

[7] Total of monthly means.

Table 22. Monthly and annual rainfall, in inches, for Dublon Island during the Japanese Administration (1927-40)

Sources: "Climatic Records of Japan and Far East Area, Central Meteorological Observatory, Tokyo, Japan", as published in "Climatology of Truk" (author not known), for 1927-34; "World Weather Records, 1941-50", publication by U.S. Weather Bureau, 1959, for 1935-40.

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1927	7.52	6.81	4.33	2.52	11.72	12.36	3.70	8.60	6.08	5.87	8.56	5.96	84.03
1928	5.48	4.36	2.52	10.61	9.72	18.47	10.60	7.04	3.19	3.10	5.61	3.54	84.24
1929	5.91	.85	.88	5.84	9.58	10.77	15.72	10.71	11.16	9.56	13.27	6.18	100.43
1930	2.80	2.48	10.91	13.21	7.65	14.29	1.80	1.44	1.23	.59	9.54	5.29	71.23
1931	.59	.07	6.36	2.58	11.52	10.88	8.49	20.58	9.34	20.89	11.38	9.25	111.93
1932	--	--	--	--	--	--	--	--	--	--	--	--	--
1933	5.56	3.34	10.14	28.13	8.65	14.42	12.94	13.29	15.06	16.35	11.65	9.27	148.80
1934	17.52	11.39	6.83	9.89	16.78	8.15	9.80	5.88	17.97	10.21	13.90	10.47	138.79
1935	4.51	8.74	5.57	11.53	14.05	9.80	18.74	8.68	13.83	8.54	13.47	23.77	141.23
1936	2.64	3.48	4.53	4.54	14.02	8.33	9.54	11.47	7.81	13.54	16.22	13.06	109.18
1937	6.09	2.46	3.33	10.70	13.11	10.71	15.59	10.85	9.73	14.55	15.80	11.69	124.61
1938	17.78	4.28	17.83	15.31	13.64	13.51	9.38	15.19	16.15	9.60	15.59	16.47	164.73
1939	4.87	1.46	7.09	5.56	7.05	5.75	8.46	10.10	12.05	17.51	7.57	9.24	96.71
1940	10.80	10.97	9.04	10.69	11.81	13.15	15.07	19.39	17.25	20.35	5.21	6.52	150.25
Mean	7.08	4.67	6.87	10.08	11.48	11.58	10.76	11.02	10.84	11.60	11.37	10.05	117.40

Table 23. Monthly and annual rainfall, in inches, for five Truk rain gages, (1933-34)

Source: "Annual report of the Meteorological Observatory of the South Seas Bureau" as published in "Climatology of Truk" (author not known).

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
						1933							
Udot	5.96	2.54	14.07	16.58	8.84	11.89	11.11	10.61	9.86	14.77	10.02	8.34	124.59
Toi	8.11	4.03	15.39	19.82	13.36	11.81	15.61	10.55	14.69	17.27	9.49	10.23	150.36
Moen	5.37	4.20	10.44	24.90	8.87	13.99	12.32	8.83	16.13	16.84	13.51	13.70	149.09
Uman	7.43	3.19	11.85	25.33	10.13	13.76	16.44	15.08	11.39	13.79	13.54	8.37	150.30
Dublon Island	5.56	3.34	10.14	28.13	8.65	14.42	12.94	13.29	15.06	16.35	11.65	9.27	148.80
						1934							
Udot	14.91	1/ 2.59	6.45	11.39	11.68	1/ 2.19	9.77	9.58	15.09	12.62	11.36	8.19	115.82
Toi	20.33	10.52	8.71	13.05	13.53	13.09	10.78	6.86	14.97	13.34	13.67	14.36	153.21
Moen	21.37	9.66	11.60	11.61	10.86	10.12	9.80	7.90	18.78	7.54	15.70	13.73	148.67
Uman	19.22	9.46	5.94	12.90	--	--	--	--	18.72	9.77	15.42	9.89	--
Dublon Island	17.52	11.39	6.83	9.89	16.78	8.15	9.80	5.88	17.97	10.21	13.90	10.47	138.79

1/ Appears low.

Table 24. Monthly and annual rainfall, in inches, for Moen Airport (1946-82)

Obtained by U.S. Navy during 1946-53 and by National Weather Service since 1954.
Source: U.S. National Oceanic and Atmospheric Administration, 1981, monthly reports, 1982.

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1946	10.31	7.31	3.74	15.85	15.17	--	--	--	--	--	--	--	--
1947	--	--	--	--	--	--	--	15.35	8.81	15.32	15.60	9.68	--
1948	9.78	1.89	2.97	6.78	15.06	14.38	9.97	11.22	10.50	13.68	8.63	24.14	129.00
1949	--	--	--	--	--	--	--	5.37	7.39	8.04	12.48	7.37	--
1950	4.55	.84	2.30	12.54	15.57	21.72	18.39	11.33	18.78	14.29	7.91	17.90	146.12
1951	15.71	7.31	6.56	17.71	--	--	11.71	15.04	7.89	21.29	7.83	8.54	--
1952	10.13	2.93	7.39	5.62	11.37	16.50	11.91	14.51	11.98	11.69	13.71	6.95	124.69
1953	8.26	6.34	8.96	18.30	8.41	15.30	11.10	20.42	9.49	15.31	18.29	9.95	150.13
1954	4.13	10.52	6.26	9.70	22.47	14.38	13.65	14.07	17.02	12.69	13.60	23.64	162.13
1955	8.92	4.75	4.88	23.03	23.57	11.76	14.30	15.89	21.17	22.42	13.20	9.88	173.77
1956	10.59	8.79	12.21	23.38	17.11	12.41	15.76	10.92	15.75	9.83	12.33	14.53	163.61
1957	14.22	5.04	4.68	11.15	11.97	10.96	10.71	9.64	12.39	11.97	13.41	3.43	119.57
1958	6.01	4.19	13.46	18.81	16.22	9.73	13.71	15.03	11.21	6.91	13.66	7.51	136.45
1959	.96	8.23	9.11	16.12	20.08	7.97	13.78	11.47	14.53	11.36	11.30	34.89	159.80
1960	12.50	6.30	7.43	10.86	14.15	11.09	9.45	13.19	8.49	11.14	16.00	18.10	138.70
1961	9.12	7.62	6.01	11.28	22.36	12.71	19.24	17.86	17.12	17.89	7.82	15.24	164.27
1962	7.91	9.85	12.77	6.98	18.33	12.27	32.99	16.51	14.64	9.77	26.12	11.04	179.18
1963	11.27	7.35	5.44	7.41	8.54	7.64	14.01	18.35	16.88	16.61	7.08	9.48	130.06
1964	2.00	10.80	2.44	12.29	18.45	9.99	13.55	12.47	16.88	15.80	7.85	17.73	140.25
1965	13.86	6.70	15.30	8.17	10.79	12.17	25.19	9.13	16.97	9.53	5.54	4.26	137.61
1966	4.61	1.70	7.57	7.53	13.62	6.10	20.11	12.39	12.49	8.88	8.44	18.21	121.65
1967	8.04	6.38	24.02	17.21	15.17	14.13	19.90	17.36	7.82	15.80	15.55	14.17	175.55
1968	8.67	9.23	13.91	20.50	10.00	14.20	15.75	7.77	12.37	11.78	6.91	24.51	155.60
1969	1.22	1.44	3.82	11.28	19.26	14.91	16.38	14.29	12.26	10.38	16.00	10.39	131.63
1970	14.80	11.80	2.40	10.43	18.60	13.99	7.49	12.98	10.75	19.04	8.43	13.57	144.28
1971	8.25	8.63	9.85	10.20	15.33	13.92	13.18	10.63	14.54	16.40	5.20	8.04	134.17
1972	9.83	10.65	18.49	15.79	16.68	14.73	16.68	11.58	13.60	4.17	7.49	9.26	148.95
1973	1.36	2.30	4.59	8.83	8.96	10.31	13.78	13.18	11.34	21.16	8.59	17.60	122.00
1974	10.23	13.44	19.75	11.59	13.47	14.83	12.49	10.72	14.33	20.14	14.91	8.84	164.74
1975	3.71	3.86	11.17	4.25	17.91	16.12	7.35	13.72	12.02	12.24	17.44	9.99	129.78
1976	10.57	9.37	5.70	17.80	28.39	12.26	11.55	14.74	15.14	15.22	16.09	6.41	163.24
1977	6.44	1.98	8.31	11.47	11.67	7.07	9.11	14.20	13.94	16.21	12.45	3.24	116.09
1978	5.73	2.29	4.85	8.17	13.25	10.10	8.40	14.37	14.98	21.21	12.99	12.47	128.81
1979	7.69	4.39	7.83	20.32	13.91	19.02	9.02	25.96	10.44	24.71	20.97	7.36	171.62
1980	13.91	5.96	8.14	6.55	18.26	12.88	17.26	12.78	8.50	18.91	2.98	18.44	144.57
1981	19.19	4.41	7.24	12.54	6.04	14.46	8.44	10.76	11.35	14.48	9.62	18.20	136.73
1982	7.04	5.92	11.21	8.67	14.68	11.99	11.55	10.70	9.38	6.76	1.88	4.61	104.39
Mean 1948, 1950, 1952-82	8.35	6.24	8.80	12.29	15.44	12.78	14.12	13.64	13.31	14.20	11.59	13.15	143.91

Table 25. Rainfall, in inches, at U.S. Geological Survey rain gages (1955-57)

Location	Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Moen													
Pou Stream ----	1955	--	--	--	1/ 23.4	20.7	9.0	9.4	14.3	18.3	--	--	--
	1956	--	--	--	22.1	16.3	10.9	4.7	18.7	16.1	16.3	10.2	16.1
	1957	14.8	3.9	4.3									
Dublon Island													
Elin Village --	1955	--	--	--	19.3	21.3	11.9	10.6	15.5	16.4	9.7	7.4	3.2
	1956	2.5	--	11.1	22.0	14.7	--	--	--	--	--	6.0	22.0
	1957	8.0	9.0	5.0									
Eot ----------	1955	--	--	--	--	--	--	1/ 14.0	1/ 15.9	15.8	17.9	15.7	1/ 12.3
	1956	13.4	10.6	15.4	20.0	16.8	10.5	1/ 11.8	1/ 13.6	12.1	14.1	10.3	18.8
	1957	10.8	4.3	4.0									
Pis ----------	1955	--	--	--	1/ 11.9	22.4	13.9	8.8	12.1	15.8	13.6	1/ 11.3	1/ 8.2
	1956	13.5	21.5	1/ 10.5	14.9	11.1	7.3	9.4	8.5	11.9	14.9	11.5	

1/ A few days of no record during the month.

Total rainfall for 1956 at Eot: 167.4 inches.

Table 26. Cumulative rainfall readings, in inches, at Wichen River, Moen

Location: Lat 7°26'38" N., long 151°51'38" E., along jeep road near U.S. Geological Survey gaging station site; altitude, 220 ft (from topographic map).

Gage: Six-inch diameter steel cylinder, read once or twice monthly (cumulative readings).

Period	Rainfall	Period	Rainfall
		1974	
Apr. 28 to May 7	12.0	July 11-26	9.6
May 7-20	8.4	Oct. 11 to Nov. 6	12.4
May 20 to June 4	6.4	Nov. 6 to Dec. 5	7.8
June 5-19	8.4	Dec. 5-31	7.0
June 19 to July 11	21.5		
		1975	
Dec. 31 to Jan. 13	2.9	Aug. 20 to Sept. 2	7.8
Jan. 13-20	.4	Sept. 2-15	4.6
Jan. 20 to Feb. 1	.3	Sept. 15 to Oct. 1	12.4
Apr. 1-17	2.7	Oct. 1-8	4.5
Apr. 17-30	1.1	Oct. 8-15	4.3
June 3-12	5.5	Oct. 15-28	4.3
June 12-18	5.6	Oct. 28 to Nov. 7	3.8
June 18-30	16.6	Nov. 7-17	6.6
June 30 to July 11	11.9	Nov. 17 to Dec. 1	8.1
July 11-15	2.5	Dec. 1-15	6.7
July 15-30	5.9	Dec. 15-29	4.3
July 30 to Aug. 20	16.6		
		1976	
Dec. 29 to Jan. 14	.9	June 3-16	2.1
Jan. 14-22	5.4	June 16 to July 8	7.7
Jan. 22 to Feb. 4	5.7	July 8-30	8.5
Feb. 4-10	2.3	July 30 to Sept. 9	23.5
Feb. 10 to Mar. 2	5.5	Sept. 9 to Oct. 5	5.9
Mar. 2-16	1.6	Oct. 5-15	3.8
Mar. 16-29	4.1	Oct. 15 to Nov. 2	7.7
Mar. 29 to Apr. 14	11.5	Nov. 2-16	6.6
Apr. 14-30	5.1	Nov. 16 to Dec. 9	4.5
Apr. 30 to May 14	9.1	Dec. 9 to Jan. 4, 1977	1.5
May 14 to June 3	21.5		

Table 26. Cumulative rainfall readings, in inches, at Wichen River, Moen--Continued

Period	Rainfall	Period	Rainfall
		1977	
Jan. 4 to Feb. 1 ------	4.4	May 19 to June 15 ------	5.1
Feb. 1-15 ----------	4.0	June 15 to July 6 ------	4.4
Feb. 15-28 ----------	0	July 6 to Aug. 5 -------	6.8
Feb. 28 to Mar. 10 ----	3.3	Aug. 5-17 ----------	5.5
Apr. 5-15 ----------	2.5	Aug. 17-31 ----------	5.8
Apr. 15 to May 19 -----	6.8	Aug. 31 to Oct. 23 -----	25.5

Total rainfall for 1976 (Dec. 29, 1975 to Jan. 4, 1977): 152.0 inches.

Table 27. Cumulative rainfall readings, in inches, at Nachiponong Stream, Moen

Location: Lat 7°25'39" N., long 151°51'07" E., on right bank of Nachiponong Stream at U.S. Geological Survey gaging station site; altitude, 30 ft (from topograhic map).

Gage: Six-inch diameter steel cylinder, read once or twice monthly (cumulative readings).

Period	Rainfall	Period	Rainfall
		1973	
Dec. 29 to Jan. 14	0.9	Aug. 27 to Sept. 10	2.0
Mar. 29 to Apr. 11	2.7	Sept. 10-19	3.6
Apr. 11-23	5.8	Sept. 19 to Oct. 2	6.5
Apr. 23 to May 8	2.8	Oct. 2-17	9.6
May 8-24	4.0	Oct. 17 to Nov. 1	1.8
May 24 to June 14	3.9	Nov. 1-16	5.2
June 14 to July 17	15.6	Nov. 16-27	2.5
July 17 to Aug. 27	14.5	Nov. 27 to Jan. 3, 1974	22.8
		1974	
Jan. 3-28	4.6	Aug. 13 to Sept. 11	4.8
Jan. 28 to Feb. 14	6.6	Sept. 11 to Oct. 7	16.8
Apr. 24 to May 6	3.2	Oct. 7-22	10.9
May 6-20	9.1	Oct. 22-31	10.0
May 20 to June 13	14.6	Oct. 31 to Nov. 6	7.4
June 13-19	3.7	Nov. 6 to Dec. 3	10.3
June 19 to July 11	12.0	Dec 3-17	9.0
July 11-26	3.3	Dec. 17-27	.5
July 26 to Aug. 13	14.1		
		1975	
Dec. 27 to Jan. 3	2.2	July 8-15	2.4
Jan. 3-20	.9	July 15-30	5.4
Jan. 20-28	.3	July 30 to Aug. 18	15.2
Jan. 28 to Feb. 20	1.2	Aug. 18-30	5.6
Feb. 20 to Mar. 18	8.8	Aug. 30 to Sept. 15	3.9
Mar. 18-31	4.0	Sept. 15-30	7.8 [1/]
Mar. 31 to Apr. 16	7.2	Oct. 1-7	6.7
Apr. 16-30	2.9	Oct. 7-28	2.1
Apr. 30 to May 13	2.4	Oct. 28 to Nov. 7	10.4
May 13 to June 2	16.3	Nov. 7-17	8.3
June 2-12	6.8	Nov. 17 to Dec. 1	5.7
June 12-19	6.5	Dec. 1-15	5.4
June 19-30	18.2	Dec. 15-29	6.7
June 30 to July 8	2.8	Dec. 29 to Jan. 2, 1976	1.2

Table 27. Cumulative rainfall readings, in inches, at Nachiponong Stream, Moen--Continued

Period	Rainfall	Period	Rainfall
		1976	
Jan. 2-14	0.7	June 2-16	5.5
Jan. 14-19	1.7	June 16-30	6.3
Jan. 19 to Feb. 4	7.8	June 30 to July 9	1.1
Feb. 4-10	4.1	July 9-30	9.9
Feb. 10 to Mar. 2	7.6	July 30 to Sept. 9	32.5
Mar. 2-16	1.8	Sept. 9 to Oct. 6	10.7
Mar. 16-29	3.9	Oct. 6-7	0
Mar. 29 to Apr. 14	12.4	Oct. 7-14	3.6
Apr. 14-30	5.7	Dec. 2-14	7.0
Apr. 30 to May 14	7.7	Dec. 14 to Jan. 3, 1977	2.8
May 14 to June 2	21.0		

1/ From National Weather Service rain gage, Moen airport.

Total rainfall for 1975 (Jan. 2, 1975 to Jan. 3, 1976): 165.1 inches.

Table 28. Cumulative rainfall readings, in inches, at Echapachik Stream, Tol

Location: Lat 7°20'49" N., long 151°37'04" E., on left bank of Echapachik Stream at U.S. Geological Survey gaging station site; altitude, 20 ft (from topographic map).

Gage: Six-inch diameter steel cylinder, read once or twice monthly (cumulative readings).

Altitude of gage is 20 ft (from topographic map).

Period	Rainfall	Period	Rainfall
		1973	
Jan. 5-23	0.5	June 21 to Aug. 21	21.0
Feb. 24 to Mar. 28	8.3	Aug. 21 to Sept. 1	5.1
Mar. 28 to Apr. 24	9.9	Sept. 1-14	2.0
Apr. 24 to May 21	2.0	Sept. 14 to Oct. 9	4.7
May 21 to June 6	3.9	Oct. 9-20	4.5
June 6-21	8.1		

Table 29. Cumulative rainfall readings, in inches, at Chun Stream, Dublon Island

Location: Lat 7°22'30" N., long 151°51'43" N., on left bank of Chun Stream at U.S. Geological Survey gaging station site; altitude, 25 ft (from topographic map).

Gage: Six-inch diameter steel cylinder, read once or twice monthly (cumulative readings).

Altitude of gage is 25 ft (from topographic map).

Period	Rainfall	Period	Rainfall
	1974		
Apr. 27 to May 10 -----	8.0	Oct. 10 to Nov. 1 -----	13.0
May 10-24 ----------	9.2	Nov. 1-7 ----------	5.0
May 24 to June 12 -----	12.0	Nov. 7 to Dec. 2 ------	9.0
June 12-18 ----------	1.4	Dec. 2 to Jan. 11, 1975	12.7
June 18 to July 10 ----	7.2		
	1975		
Jan. 11-21 ----------	1.0	July 9 to Aug. 4 ------	6.3
Mar. 13 to Apr. 1 -----	10.9	Aug. 4-21 ----------	8.7
Apr. 1-15 ----------	1.2	Aug. 21 to Sept. 4 ----	.5
Apr. 15 to May 5 ------	3.5	Sept. 4 to Oct. 3 -----	13.3
May 5-22 ----------	13.2	Oct. 3-9 ----------	5.6
May 22-30 ----------	5.2	Oct. 9-17 ----------	2.1
May 30 to June 17 -----	8.4	Oct. 17 to Nov. 18 ----	23.5
June 17 to July 9 -----	11.6	Dec. 17 to Jan. 5, 1976	8.8
	1976		
Jan. 5-21 ----------	3.4	Mar. 15-30 ----------	5.7
Jan. 21 to Feb. 3 -----	5.9	Mar. 30 to Apr. 20 ----	17.2
Feb. 3 to Mar. 1 ------	7.6	Apr. 20-29 ----------	1.6
Mar. 1-15 ----------	2.2		

Table 30. Cumulative rainfall readings, in inches, at Tumunu Stream, Dublon Island

Location: Lat 7°22'34" N., long 151°52'27" E., on left bank of Tumunu Stream at U.S. Geological Survey gaging station site; altitude, 25 ft (from topograhic map).

Gage: Six-inch diameter steel cylinder, read once or twice monthly (cumulative readings).

Period	Rainfall	Period	Rainfall
	1973		
Aug. 31 to Sept. 7	1.3	Oct. 11-29	9.3
Sept. 7-18	2.7	Oct. 29 to Nov. 14	3.1
Sept. 18 to Oct. 11	13.1	Nov. 14-26	4.3
	1974		
Jan. 22 to Feb. 11	5.1	June 18 to July 10	2.6
Feb. 11 to Mar. 7	15.7	July 10-24	6.0
Apr. 27 to May 10	1.1	Oct. 11 to Nov. 4	12.6
May 10-24	9.0	Nov. 4-7	2.1
May 24 to June 12	14.0	Nov. 7 to Dec. 2	9.3
June 12-18	4.0		
	1975		
Jan. 12-21	.8	Aug. 4-21	6.9
Jan. 21 to Feb. 4	.3	Aug. 21 to Sept. 4	3.2
Feb. 4-11	.5	Sept. 4 to Oct. 3	8.9
Mar. 13 to Apr. 1	10.6	Oct. 3-9	6.5
Apr. 1-15	.7	Oct. 9-17	2.3
Apr. 15 to May 5	3.6	Oct. 17 to Nov. 18	20.0
May 23-30	3.6	Nov. 18 to Dec. 3	6.8
May 30 to June 17	7.9	Dec. 3-16	6.9
June 17 to July 9	7.8	Dec. 16 to Jan. 5, 1976	6.0
July 9 to Aug. 4	4.8		
	1976		
Jan. 5-21	2.6	June 14-29	5.8
Mar. 2-15	1.5	June 29 to July 7	.7
Mar. 15-30	5.2	Oct. 19 to Nov. 1	6.9
Mar. 30 to Apr. 20	14.2	Nov. 1-23	11.9
Apr. 20-29	1.8	Nov. 23 to Dec. 3	6.8
Apr. 29 to May 25	16.0	Dec. 3-13	4.9
May 25 to June 1	2.3	Dec. 13-16	1.7
June 1-14	3.3	Dec. 16 to Jan. 20, 1977	4.9

Air Temperatures

Table 31. Monthly and annual mean air temperatures, in degrees Celsius, on Dublon Island during the Japanese Administration

Source: U.S. Weather Bureau, 1959.

Year	Jan.	Feb.	Mar.	Apr.	May	June
1935	27.2	27.2	27.3	27.2	27.0	26.9
1936	27.3	26.8	27.2	27.6	26.8	27.1
1937	27.2	27.0	27.0	27.2	27.0	27.2
1938	27.1	27.2	26.9	26.9	26.8	26.8
1939	26.4	26.7	26.4	26.8	26.9	26.9
1940	26.2	26.0	26.5	26.7	26.9	26.8

Year	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1935	26.9	27.0	27.2	27.3	27.3	26.7	27.1
1936	27.3	26.9	27.4	27.3	27.2	27.1	27.2
1937	26.8	27.3	27.4	27.1	27.3	27.5	27.2
1938	26.7	26.7	26.7	27.2	27.1	27.0	26.9
1939	26.6	26.9	26.7	26.2	26.9	26.6	26.7
1940	26.4	26.6	26.7	26.3	26.9	26.5	26.5

Table 32. Monthly and annual mean air temperatures, in degrees Celsius, at Moen Airport

Sources: U.S. Weather Bureau, 1959, for 1949-51 and
U.S. National Oceanic and Atmospheric Administration, 1981, for 1952-81.

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1949	--	--	--	--	--	--	--	27.3	26.8	27.3	27.2	27.2	--
1950	27.5	27.7	27.8	27.3	27.4	27.1	26.7	27.2	26.8	26.7	27.1	27.2	27.2
1951	27.2	26.9	27.2	27.2	--	--	27.1	27.1	27.3	26.8	27.3	27.5	--
1952	26.8	27.0	27.3	27.6	27.2	26.8	26.9	26.6	27.0	27.3	27.1	27.3	27.1
1953	27.2	26.9	27.2	27.5	27.7	27.3	27.3	26.9	27.5	27.2	27.0	26.8	27.2
1954	27.0	27.0	27.3	28.0	27.2	27.7	27.0	27.2	26.7	27.1	26.9	27.4	27.2
1955	27.5	27.5	27.6	26.7	26.8	27.3	27.0	26.8	26.5	26.7	27.2	27.4	27.1
1956	27.1	27.3	26.9	26.9	26.7	27.1	26.8	27.0	27.1	27.4	27.6	27.6	27.1
1957	27.6	27.4	27.9	27.7	27.9	27.6	27.3	27.4	27.3	27.3	27.6	27.7	27.6
1958	27.4	27.6	27.6	27.6	27.8	27.8	27.5	27.6	27.7	28.1	27.7	27.8	27.7
1959	27.8	27.4	27.3	27.1	27.5	28.1	27.4	27.2	27.6	27.4	27.4	27.4	27.5
1960	27.0	27.4	27.6	27.6	27.4	27.3	27.7	27.4	27.4	27.5	27.4	27.3	27.4
1961	27.6	27.6	27.6	27.8	27.6	27.3	26.9	27.1	27.1	27.1	27.1	27.1	27.3
1962	27.4	27.3	27.5	27.8	27.4	27.4	26.8	26.9	27.1	27.4	27.1	27.3	27.3
1963	26.7	26.9	27.1	27.3	27.3	27.4	27.1	27.2	27.1	27.2	27.2	27.5	27.2
1964	27.7	27.1	27.6	27.4	27.3	27.3	26.9	26.8	26.8	27.1	27.4	26.8	27.2
1965	26.8	26.8	26.7	26.9	27.1	26.7	26.1	27.1	27.0	27.0	27.2	27.4	26.9
1966	26.7	27.4	27.4	27.8	27.4	27.3	27.3	27.4	27.3	27.4	27.5	27.1	27.3
1967	27.4	27.4	27.1	26.9	27.5	27.1	26.9	26.7	27.1	27.2	27.3	27.6	27.2
1968	27.2	27.2	27.1	27.1	27.4	27.5	26.8	27.3	27.2	27.3	27.1	27.1	27.2
1969	27.1	26.8	27.4	27.2	27.6	27.6	27.1	27.2	27.2	27.4	27.7	27.7	27.3
1970	27.5	27.7	28.1	28.0	27.7	27.7	27.7	27.6	27.6	27.3	27.8	27.5	27.7
1971	27.5	27.4	27.5	27.6	27.3	27.2	26.9	27.5	27.3	27.4	27.8	27.6	27.4
1972	27.2	26.9	27.3	27.2	27.5	27.4	27.1	27.1	27.4	27.6	27.8	27.4	27.3
1973	27.6	27.3	27.9	27.7	27.9	28.0	27.6	27.7	27.6	27.2	27.9	27.7	27.7
1974	27.3	27.3	27.6	27.7	27.8	27.4	27.3	27.4	27.5	27.6	27.7	27.6	27.5
1975	27.6	27.6	27.6	27.9	27.4	27.3	27.2	27.3	27.3	27.2	26.9	27.3	27.4
1976	27.3	27.1	27.4	27.2	27.2	27.2	27.4	27.1	26.9	27.6	27.6	27.6	27.3
1977	27.4	27.6	27.4	27.8	27.8	28.1	27.6	27.7	27.6	27.8	27.3	27.9	27.7
1978	27.4	27.6	28.0	27.8	27.8	27.8	28.0	27.8	27.7	27.7	27.7	27.8	27.8
1979	27.7	27.8	27.7	27.7	27.7	27.9	27.7	27.4	28.0	27.4	27.5	27.5	27.7
1980	27.3	27.5	27.7	28.1	27.8	27.7	27.1	27.3	27.5	26.9	27.4	27.3	27.4
1981	27.2	27.8	27.9	28.1	28.3	27.8	28.2	28.1	28.0	27.9	28.0	28.0	27.9
Mean	27.3	27.3	27.4	27.5	27.5	27.4	27.2	27.2	27.3	27.3	27.4	27.4	27.4
Daily													
Max.	29.6	29.6	29.8	30.0	30.3	30.4	30.3	30.4	30.5	30.5	30.4	30.0	30.2
Min.	24.9	24.9	25.0	24.9	24.6	24.4	24.0	23.9	24.1	24.1	24.5	24.9	24.6

Gaging stations

Table 33. Streamflow records for Wichen River at altitude 55 m, Moen (16893700)

Location: Lat 7°26'37" N., long 151°51°39" E., on left bank, 0.9 mile upstream from mouth, and 1.6 miles west of Xavier High School.

Drainage area: 0.21 mi^2.

Period of record: June 1968 to September 1978, June 1979, September 1979 to January 1980, May to December 1980 (discontinued).

Gage: Water-stage recorder and concrete control. Altitude of gage is 180 ft (from topographic map).

Remarks: Records fair. No diversion above station.

Average discharge: 10 years (1969-78), 1.03 ft^3/s (746 acre-ft/yr).

Extremes for period of record: Maximum discharge, 338 ft^3/s Sept. 27, 1978 (gage height, 4.25 ft, from floodmark), from rating curve extended above 4.6 ft^3/s; minimum 0.01 ft^3/s on many days for several years.

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

Date	Discharge	Location
Mar. 16, 1966	0.04	At gaging station.
Oct. 18, 1967	.72	Do.
Dec. 21, 1978	.47	Do.
Feb. 8, 1979	.30	Do.
May 13, 1979	3.0	Do.
Aug. 22, 1979	.73	Do.

Table 33. Streamflow records for Wichen River at altitude 55 m, Moen--Continued

B. Miscellaneous discharge measurements, in cubic feet per second, made 0.1 mile from gaging station site

Date	Discharge		Location
Mar. 16, 1966	0.08	---	0.1 mile downstream at lat 7°26'09" N., long 151°51'43" E.
Mar. 17, 1966	6.4	---	Do.
Oct. 18, 1967	.37	---	0.1 mile upstream at lat 7°26'03" N., long 151°51'35" E.

C. Seepage investigation on May 4, 1980

[Measurements represent base flow conditions; during 5 preceding days only 0.17 inches of precipitation recorded at Moen airport]

Location	Discharge (ft^3/s)
250 ft upstream from Japanese dam	0.09
250 ft downstream from Japanese dam	.29
At gaging station at altitude 55 m	.30
250 ft downstream from gaging station at altitude 55 m	.38
100 ft downstream from falls	.33
500 ft downstream from falls	.53
600 ft upstream from gaging station at altitude 18 m	.64
At gaging station at altitude 18 m	.79

Table 33. Streamflow records for Wichen River at altitude 55 m, Moen--Continued

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

[Discharge in cubic feet per second, gage height in feet]

Date	Time	Discharge	Gage height
June 12, 1968	0230	* 82	2.71
Aug. 2, 1968	1100	74	2.58
Dec. 9, 1968	0100	92	2.86
Dec. 19, 1968	1500	* 95	2.90
Dec. 24, 1968	1800	71	2.53
Oct. 27, 1969	1300	125	3.30
Nov. 3, 1969	0300	80	2.68
Nov. 25, 1969	0700	*193	4.08
Feb. 18, 1970	2300	77	2.64
Sept. 20, 1971	1730	a/* 75	a/2.6
Mar. 1, 1972	0600	110	3.11
Apr. 20, 1972	1430	141	3.50
June 4, 1972	0500	*192	4.07
Aug. 26, 1973	2100	* 16	2.02
Dec. 26, 1973	0430	*140	3.17
Aug. 3, 1974	1300	126	3.07
Dec. 8, 1974	1830	* 60	2.47
Apr. 2, 1976	2200	105	2.90
May 18, 1976	0300	*163	3.32
Oct. 1, 1976	a/1200	*103	+2.88
Sept. 6, 1977	0300	71	2.58
Oct. 27, 1977	1000	71	2.58
Sept. 27, 1978	a/2100	*338	+4.25
Aug. 10, 1979	a/0900	*138	3.15
Oct. 6, 1979	0800	80	2.66
Nov. 26, 1979	2100	* 92	2.77
Oct. 29, 1980	1300	*104	2.88

\+ From floodmarks.

a/ About.

Table 33. Streamflow records for Wichen River at altitude 55 m, Moen--Continued

E. Annual minimum discharge in cubic feet per second

Water year	Date	Discharge
1968[1/]	Sept. 15, 1968	0.18
1969	Mar. 29-31, 1969	.01
1970	Feb. 7, 9-11, 1970	.05
1971	Mar. 10, 1971	.13
1972	Feb. 13-17, 1972	.15
1973	Several days in March, April, 1973	.01
1974	Jan. 20, 21, 1974	.03
1975	Many days in February, March, 1975	.01
1976	Mar. 22-25, 1976	.04
1977	Many days in February to April, 1977	.01
1978	Jan. 14, 15, Mar. 27 to Apr. 10, 1978	.01
1979	During first half of April, 1979	.02
1980[2/]	Nov. 26-29, 1979	.04

[1/] May 16 to September 30, 1968.

[2/] October to December 1979.

Table 33. Streamflow records for Wichen River at altitude 55 m, Moen--Continued

F. 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							34.10	36.68	35.76	23.37				--
		--										31.22	20.15	81.46	
	Mean	--						1.14	1.18	1.15	.78	1.01	.67	2.63	--
	Max	--						11	5.7	6.4	10	13	2.5	12	--
	Min	--						.29	.21	.25	.21	.11	.21	.18	--
1969	Total		5.19	1.18	1.21	4.99	44.66	46.47	53.13	39.47	35.16				364.29
		340.02										23.29	61.57	23.70	
	Mean	.93	.17	.042	.039	.17	1.44	1.55	1.71	1.27	1.17	.75	2.05	.76	1.00
	Max	19	.54	.07	.11	.67	7.3	7.2	9.3	7.1	6.4	11	19	4.4	13
	Min	.02	.05	.03	.02	.03	.11	.21	.48	.44	.44	.22	.48	.28	.02
1970	Total		42.47	22.91	9.17	18.44	50.19	31.50	14.71	19.11	16.17				333.23
		354.39										65.60	33.89	30.23	
	Mean	.97	1.37	.82	.30	.61	1.62	1.05	.47	.62	.54	2.12	1.13	.98	.91
	Max	9.6	6.5	9.0	.64	5.6	6.1	8.0	1.1	3.1	2.8	9.6	5.8	6.1	19
	Min.	.05	.28	.05	.07	.07	.34	.34	.31	.28	.19	.80	.35	.26	.05
1971	Total		22.94	18.88	16.33	13.32	64.55	47.74	36.49	30.53	45.26				425.76
		390.53										62.91	16.72	14.86	
	Mean	1.07	.74	.67	.53	.44	2.08	1.59	1.18	.98	1.51	2.03	.56	.48	1.17
	Max	17	4.8	5.2	3.7	1.4	17	9.7	2.1	5.2	6.5	12	4.4	4.4	17
	Min	.13	.17	.15	.13	.23	.47	.41	.35	.30	.20	.26	.17	.20	.13
1972	Total		29.40	15.53	81.61	38.08	58.35	60.02	55.10	58.02	52.06				542.66
		507.65										23.71	13.34	22.43	
	Mean	1.39	.95	.54	2.63	1.27	1.88	2.00	1.78	1.87	1.74	.76	.44	.72	1.48
	Max	29	5.8	5.2	29	10	8.8	23	9.1	5.2	9.8	3.1	2.3	6.6	29
	Min	.15	.17	.15	.26	.26	.35	.62	.70	.62	.54	.26	.20	.23	.15
1973	Total		5.03	1.64	1.31	6.31	4.98	14.20	43.82	26.60	24.84				188.21
		262.03										71.65	24.70	36.95	
	Mean	.72	.16	.059	.042	.21	.16	.47	1.41	.86	.83	2.31	.82	1.19	.52
	Max	10	.54	.09	.23	3.2	1.3	1.8	4.0	3.1	2.2	6.9	1.8	10	6.6
	Min	.01	.05	.05	.01	.01	.03	.13	.41	.26	.30	.88	.34	.16	.01
1974	Total		21.96	21.46	68.07	36.99	25.70	44.45	38.76	31.61	19.22				441.52
		452.32										70.40	42.71	30.99	
	Mean	1.24	.71	.77	2.20	1.23	.83	1.48	1.25	1.02	.64	2.27	1.42	1.00	1.21
	Max	9.0	3.3	3.7	9.0	5.1	5.0	4.7	4.0	6.4	3.0	5.5	4.4	4.6	10
	Min	.04	.04	.16	.26	.22	.15	.55	.19	.11	.09	.55	.25	.14	.04
1975	Total		2.76	.49	13.25	1.75	25.37	52.37	16.02	41.26	14.75				312.12
		297.04										30.59	69.43	29.00	
	Mean	.81	.089	.018	.43	.058	.82	1.75	.52	1.33	.49	.99	2.31	.94	.86
	Max	7.3	.30	.06	2.4	.15	4.6	7.3	1.4	5.8	2.9	3.8	6.8	2.0	7.3
	Min	.01	.02	.01	.01	.02	.02	.34	.22	.22	.16	.22	.49	.26	.01

Table 33. Streamflow records for Wichen River at altitude 55 m, Moen--Continued

F. 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	506.38	19.40	27.05	7.37	53.54	93.87	33.07	30.69	51.19	53.44	54.37	58.45	23.94	498.64
	Mean	1.38	.63	.93	.24	1.78	3.03	1.10	.99	1.65	1.78	1.75	1.95	.77	1.36
	Max	23	5.2	5.0	.90	5.9	2.3	4.0	4.1	11	4.5	10	7.9	7.2	23
	Min	.05	.05	.15	.05	.30	.26	.22	.16	.30	.19	.34	.29	.07	.05
1977	Total	307.03	10.02	.68	3.63	10.39	32.34	15.28	33.53	26.33	69.31	60.57	37.34	7.61	338.27
	Mean	.84	.32	.024	.12	.35	1.04	.51	1.08	.85	2.31	1.95	1.24	.25	.93
	Max	9.7	5.4	.13	1.2	3.4	3.8	2.8	5.9	3.1	9.7	7.8	7.0	1.8	10
	Min	.01	.02	.01	.01	.01	.13	.05	.25	.25	.40	.29	.21	.02	.01
1978	Total	--	4.65	3.43	5.13	3.87	30.63	38.72	12.49	56.10	49.70	--	--	--	310.24
	Mean	--	.15	.12	.17	.13	.99	1.29	.40	1.81	1.66	--	--	--	.85
	Max	--	2.0	2.0	2.8	.50	3.1	7.2	1.2	9.0	15	--	--	--	15
	Min	--	.01	.02	.01	.01	.21	.13	.12	.15	.10	--	--	--	.01
1979	Total	--	--	--	--	--	--	71.25	--	--	8.70	108.97	68.62	33.26	--
	Mean	--	--	--	--	--	--	2.38	--	--	.29	3.52	2.29	1.07	--
	Max	--	--	--	--	--	--	7.5	--	--	1.4	18	7.6	5.2	--
	Min	--	--	--	--	--	--	.52	--	--	.04	.25	.46	.15	--
1980	Total	--	58.49	--	--	--	69.19	44.29	103.00	58.70	25.30	57.60	17.37	58.03	--
	Mean	--	1.88	--	--	--	2.23	1.48	3.32	1.89	.84	1.86	.58	1.87	--
	Max	--	8.0	--	--	--	5.9	5.0	12	4.9	2.8	15	3.4	6.3	--
	Min	--	.50	--	--	--	.59	.46	.80	.46	.20	.20	.05	.07	--
1969-77	Mean	379.71	17.69	12.26	22.44	20.42	44.45	38.34	35.81	36.01	36.69	51.45	39.79	24.41	
(9 yrs)	Percent		100	4.7	3.2	5.9	5.4	11.7	10.1	9.4	9.5	9.7	13.5	10.5	6.4

Table 34. Streamflow records for Wichen River at altitude 18 m, Moen (16893800)

Location: Lat 7°27'01" N., long 151°51'56" E., on left bank, 0.3 mile upstream from mouth, and 1.4 miles west of Xavier High School.

Drainage area: 0.57 mi^2.

Period of record: April 1955 to March 1956 (published as "at Peniesence"), June 1968 to January 1980, May 1980 to December 1981. As discharge values above 3 ft^3/s are unreliable for 1955-56, only the minimum daily discharge during this period is given: 0.12 ft^3/s, Apr. 2, 1955.

Gage: Water-stage recorder. Concrete control since March 29, 1973. Altitude of gage is 60 feet (from topographic map). Prior to April 1, 1956, non-recording gage site 100 ft downstream at different datum.

Remarks: Records fair. No diversion above station.

Average discharge: 12 years (water years 1969-79, 1981), 3.02 ft^3/s (2,190 acre-ft/yr).

Extremes for period of record (1968-81): Maximum discharge, 910 ft^3/s June 4, 1972 (gage height, 6.80 ft), from rating curve extended above 20 ft^3/s; minimum, 0.01 ft^3/s April 16-19, 1977.

A. Discharge measurements, in cubic feet per second, made prior to beginning of continuous discharge record

Date	Discharge	Location
June 3, 1946	3.1	At gaging station.
Feb. 5, 1955	.45	Do.
Feb. 19, 1955	.70	Do.
June 6, 1957	1.6	At altitude 40 m.
June 6, 1957	3.7	At gaging station.
Mar. 16, 1966	.16	Do.
Oct. 18, 1967	2.2	Do.

Table 34. Streamflow records for Wichen River at altitude 18 m, Moen--Continue

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

[Discharge in cubic feet per second, gage height in feet]

Date	Time	Discharge	Gage height
June 12, 1968	0300	*232	3.59
Aug. 2, 1968	1200	200	3.45
Dec. 9, 1968	0100	335	3.95
Dec. 19, 1968	1500	*508	4.42
Nov. 25, 1969	0800	*724	6.18
Feb. 18, 1970	2300	229	3.95
Oct. 9, 1970	1200	206	3.57
June 9, 1971	0730	216	3.60
Sept. 20, 1971	1900	*333	4.38
Mar. 1, 1972	0830	343	4.54
Apr. 20, 1972	1600	410	5.00
June 4, 1972	a/ 0600	*910	6.80
Aug. 26, 1973	2100	*113	3.08
Oct. 20, 1973	0300	360	4.54
Dec. 26, 1973	0500	*404	4.77
Mar. 9, 1974	2100	266	3.95
Aug. 3, 1974	1300	346	4.46
Aug. 11, 1974	0530	251	3.84
Oct. 17, 1974	1900	*235	3.73
Oct. 23, 1974	1330	212	3.56
Dec. 8, 1974	1830	216	3.59
June 23, 1975	0700	210	3.56
Feb. 27, 1976	1430	220	3.62
Apr. 2, 1976	2230	300	4.18
May 18, 1976	a/ 0330	*605	+5.72
Oct. 1, 1976	1200	*478	5.09
Nov. 15, 1976	1330	280	3.77
Apr. 24, 1977	0730	212	3.31
July 8, 1977	1500	398	4.80
July 13, 1977	2400	322	4.30
Sept. 6, 1977	a/ 0330	459	+5.31
Oct. 27, 1977	1030	297	3.88
Sept. 27, 1978	2100	*720	6.30

Table 34. Streamflow records for Wichen River at altitude 18 m, Moen--Continued

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

[Discharge in cubic feet per second, gage height in feet]

Date	Time	Discharge	Gage height
Oct. 2, 1978	1800	246	3.54
Oct. 8, 1978	0930	206	3.27
Oct. 10, 1978	a/1830	350	4.23
Apr. 9, 1979	a/0700	256	3.61
June 8, 1979	a/1030	234	3.46
Aug. 10, 1979	a/0900	*488	+5.14
Oct. 6, 1979	0800	414	4.63
Oct. 7, 1979	0100	248	3.51
Nov. 26, 1979	2130	*414	4.66
May 14, 1980	0730	288	3.82
Oct. 24, 1980	1730	236	3.47
Oct. 28, 1980	1145	204	3.26
Oct. 29, 1980	1315	*477	5.08
Jan. 4, 1981	2200	375	4.40
Jan. 13, 1981	0930	232	3.45
Jan. 18, 1981	2015	224	3.39
Apr. 27, 1981	1500	454	4.98

+ From floodmarks.

a/ About.

Table 34. Streamflow records for Wichen River at altitude 18 m, Moen--Continued

C. Annual minimum discharge in cubic feet per second

Water year	Date	Discharge
1968[1/]	Sept. 15, 1968	0.19
1969	Mar. 31, 1969	.03
1970	Mar. 24-26, Apr. 1, 1970	.07
1971	Jan. 29, 1971	.10
1972	Feb. 16, 1972	.14
1973	Apr. 4-7, 1973	.04
1974	Jan. 21, 1974	.04
1975	Feb. 14, 1975	.02
1976	Jan. 17-20, 1976	.12
1977	Apr. 16-19, 1977	.01
1978	Mar. 27-30, Apr. 1-10, 1978	.02
1979	Sometime during Apr. 3-8, 1979	.08
1980[2/]	Dec. 30, 1979	.37
1981	Mar. 13, 17, 1981	.03

[1/] May 11 to September 30, 1968.

[2/] October 1979 to January 1980, May to September 1980.

Table 34. Streamflow records for Wichen River at altitude 18 m, Moen--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	--						74.39	74.40	74.94	45.74	63.86	38.36	148.56	--
	Mean	--						2.48	2.40	2.42	1.52	2.06	1.28	4.79	--
	Max	--						21	14	14	21	34	5.0	26	--
	Min	--						.30	.30	.34	.24	.15	.28	.28	--
1969	Total	652.14	7.18	1.72	2.35	8.71	85.56	92.85	97.7	74.65	64.82	37.75	124.35	54.50	686.32
	Mean	1.79	.23	.061	.076	.29	2.76	3.10	3.15	2.41	2.16	1.22	4.15	1.76	1.88
	Max	46	1.1	.09	.18	1.5	12	12	11	9.7	9.3	13	46	9.2	34
	Min	.03	.07	.04	.03	.04	.08	.60	1.1	.70	.47	.16	.95	.50	.03
1970	Total	803.14	90.16	56.66	15.30	41.22	112.20	69.98	28.80	43.84	36.08	152.0	73.50	83.40	710.84
	Mean	2.20	2.91	2.02	.49	1.37	3.62	2.33	.93	1.41	1.20	4.90	2.45	2.69	1.95
	Max	22	16	21	1.6	14	13	20	2.7	9.3	7.5	22	12	20	46
	Min	.10	.40	.10	.14	.10	.40	.40	.32	.40	.25	1.2	.56	.40	.10
1971	Total	1,017.63	62.49	45.84	45.22	32.66	183.1	115.62	90.02	68.48	134.86	157.04	42.88	39.42	1,087.19
	Mean	2.79	2.02	1.64	1.46	1.09	5.91	3.85	2.90	2.21	4.50	5.07	1.43	1.27	2.98
	Max	62	13	13	13	4.1	62	26	6.8	13	22	31	11	12	62
	Min	.19	.19	.19	.19	.32	1.0	.56	.56	.48	.48	.56	.40	.40	.19
1972	Total	1,263.76	80.22	40.35	205.04	96.14	139.98	150.5	134.3	145.4	131.3	56.40	29.66	54.47	1,362.57
	Mean	3.45	2.59	1.39	6.61	3.20	4.52	5.02	4.33	4.69	4.38	1.82	.99	1.76	3.72
	Max	76	17	15	76	26	21	60	23	14	25	7.9	6.3	16	76
	Min	.19	.32	.19	.40	.64	.80	1.5	1.5	1.5	1.3	.40	.25	.56	.19
1973	Total	823.89	12.73	2.33	2.72	22.30	11.91	35.86	121.43	93.09	70.83	232.10	64.23	154.36	513.73
	Mean	2.26	.41	.083	.088	.74	.38	1.20	3.92	3.00	2.36	7.49	2.14	4.98	1.41
	Max	60	1.0	.16	.65	12	4.0	6.4	15	13	8.8	40	4.4	60	16
	Min	.04	.07	.07	.05	.04	.06	.18	.55	.55	.47	.80	.32	.10	.04
1974	Total	1,528.38	86.08	95.43	225.29	87.59	112.70	130.37	141.64	128.12	76.22	210.1	129.59	105.25	1,534.13
	Mean	4.19	2.78	3.41	7.27	2.92	3.64	4.35	4.57	4.13	2.54	6.78	4.32	3.40	4.20
	Max	43	18	20	43	19	21	19	16	31	12	18	24	25	60
	Min	.06	.06	.52	.15	.10	.19	.80	.52	.19	.15	1.4	.47	.27	.06
1975	Total	974.89	6.54	2.19	57.19	5.83	97.02	145.06	36.75	136.85	48.26	101.08	234.55	103.57	980.63
	Mean	2.67	.21	.078	1.84	.19	3.13	4.84	1.19	4.41	1.61	3.26	7.82	3.34	2.69
	Max	32	.85	.27	12	.47	21	29	3.3	22	13	16	32	8.5	29
	Min	.03	.10	.03	.05	.06	.08	.74	.27	.40	.15	.64	.85	.74	.03

Table 34. Streamflow records for Wichen River at altitude 18 m, Moen,--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
1976	Total	1,651.90	93.43	92.48	21.28	200.30	258.75	86.17	96.37	176.41	174.41	173.08	201.6	77.62	1,638.80
	Mean	4.51	3.01	3.19	.69	6.68	8.35	2.87	3.11	5.69	5.81	5.58	6.72	2.50	4.48
	Max	70	41	24	2.8	26	70	14	16	54	17	40	27	28	70
	Min	.12	.12	.33	.15	.85	.85	.33	.27	.64	.47	.88	1.3	.30	.12
1977	Total	1,011.94	37.39	4.65	18.79	47.23	109.00	50.41	156.54	80.29	234.2	150.10	100.89	22.45	1,190.80
	Mean	2.77	1.21	.17	.61	1.57	3.52	1.68	5.05	2.59	7.81	4.84	3.36	.72	3.26
	Max	46	20	.65	5.1	19	14	9.1	46	13	40	30	21	5.0	46
	Min	.01	.08	.03	.02	.01	.76	.19	.55	.45	1.2	.70	.45	.08	.01
1978	Total	1,006.25	14.79	13.23	15.62	9.43	88.10	93.54	29.58	139.92	131.45	234.4	119.3	116.89	809.10
	Mean	2.76	.48	.47	.50	.31	2.84	3.12	.95	4.51	4.38	7.56	3.98	3.77	2.22
	Max	41	5.0	7.7	9.2	1.3	8.8	21	2.6	23	41	34	20	10	41
	Min	.02	.08	.03	.02	.02	.76	.24	.30	.30	.24	1.2	1.3	.55	.02
1979	Total	1,789.60	50.36	14.37	45.60	202.54	143.00	190.6	82.05	224.50	48.86	414.8	272.8	100.12	1,472.47
	Mean	4.90	1.62	.51	1.47	6.75	4.61	6.35	2.65	7.24	1.63	13.4	9.09	3.23	4.03
	Max	78	13	3.8	8.6	50	26	31	21	30	7.6	78	40	18	50
	Min	.09	.15	.11	.11	.09	.80	1.0	.20	.30	.30	1.2	1.6	.45	.09
1980	Total	--	152.7	--	--	--	247.4	129.2	268.8	143.6	72.06	209.62	43.00	157.85	--
	Mean	--	4.93	--	--	--	7.98	4.31	8.67	4.63	2.40	6.76	1.43	5.09	--
	Max	--	21	--	--	--	35	20	29	12	7.1	77	9.0	21	--
	Min	--	1.3	--	--	--	1.7	1.5	2.4	1.2	.66	.53	.17	.18	--
1981	Total	1,299.36	254.1	24.04	15.28	111.05	44.63	108.54	70.46	115.09	96.59	156.30	91.86	211.42	1,250.25
	Mean	3.56	8.20	.86	.49	3.70	1.44	3.62	2.27	3.71	3.22	5.04	3.06	6.82	3.42
	Max.	59	41	2.0	3.8	59	7.1	17	6.9	18	17	38	11	49	77
	Min.	.05	2.0	.18	.05	.11	.27	.26	.46	.59	.62	1.4	.55	.43	.05
1969-79	Mean	1,138.5	49.2	33.6	59.5	68.5	121.9	105.5	92.3	119.2	104.7	174.4	126.7	82.9	
(11 yrs)		Percent	100	4.3	3.0	5.2	6.0	10.7	9.3	8.1	10.5	9.2	15.3	11.1	7.3

Table 35. Streamflow records for Nachiponong Stream, Moen (16894200)

Location: Lat 7°25'39" N., long 151°51'07" E., on left bank at Wichap, 300 ft downstream from dam site, and 0.15 mile upstream from mouth.

Drainage area: 0.14 mi^2.

Period of record: June 1968 to December 1976 (discontinued).

Gage: Water-stage recorder. Concrete control since Aug. 10, 1971. Altitude of gage is 33 ft (from topographic map).

Remarks: Records fair. No diversion above station.

Average discharge: 8 years, 0.588 ft^3/s (426 acre-ft/yr).

Extremes for period of record: Maximum discharge, 110 ft^3/s Oct. 1, 1976 (gage height, 3.36 ft), from curve extended above 11 ft^3/s; no flow Mar. 26-31, 1969, many days in March and April 1973, Dec. 10, 1973, Jan. 19, Mar. 21-24, 1976.

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

Date	Discharge
Oct. 18, 1967	0.32
Mar. 4, 1982	.07
Sept. 16, 1982	.34

Table 35. Streamflow records for Nachiponong Stream, Moen--Continued

B. Annual maximum discharge (*) and peak discharges above base (40 ft^3/s)

[Discharge in cubic feet per second, gage height in feet]

Date	Time	Discharge	Gage height
Dec. 19, 1968	1430	* 13	+3.10
Nov. 25, 1969	0700	* 26	3.32
Sept. 11, 1971	1700	46	2.25
Sept. 20, 1971	1400	* 59	2.50
Sept. 27, 1971	1900	40	2.12
Oct. 4, 1971	0030	50	2.33
Oct. 21, 1971	0400	50	2.31
Jan. 27, 1972	1230	54	2.40
Mar. 1, 1972	0600	69	2.68
Apr. 20, 1972	1430	96	3.83
May 28, 1972	0900	59	2.50
June 4, 1972	0430	*102	3.86
July 29, 1972	0200	45	2.20
Aug. 22, 1972	1300	46	2.93
Dec. 29, 1972	1200	* 37	2.06
Oct. 2, 1973	2400	46	2.45
Oct. 20, 1973	0200	52	2.35
Dec. 26, 1973	0330	62	3.06
Aug. 3, 1974	1200	* 74	2.76
Oct. 17, 1974	1900	* 54	2.42
Dec. 8, 1974	1800	52	2.35
May 17, 1975	0030	42	2.17
June 21, 1975	0800	41	2.16
Apr. 2, 1976	2200	57	2.46
May 18, 1976	0300	*104	3.26
Oct. 1, 1976	1400	*110	3.36
Nov. 15, 1976	1230	65	2.62

+ From floodmark.

Table 35. Streamflow records for Nachiponong Stream, Moen--Continued

C. Annual minimum discharge in cubic feet per second

Water year	Date	Discharge
1969 ------	Mar. 26-31, 1969 ----------	0
1970 ------	Feb. 15, Apr. 4, 1970 ----------	.03
1971 ------	Mar. 12, 1971 ----------	.04
1972 ------	Dec. 12-15, 1971 ----------	.01
1973 ------	Many days in March, April, 1973 -----	0
1974 ------	Dec. 10, 1973 ----------	0
1975 ------	Many days in February, 1975 ---------	.01
1976 ------	Jan. 19, Mar. 21-24, 1976 ----------	0
1977[1/]-----	Dec. 26, 27, 1976 ----------	.03

[1/] October to December 1976.

Table 35. Streamflow records for Nachiponong Stream, Moen,--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							6.10	6.57	6.35	8.49				--
		--										6.80	7.89	18.31	
	Mean	--						.20	.21	.20	.28	.22	.26	.59	--
	Max	--						.69	.55	.55	1.0	2.2	.56	2.3	--
	Min	--						.07	.09	.12	.09	.08	.12	.12	--
1969	Total		2.55	.57	.49	2.68	13.57	13.21	17.30	13.25	12.23				108.85
		116.78										10.28	19.69	10.96	
	Mean	.32	.082	.020	.016	.089	.44	.44	.56	.43	.41	.33	.66	.35	.30
	Max	2.6	.29	.03	.06	.36	1.2	.92	1.4	1.2	.95	2.0	2.6	1.0	2.3
	Min	0	.02	.01	0	.01	.02	.20	.23	.19	.21	.10	.27	.17	0
1970	Total		14.15	7.97	4.43	8.12	18.57	14.21	8.29	11.29	9.10				137.06
		150.15										26.59	14.37	13.06	
	Mean	.41	.46	.28	.14	.27	.60	.47	.27	.36	.30	.86	.48	.42	.38
	Max	4.0	1.1	1.4	.34	2.0	1.4	2.5	.82	1.2	1.1	4.0	1.3	2.0	2.6
	Min	0.4	.16	.04	.05	.04	.17	.16	.12	.14	.08	.30	.20	.12	.04
1971	Total		15.01	7.76	4.24	11.68	33.76	33.56	26.78	21.55	31.26				239.62
		248,00										45.40	10.39	6.61	
	Mean	.68	.48	.28	.14	.39	1.09	1.12	.86	.70	1.04	1.46	.35	.21	.66
	Max	7.4	2.3	3.1	.80	1.0	7.0	3.7	1.7	2.1	5.7	7.4	3.3	3.1	7.0
	Min	.01	.08	.05	.04	.10	.29	.29	.30	.25	.12	.28	.08	.01	.04
1972	Total		20.96	15.41	51.79	25.10	37.96	37.21	33.80	33.19	28.26				346.08
		315.19										11.64	6.30	13.57	
	Mean	.86	.68	.53	1.67	.84	1.22	1.24	1.09	1.07	.94	.38	.21	.44	.95
	Max	18	6.9	4.6	18	6.2	7.3	11	8.4	4.6	5.0	1.6	1.7	6.6	18
	Min	.02	.02	.10	.20	.12	.31	.51	.28	.31	.34	.08	.04	.03	.01
1973	Total		2.52	1.40	1.13	4.07	4.94	13.21	27.20	17.48	17.94				121.40
		170.50										43.06	15.47	22.08	
	Mean	.47	.081	.050	.037	.14	.16	.44	.88	.56	.60	1.39	.52	.71	.33
	Max	7.1	.24	.09	.50	2.4	1.5	2.4	4.0	2.2	2.4	5.2	1.1	7.1	6.6
	Min	0	.03	.01	0	0	.01	.11	.13	.22	.20	.39	.20	.01	0
1974	Total		40.76	16.87	51.20	19.19	22.14	19.87	21.06	23.83	9.09				304.62
		314.73										46.51	25.14	19.07	
	Mean	.86	1.31	.60	1.65	.64	.71	.66	.68	.77	.30	1.50	.84	.62	.83
	Max	7.4	4.1	3.7	7.4	2.2	6.1	3.1	2.7	6.6	2.7	4.6	2.9	5.0	7.4
	Min	.02	.20	.12	.15	.12	.09	.09	.12	.03	.02	.37	.12	.04	.01

Table 35. Streamflow records for Nachiponong Stream, Moen--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		1.37	.50	7.48	1.25	20.84	36.96	8.53	25.32	6.36				199.33
		205.83										17.66	63.91	15.65	
	Mean	.56	.044	.018	.24	.042	.67	1.23	.28	.82	.21	.57	2.13	.50	.55
	Max	5.7	.10	.07	2.8	.10	4.9	5.7	.82	3.4	2.1	2.8	5.5	2.2	5.7
	Min	.01	.02	.01	.01	.03	.03	.20	.05	.10	.04	.10	.43	.20	.01
1976	Total		15.39	11.26	5.46	37.95	82.13	20.44	17.86	46.21	32.80				366.72
		366.50										37.77	44.16	15.07	
	Mean	1.00	.50	.39	.18	1.27	2.65	.68	.58	1.49	1.09	1.22	1.47	.49	1.00
	Max	29	6.9	2.3	1.5	5.7	29	2.6	4.0	9.3	4.0	6.6	5.9	5.3	29
	Min	.01	.01	.06	.02	.25	.22	.10	.08	.10	.10	.20	.20	.07	.01
1969-76 (8 yrs)	Mean	235.97	14.09	7.72	15.78	13.75	29.24	23.58	20.10	24.01	18.38	29.88	24.93	14.51	
	Percent		100	6.0	3.3	6.7	5.8	12.4	10.0	8.5	10.2	7.8	12.7	10.5	6.1

Table 36. Streamflow records for Echapachik Stream, Tol (16895000)

Location: Lat 7°20'49" N., long 151°37'04" E., on right bank 0.2 mile upstream from mouth and 0.6 mile north of Mount Winipot.

Drainage area: 0.11 mi^2.

Period of record: April 1955 to March 1957 (published as "at Fasan"), June 1968 to September 1975 (discontinued).

Gage: Water-stage recorder. Concrete control since Nov. 6, 1971. Altitude of gage is 20 ft (from topographic map). Prior to April 1, 1957, non-recording gage at same site at different datum.

Remarks: Records fair to poor. No diversion above station.

Average discharge: 8 years (1955-56, 1968-75), 0.526 ft^3/s (381 acre-ft/yr).

Extremes for period of record: Maximum discharge, 51 ft^3/s Sept. 1, 1970 (gage height, 3.23 ft), from rating curve extended above 0.7 ft^3/s; no flow Mar. 24-25, 1957, many days in 1969, Feb. 17, 1974.

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

Date	Discharge	Location
Jan. 28, 1955	3.0	At gaging station.
June 20, 1957	1.3	Do.
Do.	.87	Above right bank tributary, at altitude 115 ft.
Do.	.23	Right bank tributary at same altitude.
Do.	.59	At altitude 180 ft.
Oct. 20, 1967	.21	At gaging station.

Table 36. Streamflow records for Echapachik Stream, Tol--Continued

B. Annual maximum discharge (*) and peak discharges above base (15 ft^3/s)

[Discharge in cubic feet per second, gage height in feet]

Date	Time	Discharge	Gage height
Dec. 8, 1968	2400	26	2.90
Dec. 21, 1968	2100	*28	3.05
Nov. 3, 1969	0100	42	2.84
Feb. 18, 1970	2230	48	3.01
Sept. 1, 1970	0500	*51	3.23
Oct. 20, 1970	1500	*31	2.63
May 1, 1971	0700	30	2.52
Oct. 4, 1971	0130	31	2.67
Jan. 27, 1972	1300	15	2.50
Mar. 1, 1972	1200	19	2.75
Mar. 14, 1972	0130	31	3.47
May 28, 1972	0900	17	2.65
June 4, 1972	0400	23	3.01
July 1, 1972	1600	21	2.91
Aug. 22, 1972	1400	*34	3.62
Dec. 4, 1972	0300	*13	2.38
Mar. 1, 1974	0130	18	2.78
Mar. 9, 1974	1930	16	2.74
Aug. 3, 1974	1300	21	3.00
Aug. 11, 1974	0430	*23	3.40
Oct. 6, 1974	a/ 2400	26	3.20
Nov. 27, 1974	2400	17	2.71
Dec. 11, 1974	1900	21	2.99
Apr. 29, 1975	1200	18	2.73
May 17, 1975	0400	24	3.08
May 20, 1975	a/ 0600	*27	3.26
June 23, 1975	a/ 0800	17	2.65

a/ About.

Table 36. Streamflow records for Echapachik Stream, Tol--Continued

C. Annual minimum discharge in cubic feet per second

Water year	Date	Discharge
1968[1/] ----	June 9, 11, 1968 ----------	0.02
1969 -----	Many days in February, March, May, 1969	0
1970 -----	Feb. 16, 1970 ----------	.05
1971 -----	Feb. 3, 9, 10, 1971 ----------	.04
1972 -----	Jan. 14, 1972 ----------	.04
1973 -----	Many days March to May, 1973 ----------	.01
1974 -----	Feb. 17, 1974 ----------	0
1975 -----	Many days October to March and in September, 1975 ----------	.01

[1/] June to September 1968.

Table 36. Streamflow records for Echapachik Stream, Tol--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
1955	Total					32.65	37.36	16.63	18.50	26.19	34.78				--
		--										36.13	11.85	24.01	
	Mean	--				1.09	1.21	.55	.60	.84	1.16	1.17	.40	.72	--
	Max	--				4.2	3.2	1.9	1.8	3.2	7.0	7.1	1.0	7.4	--
	Min	--				0.1	.25	.20	.09	.15	.22	.20	.12	.12	--
1956	Total		25.99	12.78	10.26	34.52	26.35	11.06	18.41	20.07	20.83				252.26
		230.94										18.57	13.10	19.00	
	Mean	.63	.84	.44	.33	1.15	.85	.37	.59	.65	.69	.60	.44	.61	.69
	Max	6.3	6.3	2.7	2.2	3.9	2.3	2.0	3.2	3.6	2.9	4.1	2.0	3.0	7.4
	Min	.01	.08	.05	.01	.12	.23	.01	.06	.11	.11	.09	.06	.08	.01
1957	Total		20.62	5.23	5.48										--
		--													
	Mean	--	.67	.19	.18										--
	Max	--	3.2	1.2	2.0										--
	Min	--	.09	.05	0										--
1968	Total							3.28	5.69	9.68	5.08				--
		--										4.65	9.91	12.90	
	Mean	--						.11	.18	.31	.17	.15	.33	.42	--
	Max	--						.28	.70	1.0	1.1	1.6	.54	2.3	--
	Min	--						.04	.08	.06	.05	.05	.24	.06	--
1969	Total		2.25	.17	.37	1.10	3.01	5.39	5.99	26.03	18.35				90.12
		126.60										18.23	29.43	16.28	
	Mean	.35	.073	.006	.012	.037	.097	.18	.19	.84	.61	.59	.98	.53	.25
	Max	7.5	.25	.01	.10	.20	.40	.79	.54	4.9	4.5	3.7	7.5	1.5	4.9
	Min	0	.01	0	0	.01	0	.08	.05	.05	.07	.08	.19	.17	0
1970	Total		20.65	22.65	3.85	9.96	13.42	10.36	6.56	7.40	14.85				173.64
		169.03										32.17	16.45	10.71	
	Mean	.46	.67	.81	.12	.33	.43	.35	.21	.24	.50	1.04	.55	.35	.48
	Max	9.2	3.7	8.6	.32	2.6	2.1	1.6	1.6	1.2	9.2	4.1	1.8	2.3	9.2
	Min	.06	.10	.07	.06	.06	.09	.11	.09	.10	.06	.15	.15	.16	.06
1971	Total		14.93	2.46	9.92	7.29	29.53	11.35	17.76	14.27	8.26				175.10
		146.43										16.20	5.14	9.32	
	Mean	.40	.48	.088	.32	.24	.95	.38	.57	.46	.28	.52	.17	.30	.48
	Max	8.6	2.3	.26	1.1	1.3	8.6	1.3	1.6	2.6	1.0	5.4	.35	3.9	8.6
	Min	.04	.07	.04	.05	.09	.14	.13	.16	.22	.13	.11	.09	.06	.04
1972	Total		15.21	9.31	27.80	20.39	25.54	21.64	36.15	37.24	20.81				244.75
		254.29										13.78	5.71	20.71	
	Mean	.69	.49	.32	.90	.68	.82	.72	1.17	1.20	.69	.44	.19	.67	.67
	Max	6.1	4.2	1.7	6.1	3.3	4.7	5.7	3.5	4.1	2.3	2.0	1.4	3.7	6.1
	Min	.04	.04	.10	.09	.10	.14	.14	.21	.24	.18	.12	.07	.10	.04

Table 36. Streamflow records for Echapachik Stream, Tol--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
1973	Total		2.18	2.10	3.98	7.62	5.08	16.77	13.82	24.22	17.79				133.76
		170.53										28.91	14.87	33.19	
	Mean	.47	.070	.075	.13	.25	.16	.56	.45	.78	.59	.93	.50	1.07	.37
	Max	5.5	.18	.43	2.5	4.7	.90	3.0	3.0	5.5	5.0	5.0	2.6	4.8	5.5
	Min	.01	.03	.03	.01	.01	.01	.06	.06	.07	.09	.09	.14	.09	.01
1974	Total		7.69	8.77	30.07	11.61	9.59	9.68	24.00	34.64	15.02				228.04
		247.96										38.03	20.77	38.09	
	Mean	.68	.25	.31	.97	.39	.31	.32	.77	1.12	.50	1.23	.69	1.23	.62
	Max	6.6	2.3	1.4	4.9	1.5	1.9	1.4	5.7	6.6	3.3	6.0	5.4	4.4	6.6
	Min	.01	.04	.01	.04	.04	.04	.09	.07	.09	.07	.01	.01	.01	.01
1975	Total		14.43	.36	17.51	9.36	35.51	26.55	5.49	13.94	13.72				233.76
		--													
	Mean	--	.47	.013	.56	.31	1.15	.89	.18	.45	.46				.64
	Max	--	4.6	.03	6.7	3.7	8.3	4.0	.60	2.7	2.4				8.3
	Min	--	.01	.01	.01	.02	.04	.03	.03	.03	.01				.01
1968-75 (7 yrs)	Mean	182.73	11.05	6.55	13.36	9.62	17.38	14.53	15.68	22.53	15.54	21.71	14.61	20.17	
	Percent		100	6.0	3.6	7.3	5.3	9.5	8.0	8.6	12.3	8.5	11.9	8.0	11.0

Table 37. Streamflow records for Imor Stream, Tol (16895600)

Location: Lat 7°20'45" N., long 151°36'43" E., 500 ft upstream from mouth and 0.4 mile northwest of Mount Winipot.

Drainage area: 0.02 mi^2.

Period of record: April 1955 to March 1957 (published as "at Fasan") (discontinued).

Gage: Staff gage, read twice daily. Altitude of gage is 35 feet (from topographic map).

Remarks: Records fair. No diversion above station.

Extremes for period of record: Maximum daily discharge, 7.3 ft^3/s Dec. 30, 1955; minimum daily, 0.02 ft^3/s Apr. 1, 2, 1956, Mar. 31, 1957.

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

Date	Discharge	Location
Jan. 28, 1955	1.9	At gage.
June 21, 1957	.17	At altitude 180 ft.
Do.	.17	At altitude 115 ft.
Do.	.34	At altitude 60 ft.
Do.	.38	At gage.

Table 37. Streamflow records for Imor Stream, Tol--Continued

B. Monthly and annual discharges in cubic feet per second

Year		Calendar year	Jan.	Feb.	Mar.	Apr.	May	June
1955	Total					27.74	37.83	17.33
		--						
	Mean	--				.92	1.22	.58
	Max	--				3.5	3.9	2.0
	Min	--				.01	.29	.15
1956	Total		23.94	11.81	12.42	30.91	22.96	11.05
		222.97						
	Mean	.61	.77	.41	.40	1.03	.74	.37
	Max	5.0	3.1	1.8	2.0	4.4	1.9	1.5
	Min	.05	.12	.08	.05	.19	.28	.12
1957	Total		15.80	6.10	6.10			
		--						
	Mean	--	.51	.22	.20			
	Max	--	2.6	.70	1.6			
	Min	--	.12	.06	.01			

Year		July	Aug.	Sept.	Oct.	Nov.	Dec.	Water year
1955	Total	18.06	26.81	23.33				--
					31.01	13.57	24.40	
	Mean	.58	.86	.78	1.00	.45	.79	--
	Max	1.4	4.6	2.4	6.3	3.0	7.3	--
	Min	.20	.26	.28	.29	.14	.12	--
1956	Total	10.21	19.56	16.80				228.64
					18.97	13.23	31.11	
	Mean	.33	.63	.56	.61	.44	1.00	.62
	Max	1.4	2.1	1.8	4.4	1.6	5.0	7.3
	Min	.09	.15	.20	.09	.08	.14	.05

Table 38. Streamflow records for Chun Stream, Dublon Island (16896800)

Location: Lat 7°22'30" N., long 151°51'43" E., on right bank at Chun, 0.3 mile upstream from mouth, and 0.5 mile southwest of Mount Foukenau.

Drainage area: 0.12 mi^2.

Period of record: June 1968 to February 1978 (discontinued).

Gage: Water-stage recorder. Concrete control since Sept. 10, 1971. Altitude of gage is 25 ft (from topographic map).

Remarks: Records fair to poor. No diversion above station.

Average discharge: 9 years, 0.494 ft^3/s (358 acre-ft/yr).

Extremes for period of record: Maximum discharge, 42 ft^3/s Sept. 6, 1977 (gage height, 3.25 ft), from rating curve extended above 1.9 ft^3/s; minimum, 0.01 ft^3/s May 16, 1968, many days in February to April 1969, in March and April 1973, March 23, 1976.

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

Date	Discharge
Feb. 14, 1955	0.014
June 11, 1957	.35
Oct. 16, 1967	.48
June 5, 1978	.62
July 10, 1978	.16
July 17, 1978	.16
Aug. 4, 1978	.27
Sept. 20, 1978	.22

Table 38. Streamflow records for Chun Stream, Dublon Island--Continued

B. Annual maximum discharge (*) and peak discharges above base (16 ft^3/s)

[Discharge in cubic feet, gage height in feet]

Date	Time	Discharge	Gage height
June 21, 1968 --------	1900	*36	2.43
Dec. 23, 1968 --------	1500	*18	2.04
Nov. 25, 1969 --------	0700	32	2.51
Feb. 18, 1970 --------	2200	*39	3.00
May 15, 1970 ---------	0900	19	2.04
Apr. 3, 1971 ---------	1200	16	2.48
July 21, 1971 --------	1700	16	2.50
Sept. 27, 1971 -------	0900	*28	2.94
Oct. 4, 1971 ---------	0230	18	2.90
Jan. 24, 1972 --------	1600	17	2.64
Apr. 15, 1972 --------	0600	26	2.90
Apr. 20, 1972 --------	1430	20	2.76
June 4, 1972 ---------	0100	*34	3.10
July 31, 1972 --------	1900	31	3.02
Aug. 3, 1972 ---------	0100	24	2.94
Sept. 12, 1972 -------	--	30	3.01
Dec. 19, 1972 --------	0430	*34	3.10
Sept. 27, 1973 -------	2300	18	2.73
Oct. 30, 1973 --------	0130	19	2.73
Dec. 26, 1973 --------	0300	30	3.08
Dec. 31, 1973 --------	1400	19	2.77
Mar. 1, 1974 ---------	0100	24	2.88
May 18, 1974 ---------	1300	20	2.77
Aug. 3, 1974 ---------	1230	*36	3.15
Aug. 11, 1974 --------	0400	20	2.74
May 20, 1975 ---------	0700	*22	2.81
June 21, 1975 -------- a/	0800	20	2.75
Nov. 2, 1975 ---------	0200	33	3.17
Nov. 20, 1975 --------	1500	17	2.80
Mar. 29, 1976 --------	0430	18	2.78
Apr. 2, 1976 ---------	2100	26	2.90
May 18, 1976 ---------	0300	*41	3.24
Dec. 3, 1976 ---------	1000	17	2.65
Sept. 6, 1977 --------	0230	*42	3.25
Nov. 20, 1977 -------- a/	1300	*16	2.63

a/ About.

Table 38. Streamflow records for Chun Stream, Dublon Island--Continued

C. Annual minimum discharge in cubic feet per second

Water year	Date	Discharge
1969	Many days February to April, 1969	0.01
1970	Feb. 13, 14, 1970	.07
1971	Feb. 2, 1971	.06
1972	Dec. 19-21, 1971	.04
1973	Many days in March, April, 1973	.01
1974	Jan. 21, 1974	.06
1975	Mar. 13, 1975	.02
1976	Mar. 23, 1976	.01
1977	Mar. 29, 1977	.04
1978[1/]	Feb. 27, 28, 1978	.04

[1/] October 1977 to February 1978.

Table 38. Streamflow records for Chun Stream, Dublon Island--Continued

D. Monthly and annual discharge in cubic feet per second

Year		Calendar year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Water year
1968	Total	--						5.50	5.08	4.34	3.03	9.98	12.17	18.57	--
	Mean	--						.18	.16	.14	.10	.32	.41	.60	--
	Max	--						1.4	.60	.55	.30	3.3	1.3	2.0	--
	Min	--						.06	.06	.07	.07	.10	.24	.24	--
1969	Total	112.09	5.78	1.61	.79	1.12	10.96	10.44	9.36	15.85	16.77	11.66	15.48	12.27	113.40
	Mean	.31	.19	.058	.025	.037	.35	.35	.30	.51	.56	.38	.52	.40	.31
	Max	2.6	.38	.10	.09	.19	1.4	1.6	.70	1.3	1.5	.78	2.6	.87	3.3
	Min	.02	.09	.02	.02	.02	.03	.13	.15	.15	.28	.24	.30	.23	.02
1970	Total	169.10	18.22	13.65	7.43	8.43	11.00	10.80	9.47	9.22	9.89	31.92	24.70	14.37	137.52
	Mean	.46	.59	.49	.24	.28	.35	.36	.31	.30	.33	1.03	.82	.46	.38
	Max	2.8	1.7	2.8	.62	1.3	1.5	2.0	.48	1.0	.87	2.4	1.8	1.5	2.8
	Min	.08	.23	.08	.12	.10	.16	.16	.23	.17	.25	.48	.32	.22	.08
1971	Total	197.35	10.52	6.86	9.81	14.99	27.83	24.63	21.68	12.44	23.29	32.24	7.71	5.35	223.04
	Mean	.54	.34	.25	.32	.50	.90	.82	.70	.40	.78	1.04	.26	.17	.61
	Max	6.3	.98	.86	1.1	2.0	6.3	2.4	1.3	1.3	2.8	3.9	.65	.65	6.3
	Min	.05	.11	.08	.11	.19	.40	.40	.40	.19	.25	.52	.14	.05	.08
1972	Total	211.94	11.05	9.38	26.41	19.01	23.44	22.18	21.71	24.57	25.70	12.06	6.42	10.01	228.75
	Mean	.58	.36	.32	.85	.63	.76	.74	.70	.79	.86	.39	.21	.32	.63
	Max	6.9	2.4	.90	4.4	1.7	2.3	6.9	4.0	3.2	5.0	2.0	.56	3.0	6.9
	Min	.05	.05	.17	.37	.17	.33	.29	.29	.30	.20	.15	.13	.09	.05
1973	Total	142.39	3.36	1.67	1.15	4.07	2.81	4.41	23.83	16.36	19.16	30.64	15.61	19.32	105.31
	Mean	.39	.11	.060	.037	.14	.091	.15	.77	.53	.64	.99	.52	.62	.29
	Max	4.5	.18	.09	.15	2.4	.29	.42	2.0	2.2	2.2	2.9	1.0	4.5	3.0
	Min	.01	.08	.03	.01	.01	.02	.06	.08	.26	.18	.33	.26	.15	.01
1974	Total	250.59	27.00	21.71	31.95	12.06	19.30	15.36	10.92	20.13	8.78	34.10	27.99	21.29	232.78
	Mean	.69	.87	.78	1.03	.40	.62	.51	.35	.65	.29	1.10	.93	.69	.64
	Max	3.9	3.5	2.3	3.9	1.2	2.8	1.0	.70	3.3	1.0	3.5	1.7	1.5	4.5
	Min	.08	.08	.26	.18	.18	.18	.15	.23	.15	.11	.35	.47	.23	.08
1975	Total	181.01	6.50	2.89	10.47	3.36	18.08	32.79	11.30	16.72	10.61	20.17	33.51	14.61	196.10
	Mean	.50	.21	.10	.34	.11	.58	1.09	.36	.54	.35	.65	1.12	.47	.54
	Max	3.3	.61	.20	2.5	.18	3.0	3.0	.90	1.7	.80	2.3	3.3	1.7	3.5
	Min	.05	.10	.06	.05	.08	.06	.37	.18	.18	.20	.09	.26	.15	.05

Table 38. Streamflow records for Chun Stream, Dublon Island--Continued

D. Monthly and annual discharge 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	221.52	9.78	12.00	4.85	25.00	38.87	13.43	13.63	21.84	16.80	18.99	30.85	15.48	224.49
	Mean	.61	.32	.41	.16	.83	1.25	.45	.44	.70	.56	.61	1.03	.50	.61
	Max	7.9	1.6	1.4	1.3	3.3	7.9	1.4	1.9	3.5	1.2	2.1	3.4	3.1	7.9
	Min	.04	.04	.20	.04	.20	.20	.20	.13	.16	.15	.26	.37	.15	.04
1977	Total	139.41	6.60	4.72	4.52	6.66	19.11	9.13	16.12	8.57	18.33	19.98	18.53	7.14	159.08
	Mean	.38	.21	.17	.15	.22	.62	.30	.52	.28	.61	.64	.62	.23	.44
	Max	3.7	1.7	1.6	.52	.90	1.9	.90	2.1	.64	3.7	2.6	1.8	.75	3.7
	Min	.05	.09	.06	.06	.05	.23	.15	.15	.11	.20	.18	.20	.11	.05
1978	Total	--	3.91	2.09											--
	Mean	--	.13	.075											--
	Max	--	.61	.13											--
	Min	--	.07	.04											--
1969-77	Mean	180.60	10.98	8.28	10.82	10.52	19.04	15.91	15.33	16.19	16.59	23.53	20.09	13.32	
(9 yrs)	Percent	100	6.1	4.6	6.0	5.8	10.5	8.8	8.5	9.0	9.2	13.0	11.1	7.4	

Table 39. Streamflow records for Fansinifo Stream, Dublon Island (16897000)

Location: Lat 7°22'32" N., long 151°52'20" E., 400 feet upstream from mouth and 0.55 mile southeast of Mount Foukenau.

Drainage area: 0.08 mi^2.

Period of record: April 1955 to March 1957 (discontinued).

Gage: Staff gage, read twice daily. Altitude of gage is 80 feet.

Remarks: Records fair. No diversion above station.

Extremes for period of record: Maximum daily discharge, 6.5 ft^3/s Aug. 10, 1955; minimum daily, 0.005 ft^3/s Apr. 1, 2, 1955.

A. Discharge measurements, in cubic feet per second, made on June 10, 1957

Altitude	Discharge
At 250 ft	0
At 150 ft	.011
At gage (80 ft)	.12

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

Date	Discharge	Date	Discharge
Feb. 11, 1955	.23	Oct. 15, 1969	.29
June 10, 1957	.12	Oct. 27, 1969	.61
		Nov. 26, 1969	1.2
Oct. 20, 1967	.10	Jan. 7, 1970	.52
Jan. 20, 1969	.36	Jan. 23, 1970	.15
Feb. 27, 1969	0	Jan. 30, 1970	.12
Mar. 11, 1969	0	Mar. 27, 1970	.07
Apr. 16, 1969	±.01	Apr. 13, 1970	.07
June 5, 1969	.08	May 5, 1970	.07
Aug. 18, 1969	.42	July 7, 1970	.13
Sept. 2, 1969	.09	July 22, 1970	.06
Sept. 15, 1969	.44	Nov. 16, 1970	1.1
Sept. 29, 1969	.29	Dec. 30, 1970	.18

± Estimated.

Table 39. Streamflow records for Fansinifo Stream, Dublon Island--Continued

C. Monthly and annual discharges in cubic feet per second

Year		Calendar year	Jan.	Feb.	Mar.	Apr.	May	June
1955	Total					37.78	53.15	14.54
		--						
	Mean	--				1.25	1.72	.48
	Max	--				3.8	6.1	1.4
	Min	--				.005	.32	.11
1956	Total		20.93	8.01	7.49	45.83	28.44	13.97
		226.90						
	Mean	.62	.68	.28	.24	1.5	.92	.47
	Max	6.2	3.2	2.1	1.4	6.2	2.9	1.3
	Min	.01	.05	.05	.01	.29	.3	.09
1957	Total		26.13	3.57	2.41			
		--						
	Mean	--	.84	.13	.078			
	Max	--	4.0	.46	.39			
	Min	--	.19	.05	.01			

Year		July	Aug.	Sept.	Oct.	Nov.	Dec.	Water year
1955	Total	23.64	29.77	27.01				--
					21.85	19.20	20.35	
	Mean	.76	.96	.90	.71	.63	.65	--
	Max	2.3	6.5	3.0	3.1	1.5	3.0	--
	Min	.26	.09	.12	.09	.28	.05	--
1956	Total	11.87	13.97	18.89				230.80
					5.18	17.96	34.36	
	Mean	.38	.45	.63	.17	.60	1.1	.63
	Max	1.4	1.3	3.2	.43	2.9	4.3	6.2
	Min	.08	.08	.17	.06	.06	.19	.01

Table 40. Streamflow records for Tumunu Stream, Dublon Island (16897200)

Location: Lat 7°22'34" N., long 151°52'27" E., on left bank at Roro, 0.15 mile upstream from mouth, and 0.6 mile southeast of Mount Foukenau.

Drainage area: 0.28 mi^2.

Period of record: June 1968 to January 1978 (discontinued).

Gage: Water-stage recorder. Concrete control since Aug. 13, 1971. Altitude of gage is 25 ft (from topographic map).

Remarks: Records fair. Since 1975, part of flow is diverted at times from spring basin above station for domestic use.

Average discharge: 9 years, 1.12 ft^3/s (811 acre-ft/yr).

Extremes for period of record: Maximum discharge, 168 ft^3/s Feb. 18, 1970 (gage height, 5.08 ft), from rating curve extended above 5.4 ft^3/s; no flow part or all of each day Mar. 9-13, Apr. 6-11, 13, 1975, part of Mar. 28-30, 1977, during diversion of flow upstream.

A. Results of discharge measurements made on June 10, 1957

Altitude	Discharge (ft^3/s)
At 200 ft	0.07
At 150 ft	.10
At 80 ft	.13

B. Results of discharge measurements made outside the period of continuous discharge record

Date	Discharge (ft^3/s)	Location
Feb. 25, 1953	0.20	At gaging station.
Oct. 19, 1957	1.2	Do.
Feb. 9, 1978	.05	Do.
Feb. 16, 1978	.04	Do.
June 5, 1978	1.2	Do.
June 27, 1978	1.5	Do.
July 10, 1978	.14	Do.
July 17, 1978	.13	Do.

Table 40. Streamflow records for Tumunu Stream, Dublon Island--Continued

C. Annual maximum discharge (*) and peak discharges above base (30 ft^3/s)

[Discharge in cubic feet per second, gage height in feet]

Date	Time	Discharge	Gage height
June 21, 1968	2100	* 34	2.63
Aug. 2, 1968	1200	31	2.56
Oct. 31, 1968	1200	43	2.88
Dec. 23, 1968	1500	* 48	3.00
Dec. 26, 1968	0200	33	2.61
Nov. 25, 1969	0700	129	4.54
Feb. 18, 1970	2230	*168	5.08
May 15, 1970	0830	30	2.66
Nov. 15, 1970	1800	35	2.68
Apr. 3, 1971	1200	46	2.96
May 1, 1971	0900	51	3.08
Sept. 27, 1971	0800	* 60	3.25
June 4, 1972	0500	* 82	3.70
Aug. 3, 1972	0100	32	2.61
Dec. 19, 1972	0500	* 22	2.33
Dec. 26, 1973	[a/] 0300	* 52	3.11
Mar. 31, 1974	0300	33	2.61
May 18, 1974	1200	30	2.54
Aug. 3, 1974	1200	46	2.95
May 20, 1975	0700	* 28	2.48
Nov. 2, 1975	0200	60	3.32
May 18, 1976	0230	*164	4.90
Sept. 6, 1977	0200	* 61	3.28
Nov. 20, 1977	1300	* 29	2.46

[a/] About.

Table 40. Streamflow records for Tumunu Stream, Dublon Island--Continued

D. Annual minimum discharge in cubic feet per second

Water year	Date	Discharge
1968[1/]	June 20, 1968	0.10
1969	Mar. 1, 2, 1969	.02
1970	Feb. 14-16, 1970	.08
1971	Feb. 3, 1971	.10
1972	Dec. 19, 21, 22, 1971	.03
1973	Mar. 29, Apr. 1-7, 1973	.01
1974	May 16, 1974	.01
1975	Mar. 9-13+, Apr. 6-11+, 13+, 1975	0
1976	Jan. 24+, Mar. 17+, 18+, 1976	.02
1977	Mar. 28-30+, 1977	0
1978[2/]	Jan. 20+, 1978	.01

\+ During diversion upstream.

[1/] June to September 1968.

[2/] October 1977 to January 1978.

Table 40. Streamflow records for Tumunu Stream, Dublon Island--Continued

E. 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							8.74	39.20	54.18	9.60				--
		--										26.82	36.02	49.19	
	Mean	--						.29	1.26	1.75	.32	.87	1.20	1.59	--
	Max	--						2.1	4.6	6.3	2.9	13	3.9	7.5	--
	Min	--						.12	.16	.32	.13	.12	.42	.28	--
1969	Total		13.27	2.10	2.00	2.30	24.51	19.09	14.89	36.22	33.04				259.45
		237.95										24.16	47.76	18.61	
	Mean	.65	.43	.075	.065	.077	.79	.64	.48	1.17	1.10	.78	1.59	.60	.71
	Max	11	1.2	.16	.28	.39	3.0	3.2	1.2	2.8	2.5	1.6	11	2.1	13
	Min	.04	.10	.04	.04	.04	.04	.23	.25	.25	.40	.35	.74	.24	.04
1970	Total		34.89	39.95	10.97	11.96	20.08	19.10	16.12	21.09	17.22				281.91
		326.86										49.03	59.15	27.30	
	Mean	.90	1.13	1.43	.35	.40	.65	.64	.52	.68	.57	1.58	1.97	.88	.77
	Max	18	4.3	18	1.1	2.0	3.6	4.0	1.0	2.4	1.7	3.0	3.9	3.3	18
	Min	.10	.31	.10	.17	.13	.15	.22	.24	.22	.27	.67	.73	.39	.10
1971	Total		17.16	14.25	18.82	34.97	57.91	46.00	40.96	24.91	57.28				447.74
		403.14										67.91	13.38	9.59	
	Mean	1.10	.55	.51	.61	1.17	1.87	1.53	1.32	.80	1.91	2.19	.45	.31	1.23
	Max	17	1.9	1.7	2.9	4.2	17	3.7	3.1	2.2	5.5	8.0	1.4	1.3	17
	Min	.04	.15	.13	.22	.51	.51	.80	.51	.42	.56	.75	.18	.04	.13
1972	Total		19.93	15.23	47.83	39.88	48.88	45.63	42.28	49.60	51.87				452.01
		424.93										25.50	15.72	22.58	
	Mean	1.16	.64	.53	1.54	1.33	1.58	1.52	1.36	1.60	1.73	.82	.52	.73	1.24
	Max	12	3.6	1.3	6.5	3.4	4.3	12	5.5	5.4	10	3.0	1.4	3.2	12
	Min	.08	.08	.23	.61	.23	.56	.56	.61	.61	.50	.32	.30	.25	.04
1973	Total		9.23	2.85	2.10	6.48	7.17	10.97	44.66	31.75	44.81				223.82
		327.98										69.01	49.44	49.51	
	Mean	.90	.30	.10	.068	.22	.23	.37	1.44	1.02	1.49	2.23	1.65	1.60	.61
	Max	10	.79	.18	.38	2.6	.53	.87	3.2	3.3	5.0	6.0	3.0	10	5.0
	Min	.01	.12	.05	.01	.01	.05	.09	.28	.50	.60	.79	.84	.40	.01
1974	Total		57.80	55.70	79.32	32.39	58.21	62.04	29.67	46.96	23.07				613.12
		645.62										88.50	58.55	53.41	
	Mean	1.77	1.86	1.99	2.56	1.08	1.88	2.07	.96	1.51	.77	2.85	1.95	1.72	1.68
	Max	10	6.0	5.8	10	3.5	7.9	3.8	1.9	6.0	4.0	9.0	4.0	3.8	10
	Min	.12	.40	.90	.35	.35	.12	.62	.32	.38	.25	.70	.72	.62	.12
1975	Total		14.26	2.93	23.73	3.96	41.73	71.55	25.12	38.63	26.95				449.32
		437.45										51.52	97.66	39.41	
	Mean	1.20	.46	.10	.77	.13	1.35	2.39	.81	1.25	.90	1.66	3.26	1.27	1.23
	Max	8.2	1.1	.21	6.0	.32	5.9	6.7	1.8	3.4	2.4	5.0	8.2	3.6	9.0
	Min	0	.15	.05	.01	0	.12	.89	.21	.35	.45	.25	.72	.42	0

Table 40. Streamflow records for Tumunu Stream, Dublon Island--Continued

E. 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	584.40	24.28	27.47	11.00	67.55	123.94	41.15	36.77	55.85	51.15	51.77	65.28	28.19	627.75
	Mean	1.60	.78	.95	.35	2.25	4.00	1.37	1.19	1.80	1.71	1.67	2.18	.91	1.72
	Max	35	3.7	2.6	2.6	7.3	35	4.5	4.8	9.4	4.0	4.6	6.5	6.3	35
	Min	.07	.09	.38	.07	.62	.50	.56	.32	.38	.37	.71	.78	.15	.07
1977	Total	305.76	10.93	6.74	5.66	14.09	40.77	17.96	40.25	12.49	42.73	51.08	49.35	13.71	336.86
	Mean	.84	.35	.24	.18	.47	1.32	.60	1.30	.40	1.42	1.65	1.65	.44	.92
	Max	8.9	3.3	3.0	.90	2.3	3.3	1.9	5.0	1.4	8.9	6.0	4.7	1.9	8.9
	Min	.01	.10	.03	.01	.01	.27	.21	.27	.18	.33	.33	.58	.04	.01
1978	Total	--	5.93												--
	Mean	--	.19												--
	Max	--	.90												--
	Min	--	.06												--
1969-77 (9 yrs)	Mean	410.45	22.42	18.58	22.38	23.73	47.02	37.05	32.30	35.28	38.68	53.16	50.70	29.15	
	Percent		100	5.5	4.5	5.5	5.8	11.5	9.0	7.9	8.6	9.4	12.9	12.3	7.1

Low-flow partial-record stations

Table 41. Discharge measurements, in cubic feet per second, on Pou Stream and Pou Stream catchment area, Moen

Pou Stream (16893900)

Location: Lat 7°26'47" N., long 151°50'56" E., 0.3 mile upstream from mouth and 0.6 mile north of Mount Teroken at altitude 65 feet (from topographic map).

Drainage area: 0.20 mi^2.

Period of record: 1968-70, 1972, 1978, 1980 (water years).

Date	Discharge	Date	Discharge
Oct. 20, 1967	0.10	Nov. 5, 1969	1.7
Nov. 22, 1968	.30	Dec. 3, 1969	.62
Dec. 28, 1968	.13	Apr. 17, 1970	.08
Feb. 2, 1969	.02	Apr. 30, 1970	.31
June 6, 1969	.12	May 13, 1970	.32
June 18, 1969	.04	Jan. 30, 1972	.19
Aug. 26, 1969	.24	Apr. 19, 1977	0
Sept. 12, 1969	.42	Apr. 20, 1977	.40
Sept. 25, 1969	.39	May 5, 1980	.19

Pou Stream catchment area

Date	Discharge
Apr. 20, 1977	0.50 (light rain)
May 7, 1980	.18

Table 42. Discharge measurements, in cubic feet per second, on Nefounumas Spring, Moen (16894300)

Location: Lat 7°25'43" N., long 151°51'08" E., 0.15 mile upstream from mouth of Nefounumas Stream and 0.6 mile southwest of Mount Teroken at altitude of 60 ft (from topographic map).

Period of record: 1969-70 (water years).

Date	Discharge	Date	Discharge
Nov. 23, 1968	0.30	June 20, 1969	0.22
Dec. 28, 1968	.22	Sept. 12, 1969	.15
Jan. 23, 1969	.14	Sept. 25, 1969	.10
Jan. 27, 1969	e/ .01	Nov. 5, 1969	.24
June 3, 1969	.09		

e/ Estimated.

Table 43. Discharge measurements on Afeibung Stream, Tol (16895100)

Location: Lat 7°20'49" N., long 151°36'43" E., 300 ft upstream from mouth and 0.6 mile northwest of Mount Tumuital at altitude 20 ft (from topographic map).

Drainage area: 0.09 mi^2.

Period of record: 1968-71, 1973-76 (water years).

Date	Discharge	Date	Discharge
Oct. 20, 1967	0.55	Oct. 2, 1970	0.77
Dec. 17, 1968	.24	Nov. 17, 1970	.29
Jan. 20, 1969	.15	Jan. 29, 1971	.05
Jan. 29, 1969	.02	Mar. 4, 1971	.27
Mar. 10, 1969	0	Mar. 23, 1971	.08
May 7, 1969	0	Jan. 23, 1973	e/.02
June 4, 1969	.05	Mar. 28, 1973	e/.01
Aug. 8, 1969	.12	May 23, 1973	.05
Aug. 29, 1969	.05	June 6, 1973	.06
Sept. 9, 1969	.23	Sept. 1, 1973	.15
Sept. 24, 1969	.30	May 23, 1974	.48
Oct. 7, 1969	.80	June 6, 1974	.42
Mar. 3, 1970	.08	June 24, 1974	.41
Mar. 20, 1970	.04	Oct. 10, 1974	1.2
Apr. 2, 1970	.02	Apr. 17, 1975	.04
Apr. 16, 1970	.02	July 10, 1975	1.2
May 11, 1970	.11	July 17, 1975	.08
July 10, 1970	.09	Sept. 3, 1975	.07
Sept. 15, 1970	.04	Oct. 10, 1975	.36

e/ Estimated.

Miscellaneous sites

Table 44. Discharge measurements, in cubic feet per second, on unnamed water sources on Moen (See fig. 34)

No.	Latitude North	Longitude East	Altitude (ft)	Measurement		Weather conditions	Remarks	Note
				Date	Discharge			
1	7°27'11"	151°53'05"	10	6-6-57	0.04	No rain		
2	7°27'12"	151°52'54"	10	do.	.25	do.		
3	7°27'12"	151°52'39"	25	do.	.11	do.		
4	7°27'28"	151°52'23"	25	do.	.03	do.	Seep	
5	7°27'14"	151°51'54"	25	do.	.02	do.	do.	(1).
6	7°27'01"	151°51'40"	6	do.	.03	do.	do.	(1).
7	7°27'02"	151°51'32"	6	2-9-55	.09	do.		(2).
				6-6-57	.21	do.		
8	7°27'02"	151°51'28"	6	do.	.34	do.	do.	
9	7°27'04"	151°51'27"	6	do.	1.43	do.	Pou Stream at mouth	
				6-14-57	.18	do.	do.	
10	7°26'37"	151°51'24"	425	2-9-55	.07	do.	Spring at head of small stream	
				6-14-57	.03	do.	do.	(3).
11	7°26'30"	151°50'57"	35	2-9-55	.01	do.		
				6-5-57	.52	Rainy		
12	7°26'28"	151°50'56"	30	2-9-55	.006	No rain		
				6-5-57	.30	Rainy		
13	7°26'23"	151°50'55"	25	2-9-55	.005	No rain		
				6-5-57	.19	Rainy		
14	7°26'18"	151°50'53"	45	do.	.01	do.		(1).
15	7°25'43"	151°50'48"	45	2-8-55	.005	No rain		
				6-5-57	.24	Rainy		
16	7°25'35"	151°50'52"	80	2-8-55	.006	No rain		
				6-5-57	.10	Rainy		
17	7°25'18"	151°50'58"	65	do.	.01	do.	Spring	(1).
18	7°25'13"	151°51'34"	25	do.	.06	do.	Village intake	

(1) Estimated.

(2) Upstream from location of 1955 measurement.

(3) Downstream from location of 1955 measurement.

Note: Locations based on 1954 Army Map Service 1:25,000 scale maps.

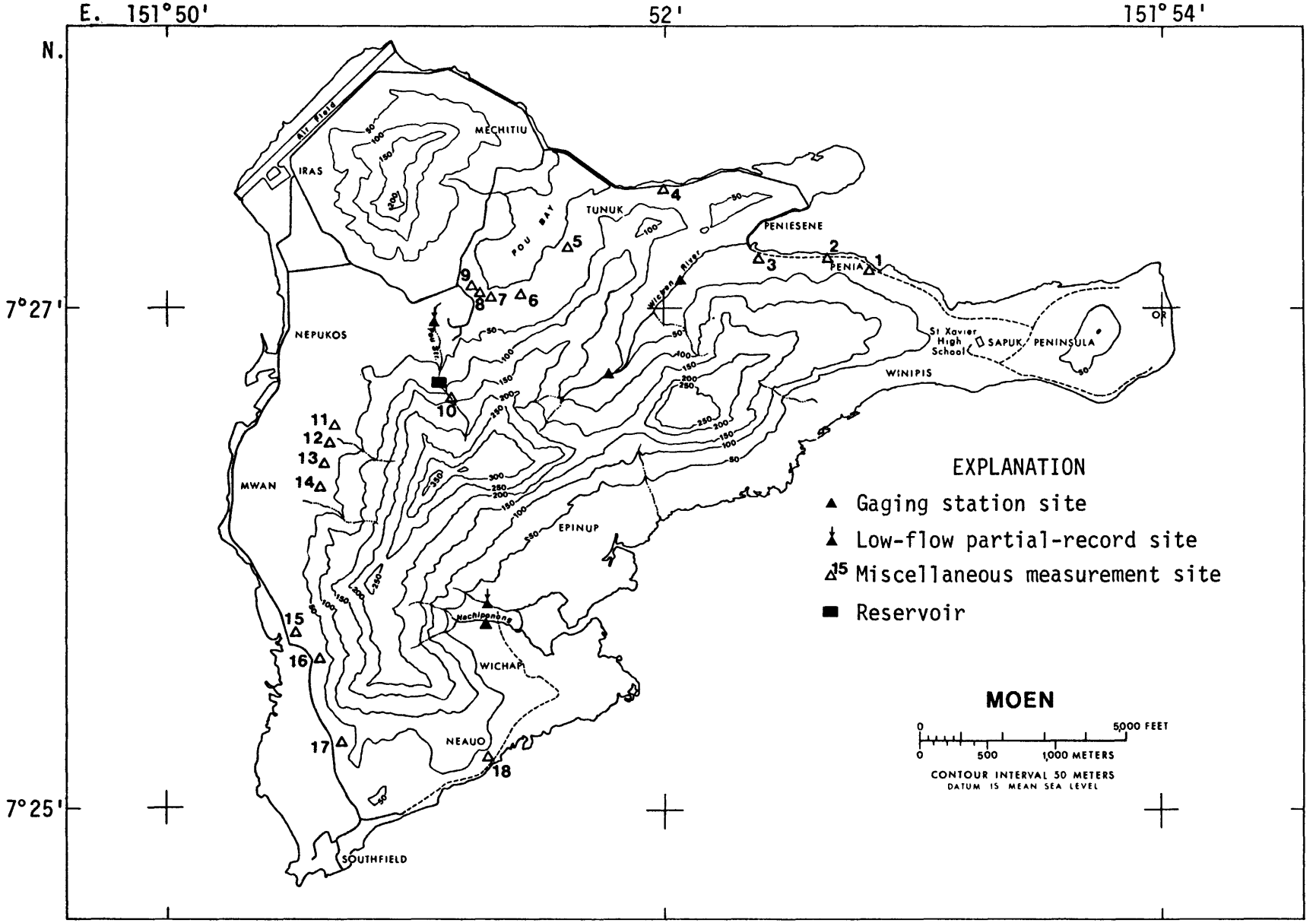


Figure 34. Location of miscellaneous discharge measurements made on Moen.

Table 45. Discharge measurements, in cubic feet per second, on unnamed streams on Dublon Island (See fig. 35)

No.	Latitude North	Longitude East	Altitude (ft)	Measurement		Weather conditions	Note
				Date	Discharge		
1	7°21'56"	151°52'27"	100	6-8-57	0.006	No rain	
2	7°21'57"	151°52'42"	80	do.	.07	do.	
3	7°21'59"	151°52'50"	65	do.	Dry	do.	
4	7°22'04"	151°53'06"	80	2-11-55	.001	do.	
				6-8-57	.001	do.	
5	7°22'09"	151°53'10"	50	do.	.001	do.	
6	7°22'36"	151°53'03"	6	2-11-55	.07	do.	
				6-10-57	.21	do.	
7	7°22'37"	151°52'57"	15	2-11-55	.02	do.	
				6-10-57	.08	do.	
8	7°22'39"	151°52'53"	6	do.	.014	do.	
9	7°22'47"	151°52'39"	65	2-11-55	.23	do.	
				6-10-57	.07	do.	(2).
10	7°22'50"	151°52'56"	6	2-11-55	.001	do.	
				6-10-57	.06	do.	
11	7°22'59"	151°52'59"	6	do.	.006	do.	(e).
12	7°23'17"	151°52'51"	25	2-14-55	.01	do.	
				6-11-57	.02	Rainy	
13	7°22'54"	151°52'06"	30	2-14-55	.01	No rain	
				6-11-57	.03	Rainy	
14	7°22'50"	151°52'07"	45	2-14-55	.006	No rain	
				6-11-57	.04	Rainy	
15	7°22'36"	151°52'13"	65	2-14-55	.014	No rain	Chun Stream.
				6-11-57	.35	Rainy	Do.

(1) Downstream from location of 1955 measurement.

(2) Estimated.

Note: Locations based on 1954 Army Map Service 1:25,000 scale maps.

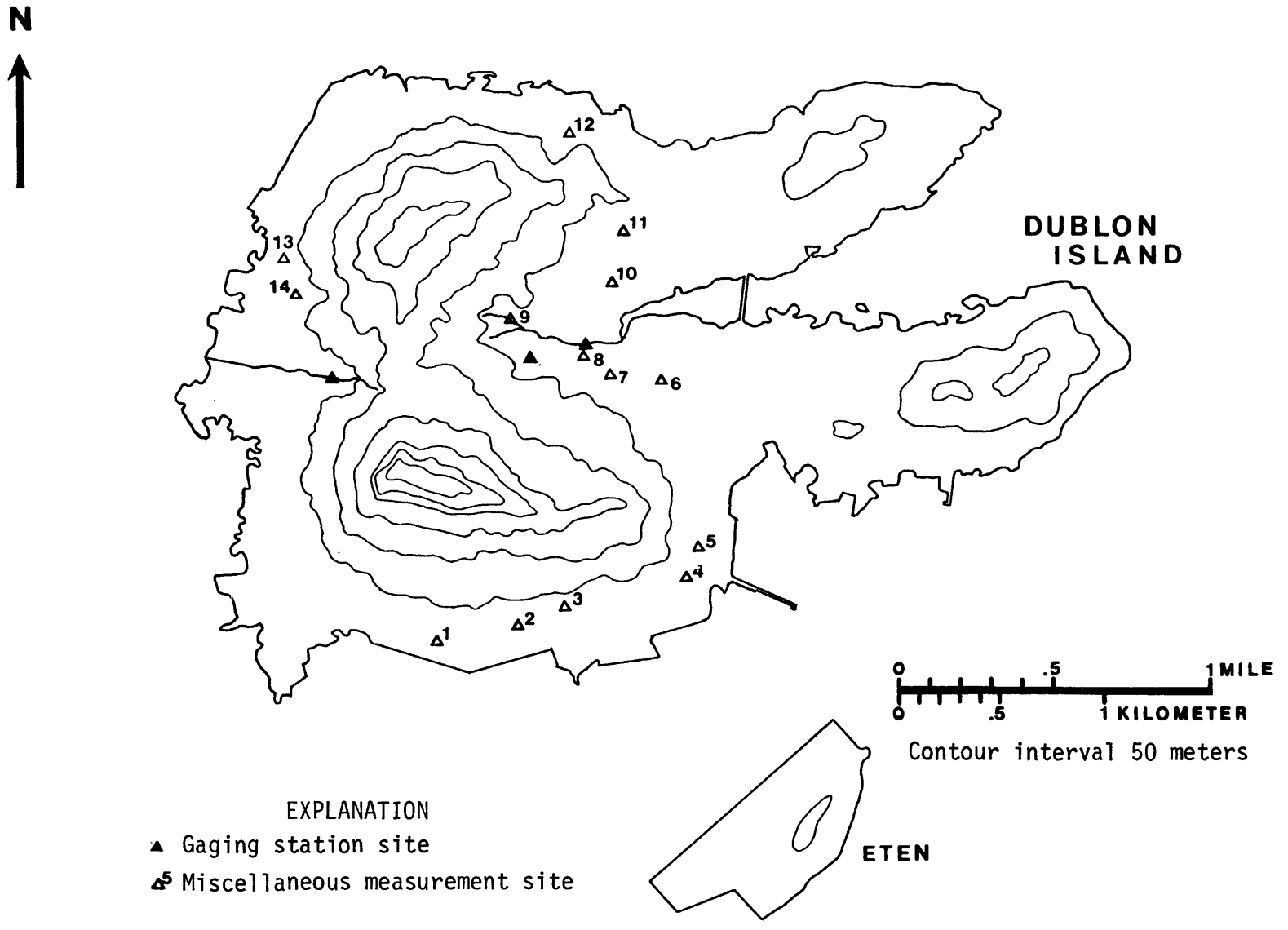


Figure 35. Location of miscellaneous discharge measurements made on Dublon Island.

Table 46. Discharge measurements, in cubic feet per second, on unnamed streams on Fefan (See fig. 36)

No.	Latitude North	Longitude East	Altitude (ft)	Measurement		Weather conditions	Note
				Date	Discharge		
1	7°20'38"	151°51'14"	30	2-18-55	0.005	No rain	
				6-12-57	.05	Showers	
2	7°20'41"	151°51'08"	50	2-18-55	.005	No rain	
				6-12-57	.06	Showers	
3	7°20'46"	151°51'06"	25	2-18-55	.005	No rain	
				6-12-57	.15	Showers	
4	7°20'48"	151°51'10"	20	2-18-55	.01	No rain	
				6-12-57	.04	Showers	
5	7°20'56"	151°51'11"	25	do.	.001	do.	
6	7°21'20"	151°51'19"	40	2-17-55	.005	No rain	(e 2).
				6-12-57	.10	Showers	
7	7°21'29"	151°49'35"	5	2-17-55	.005	No rain	
				6-12-57	.05	Showers	
8	7°21'08"	151°49'46"	20	2-17-55	.009	No rain	(e 1).
				6-12-57	.005	Showers	
9	7°20'52"	151°50'18"	25	2-17-55	.02	No rain	
				6-13-57	.006	do.	
10	7°20'43"	151°50'21"	20	2-18-55	.03	After heavy shower	(e).
				6-13-57	.006	No rain	
11	7°20'37"	151°50'25"	7	2-18-55	.03	After heavy shower	
				6-13-57	.14	No rain	
12	7°20'34"	151°50'29"	5	do.	.12	do.	
13	7°19'36"	151°50'38"	15	2-18-55	.006	do.	
				6-13-57	.01	do.	
14A	7°20'59	151°50'15"	10	do.	.44	Seepage run on largest stream on Fefan (drainage area 0.14 mi^2)	
14B	7°21'02	151°50'16"	50	do.	.29		
14C	7°21'04	151°50'17"	100	do.	.24		

(e) Estimated.

(1) Upstream, may not be equivalent to measurement made in 1955.

(2) Downstream, may not be equivalent to measurement made in 1955.

Note: Locations based on 1954 Army Map Service 1:25,000 scale maps.

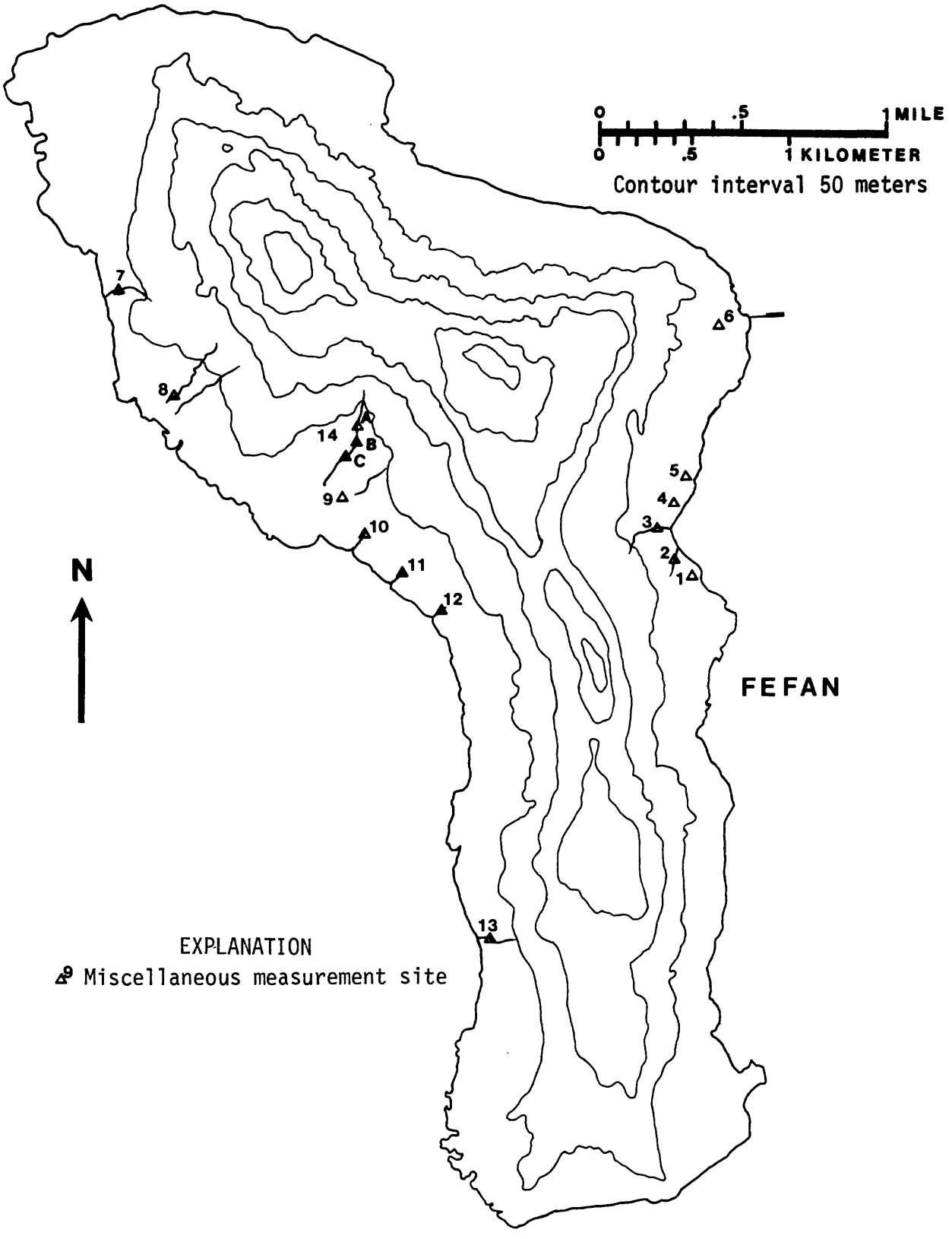


Figure 36. Location of miscellaneous discharge measurements made on Fefan.

Table 47. Discharge measurements, in cubic feet per second, on unnamed streams on Udot (See fig. 37)

[No rain during measurements]

No.	Latitude North	Longitude East	Altitude (ft)	Measurement		Note
				Date	Discharge	
1	7°23'21"	151°43'04"	10	2-15-55	0.001	
				6-22-57	.005	Estimated.
2	7°23'24"	151°43'03"	10	2-15-55	.006	
				6-22-57	.001	Estimated.
3	7°23'26"	151°42'50"	25	2-15-55	.03	
				6-22-57	.014	
4	7°23'25"	151°42'48"	50	2-15-57	.001	
				6-22-57	.005	
5	7°23'24"	151°42'46"	15	2-15-55	.006	
				6-22-57	.011	
6	7°23'00"	151°42'36"	5	do.	.009	
7	7°22'52"	151°42'36"	90	do.	.03	
8	7°22'43"	151°42'39"	35	2-15-55	.009	
				6-22-57	.014	
9	7°22'45"	151°42'59"	10	2-3-55	.001	Estimated.
				6-22-57	.21	
10	7°22'38"	151°43'18"	90	2-15-55	.014	
				6-22-57	.05	
11	7°22'39"	151°43'35"	20	2-15-55	.04	
				6-22-57	.04	

Note: Locations based on 1954 Army Map Service 1:25,000 scale maps.

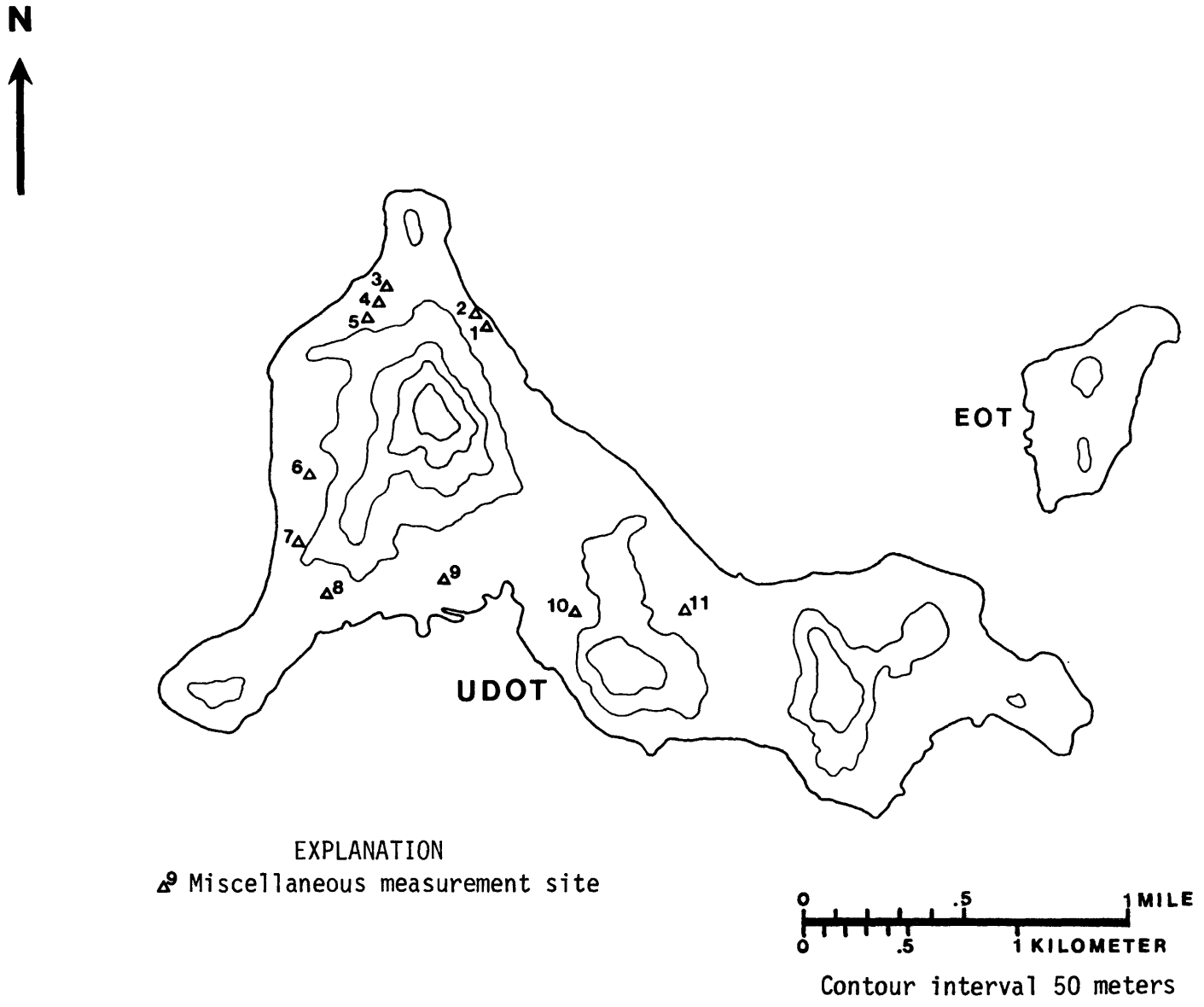


Figure 37. Location of miscellaneous discharge measurements made on Udot.

Table 48. Discharge measurements, in cubic feet per second, on unnamed streams on Uman and Fala-Beguets (See figs. 38, 39)

[No rain during measurements]

No.	Location	Latitude North	Longitude East	Altitude (ft)	Measurement		Note
					Date	Discharge	
1	Uman	7°17'45"	151°53'26"	40	6-15-57	0.03	
2	do.	7°17'44"	151°53'16"	200	do.	Dry	
3	do.	7°17'27"	151°53'08"	30	3-10-55	.009	
					6-15-57	.07	
4	do.	7°17'33"	151°53'17"	100	do.	.05	Seepage run on largest stream on Uman (drainage area (0.09 mi^2).
5	do.	7°17'34"	151°53'15"	150	do.	.07	
6	do.	7°17'39"	151°53'09"	230	do.	.05	
1	Fala-beguets	7°21'19"	151°40'06"	20	2-16-55	.001	
					6-21-57	.03	
2	do.	7°21'13"	151°40'08"	7	do.	.014	
3	do.	7°21'08"	151°40'10"	10	2-16-55	.014	
					6-21-57	.04	
4	do.	7°20'59"	151°40'14"	5	do.	.01	Estimated.
5	do.	7°20'55"	151°40'18"	40	do.	.005	

Note: Locations based on 1954 Army Map Service 1:25,000 scale maps.

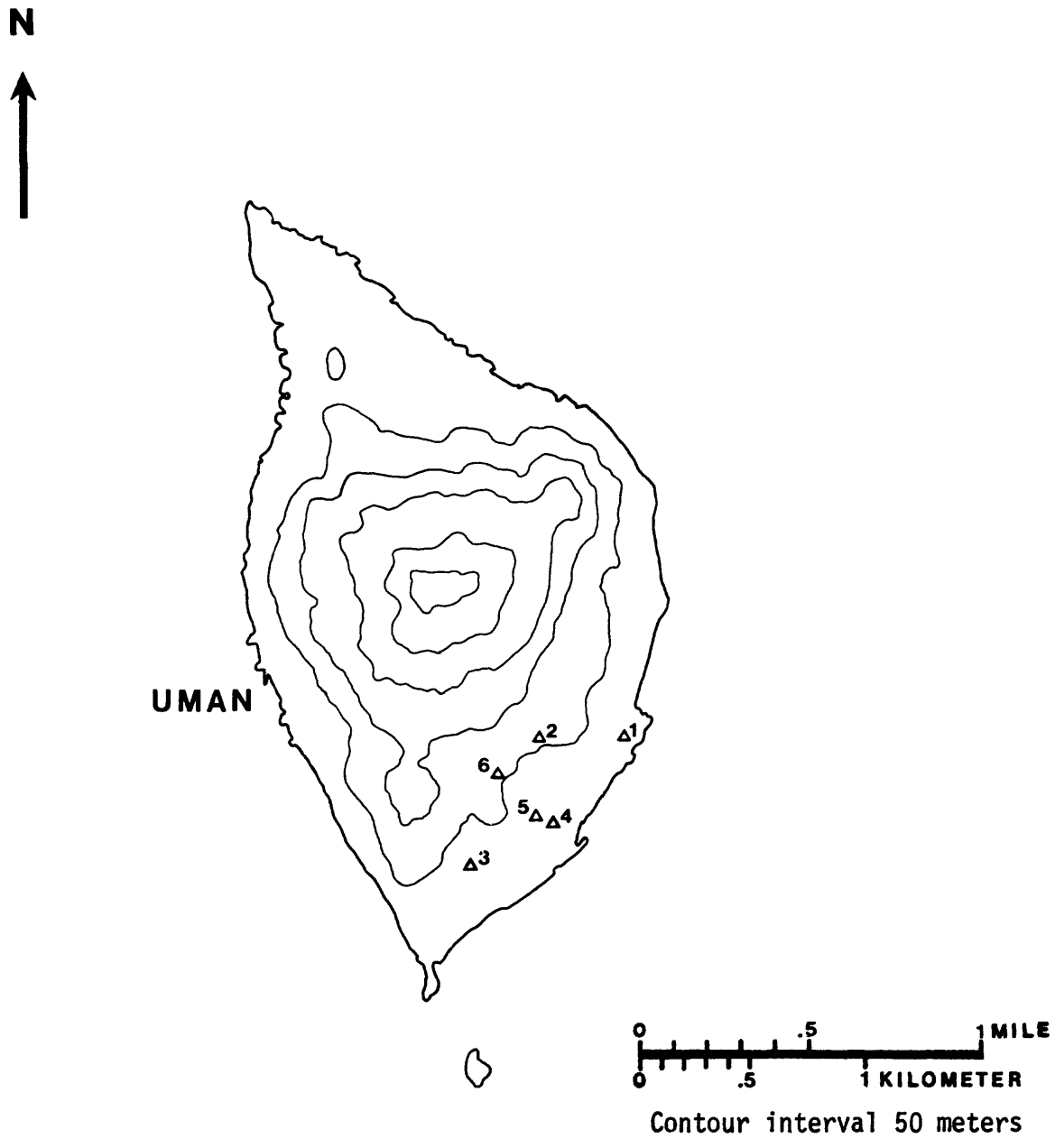


Figure 38. Location of miscellaneous discharge measurements made on Uman.

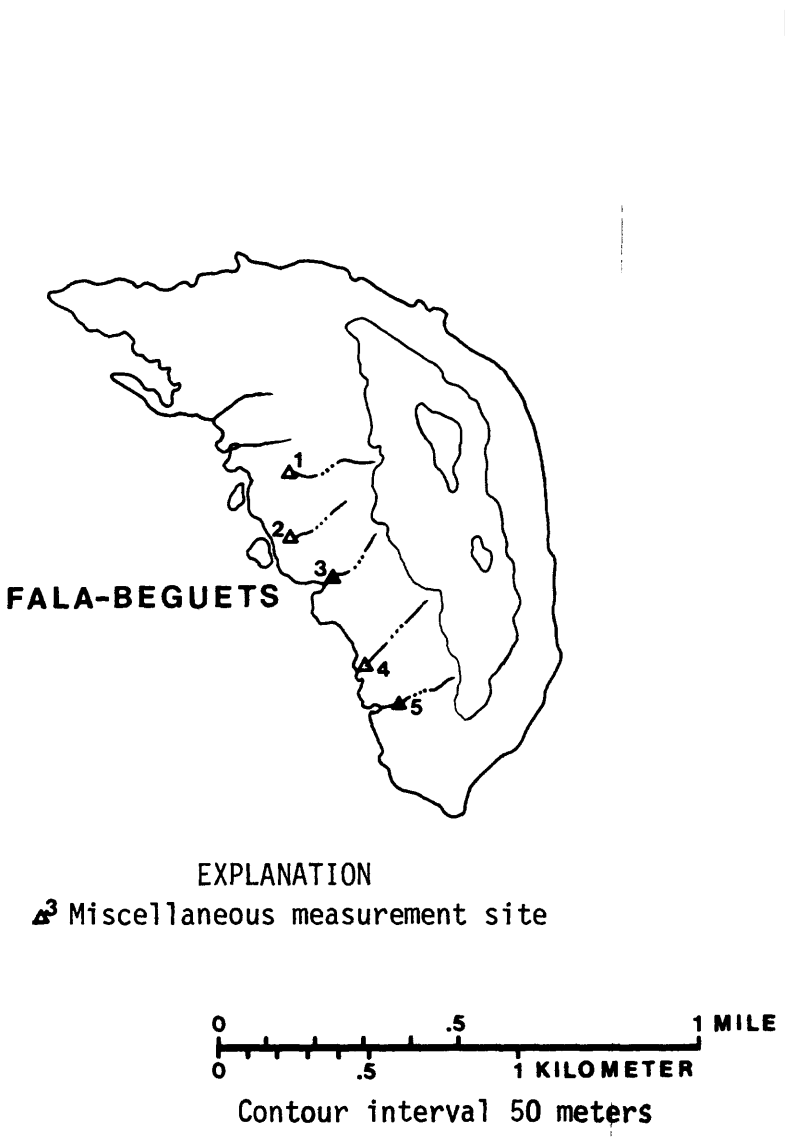


Figure 39. Location of miscellaneous discharge measurements made on Fala-Beguets.

Table 49. Discharge measurements, in cubic feet per second, on unnamed streams on Polle, Tol, and Pata (See fig. 40)

No.	Location	Latitude North	Longitude East	Altitude (ft)	Measurement Date	Measurement Discharge	Weather conditions	Note
1	Polle	7°20'56"	151°36'07"	5	1-31-55	0.25	No rain	
					6-18-57	.07	Rainy	
2	do.	7°20'51"	151°36'03"	5	1-31-55	.005	No rain	
					6-18-57	.04	Rainy	
3	do.	7°20'41"	151°35'55"	30	1-31-55	.25	No rain	
					6-18-57	.04	Rainy	(1).
4	do.	7°20'37"	151°35'41"	80	1-31-55	.25	No rain	
					6-18-57	.05	Rainy	(1).
5	do.	7°20'40"	151°35'40"	5	1-31-55	.001	No rain	(2).
					6-18-57	.11	Rainy	
6	do.	7°20'32"	151°35'14"	5	1-31-55	.02	No rain	
					6-19-57	.05	Rainy	
7	do.	7°20'31"	151°34'57"	15	1-31-55	.004	No rain	
					6-19-57	.07	Rainy	
8	do.	7°20'31"	151°34'41"	20	1-31-55	.001	No rain	
					6-19-57	.06	Rainy	
9	do.	7°20'26"	151°34'21"	5	1-31-55	.009	No rain	
					6-19-57	.03	Rainy	
10	do.	7°20'09"	151°36'00"	5	6-20-57	.03	After moderate rain	
11	do.	7°20'18"	151°36'02"	20	1-31-55	.50	No rain	
					6-20-57	.27	After moderate rain	
12	do.	7°20'26"	151°36'13"	10	6-20-57	.006	do.	
13	do.	7°20'33"	151°36'14"	20	1-31-55	.001	No rain	(2).
					6-20-57	.001	After rain	(2).
14	Tol (south)	7°20'38"	151°37'00"	5	1-28-55	3.43	Rain	
					6-21-57	1.43	After rain	
15	do.	7°20'31"	151°37'00"	50	do.	.06	do.	
16	do.	7°20'20"	151°36'55"	5	1-28-55	8.51	Rain	
					6-21-57	1.18	After rain	
17	do.	7°20'14"	151°36'56"	25	do.	.17	do.	
18	do.	7°20'07"	151°36'54"	5	1-28-55	.80	Rain	
					6-21-57	.20	After rain	
19	do.	7°19'54"	151°36'39"	20	1-28-55	2.57	Rain	
					6-21-57	.03	After rain	
20	Tol (south)	7°19'25"	151°36'32"	5	1-28-55	1.00	Rain	
					6-21-57	.30	After rain	
21	do.	7°20'20"	151°38'09"	25	6-20-57	.67	Rainy	
22	do.	7°20'24"	151°38'10"	20	1-28-55	.16	Rain	
					6-20-57	.79	Rainy	
23	do.	7°20'29"	151°38'07"	5	1-28-55	.73	Rain	
					6-20-57	.04	Rainy	

Table 49. Discharge measurements, in cubic feet per second, on unnamed streams on Polle, Tol, and Pata--Continued

No.	Location	Latitude North	Longitude East	Altitude (ft)	Measurement Date	Measurement Discharge	Weather conditions	Note
24	Tol (north)	7°21'44"	151°37'25"	3	1-27-55	.03	Rain	
					6-19-57	1.56	Rainy	(3).
25	do.	7°21'43"	151°38'17"	15	do.	.06	do.	
26	do.	7°21'51"	151°38'07"	30	1-27-55	.10	No rain	
					6-19-57	.001	Rain	
27	do.	7°21'56"	151°38'10"	25	1-27-55	.15	No rain	
					6-19-57	1.50	Rainy	(3).
28	Pata	7°22'38"	151°35'30"	40	1-29-55	.25	Rain	
					6-17-57	Dry	No rain	
29	do.	7°22'45"	151°35'29"	50	1-29-55	.20	Rain	
					6-17-57	.001	No rain	(2).
30	do.	7°22'58"	151°35'16"	20	1-29-55	.20	Rain	
					6-17-57	Dry	No rain	
31	do.	7°22'31"	151°34'34"	65	1-29-55	.001	Rain	(2).
					6-17-57	.001	No rain	
32	do.	7°22'23"	151°34'38"	50	1-29-55	.001	Rain	(2).
					6-17-57	.001	No rain	(2).
33	do.	7°22'24"	151°34'46"	65	1-29-55	.25	Rain	
					6-17-57	.005	No rain	
34	do.	7°22'25"	151°35'11"	80	1-29-55	.33	Rain	
					6-17-57	.001	No rain	
35	do.	7°22'18"	151°35'27"	150	1-29-55	.25	Rain	
					6-17-57	.001	No rain	(2).

(1) Upstream, may not be equivalent to measurement made in 1955.
(2) Estimated.
(3) Downstream, may not be equivalent to measurement made in 1955.
Note: Locations based on 1954 Army Map Service 1:25,000 scale maps.

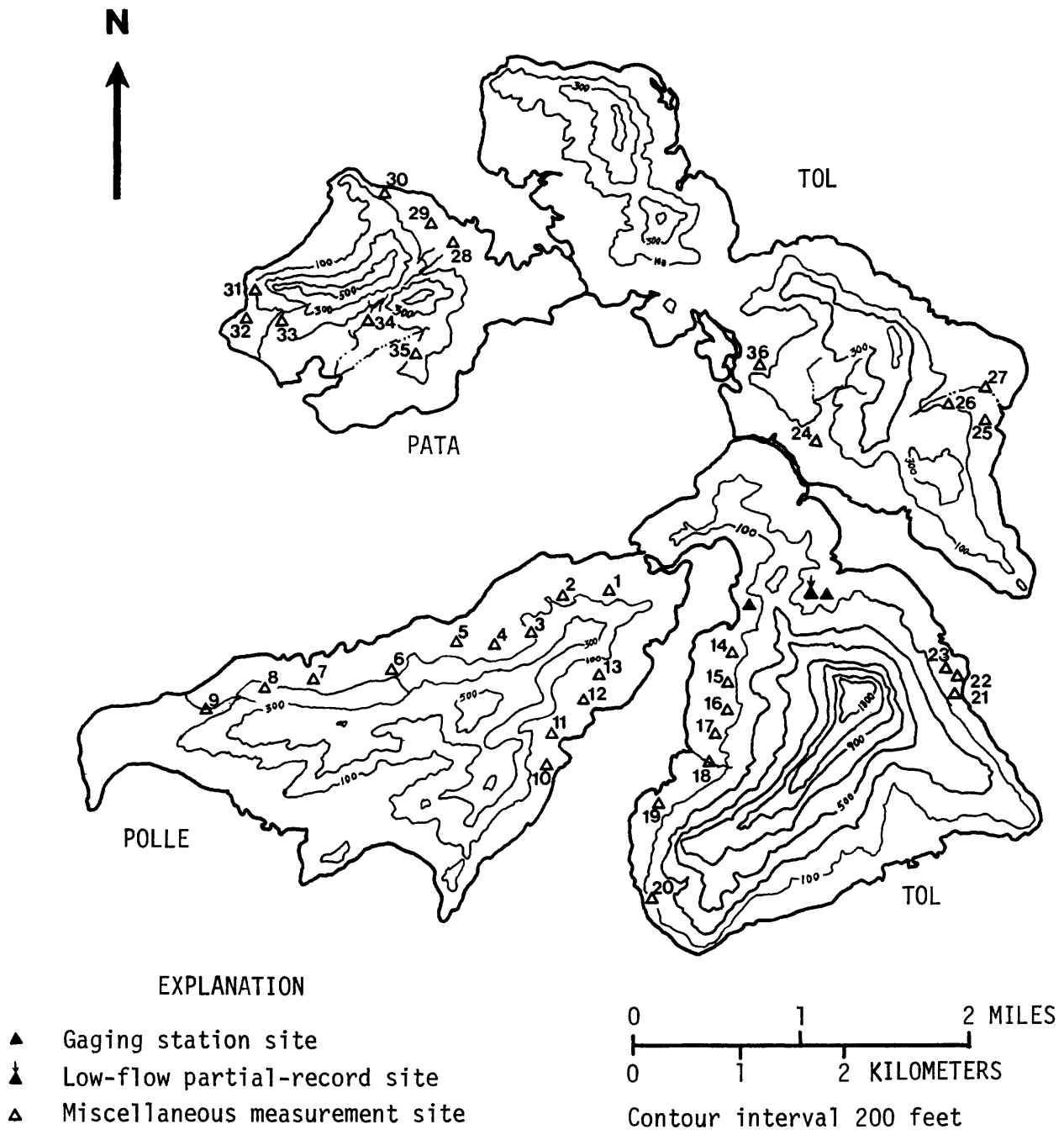


Figure 40. Location of miscellaneous discharge measurements made on Polle, Tol, and Pata.

Table 50. Water and air temperatures and instantaneous discharges at Wichen River at altitude 55 m, Moen

Date	Time	Instantaneous discharge (ft^3/s)	Water temperature (^oC)	Air temperature (^oC)
May 16, 1968	1000	0.22	28.0	--
May 20, 1968	1105	.13	29.5	--
June 4, 1968	1430	.11	29.0	--
June 26, 1968	1300	.17	28.5	--
July 18, 1968	1305	.21	29.5	--
Aug. 7, 1968	1400	.15	28.0	--
Aug. 29, 1968	1330	.25	28.5	--
Sept. 19, 1968	1030	.16	28.5	--
Oct. 8, 1968	1630	.15	28.5	--
Oct. 25, 1968	1100	.09	29.5	--
Nov. 23, 1968	1350	.46	30.5	--
Dec. 28, 1968	0930	.51	28.5	--
Jan. 27, 1969	1520	.08	26.5	--
Feb. 12, 1969	1010	.02	25.5	--
Feb. 17, 1969	1050	.07	26.5	--
Feb. 25, 1969	1350	.02	31.0	--
Mar. 12, 1969	1020	.01	30.5	--
Mar. 20, 1969	1130	.02	28.5	--
Apr. 3, 1969	0930	.03	26.5	--
Apr. 21, 1969	1215	.03	28.0	--
June 3, 1969	1350	.66	28.0	--
June 20, 1969	0940	.86	28.0	--
Jan. 9, 1970	0940	.57	27.0	--
Jan. 29, 1970	0955	3.2	25.5	--
Mar. 4, 1970	0915	.40	26.0	--
Mar. 24, 1970	0920	.20	26.0	--
Apr. 7, 1970	0910	.14	26.0	--
Apr. 24, 1970	1030	.72	26.0	--
May 14, 1970	1350	.64	27.0	--
June 29, 1970	0910	2.0	26.0	--
Aug. 6, 1970	0900	.58	25.0	--
Aug. 26, 1970	0950	.78	26.0	--
Sept. 17, 1970	0900	.25	25.0	--
Oct. 1, 1970	0900	3.6	25.0	--
Nov. 2, 1970	1330	.48	27.0	--
Nov. 14, 1970	1345	.46	26.0	--
Dec. 3, 1970	0900	2.6	26.0	--
Jan. 20, 1971	0850	2.1	26.0	--
Feb. 3, 1971	0900	.17	27.0	--
Feb. 17, 1971	0940	.56	27.0	--
Mar. 3, 1971	1440	.71	26.0	--

Table 50. Water and air temperatures and instantaneous discharges at Wichen River at altitude 55 m, Moen--Continued

Date	Time	Instantaneous discharge (ft^3/s)	Water temperature (^oC)	Air temperature (^oC)
Mar. 18, 1971	1000	5.7	26.0	--
Mar. 31, 1971	1410	.29	27.0	--
Apr. 29, 1971	1345	.29	26.0	--
June 8, 1971	1440	.69	27.0	--
July 2, 1971	0930	.64	26.0	--
July 27, 1971	1450	.78	26.0	--
Sept. 7, 1971	1415	.23	27.0	--
Oct. 15, 1971	1335	.34	26.0	--
Nov. 9, 1971	0920	.75	26.0	--
Dec. 4, 1971	1000	.22	26.0	--
Dec. 20, 1971	1005	1.0	26.0	--
Jan. 11, 1972	1420	.24	27.0	--
Jan. 30, 1972	0900	.49	25.0	--
Feb. 11, 1972	1345	.23	27.0	--
Feb. 25, 1972	0915	.37	27.0	--
Apr. 5, 1972	1500	.39	27.0	--
Apr. 24, 1972	1400	.36	26.0	--
May 16, 1972	1430	1.0	26.0	--
June 7, 1972	1430	2.5	26.0	--
July 28, 1972	1500	1.0	26.0	--
Sept. 19, 1972	1420	.90	27.0	--
Oct. 31, 1972	1500	.24	27.0	--
Nov. 20, 1972	1510	.25	27.0	--
Dec. 12, 1972	0850	.35	26.0	--
Dec. 28, 1972	1435	.29	27.0	--
Jan. 24, 1973	1030	.08	24.5	--
Feb. 15, 1973	1015	.07	27.0	--
May 20, 1974	1450	.71	28.0	30.0
June 5, 1974	1410	.73	27.0	29.0
June 19, 1974	1220	.28	27.5	29.0
Nov. 6, 1974	0950	2.0	25.0	26.0
Nov. 8, 1974	0840	2.9	25.0	26.0
Dec. 5, 1974	1200	1.1	25.5	28.5
Dec. 31, 1974	1600	.74	25.5	28.0
Jan. 13, 1975	1000	.62	25.0	27.0
Feb. 1, 1975	1020	.10	26.0	27.5
Mar. 3, 1975	1425	.05	26.0	28.0
Mar. 31, 1975	0955	1.1	26.0	28.0
Apr. 18, 1975	0935	.08	25.0	26.0
Apr. 30, 1975	1425	.06	26.0	28.0
May 13, 1975	1430	.18	26.0	28.0
June 2, 1975	1100	.51	26.0	27.5
June 12, 1975	1050	.53	26.0	27.5
June 18, 1975	0935	.42	26.0	28.0

Table 50. Water and air temperatures and instantaneous discharges at Wichen River at altitude 55 m, Moen--Continued

Date	Time	Instantaneous discharge (ft^3/s)	Water temperature (^oC)	Air temperature (^oC)
June 30, 1975	1100	0.61	26.0	28.0
July 11, 1975	0915	.76	25.0	26.5
July 15, 1975	1355	.36	26.0	28.5
July 30, 1975	1415	.67	26.0	28.0
Aug. 20, 1975	1345	1.3	26.0	28.0
Sept. 2, 1975	1500	.47	25.0	28.0
Sept. 15, 1975	0945	.75	25.0	27.5
Oct. 1, 1975	1145	1.2	26.0	28.0
Oct. 8, 1975	1510	1.1	25.0	26.5
Oct. 15, 1975	1425	1.0	26.0	28.0
Oct. 28, 1975	1400	2.1	25.0	28.0
Oct. 29, 1975	0940	1.3	27.0	28.0
Nov. 7, 1975	1255	2.0	25.0	26.5
Nov. 17, 1975	1420	.48	25.0	27.5
Dec. 1, 1975	1440	.36	25.0	28.0
Dec. 15, 1975	1435	.65	25.0	27.0
Dec. 29, 1975	0930	.27	27.0	28.0
Jan. 2, 1976	1415	.26	26.0	28.0
Jan. 14, 1976	1355	.11	26.0	28.0
Feb. 4, 1976	1135	.46	25.0	27.5
Feb. 10, 1976	1105	.46	25.0	28.0
Mar. 2, 1976	1105	.47	26.0	27.5
Mar. 16, 1976	1355	.16	26.0	28.0
Mar. 29, 1976	1345	.81	25.0	27.5
Apr. 14, 1976	1345	.76	26.0	28.0
Apr. 30, 1976	0910	.55	25.5	28.0
May 14, 1976	1340	.96	26.0	28.0
June 3, 1976	0920	.83	27.0	28.0
June 16, 1976	1005	.45	25.5	28.0
June 30, 1976	0915	.40	25.0	28.0
July 30, 1976	1325	.48	25.5	28.0
Sept. 9, 1976	1410	.81	26.0	28.0
Oct. 5, 1976	0930	.97	26.0	28.0
Oct. 15, 1976	1020	.84	25.5	28.0
Nov. 2, 1976	1115	.27	26.0	28.0
Dec. 9, 1976	0935	.21	26.0	28.0
Dec. 17, 1976	0845	.45	25.0	26.0
Jan. 4, 1977	1015	.43	26.0	28.0
Feb. 1, 1977	0940	.15	25.0	28.0
Feb. 15, 1977	0930	.27	26.0	28.0
Feb. 28, 1977	0945	.28	26.0	28.0
Apr. 4, 1977	1100	.31	26.0	28.0
Apr. 15, 1977	0950	.11	26.0	28.0
May 19, 1977	1020	.58	26.0	28.0

Table 50. Water and air temperatures and instantaneous discharges at Wichen River at altitude 55 m, Moen--Continued

Date	Time	Instantaneous discharge (ft^3/s)	Water temperature (^oC)	Air temperature (^oC)
June 15, 1977	0935	0.57	26.0	28.0
July 6, 1977	1030	.60	26.0	28.0
Aug. 5, 1977	1040	.47	26.0	28.0
Aug. 17, 1977	0955	.75	27.5	28.0
Aug. 31, 1977	1025	1.2	26.0	28.0
Oct. 25, 1977	1025	.58	26.0	28.0
Jan. 30, 1978	1105	.08	26.0	28.0
Feb. 17, 1978	1155	.23	25.5	28.0
Mar. 6, 1978	1020	.07	26.0	28.0
Apr. 24, 1978	0945	.29	25.5	--
June 6, 1978	0905	.48	26.5	27.0
June 12, 1978	1245	.35	27.5	28.0
July 6, 1978	0955	.20	26.0	28.0
May 13, 1979	1200	3.0	25.0	25.5
Oct. 31, 1979	1205	3.3	26.0	--

Table 51. Water and air temperatures and instantaneous discharges at Wichen River at altitude 18 m, Moen

Date	Time	Instantaneous discharge (ft^3/s)	Water temperature (^oC)	Air temperature (^oC)
May 16, 1968	1135	0.79	28.5	--
May 20, 1968	1410	.21	29.0	--
June 5, 1968	1015	.72	28.0	--
June 26, 1968	1355	.26	28.5	--
July 18, 1968	1335	.16	29.5	--
Aug. 7, 1968	1120	.37	28.5	--
Aug. 29, 1968	1415	.14	28.0	--
Sept. 19, 1968	1130	.75	28.5	--
Oct. 8, 1968	1645	.38	28.5	--
Oct. 25, 1968	1420	.10	29.5	--
Nov. 23, 1968	1500	1.2	26.5	--
Dec. 28, 1968	0950	.30	28.5	--
Jan. 27, 1969	1645	.08	27.0	--
Feb. 12, 1969	1100	.04	26.5	--
Feb. 25, 1969	1430	.06	28.5	--
Mar. 12, 1969	1050	.01	27.0	--
Mar. 20, 1969	1220	.02	28.0	--
Apr. 3, 1969	1020	.05	29.5	--
Apr. 21, 1969	1315	.05	31.0	--
June 3, 1969	1415	.58	28.0	--
June 20, 1969	1000	.53	26.5	--
Jan. 9, 1970	1220	1.2	27.0	--
Jan. 29, 1970	1200	8.2	26.0	--
Mar. 4, 1970	1050	.54	26.0	--
Mar. 24, 1970	1100	.25	26.0	--
Apr. 7, 1970	1020	.15	27.0	--
Apr. 24, 1970	1130	.92	26.0	--
May 14, 1970	1525	1.4	27.0	--
June 29, 1970	1005	2.7	26.0	--
Aug. 6, 1970	1000	1.1	26.0	--
Aug. 26, 1970	1015	.95	26.0	--
Sept. 17, 1970	1000	.43	25.0	--
Oct. 1, 1970	1000	4.7	25.0	--
Jan. 6, 1971	1605	8.8	25.0	--
Jan. 20, 1971	0950	4.3	26.0	--
Feb. 3, 1971	0950	.32	27.0	--
Feb. 17, 1971	1030	.81	27.0	--
Mar. 3, 1971	1530	1.7	26.0	--
Mar. 18, 1971	1050	17	26.0	--
Mar. 31, 1971	1500	.54	27.0	--
Apr. 29, 1971	1430	.52	26.0	--
June 8, 1971	1535	1.6	27.0	--
July 2, 1971	1025	.80	26.0	--
Sept. 7, 1971	1510	.46	27.0	--

Table 51. Water and air temperatures and instantaneous discharges at Wichen River at altitude 18 m, Moen--Continued

Date	Time	Instantaneous discharge (ft^3/s)	Water temperature (^oC)	Air temperature (^oC)
Nov. 9, 1971	1100	0.86	26.0	--
Dec. 4, 1971	1100	.74	26.0	--
Dec. 20, 1971	1105	2.2	26.0	--
Jan. 10, 1972	1505	.52	27.0	--
Jan. 30, 1972	1030	1.7	25.0	--
Feb. 16, 1972	1410	.29	27.0	--
Feb. 25, 1972	0950	1.2	26.0	--
Mar. 17, 1972	1525	26	25.0	--
Apr. 5, 1972	1510	.71	27.0	--
May 16, 1972	1530	2.0	26.0	--
June 8, 1972	1420	2.6	26.0	--
July 11, 1972	0925	1.7	26.0	--
Aug. 9, 1972	1520	2.5	27.0	--
Sept. 21, 1972	0910	1.3	27.0	--
Nov. 7, 1972	1110	.27	27.0	--
Dec. 12, 1972	0935	.69	26.0	--
Dec. 28, 1972	1515	.54	27.0	--
Jan. 24, 1973	1145	.18	28.0	--
Feb. 15, 1973	1100	.07	27.0	--
May 7, 1974	1150	.48	28.0	30.0
May 14, 1974	1005	.44	27.5	28.0
May 21, 1974	0945	2.9	28.0	27.0
June 5, 1974	1505	.43	28.0	29.0
June 19, 1974	1330	.46	29.0	30.0
Nov. 6, 1974	1155	3.8	26.5	29.0
Nov. 8, 1974	1010	7.4	25.5	28.0
Dec. 5, 1974	1445	1.6	26.0	28.0
Dec. 31, 1974	1600	.98	26.0	26.5
Jan. 13, 1975	1200	.67	25.0	27.5
Jan. 20, 1975	1445	.38	25.0	26.5
Feb. 3, 1975	1440	.13	25.0	26.5
Feb. 20, 1975	1055	.17	26.0	28.0
Mar. 3, 1975	1530	.09	24.5	28.0
Mar. 31, 1975	1030	1.1	26.0	28.0
Apr. 17, 1975	1610	.18	26.0	27.0
Apr. 30, 1975	1525	.05	26.0	28.0
May 13, 1975	1515	.20	26.0	27.0
June 2, 1975	1200	.60	26.0	28.0
June 12, 1975	1155	1.3	26.0	27.0
June 18, 1975	1020	2.4	26.0	27.5
June 30, 1975	1200	3.0	26.0	28.0
July 11, 1975	1200	1.5	26.0	28.0
July 15, 1975	1450	.49	26.0	27.5
July 30, 1975	1525	.88	26.0	27.5

Table 51.. Water and air temperatures and instantaneous discharges at Wichen River at altitude 18 m, Moen--Continued

Date	Time	Instantaneous discharge (ft^3/s)	Water temperature (^oC)	Air temperature (^oC)
Aug. 20, 1975	1510	1.8	25.0	28.0
Sept. 2, 1975	1610	.78	26.0	28.0
Oct. 1, 1975	1300	1.1	25.0	27.5
Oct. 8, 1975	1610	2.7	26.0	27.5
Oct. 15, 1975	1515	1.7	26.0	28.0
Nov. 7, 1975	1405	2.3	26.0	28.0
Dec. 1, 1975	1620	.72	25.0	27.5
Dec. 29, 1975	1100	.61	26.0	27.5
Jan. 2, 1976	1600	1.1	26.0	28.0
Jan. 22, 1976	1310	2.3	24.0	26.0
Feb. 4, 1976	1250	1.0	26.5	28.0
Feb. 10, 1976	1240	.40	26.0	28.0
Mar. 2, 1976	1210	.49	26.5	28.0
Mar. 16, 1976	1505	.21	26.5	28.0
Mar. 29, 1976	1455	1.2	25.0	27.5
Apr. 30, 1976	1200	.57	26.0	28.0
May 14, 1976	1450	1.1	25.0	28.0
June 3, 1976	1045	.61	27.0	28.0
June 30, 1976	1035	.53	27.0	28.0
July 8, 1976	1420	.38	25.5	27.0
July 30, 1976	1415	.73	25.0	28.0
Sept. 9, 1976	1520	.33	26.0	28.0
Oct. 5, 1976	1040	.77	26.5	28.0
Oct. 15, 1976	1145	.70	26.0	28.0
Nov. 2, 1976	1000	.92	25.5	28.0
Dec. 6, 1976	1130	.52	26.0	27.5
Dec. 17, 1976	1015	1.5	26.0	27.5
Jan. 4, 1977	1130	.55	26.0	28.0
Feb. 1, 1977	1100	.36	26.0	28.0
Feb. 15, 1977	0940	.32	26.0	28.0
Feb. 28, 1977	1100	.40	26.0	28.0
Apr. 4, 1977	0955	.54	26.0	28.0
Apr. 15, 1977	1050	.25	26.0	28.0
May 19, 1977	1140	.79	26.0	28.0
June 15, 1977	1050	.40	26.0	28.0
July 6, 1977	1145	.52	26.5	28.0
Aug. 5, 1977	1145	.88	26.0	28.0
Aug. 17, 1977	1120	.94	26.0	28.0
Aug. 31, 1977	1120	1.6	26.0	28.0
Oct. 25, 1977	1135	1.3	26.0	28.0
Jan. 11, 1978	1340	.11	25.0	28.0
Jan. 30, 1978	1225	.17	26.0	28.0
Feb. 17, 1978	1250	.27	26.0	28.0
Mar. 6, 1978	1140	.06	26.0	28.0

Table 51. Water and air temperatures and instantaneous discharges at Wichen River at altitude 18 m, Moen--Continued

Date	Time	Instantaneous discharge (ft^3/s)	Water temperature (^oC)	Air temperature (^oC)
Apr. 24, 1978	1100	0.96	26.5	28.0
June 6, 1978	1005	1.2	27.0	28.0
June 12, 1978	1340	1.2	26.0	28.0
July 6, 1978	1055	.93	26.5	28.0
July 18, 1978	1020	1.1	26.5	28.0
Aug. 7, 1978	0940	1.5	26.5	28.0
Aug. 17, 1978	1410	1.0	26.5	28.0
Sept. 1, 1978	0935	.56	26.0	28.0
Sept. 14, 1978	0935	1.2	26.0	28.0
Oct. 13, 1978	0905	2.8	26.0	28.0
May 13, 1979	0925	6.3	25.0	25.5

Table 52. Water temperatures and instantaneous discharges at Pou Stream, Moen

Date	Time	Instantaneous discharge (ft^3/s)	Water temperature (^oC)
Nov. 22, 1968	1505	0.30	31.5
Dec. 28, 1968	1415	.13	29.5
Feb. 2, 1969	1110	.02	28.0
June 6, 1969	0850	.12	26.5
June 18, 1969	0920	.04	26.5
Apr. 17, 1970	0940	.08	27.0
Apr. 30, 1970	1035	.31	26.0
May 13, 1970	1515	.32	27.0

Table 53. Water and air temperatures and instantaneous discharges at Nachiponong Stream, Moen

Date	Time	Instantaneous discharge (ft^3/s)	Water temperature (^oC)	Air temperature (^oC)
May 15, 1968	1415	0.13	28.0	--
May 21, 1968	1430	.06	28.0	--
June 4, 1968	1050	.13	28.0	--
June 26, 1968	1010	.19	28.0	--
July 18, 1968	0855	.13	28.0	--
Aug. 7, 1968	1000	.18	32.0	--
Aug. 29, 1968	0940	.16	28.0	--
Sept. 19, 1968	1430	.13	28.5	--
Oct. 8, 1968	0955	.18	29.5	--
Oct. 24, 1968	0955	.12	30.0	--
Nov. 23, 1968	1025	.20	31.0	--
Dec. 28, 1968	1130	.32	29.5	--
Jan. 23, 1969	1340	.22	29.5	--
Jan. 27, 1969	1300	.02	27.0	--
Feb. 11, 1969	1130	.02	28.0	--
Feb. 25, 1969	1100	.01	26.5	--
Mar. 12, 1969	0910	.01	26.5	--
Apr. 21, 1969	1100	.01	29.5	--
May 20, 1969	0820	.17	29.5	--
June 3, 1969	1000	.47	27.0	--
June 20, 1969	1215	.37	27.0	--
Jan. 16, 1970	0935	.25	25.5	--
Jan. 29, 1970	1455	.75	26.0	--
Feb. 12, 1970	0905	.10	26.0	--
Mar. 12, 1970	0915	.30	26.0	--
Mar. 24, 1970	1355	.09	27.0	--
Apr. 17, 1970	0850	.10	27.0	--
Apr. 30, 1970	0925	.27	26.0	--
May 14, 1970	1020	.48	26.0	--
June 29, 1970	1140	.73	26.0	--
Aug. 6, 1970	1125	.25	26.0	--
Aug. 26, 1970	1115	.26	26.0	--
Sept. 17, 1970	1115	.10	27.0	--
Oct. 1, 1970	1120	1.4	25.0	--
Nov. 2, 1970	1050	.25	27.0	--
Nov. 17, 1970	1550	.58	26.0	--
Dec. 3, 1970	1145	.29	26.0	--
Jan. 7, 1971	1530	.95	25.0	--
Jan. 20, 1971	1130	.91	26.0	--
Feb. 3, 1971	1105	.06	27.0	--
Feb. 17, 1971	1210	.12	27.0	--
Mar. 5, 1971	0915	.08	26.0	--
Mar. 26, 1971	1405	.10	27.0	--
Apr. 23, 1971	1545	.54	27.0	--

Table 53. Water and air temperatures and instantaneous discharges at Nachiponong Stream, Moen--Continued

Date	Time	Instantaneous discharge (ft^3/s)	Water temperature (^oC)	Air temperature (^oC)
May 13, 1971	0945	0.70	26.0	--
June 14, 1971	1445	1.1	26.0	--
July 8, 1971	1445	.36	26.0	--
Aug. 31, 1971	1015	.24	26.0	--
Oct. 15, 1971	1045	.36	26.0	--
Nov. 9, 1971	1200	.28	26.0	--
Dec. 4, 1971	0815	.10	26.0	--
Dec. 20, 1971	1435	.09	26.0	--
Jan. 10, 1972	1335	.12	27.0	--
Jan. 28, 1972	1700	.93	26.0	--
Feb. 10, 1972	1420	.64	25.0	--
Mar. 7, 1972	1415	.23	26.0	--
Apr. 10, 1972	1525	.19	26.0	--
May 10, 1972	1425	.38	27.0	--
July 11, 1972	1515	.58	27.0	--
Aug. 10, 1972	1430	.70	26.0	--
Sept. 18, 1972	1130	.59	26.0	--
Oct. 13, 1972	1520	.20	27.0	--
Nov. 10, 1972	1520	.07	27.0	--
Dec. 11, 1972	1450	.08	27.0	--
Dec. 28, 1972	0940	.22	26.0	--
Jan. 22, 1973	1530	.03	26.0	--
Feb. 15, 1973	1145	.03	27.0	--
May 6, 1974	1425	.12	29.0	32.0
May 20, 1974	1120	.90	28.0	25.0
June 19, 1974	0935	.37	29.0	30.0
Oct. 7, 1974	1530	1.9	25.5	26.5
Nov. 6, 1974	1355	.79	26.0	29.0
Dec. 3, 1974	1125	1.1	26.5	28.5
Dec. 17, 1974	1450	1.0	25.0	27.0
Dec. 27, 1974	1455	.20	26.0	27.5
Jan. 3, 1975	1145	.95	26.0	28.0
Jan. 20, 1975	1005	.03	25.0	27.0
Jan. 28, 1975	1540	.02	25.5	27.0
Feb. 20, 1975	1200	.03	26.0	27.5
Mar. 18, 1975	0925	.02	26.0	28.0
Mar. 31, 1975	1115	.94	25.5	27.5
Apr. 30, 1975	0950	.03	26.0	27.5
May 13, 1975	0945	.04	26.0	27.5
June 2, 1975	1320	.24	26.0	28.0
June 12, 1975	0910	.19	26.0	28.0
June 19, 1975	1035	.85	26.0	28.0
June 30, 1975	0900	.74	26.0	28.0
July 8, 1975	1425	.23	26.0	27.5

Table 53. Water and air temperatures and instantaneous discharges at Nachiponong Stream, Moen--Continued

Date	Time	Instantaneous discharge (ft^3/s)	Water temperature (^oC)	Air temperature (^oC)
July 15, 1975	0935	0.17	26.0	28.0
July 30, 1975	1045	.30	26.0	28.0
Aug. 18, 1975	0950	.74	26.0	28.0
Aug. 30, 1975	0855	.17	25.0	27.5
Oct. 1, 1975	0930	.57	25.0	27.5
Oct. 7, 1975	1440	.52	26.0	28.5
Oct. 28, 1975	0955	.66	25.0	27.5
Nov. 17, 1975	0950	.58	25.0	26.5
Dec. 1, 1975	1035	.13	26.0	28.0
Dec. 15, 1975	0945	.20	25.0	27.5
Dec. 29, 1975	1410	.11	27.0	28.5
Jan. 14, 1976	1110	.05	26.0	28.0
Feb. 4, 1976	0940	.37	26.0	28.0
Feb. 10, 1976	0900	.18	27.0	28.0
Mar. 2, 1976	1345	.19	25.0	27.5
Mar. 16, 1976	0930	.06	26.0	28.0
Mar. 29, 1976	1015	.40	26.0	28.0
Apr. 14, 1976	0930	.36	26.0	28.0
Apr. 30, 1976	1430	.12	25.0	28.0
May 14, 1976	0930	.38	25.5	28.0
June 2, 1976	1445	.20	27.0	28.0
June 16, 1976	1320	.11	26.0	28.0
June 30, 1976	1245	.06	25.5	28.0
Sept. 9, 1976	0950	.09	25.0	28.0
Oct. 6, 1976	0930	.16	25.5	28.0
Oct. 7, 1976	1020	.16	26.0	28.0
Oct. 14, 1976	0950	.21	26.0	28.0
Dec. 1, 1976	0900	.10	26.0	28.0
Dec. 14, 1976	1530	.17	26.0	28.0
Jan. 3, 1977	0955	.15	26.0	28.0
Jan. 30, 1977	0930	.05	25.5	28.0

Table 54. Water temperatures and instantaneous discharges at Nefounumas Spring, Moen

Date	Time	Instantaneous discharge (ft^3/s)	Water temperature (^oC)
Nov. 23, 1968	--	0.30	29.5
Dec. 28, 1968	--	.22	29.5
Jan. 23, 1969	1405	.14	28.5
June 3, 1969	1015	.09	26.5
June 20, 1969	1235	.22	26.5

Table 55. Water and air temperatures and instantaneous discharges at Echapachik Stream, Tol

Date	Time	Instantaneous discharge (ft^3/s)	Water temperature (^oC)	Air temperature (^oC)
May 23, 1968	1100	0.18	27.0	--
June 6, 1968	1050	.05	28.0	--
June 24, 1968	0935	.13	27.0	--
July 22, 1968	0945	.22	27.0	--
Aug. 6, 1968	1020	.16	28.0	--
Aug. 26, 1968	1015	.10	29.5	--
Sept. 16, 1968	1020	.13	29.0	--
Oct. 10, 1968	0920	.14	30.0	--
Oct. 22, 1968	0955	.12	29.5	--
Nov. 22, 1968	1030	.47	29.5	--
Dec. 17, 1968	1050	.06	26.5	--
Jan. 20, 1969	1235	.25	29.5	--
Apr. 17, 1969	1040	.01	25.5	--
June 4, 1969	1150	.09	29.0	--
Feb. 10, 1970	1115	.12	26.0	--
Mar. 3, 1970	1135	.16	27.0	--
Mar. 20, 1970	1230	.06	27.0	--
Apr. 2, 1970	1150	.06	28.0	--
Apr. 16, 1970	1205	.24	28.0	--
May 11, 1970	1020	.81	26.0	--
July 10, 1970	1115	.10	27.0	--
July 24, 1970	1020	.12	26.0	--
Aug. 14, 1970	1205	.36	27.0	--
Sept. 15, 1970	1000	.06	27.0	--
Oct. 2, 1970	1025	1.1	25.0	--
Nov. 13, 1970	1235	.34	27.0	--
Nov. 17, 1970	1100	.33	26.0	--
Dec. 18, 1970	1105	.19	26.0	--

Table 55. Water and air temperatures and instantaneous discharges at Echapachik Stream, Tol--Continued

Date	Time	Instantaneous discharge (ft^3/s)	Water temperature (^oC)	Air temperature (^oC)
Jan. 15, 1971	1040	0.34	27.0	--
Jan. 29, 1971	1110	.07	27.0	--
Feb. 12, 1971	1115	.20	27.0	--
Mar. 4, 1971	1135	.53	26.0	--
Mar. 23, 1971	1020	.14	27.0	--
Apr. 19, 1971	1040	.21	27.0	--
May 27, 1971	1100	.35	27.0	--
June 18, 1971	1010	.20	26.0	--
Aug. 27, 1971	1215	.24	27.0	--
Oct. 13, 1971	1130	.15	26.0	--
Nov. 8, 1971	1215	.06	27.0	--
Dec. 7, 1971	1215	.12	26.0	--
Dec. 21, 1971	1025	.07	27.0	--
Jan. 14, 1971	1110	.06	27.0	--
Feb. 17, 1972	1115	.11	27.0	--
Mar. 1, 1972	1155	.12	26.0	--
Mar. 29, 1972	1135	.10	27.0	--
Apr. 11, 1972	1125	.60	26.0	--
Apr. 28, 1972	1030	.45	26.0	--
May 24, 1972	1045	.26	26.0	--
July 21, 1972	1120	.48	26.0	--
Sept. 22, 1972	1135	.20	27.0	--
Oct. 19, 1972	0930	.10	27.0	--
Nov. 3, 1972	1100	.10	27.0	--
Nov. 16, 1972	1025	.12	26.0	--
Nov. 30, 1972	1025	1.2	26.0	--
Jan. 4, 1973	1200	.16	26.0	--
Jan. 23, 1973	1115	.02	26.0	--
Apr. 25, 1974	1140	3.7	25.0	26.0
May 6, 1974	0950	.08	27.0	30.0
May 23, 1974	1105	.56	34.0	32.0
June 6, 1974	1210	.40	28.5	29.0
June 24, 1974	1105	.14	30.0	29.0
Aug. 14, 1974	1105	.39	27.5	27.0
Nov. 19, 1974	1100	.58	24.0	28.0
Jan. 6, 1975	1100	.34	26.0	28.0
Feb. 5, 1975	1050	.02	24.0	25.5
Apr. 3, 1975	1100	.02	26.0	28.0
Apr. 17, 1975	1010	.04	26.0	27.0
July 10, 1975	1015	1.4	25.0	26.5
July 17, 1975	1050	.05	26.0	28.5
July 28, 1975	1055	.03	26.0	28.5
Aug. 25, 1975	1120	.09	26.0	28.0
Sept. 2, 1975	1050	.05	26.0	28.0
Oct. 8, 1975	1030	.48	26.0	27.5

Table 56. Water and air temperatures and instantaneous discharges at Afeibung Stream, Tol

Date	Time	Instantaneous discharge (ft^3/s)	Water temperature (^oC)	Air temperature (^oC)
Dec. 17, 1968	1120	0.24	27.0	--
Jan. 20, 1969	1300	.15	28.5	--
Jan. 29, 1969	1430	.02	28.0	--
June 4, 1969	1210	.05	26.5	--
Mar. 20, 1970	1310	.04	27.0	--
Apr. 2, 1970	1215	.02	28.0	--
Apr. 16, 1970	1235	.02	28.0	--
May 11, 1970	1050	.11	26.0	--
July 10, 1970	1135	.09	27.0	--
Sept. 15, 1970	1025	.04	27.0	--
Nov. 17, 1970	1130	.29	26.0	--
Jan. 29, 1971	1030	.05	27.0	--
Feb. 23, 1971	1045	.08	27.0	--
May 23, 1974	1125	.48	30.5	29.0
June 6, 1974	1030	.42	28.0	29.0
June 24, 1974	1345	.41	29.0	28.0
Apr. 17, 1975	1030	.04	25.5	27.0
July 10, 1975	1055	1.2	26.0	28.0
July 17, 1975	1135	.08	27.0	28.0
Sept. 2, 1975	1155	.07	26.0	28.0
Oct. 8, 1975	0950	.36	25.0	26.0

Table 57. Water and air temperatures and instantaneous discharges at Chun Stream, Dublon Island

Date	Time	Instantaneous discharge (ft^3/s)	Water temperature (^oC)	Air temperature (^oC)
May 24, 1968	0920	0.06	28.0	--
June 6, 1968	1530	.09	28.5	--
June 24, 1968	1510	.18	28.0	--
July 22, 1968	1150	.15	28.5	--
Aug. 5, 1968	1225	.16	28.0	--
Aug. 27, 1968	1320	.09	28.5	--
Sept. 17, 1968	1025	.10	28.0	--
Oct. 10, 1968	1345	.13	28.5	--
Oct. 21, 1968	1445	.12	28.5	--
Dec. 16, 1968	1330	.32	27.0	--
Jan. 29, 1969	1125	.09	28.0	--
Feb. 13, 1969	1415	.05	25.5	--
Feb. 27, 1969	1530	.02	25.5	--
Mar. 11, 1969	1310	.01	26.5	--
Apr. 16, 1969	1240	.04	26.5	--
May 6, 1969	1040	.01	26.5	--
June 5, 1969	1250	.12	28.5	--
Jan. 7, 1970	1345	.47	25.5	--
Jan. 23, 1970	1250	.30	26.0	--
Jan. 30, 1970	1305	.20	26.0	--
Mar. 13, 1970	1015	.23	27.0	--
Mar. 27, 1970	1420	.15	26.0	--
Apr. 13, 1970	1250	.19	26.0	--
May 5, 1970	1500	.20	27.0	--
July 7, 1970	1230	.41	26.0	--
July 22, 1970	1145	.24	27.0	--
Aug. 4, 1970	1300	.20	27.0	--
Aug. 28, 1970	1005	.22	27.0	--
Sept. 18, 1970	1145	.24	27.0	--
Oct. 21, 1970	1425	3.1	26.0	--
Dec. 16, 1970	1335	.40	26.0	--
Dec. 31, 1970	1010	.22	26.0	--
Jan. 7, 1971	1000	.80	26.0	--
Jan. 22, 1971	1025	.23	27.0	--
Feb. 5, 1971	1155	.28	27.0	--
Feb. 19, 1971	1025	.22	26.0	--
Mar. 12, 1971	1245	.21	26.0	--
Apr. 8, 1971	1245	.97	26.0	--
May 5, 1971	1535	.55	26.0	--
June 4, 1971	1255	.72	27.0	--
June 30, 1971	0940	.60	27.0	--
July 16, 1971	1145	.54	27.0	--
Aug. 26, 1971	1455	.20	27.0	--
Nov. 2, 1971	1505	.56	26.0	--

Table 57. Water and air temperatures and instantaneous discharges at Chun Stream, Dublon Island--Continued

Date	Time	Instantaneous discharge (ft^3/s)	Water temperature (^oC)	Air temperature (^oC)
Nov. 18, 1971	1420	0.13	27.0	--
Dec. 9, 1971	1200	.09	27.0	--
Dec. 22, 1971	1400	.25	26.0	--
Jan. 12, 1972	1440	.11	27.0	--
Jan. 28, 1972	0950	.95	26.0	--
Feb. 23, 1972	1400	.25	26.0	--
Mar. 15, 1972	1435	.74	26.0	--
Apr. 4, 1972	1340	.29	26.0	--
Apr. 20, 1972	1305	.44	27.0	--
June 14, 1972	1210	.17	27.0	--
July 18, 1972	1535	.36	27.0	--
Oct. 12, 1972	1310	.18	27.0	--
Oct. 27, 1972	1455	.17	26.0	--
Nov. 23, 1972	1445	.18	26.0	--
Dec. 14, 1972	1100	.10	26.0	--
Jan. 9, 1973	1400	.10	27.0	--
Jan. 22, 1973	1110	.10	26.0	--
Feb. 28, 1973	1445	.03	27.0	--
Apr. 26, 1974	1300	.64	27.0	31.0
May 10, 1974	1230	.19	28.0	29.0
June 12, 1974	1405	.50	29.0	30.0
June 18, 1974	1225	.38	27.0	28.0
July 10, 1974	1155	1.1	25.0	--
Nov. 7, 1974	1130	1.2	25.5	26.0
Jan. 11, 1975	1000	.14	25.5	27.5
Jan. 21, 1975	0910	.03	26.0	28.0
Feb. 4, 1975	0955	.02	26.0	28.0
Feb. 11, 1975	1020	.04	26.0	28.0
Mar. 12, 1975	0940	.02	25.0	28.0
Apr. 1, 1975	1000	.97	25.5	27.5
Apr. 16, 1975	1615	.09	26.0	27.0
May 5, 1975	1145	.14	25.0	27.5
May 22, 1975	1250	.17	26.0	27.5
May 30, 1975	1300	.26	26.0	27.0
June 17, 1975	1125	1.9	26.0	28.0
July 9, 1975	1200	.31	25.5	27.0
Aug. 4, 1975	1220	.16	26.0	27.5
Aug. 21, 1975	1155	.35	26.0	28.0
Sept. 4, 1975	1255	.16	25.0	27.5
Oct. 9, 1975	1150	1.1	25.0	28.0
Oct. 17, 1975	1030	.30	25.0	28.0
Nov. 18, 1975	1255	.21	25.0	28.0
Dec. 3, 1975	1200	.12	26.0	28.0
Dec. 16, 1975	1135	.19	26.0	28.0

Table 57. Water and air temperatures and instantaneous discharges at Chun Stream, Dublon Island--Continued

Date	Time	Instantaneous discharge (ft^3/s)	Water temperature (^oC)	Air temperature (^oC)
Jan. 5, 1976	1600	0.06	26.0	28.0
Feb. 3, 1976	1155	.92	26.5	28.0
Mar. 1, 1976	1305	.21	27.0	28.0
Mar. 15, 1976	1300	.07	26.0	28.0
Mar. 30, 1976	1140	.25	25.0	27.5
Apr. 20, 1976	1220	.97	25.0	27.5
Apr. 29, 1976	1020	.18	26.0	28.0
May 25, 1976	1345	.26	25.0	28.0
June 1, 1976	1240	.14	26.0	28.0
June 14, 1976	1145	.05	25.0	28.0
June 29, 1976	1150	.13	25.0	28.0
Sept. 1, 1976	1220	.11	26.0	28.0
Oct. 18, 1976	1200	.23	26.0	28.0
Nov. 1, 1976	1120	.07	26.0	28.0
Nov. 23, 1976	1200	.08	25.0	28.0
Dec. 13, 1976	1200	.08	25.5	28.0
Jan. 21, 1977	1015	.10	25.5	28.0
Feb. 10, 1977	0945	.11	26.0	28.0
Mar. 1, 1977	0955	.14	26.0	28.0
Mar. 9, 1977	1300	.23	27.0	27.5
May 3, 1977	1145	.68	26.0	28.0
June 23, 1977	1415	.22	26.0	28.0
July 28, 1977	1405	.33	26.5	28.0
Aug. 10, 1977	1110	.17	25.5	28.0
Sept. 7, 1977	1420	.69	27.5	28.0
Oct. 26, 1977	1320	.39	26.0	28.0
Dec. 7, 1977	0920	.30	26.0	28.0
Jan. 12, 1978	1035	.06	25.0	28.5
Feb. 9, 1978	1025	.08	26.0	28.0
Feb. 16, 1978	0945	.06	26.0	28.0
June 5, 1978	1215	.62	27.0	28.0
July 10, 1978	1255	.16	26.0	28.0
July 17, 1978	1325	.16	26.0	28.0
Aug. 4, 1978	1245	.27	26.5	28.0
Sept. 20, 1978	1150	.22	26.0	28.0

Table 58. Water temperatures and instantaneous discharges at Fansinifo Stream, Dublon Island

Date	Time	Instantaneous discharge (ft^3/s)	Water temperature (^oC)
Jan. 20, 1969	0945	0.36	28.5
Apr. 16, 1969	1120	.01	26.5
May 6, 1969	1350	.01	25.5
June 5, 1969	1010	.08	26.5
Jan. 30, 1970	1100	.12	26.0
Apr. 13, 1970	1045	.07	26.0
May 5, 1970	1350	.07	27.0
July 7, 1970	1020	.13	26.0
July 22, 1970	1030	.06	27.0
Dec. 30, 1970	1200	.18	26.0

Table 59. Water and air temperatures and instantaneous discharges at Tumunu Stream, Dublon Island

Date	Time	Instantaneous discharge (ft^3/s)	Water temperature (^oC)	Air temperature (^oC)
May 23, 1968	0930	0.22	29.5	--
June 6, 1968	1415	.19	29.5	--
June 24, 1968	1405	.26	26.5	--
July 22, 1968	1330	.34	28.0	--
Aug. 5, 1968	0925	1.4	29.5	--
Aug. 27, 1968	0945	.40	29.0	--
Sept. 17, 1968	1215	.35	29.5	--
Oct. 10, 1968	1145	.12	28.5	--
Oct. 21, 1968	1000	.17	32.0	--
Nov. 21, 1968	1140	1.0	30.0	--
Dec. 16, 1968	1110	.10	26.5	--
Jan. 20, 1968	0930	.37	28.5	--
Jan. 29, 1968	0830	.14	25.5	--
Feb. 13, 1969	1125	.05	25.0	--
Feb. 27, 1969	1400	.02	26.5	--
Mar. 11, 1969	1100	.01	27.0	--
Mar. 19, 1969	1000	.01	27.0	--
Apr. 16, 1969	1100	.01	26.5	--
May 6, 1969	1300	.01	26.5	--
June 5, 1969	0945	.24	28.0	--
Jan. 7, 1970	1100	1.2	26.0	--

Table 59. Water and air temperatures and instantaneous discharges at Tumunu Stream, Dublon Island--Continued

Date	Time	Instantaneous discharge (ft^3/s)	Water temperature (^oC)	Air temperature (^oC)
Jan. 23, 1970	1030	0.49	26.0	--
Jan. 30, 1970	1020	.38	26.0	--
Feb. 25, 1970	1350	.99	27.0	--
Mar. 13, 1970	1220	.33	27.0	--
Mar. 27, 1970	1030	.20	26.0	--
Apr. 13, 1970	1020	.33	26.0	--
May 5, 1970	1320	.22	27.0	--
July 7, 1970	1000	.84	26.0	--
July 22, 1970	1015	.26	27.0	--
Aug. 4, 1970	1035	.30	26.0	--
Aug. 28, 1970	1215	.37	27.0	--
Sept. 18, 1970	0915	.30	27.0	--
Oct. 21, 1970	1220	5.3	25.0	--
Dec. 16, 1970	1045	.84	26.0	--
Dec. 30, 1970	1025	.39	26.0	--
Jan. 7, 1971	1225	2.1	26.0	--
Jan. 22, 1971	1315	.24	27.0	--
Feb. 5, 1971	1010	.45	27.0	--
Feb. 19, 1971	1230	.48	26.0	--
Mar. 12, 1971	1055	.32	26.0	--
Apr. 8, 1971	1100	2.6	26.0	--
May 5, 1971	1420	1.3	26.0	--
June 4, 1971	1035	1.8	26.0	--
June 30, 1971	1215	.89	27.0	--
July 16, 1971	1005	.94	27.0	--
Aug. 26, 1971	1130	.37	27.0	--
Oct. 8, 1971	1200	1.9	27.0	--
Nov. 2, 1971	1100	1.1	26.0	--
Nov. 18, 1971	1020	.19	27.0	--
Dec. 9, 1971	1020	.11	26.0	--
Dec. 22, 1971	1145	.72	26.0	--
Jan. 12, 1972	1050	.17	27.0	--
Feb. 23, 1972	1050	.51	26.0	--
Mar. 15, 1972	1300	2.1	26.0	--
Apr. 4, 1972	1100	.48	26.0	--
Apr. 20, 1972	1040	1.5	27.0	--
May 18, 1972	1025	.86	27.0	--
June 14, 1972	1030	.88	27.0	--
July 18, 1972	1050	.84	27.0	--
Oct. 12, 1972	1100	.57	27.0	--
Oct. 27, 1972	1250	.32	27.0	--
Nov. 23, 1972	1425	.60	26.0	--
Dec. 14, 1972	0950	.32	26.0	--
Jan. 22, 1972	0950	.13	26.0	--

Table 59. Water and air temperatures and instantaneous discharges at Tumunu Stream, Dublon Island--Continued

Date	Time	Instantaneous discharge (ft^3/s)	Water temperature (^oC)	Air temperature (^oC)
Feb. 8, 1973	1040	0.13	27.0	--
Feb. 28, 1973	1225	.04	27.0	--
May 10, 1974	1045	.22	27.0	29.0
May 24, 1974	1230	.97	31.5	30.0
June 18, 1974	1050	.89	28.5	29.0
July 10, 1974	1020	.92	26.0	--
Nov. 7, 1974	1000	2.9	25.0	26.5
Dec. 2, 1974	1045	1.4	25.5	27.0
Jan. 11, 1975	1115	.42	25.5	27.0
Jan. 21, 1975	1025	.26	26.0	28.0
Feb. 4, 1975	1220	.08	26.0	27.5
Feb. 11, 1975	1200	.10	26.0	28.0
Mar. 12, 1975	1100	.10	26.0	28.0
Apr. 1, 1975	1200	.28	26.0	28.0
Apr. 16, 1975	1500	.09	26.0	27.0
May 5, 1975	1010	.26	26.0	27.5
May 22, 1975	1035	.57	26.0	28.0
May 30, 1975	1135	.30	26.0	27.5
June 17, 1975	1030	2.4	26.0	28.0
July 9, 1975	1015	.88	26.0	27.0
Aug. 4, 1975	1040	.29	26.0	28.0
Aug. 21, 1975	1055	.54	26.0	28.0
Sept. 4, 1975	1100	.37	25.0	27.5
Oct. 3, 1975	1205	.84	25.0	27.5
Oct. 9, 1975	0955	4.3	26.0	27.5
Oct. 17, 1975	1155	1.3	26.0	28.5
Nov. 18, 1975	1025	.30	25.0	27.5
Dec. 3, 1975	1104	.41	26.0	28.0
Dec. 16, 1975	1000	.29	25.0	27.5
Jan. 5, 1976	1300	.26	27.0	28.0
Jan. 21, 1976	1100	.56	25.0	27.5
Feb. 3, 1976	1005	1.6	25.0	28.0
Mar. 1, 1976	1030	.53	27.0	28.0
Mar. 15, 1976	1105	.19	27.0	28.0
Apr. 20, 1976	1050	2.4	25.0	28.0
Apr. 29, 1976	1145	.43	26.0	28.0
May 25, 1976	1125	.96	25.0	28.0
June 1, 1976	1055	.90	27.0	28.0
June 14, 1976	1040	.21	25.0	27.5
June 29, 1976	1025	.25	26.0	28.0
July 7, 1976	1005	.35	25.0	27.5
Sept. 1, 1976	1120	.22	25.5	28.0
Oct. 18, 1976	1015	.45	26.0	28.0
Nov. 1, 1976	0940	.61	26.0	28.0

Table 59. Water and air temperatures and instantaneous discharges at Tumunu Stream, Dublon Island--Continued

Date	Time	Instantaneous discharge (ft^3/s)	Water temperature (^oC)	Air temperature (^oC)
Nov. 23, 1976	1015	0.47	26.0	28.0
Dec. 13, 1976	1100	.50	26.0	28.0
Jan. 20, 1977	1210	.12	26.5	28.0
Feb. 10, 1977	1105	.16	25.0	28.0
Mar. 1, 1977	1110	.20	26.0	28.0
Mar. 9, 1977	1105	.17	26.5	25.0
May 3, 1977	1020	.25	25.5	28.0
June 23, 1977	1040	.29	26.0	28.0
July 28, 1977	1015	.31	26.0	28.0
Aug. 10, 1977	1000	.37	26.0	28.0
Sept. 7, 1977	1130	1.1	26.0	28.0
Oct. 26, 1977	1055	.91	25.5	28.0
Dec. 7, 1977	1050	.22	26.0	28.0
Jan. 12, 1978	1340	.04	26.0	28.0
Feb. 9, 1978	1145	.05	25.5	28.0
Feb. 16, 1978	1115	.04	26.5	28.0
June 5, 1978	1030	1.2	26.5	27.0
June 27, 1978	1045	1.5	26.0	28.0
July 10, 1978	1035	.14	26.0	28.0
July 17, 1978	1055	.13	26.0	28.0
Aug. 4, 1978	1120	1.6	26.0	28.0
Sept. 20, 1978	0945	.29	25.5	28.0

Chemical Analyses

Surface water

Table 60. Chemical analyses of surface water, 1953 and 1957

[Units in parts per million]

1953 analysis by U.S. Geological Survey, Salt Lake City, Utah;
1957 analyses by Navy Public Works, Guam.

Source: "Military Geology of Truk Islands, Caroline Islands, Water Resources Supplement" (Valenciano and Takasaki, 1959).

Constituents	Tumunu Stream, Dublon Island Feb. 23, 1953	Pou Stream catchment, Moen June 14, 1957	Echapachik Stream, Tol June 23, 1957
pH	7.0	7.3	7.1
Temperature (°C) when sampled	--	26	26
Total hardness as ($CaCO_3$)	40	25	32
Calcium (Ca)	8.4	5.4	8
Magnesium (Mg)	4.6	2.9	2.9
Sodium (Na)	8.1	--	--
Sodium and potassium (Na+K)	--	12	7
Potassium (K)	.9	--	--
Bicarbonate (HCO_3)	51	37	32
Alkalinity as $CaCO_3$	42	30	26
Carbon dioxide (CO_2)	--	3	4
Sulfate (SO_4)	2.6	0	3.7
Chloride (Cl)	8	15	12
Silica (SiO_2)	26	15	18
Total dissolved solids	73	100	60
Phosphate (PO_4)	--	1/ 11	1/ 10
Aluminum (Al)	--	0	0
Iron (Fe)	.18	0	.1
Manganese (Mn)	--	0	0

1/ Appears high, but listed as reported.

Table 61. Chemical analyses of surface water on Moen, December 15, 1966

Source: Austin, Smith and Assoc., 1967.

Constituents	Units	Wichen River at alt. 18 m	Nachi-ponong Stream	Nefou-numas Spring	Pou Stream catch-ment
pH	--	6.9	7.0	6.0	7.0
Temperature, water	°C	25	25	22	25
Hardness as $CaCO_3$	mg/L	22	22	153	39
Calcium, dissolved (Ca)	mg/L	2.6	2.6	4.8	2.6
Magnesium, dissolved (Mg)	mg/L	3.7	3.7	34	7.9
Carbon dioxide (CO_2)	mg/L	26	38	26	18
Sulfate, dissolved (SO_4)	mg/L	0	1.6	--	0
Chloride, dissolved (Cl)	mg/L	10	16	24	14
Fluoride, dissolved (F)	mg/L	.1	.1	.1	.1
Solids, dissolved, sum of constituents	mg/L	220	368	130	310
Iron, dissolved (Fe)	µg/L	88	33	41	76

Table 62. Chemical analysis of water from Principal's Spring, Tol

[Lat 7°20'20" N., long 151°38'01" E., altitude, 450 ft.

Analyzed by U.S. Geological Survey, Honolulu, Hawaii]

Constituents	Units	12-15-71
Time	--	0930
Specific conductance	µmho	66
pH	--	6.3
Hardness as $CaCO_3$	mg/L	1.7
Noncarbonate hardness	mg/L	0
Calcium, dissolved (Ca)	mg/L	3.9
Magnesium, dissolved (Mg)	mg/L	1.8
Sodium, dissolved (Na)	mg/L	5.6
Potassium, dissolved (K)	mg/L	.8
Bicarbonate (HCO_3)	mg/L	24
Carbonate (CO_3)	mg/L	0
Alkalinity, total as $CaCO_3$	mg/L	20
Sulfate, dissolved (SO_4)	mg/L	1.6
Chloride, dissolved (Cl)	mg/L	7.0
Fluoride, dissolved (F)	mg/L	0
Silica, dissolved (SiO_2)	mg/L	18
Solids, dissolved, sum of constituents	mg/L	51
Nitrate, as NO_3	mg/L	.5
Phosphate, ortho, dissolved (PO_4)	mg/L	.23

Table 63. Chemical analyses of water from Wichen River at altitude 55 m, Moen

[U.S. Geological Survey]

Constituents	Units	5-13-79	10-31-79	5-5-80	11-18-80
Time	--	1200	1230	1530	1630
Discharge, instantaneous	ft^3/s	3.0	3.3	8.1	0.3
Specific conductance	µmho	44	40	52	52
pH	--	6.7	7.3	7.0	6.9
Temperature, water	°C	25.0	26.0	26.5	27.0
Oxygen, dissolved	mg/L	8.0	7.6	8.1	7.4
Hardness as $CaCO_3$	mg/L	--	7	9	11
Noncarbonate hardness	mg/L	--	2	0	1
Calcium, dissolved (Ca)	mg/L	--	1.4	1.7	2.2
Magnesium, dissolved (Mg)	mg/L	--	.9	1.1	1.4
Sodium, dissolved (Na)	mg/L	--	4.6	5.1	6.0
Percent sodium	percent	--	73	54	53
Sodium adsorption ratio	--	--	.7	.8	.8
Potassium, dissolved (K)	mg/L	--	.2	.4	.2
Alkalinity, total as $CaCO_3$	mg/L	12	5	9	10
Sulfate, dissolved (SO_4)	mg/L	--	5.0	1.3	1.1
Chloride, dissolved (Cl)	mg/L	--	6.3	7.4	5.8
Fluoride, dissolved (F)	mg/L	--	.1	.1	.1
Silica, dissolved (SiO_2)	mg/L	--	10	11	16
Solids, dissolved, sum of constituents	mg/L	--	32	34	39
Solids, dissolved, ton per acre foot	ton/ac-ft	--	.04	.05	.05
Nitrite plus nitrate, dissolved as N	mg/L	0	.04	.07	.06
Iron, dissolved (Fe)	µg/L	--	130	150	130
Manganese, dissolved (Mn)	µg/L	--	9	8	10

Table 64. Chemical analyses of water from Wichen River at altitude 18 m, Moen

[U.S. Geological Survey]

Constituents	Units	5-13-79	10-31-79	5-5-80	11-18-80	4-16-81	11-11-81
Time	--	0930	1000	1200	1500	1230	1200
Discharge, instantaneous	ft^3/s	6.3	11	43	0.50	10	2.2
Specific conductance	µmho	44	39	75	58	63	36
pH	--	6.7	7.2	6.9	6.7	6.9	6.7
Temperature, water	°C	25.0	26.5	26.5	27.0	25.0	27.5
Turbidity	NTU	--	--	24	--	14	--
Oxygen, dissolved	mg/L	8.0	7.6	7.5	7.3	8.0	--
Hardness as $CaCO_3$	mg/L	11	8	8	12	11	11
Noncarbonate hardness	mg/L	8	1	0	1	4	3
Calcium, dissolved (Ca)	mg/L	3.2	1.4	1.5	2.3	2.3	2.4
Magnesium, dissolved (Mg)	mg/L	.7	1.0	1.0	1.4	1.3	1.3
Sodium, dissolved (Na)	mg/L	4.9	4.2	13	5.9	6.3	5.9
Percent sodium	percent	50	71	77	52	53	53
Sodium adsorption ratio	--	.6	.7	2.0	.8	.8	.8
Potassium, dissolved (K)	mg/L	0	.2	.5	.3	.8	.2
Alkalinity, total as $CaCO_3$	mg/L	3	7	23	11	7	8
Sulfate, dissolved (SO_4)	mg/L	2.3	5.3	2.0	.8	2.8	5.0
Chloride, dissolved (Cl)	mg/L	6.9	5.8	6.5	6.0	11	6.0
Fluoride, dissolved (F)	mg/L	.1	.1	.1	.1	.1	.1
Silica, dissolved (SiO_2)	mg/L	9.0	10	9.5	15	10	12
Solids, dissolved, sum of constituents	mg/L	29	33	48	39	39	39
Solids, dissolved, ton per acre foot	ton/ac-ft	.04	.04	.07	.05	--	--
Nitrite plus nitrate, dissolved as N	mg/L	0	.04	.07	.14	.02	.17
Iron, dissolved (Fe)	µg/L	70	170	150	180	160	120
Manganese, dissolved (Mn)	µg/L	10	7	8	10	6	10

Table 65. Chemical analysis of water from Nachiponong Stream, Moen

[U.S. Geological Survey]

Constituents	Units	9-16-82
Time	--	1258
Discharge, instantaneous	ft^3/s	0.34
Specific conductance	µmho	75
pH	--	6.8
Temperature, water	°C	27.5
Hardness as $CaCO_3$	mg/L	22
Noncarbonate hardness	mg/L	4
Calcium, dissolved (Ca)	mg/L	4.5
Magnesium, dissolved (Mg)	mg/L	2.7
Sodium, dissolved (Na)	mg/L	6.3
Percent sodium	percent	38
Sodium adsorption ratio	--	.6
Potassium, dissolved (K)	mg/L	.2
Alkalinity, total as $CaCO_3$	mg/L	18
Sulfate, dissolved (SO_4)	mg/L	< 5
Chloride, dissolved (Cl)	mg/L	14
Fluoride, dissolved (F)	mg/L	.4
Silica, dissolved (SiO_2)	mg/L	15
Nitrate, dissolved (NO_3)	mg/L	< .10
Iron, dissolved (Fe)	µg/L	44
Manganese, dissolved (Mn)	µg/L	4

Table 66. Chemical analyses of surface water from miscellaneous sites on Moen

[U.S. Geological Survey]

Constituents	Units	Pou Stream catchment[1/] 5-7-80	Pou Stream catchment[1/] 4-14-81	Pou Stream 16893900 (below catchment) 5-7-80	Faichia Stream[2/] 16894100 5-7-80
Time	--	1500	1000	1530	1000
Discharge, instantaneous	ft^3/s	0.18	0.002	0.19	0.03
Specific conductance	µmho	63	75	89	53
pH	--	7.3	7.4	7.4	7.5
Temperature, water	°C	--	29.0	28.5	27.5
Turbidity	NTU	7.4	12	4.3	6.5
Oxygen, dissolved	mg/L	--	7.6	8.0	--
Hardness as $CaCO_3$	mg/L	17	20	28	15
Noncarbonate hardness	mg/L	5	0	1	2
Calcium, dissolved (Ca)	mg/L	4.5	4.3	5.4	2.6
Magnesium, dissolved (Mg)	mg/L	1.3	2.2	3.5	2.1
Sodium, dissolved (Na)	mg/L	5.3	6.9	6.2	4.5
Percent sodium	percent	41	43	32	39
Sodium adsorption ratio	--	.6	.7	.5	.5
Potassium, dissolved (K)	mg/L	.2	.2	.2	.1
Alkalinity, total as $CaCO_3$	mg/L	12	25	29	13
Sulfate, dissolved (SO_4)	mg/L	.3	1.4	2.0	1.1
Chloride, dissolved (Cl)	mg/L	11	5.6	8.4	5.7
Fluoride, dissolved (F)	mg/L	.1	.1	.1	.1
Silica, dissolved (SiO_2)	mg/L	11	19	17	17
Solids, dissolved, sum of constituents	mg/L	41	55	60	42
Solids, dissolved, ton per acre foot	ton/ac-ft	.06	--	.08	.06
Nitrite plus nitrate, dissolved as N	mg/L	.06	.07	.23	.05
Iron, dissolved (Fe)	µg/L	140	130	80	310
Manganese, dissolved (Mn)	µg/L	3	3	3	2

[1/] At 6-inch intake at top of concrete reservoir.

[2/] Lat 7°25'28" N., long 151°50'27" E., 100 ft upstream from coast road at altitude 13 ft (from topographic map); drainage area: 0.05 mi^2.

Table 67. Chemical analyses of water from old wells 2 and 3, Moen

[Units in parts per million]

Constituents	Source	Old well 2	Old well 3
	Date collected	12-15-66	6-14-57
	Collected by	Austin, Smith, and Assoc.	USGS
	Analyzed by	Austin, Smith, and Assoc.	Navy P.W., Guam
pH		6.7	6.9
Temperature, water °C		25	28
Hardness as $CaCO_3$		85	--
Noncarbonate hardness		--	60
Calcium, dissolved (Ca)		13.4	13.7
Magnesium, dissolved (Mg)		12.5	--
Sodium, dissolved (Na)		--	6.3
Bicarbonate (HCO_3)		--	78
Alkalinity, total as $CaCO_3$		--	64
Carbon dioxide (CO_2)		38	14
Sulfate, dissolved (SO_4)		0	1.3
Chloride, dissolved (Cl)		20	12
Fluoride, dissolved (F)		.1	--
Silica, dissolved (SiO_2)		--	26
Solids, dissolved, sum of constituents		230	120
Phosphate (PO_4)		--	1/ 11
Iron, dissolved (Fe)		2/ .60	0
Manganese, dissolved (Mn)		--	0

1/ Appears high, but listed as published in "Military Geology of Truk Islands, Caroline Islands, Water Resources Supplement" (Valenciano and Takasaki, 1959).

2/ Presumed to be high because of deterioration of pump lost in the well some years ago.

Table 68. Chemical analyses of water from five wells on Moen, 1971

[Analyzed by U.S. Geological Survey (indicated by *) and by Layne International]

Constituents	Units	Well 1 2-28	Well 2 3-11	Well 3 2-28	Well 4 2-28	Well 6 2-28
Time	--	--	0800	--	--	--
Pumping rate	gal/min	--	93	--	--	--
Specific conductance	µmho	170	*191	173	172	172
pH	--	6.6	* [1/] 6.0	6.4	7.1	6.6
Temperature, water	°C	26.5	27.5	26.5	26.5	26.5
Hardness as $CaCO_3$	mg/L	60	*71	48	48	63
Noncarbonate hardness	mg/L	--	*19	--	--	--
Calcium, dissolved (Ca)	mg/L	--	*12	--	--	--
Magnesium, dissolved (Mg)	mg/L	--	*10	--	--	--
Sodium, dissolved (Na)	mg/L	--	8.9	--	--	--
Potassium, dissolved (K)	mg/L	--	* .8	--	--	--
Bicarbonate (HCO_3)	mg/L	86	*64	70	72	87
Carbonate (CO_3)	mg/L	--	* 0	--	--	--
Alkalinity, total as $CaCO_3$	mg/L	71	56	57	59	72
Carbon dioxide (CO_2)	mg/L	40	45	45	9	34
Sulfate, dissolved (SO_4)	mg/L	--	* 0	--	--	--
Chloride, dissolved (Cl)	mg/L	16	*25	23	22	15
Fluoride, dissolved (F)	mg/L	--	* .1	--	--	--
Silica, dissolved (SiO_2)	mg/L	--	*20	--	--	--
Solids, dissolved, sum of constituent	mg/L	127	148	136	138	126
Nitrate, as NO_3	mg/L	--	* 1.9	--	--	--
Aluminum (Al)	µg/L	--	*59	--	--	--
Iron, dissolved (Fe)	µg/L	--	*88	--	--	--
Manganese, dissolved (Mn)	µg/L	--	*10	--	--	--

[1/] Sample fixed with glacial acetic acid and formaldehyde.

Table 69. Chemical analyses of water from four wells on Moen, 1976

Source: Young and others, 1977.

Constituents	Units	Well 1	Well 7	Well 11	Well 16
Specific conductance -------	µmho	140	400	140	140
pH -------------------------	--	6.5	6.8	6.7	6.5
Temperature, water ---------	°C	30	30	29	29
Total coliform/100 ml ------	--	1	3	640	11
Hardness as $CaCO_3$ ----------	mg/L	103	222	104	120
Chloride (Cl) --------------	mg/L	15	12	13	6
Fluoride (F) ---------------	mg/L	.3	.3	.3	.2
Nitrate as N ---------------	mg/L	1	2	2	2

Table 70. Chemical analyses of water from well 1, Moen

Constituents	Units	Mean	Minimum	Maximum	Number of samples
Analyses by Water Resources Research Center, University of Guam, June 1979 to March 1980					
[Presented as reported by Austin, Tsutsumi and Associates, 1980]					
Specific conductivity	µmho	201	100	500	8
pH	--	6.37	5.80	6.69	9
Temperature, water	°C	27.6	26.7	28.4	9
Turbidity	NTU	.54	.32	1.00	9
Alkalinity, total as $CaCO_3$	mg/L	125	80	221	9
Free CO_2	mg/L	50	35	75	3
Sulfate (SO_4)	mg/L	1/ <1	--	--	1
Chloride (Cl)	mg/L	11.7	7.1	20.6	8
Total residue	mg/L	172	22	398	7
Total nonfilterable residue	mg/L	6.2	1.3	20	7
Nitrate nitrogen (N)	mg/L	2.81	.628	17.5	9
Total Kjeldahl nitrogen (N)	mg/L	.17	.096	.24	2
Total phosphorus (P)	mg/L	.13	.121	.136	3
Orthophosphate (PO_4)	mg/L	.12	.100	.147	9
Bacteriological data indicates contamination but is inconsistent and is, therefore, not presented (Austin, Tsutsumi and Associates, 1980).					
Local analyses (10/79-2/80), Public Works, Truk					
Total coliform	col/100 mL	12	9	15	5
Hardness as $CaCO_3$	mg/L	36	10	60	5
Chloride	mg/L	18.8	11.65	24.75	5

1/ Only one sample analyzed.

Table 71. Chemical analyses of water from well 7, Moen

Constituents	Units	Mean	Minimum	Maximum	Number of samples
Analyses by Water Resources Research Center, University of Guam, June 1979 to March 1980					
[Presented as reported by Austin, Tsutsumi, 1980]					
Specific conductivity	µmho	403	300	550	7
pH	--	6.56	5.95	7.01	9
Temperature, water	°C	27.9	26.7	29.7	8
Turbidity	NTU	34	.62	93	9
Alkalinity, total as $CaCO_3$	mg/L	283	124	371	9
Free CO_2	mg/L	140	100	160	3
Sulfate (SO_4)	mg/L	8.5 [1/]	--	--	1
Chloride (Cl)	mg/L	33.9	19.9	41.9	8
Total residue	mg/L	283	136	510	7
Total nonfilterable residue	mg/L	29.6	.8	104	9
Nitrate nitrogen (N)	mg/L	.25	.13	.444	8
Total Kjeldahl nitrogen (N)	mg/L	.19	.096	.28	2
Total phosphorus (P)	mg/L	.13	.07	.294	4
Orthophosphate (PO_4)	mg/L	.09	.021	.19	8
Local analyses (10/79-2/80) Public Works, Truk					
Total coliform	col/100 mL	13	0	25	
Hardness as $CaCO_3$	mg/L	175	33	250	5
Chloride	mg/L	141	33	337	5

[1/] Only one sample analyzed.

Table 72. Chemical analyses of water from well 9, Moen

Constituents	Units	Mean	Minimum	Maximum	Number of samples
Analyses by Water Resources Research Center, University of Guam, June 1979 to March 1980					
[Presented as reported by Austin, Tsutsumi, 1980]					
Specific conductivity	µmho	1,296	640	2,000	8
pH	--	6.45	5.80	7.30	10
Temperature, water	°C	28.0	27.2	29.5	10
Turbidity	NTU	13.1	.26	28.0	10
Alkalinity, total as $CaCO_3$	mg/L	198	88	407	10
Free CO_2	mg/L	90	60	140	3
Sulfate (SO_4)	mg/L	1/ 14.5	--	--	1
Chloride (Cl)	mg/L	212	46.9	373	9
Total residue	mg/L	634	340	860	8
Total nonfilterable residue	mg/L	83	1.1	443	10
Nitrate nitrogen (N)	mg/L	.73	.56	1.34	8
Nitrite nitrogen (N)	mg/L	.002	0	.005	6
Total Kjeldahl nitrogen (N)	mg/L	.18	.051	.31	2
Total phosphorus (P)	mg/L	.14	.065	.245	3
Orthophosphate (PO_4)	mg/L	.18	.04	.96	9
Local analyses (10/79-2/80), Public Works, Truk					
Total coliform	col/100 mL	TNTC	TNTC	TNTC	5
Hardness as $CaCO_3$	mg/L	194	180	240	5
Chloride	mg/L	186	41	223	5

1/ Only one sample analyzed.

TNTC - Too numerous to count.

Table 73. Chemical analyses of water from well 10, Moen

Constituents	Units	Mean	Minimum	Maximum	Number of samples
Analyses by Water Resources Research Center, University of Guam, June 1979 to March 1980					
[Presented as reported by Austin, Tsutsumi, 1980]					
Specific conductivity	µmho	203	60	330	8
pH	--	6.53	5.90	7.08	10
Temperature, water	°C	27.7	26.7	28.3	10
Turbidity	NTU	.9	.45	2.5	10
Alkalinity, total as $CaCO_3$	mg/L	128	61.2	226	10
Free CO_2	mg/L	37	17	50	4
Chloride (Cl)	mg/L	18.1	12.4	24.1	9
Total residue	mg/L	238	40	723	9
Total nonfilterable residue	mg/L	11.6	.8	62.2	10
Nitrate nitrogen (N)	mg/L	.31	.16	.915	9
Nitrite nitrogen (N)	mg/L	.001	0	.004	6
Total Kjeldahl nitrogen (N)	mg/L	.12	.072	.17	2
Total phosphorus (P)	mg/L	.065	.053	.076	4
Orthophosphate (PO_4)	mg/L	.05	.04	.08	9
Local analyses (10/79-2/80), Public Works, Truk					
Total coliform	col/100 mL	8	4	12	5
Hardness as $CaCO_3$	mg/L	74	70	80	5
Chloride	mg/L	36	16	42	5

Table 74. Chemical analyses of water from well 13, Moen

Constituents	Units	Mean	Minimum	Maximum	Number of samples
Analyses by Water Resources Research Center, University of Guam, June 1979 to March 1980					
[Presented as reported by Austin, Tsutsumi, 1980]					
Specific conductivity	µmho	262	180	400	8
pH	--	6.35	5.65	7.00	9
Temperature, water	°C	27.8	26.7	28.8	9
Turbidity	NTU	2.86	.37	18.0	9
Alkalinity, total as $CaCO_3$	mg/L	139	68.7	247	9
Free CO_2	mg/L	97	95	100	3
Sulfate (SO_4)	mg/L	1/ 7.6	--	--	1
Chloride (Cl)	mg/L	16.1	6.2	20.9	9
Total residue	mg/L	143	74	272	7
Total nonfilterable residue	mg/L	4.2	.6	6.8	9
Nitrate nitrogen (N)	mg/L	1.07	2.51	.534	8
Nitrite nitrogen (N)	mg/L	.002	0	.006	6
Total Kjeldahl nitrogen (N)	mg/L	.10	.045	.15	2
Total phosphorus (P)	mg/L	.08	.031	.119	4
Orthophosphate (PO_4)	mg/L	.07	.010	.096	8
Local analyses (10/79-2/80), Public Works, Truk					
Hardness as $CaCO_3$	mg/L	97	70	140	3
Chloride	mg/L	11	8	17	3

1/ Only one sample analyzed.

Table 75. Chemical analyses of water from well 15, Moen

Constituents	Units	Mean	Minimum	Maximum	Number of samples
Analyses by Water Resources Research Center, University of Guam, June 1979 to March 1980					
[Presented as reported by Austin, Tsutsumi, 1980]					
Specific conductivity	µmho	306	150	530	6
pH	--	6.16	5.65	6.38	8
Temperature, water	°C	28.0	26.7	29.4	8
Turbidity	NTU	42	.48	160	8
Alkalinity, total as $CaCO_3$	mg/L	135	77	201	8
Free CO_2	mg/L	145	105	200	-
Sulfate (SO_4)	mg/L	1/ 9.4	--	--	1
Chloride (Cl)	mg/L	23	7.8	59.2	7
Total residue	mg/L	288	140	532	6
Total nonfilterable residue	mg/L	34	.8	80	8
Nitrate nitrogen (N)	mg/L	.49	.15	1.73	7
Nitrite nitrogen (N)	mg/L	.003	.001	.004	6
Total Kjeldahl Nitrogen (N)	mg/L	1/ .071	--	--	1
Total phosphorus (P)	mg/L	.035	.014	.056	2
Orthophosphate (PO_4)	mg/L	.057	.001	.198	7
Local analyses (10/79-2/80), Public Works, Truk					
Total coliform	col/100 mL	--	15	TNTC	4
Hardness as $CaCO_3$	mg/L	96	80	150	5
Chloride	mg/L	55	13	125	5

1/ Only one sample analyzed.

TNTC - Too numerous to count.

Table 76. Analyses of water from million-gallon tank at Intellectual Hill, Moen

[U.S. Geological Survey]

Location: Lat 7°27'05" N., long 151°50'51" E., at altitude 150 ft (from topographic map).

Water in the tank is surface water from Pou Stream catchment and ground water from wells in the Administration area.

Constituents	Units	4-17-81	6-23-81	11-13-81	3-3-82
Time	--	--	0945	1445	1100
Specific conductance	µmho	362	201	530	310
pH	--	--	6.9	--	--
Chloride, dissolved (Cl)	mg/L	68	28	96	71
Iron, dissolved (Fe)	µg/L	--	280	--	--

Table 77. Chloride concentrations, in milligrams per liter, of water from wells on Moen, March 25-29, 1980

[U.S. Geological Survey]

Well	3-25-80	3-27-80	3-29-80
10	23	--	--
12	50	53	--
13	25	--	--
14	45	46	--
15	20	21	--
17	15	--	--
18	--	--	610

Table 78. Chemical analyses of well water and depth to water of wells on Moen, May 6-8, 1980

[U.S. Geological Survey]

A. Chemical analyses of well water

Constituents	Units	Well 1	2	4	7	9	10	11	12	13	14	15	17
Date	--	5/6	5/6	5/6	5/6	5/6	5/6	5/6	5/6	5/6	5/6	5/6	5/8
Time	--	0915	0950	1600	1455	1050	1625	1640	1510	1540	1430	1355	0845
Pumping rate	gal/min	55	31	13	53	28	60	27	68	45	34	35	38
Water pressure	psi	120	120	65	80	70	30	60	90	80	75	--	--
Depth to water (pumping level)	feet	41.15	--	65.10	31.9	17.95	32.8	57.8	48.9	68.19	54.0	41.0	46.8
Specific conductance	µmho	194	165	--	371	1,450	220	148	352	247	379	198	165
pH	--	6.3	6.8	6.7	7.2	7.2	6.8	6.7	7.0	7.0	7.0	6.9	6.7
Temperature, water	°C	28.5	28.5	29.0	29.0	29.0	28.5	28.0	29.0	29.0	29.0	29.0	--
Turbidity	NTU	-	5.0	2.0	1.0	2.0	.50	.30	.40	.70	.50	.60	.30
Hardness as $CaCO_3$	mg/L	62	62	120	150	340	80	56	140	100	150	84	66
Noncarbonate hardness	mg/L	0	2	34	24	210	20	0	42	15	57	13	0
Calcium, dissolved (Ca)	mg/L	10	9.8	17	27	65	14	8.9	22	16	22	12	10
Magnesium, dissolved (Mg)	mg/L	9.1	9.1	18	21	43	11	8.3	21	15	22	13	9.9
Sodium, dissolved (Na)	mg/L	13	8.9	14	13	160	8.7	6.1	11	8.3	12	7.7	7.5
Percent sodium	percent	31	24	20	15	50	19	19	14	15	15	17	20
Sodium adsorption ratio	--	.7	.5	.6	.5	3.8	.4	.4	.4	.4	.4	.4	.4
Potassium, dissolved (K)	mg/L	1.0	.7	2.3	1.6	6.6	1.0	.6	1.2	1.1	1.0	.5	.7
Alkalinity, total as $CaCO_3$	mg/L	68	60	83	130	130	60	56	99	87	89	71	66
Sulfate, dissolved (SO_4)	mg/L	1.1	3.5	3.2	2.3	49	6.8	1.2	5.7	5.0	7.6	7.3	1.1
Chloride, dissolved (Cl)	mg/L	11	11	38	31	370	25	7.7	41	17	49	13	8.6
Fluoride, dissolved (F)	mg/L	.1	.1	.1	.1	.1	.1	.1	.1	.1	.1	.1	.1
Silica, dissolved (SiO_2)	mg/L	33	28	29	35	28	27	29	30	33	24	28	36
Solids, dissolved, sum of constituents	mg/L	122	109	175	211	802	131	96	194	151	192	126	114
Solids, dissolved, ton per acre foot	ton/ac-ft	.17	.15	.24	.29	1.09	.18	.13	.26	.21	.26	.17	.16

Table 78. Chemical analyses of well water and depth to water of wells on Moen, May 6-8, 1980--Continued

A. Chemical analyses of well water--Continued

Constituents	Units	Well 1	2	4	7	9	10	11	12	13	14	15	17
Nitrite plus nitrate, dissolved as N	mg/L	0.86	0.41	0.60	0.47	0.36	0.27	0.25	0.47	0.69	0.19	0.46	0.16
Iron, dissolved (Fe)	µg/L	10	10	690	60	320	<10	<10	40	< 10	20	20	< 10
Manganese, dissolved (Mn)	µg/L	< 1	3	10	20	40	< 1	< 1	< 1	< 1	110	< 1	< 1

Note: Total pumpage, 701,000 gal/d (487 gal/d); weighted average chloride concentration, 43 mg/L.

B. Depth to water, in feet, of wells not sampled

	Well Old 2	3	5	6	8	16	17	18		A
Date	5/6	5/7	5/7	5/6	5/7	5/7	5/7	5/7	5/8	5/7
Time	1000	1338	1400	1027	1326	1123	1024	1045	0905	0925
Depth to water (static level)	24.20	[1/]72.17	6.24	30.24	31.06	11.44	21.41	7.30	7.19	24.30

[1/] Water level with well in operation; pumping rate, 19 gal/min; water pressure, 130 psi.

Table 79. Chemical analyses of well water and depth to water of wells on Moen, November 1980

[U.S. Geological Survey]

A. Chemical analyses of well water

Constituents	Units	Well 1	2	3	4	7	8	9	10	12	14	15
Date	--	11/25	11/24	11/19	11/19	11/19	11/25	11/19	11/19	11/19	11/19	11/19
Time	--	0825	1555	1115	1030	0945	0750	0845	0815	1015	0910	0930
Pumping rate	gal/min	43	37	40	24	50	10	27	48	66	35	51
Water pressure	psi	78-82	50-56	52	60-63	25-27	65	70	75	82-83	70-85	81-84
Depth to water (pumping level)	feet	> 42	--	50.40	54.84	--	> 47	79.05	41.6	38.03	54.80	47.7
Pumping rate	gal/min	43	37	40	24	50	10	27	48	66	35	51
Specific conductance	µmho	--	164	200	283	354	387	2,220	197	349	341	222
pH	--	--	6.5	7.0	6.7	7.2	7.2	7.2	7.3	7.2	6.9	6.9
Temperature, water	°C	28.0	28.5	29.0	29.5	28.5	29.0	--	28.3	29.5	29.0	--
Hardness as $CaCO_3$	mg/L	66	57	79	110	140	130	480	70	140	130	90
Noncarbonate hardness	mg/L	--	4	6	30	20	70	370	8	37	37	19
Calcium, dissolved (Ca)	mg/L	10	8.9	12	16	23	21	93	12	20	21	13
Magnesium, dissolved (Mg)	mg/L	10	8.5	12	16	20	20	59	9.6	21	20	14
Sodium, dissolved (Na)	mg/L	11	8.6	8.5	12	13	13	250	8.1	11	13	7.8
Percent sodium	percent	26	24	19	19	17	17	53	20	15	17	16
Sodium adsorption ratio	--	.6	.5	.4	.5	.5	.5	5.0	.4	.4	.5	.4
Potassium, dissolved (K)	mg/L	1.0	.7	1.0	2.0	1.6	1.1	8.7	1.0	1.2	1.0	.5
Alkalinity, total as $CaCO_3$	mg/L	--	53	73	76	120	65	110	62	99	98	71
Sulfate, dissolved (SO_4)	mg/L	--	4.5	.9	5.9	3.4	3.0	71	4.0	5.7	10	5.7
Chloride, dissolved (Cl)	mg/L	--	10	12	33	34	72	590	18	43	40	21
Fluoride, dissolved (F)	mg/L	--	.1	.1	.1	.1	.2	.1	.1	.1	.1	.1
Silica, dissolved (SiO_2)	mg/L	--	25	32	25	33	30	26	26	27	23	27
Solids, dissolved, sum of constituents	mg/L	--	100	124	159	203	204	1,170	117	190	189	135

Table 79. Chemical analyses of well water and depth to water of wells on Moen, November 1980--Continued

[U.S. Geological Survey]

A. Chemical analyses of well water--Continued

Constituents	Units	Well 1	2	3	4	7	8	9	10	12	14	15
Solids, dissolved, ton per acre foot	ton/ac-ft	--	.14	.17	.22	.28	.28	1.59	.16	.26	.26	.18
Nitrite plus nitrate, dissolved as N	mg/L	--	0.37	0.40	0.71	0.43	1.0	0.43	0.30	0.32	0.39	0.65
Iron, dissolved (Fe)	µg/L	10	40	20	30	420	30	80	30	80	20	20
Manganese, dissolved (Mn)	µg/L	0	2	7	3	1	1	30	4	2	100	9

Note: Total pumpage, 721,000 gal/d (501 gal/min); includes water from well 17 and 18.

B. Specific conductance and chloride concentrations of wells 17 and 18

Well 17 Nov. 26, 1980 (0810): Specific conductance, 164 µmhos; water temperature, 24.9°C; chloride, 5.5 mg/L, at pumping rate of about 40 gal/min.

18 Nov. 26, 1980 (0824): Specific conductance, 2,500 µmhos; water temperature, 24.9°C; chloride, 700 mg/L at pumping rate of 30 gal/min and water pressure of 13 psi (sucking air).

C. Depth to water of wells not sampled

Well 5 Nov. 19, 1980 (0940), 6.61 ft (static level)

6 Nov. 25, 1980 (0914), 28.69 ft (static level)

11 Nov. 19, 1980 (0750), 22.98 ft (static level)

13 Nov. 19, 1980 (1100), well in operation; pumping rate, 55 gal/min; water pressure, 83 psi; pumping level of water, 45.08 ft.

Table 80. Analyses of well water and depth to water of wells on Moen, April 15-18, 1981

[U.S. Geological Survey]

A. Analyses of well water

Constituents	Units	Well								
		1		2	7	9		12		13
Date	--	4/17	4/18	4/17	4/18	4/17	4/18	4/17	4/18	4/17
Time	--	1135	1120	1125	0920	1034	1040	1027	1025	1051
Pumping rate	gal/min	33	32	24	55	--	30-32	--	58	43
Water pressure	psi	40-52	39-53	45	80-83	62-68	66-72	30-40	80-84	80-84
Specific conductance[1/]	µmho	194	198	157	364	3,150	2,950	--	370	--
Temperature, water	°C	28.0	28.3	28.5	[2/]28.2	--	--	--	28.8	28.5
Chloride (dissolved)[1/]	mg/L	10	10	10	29	900	800	41	46	17

[1/] Determined by U.S. Geological Survey laboratory in Denver, Colorado.

[2/] At 1000, April 18, 1982.

Note: Total pumpage, 408,000 gal/d (283 gal/min); weighted average chloride concentration, 110 mg/L.

B. Depth to water (static water level) of wells not in operation

Well 3: 4-15-81 (1120), 57.66 ft; 4-17-81 (1120), 56.60 ft; 4-18-81 (1100), 56.31 ft.
4 4-15-81 (1100), 44.50 ft; 4-15-81 (1103), 43.07 ft; 4-15-81 (1105), 42.53 ft.
5 4-15-81 (1025), 8.85 ft; 4-18-81 (0900), 6.62 ft.
6 4-17-81 (1115), 30.92 ft.
7 4-17-81 (1005), 27.60 ft.
8 4-15-81 (1058), 38.32 ft; 4-17-81 (1044), 37.47 ft; 4-18-81 (1045), 36.32 ft.
11 4-17-81 (1243), 27.83 ft; 4-18-81 (1245), 27.65 ft.
14 4-17-81 (1015), 18.93 ft; 4-18-81 (0910), 18.24 ft.
15 4-15-81 (1037), 24.21 ft; 4-17-81 (0955), 21.63 ft; 4-18-81 (1015), 20.92 ft.
16 4-18-81 (1300), 11.19 ft.

Table 81. Analyses of well water on Moen, June 23, 1981

[U.S. Geological Survey]

Constituents	Units	Well 1	2	7	8	9	10	12	13	15	1/ Power plant
Time	--	1008	1004	0915	1016	0810	0838	0922	0937	0907	1027
Pumping rate	gal/min	54	36	53	27	26	40	26	51	33	--
Specific conductance 2/	µmho	170	158	347	398	1,560	216	436	217	196	355
pH 2/	--	6.7	6.7	7.4	6.4	7.3	7.1	7.5	6.9	7.2	7.6
Chloride, dissolved (Cl) 2/	mg/L	10	11	33	87	390	27	76	19	14	30
Iron, dissolved (Fe) 2/	µg/L	--	--	90	--	160	--	--	--	--	310

1/ Drilled in 1978 to provide cooling water for power plant at lat 7°27'05" N., long 151°50'36" E., altitude 20 ft (from topographic map).

2/ Determined by U.S. Geological Survey laboratory in Denver, Colorado.

Note: Total pumpage, 498,000 gal/d (346 gal/min); weighted average chloride concentration, 57 mg/L.

Table 82. Analyses of well water and depth to water of wells on Moen, November 11, 12, 1981

[U.S. Geological Survey]

A. Analyses of water of wells in operation

	Units	Well 1	2	7	9	10	13	14	15	17
Date	--	11/11	11/11	11/11	11/11	11/11	11/11	11/11	11/11	11/12
Time	--	1510	1505	1425	1435	1525	1500	1405	1400	1445
Specific conductance	µmho	173	153	350	2,090	197	224	405	201	159
Chloride	mg/L	9.5	10	31	550	20	17	60	15	7.5

Determined by U.S. Geological Survey laboratory in Honolulu, Hawaii.

B. Depth to water, in feet, of wells not in operation

	Units	Well 3	4	5	6	8	11	12
Date	--	11/11	11/11	11/11	11/11	11/11	11/11	11/11
Time	--	1445	1455	1355	--	1440	1530	1420
Depth to water (static level)	feet	29.32	21.58	5.42	27.44	16.45	23.04	11.16

Table 83. Chemical analyses of water from wells 18 and 10, Moen

[U.S. Geological Survey]

Constituents	Units	Well 18	Well 10
Date	--	11-12-81	4-13-83
Time	--	1425	1100
Pumping rate	gal/min	17	--
Depth of water (static water level)	feet	6.64	--
Specific conductance	µmho	164	275
pH	--	6.9	7.0
Temperature, water	°C	28.0	27.5
Hardness as $CaCO_3$	mg/L	78	100
Noncarbonate hardness	mg/L	2	38
Calcium, dissolved (Ca)	mg/L	13	18
Magnesium, dissolved (Mg)	mg/L	11	14
Sodium, dissolved (Na)	mg/L	8.5	12
Percent sodium	percent	19	20
Sodium adsorption ratio	--	.4	.6
Potassium, dissolved (K)	mg/L	.7	1.1
Alkalinity, total as $CaCO_3$	mg/L	76	65
Sulfate, dissolved (SO_4)	mg/L	< 5.0	6.8
Chloride, dissolved (Cl)	mg/L	7.8	44
Fluoride, dissolved (F)	mg/L	.1	< .1
Silica, dissolved (SiO_2)	mg/L	35	26
Solids, dissolved, sum of constituents	mg/L	127	163
Nitrite plus nitrate, dissolved as N	mg/L	.26	.41
Iron, dissolved (Fe)	µg/L	10	4
Manganese, dissolved (Mn)	µg/L	40	4
Aluminum, total (Al)	µg/L	--	40
Arsenic, total (As)	µg/L	--	1
Barium, total (Ba)	µg/L	--	<100
Beryllium, total (Be)	µg/L	--	<10
Cadmium, total (Cd)	µg/L	--	< 1
Chromium, total (Cr)	µg/L	--	10
Cobalt, total (Co)	µg/L	--	< 1
Copper, total (Cu)	µg/L	--	15
Iron, total (Fe)	µg/L	--	190
Lead, total (Pb)	µg/L	--	8
Lithium, total (Li)	µg/L	--	<10
Manganese, total (Mn)	µg/L	--	<10
Mercury, total (Hg)	µg/L	--	.1
Molybdenum, total	µg/L	--	< 1
Nickel, total (Ni)	µg/L	--	11
Selenium, total (Se)	µg/L	--	< 1
Silver, total (Ag)	µg/L	--	< 1
Zinc, total (Zn)	µg/L	--	20

Table 84. Analyses of well water and depth to water of wells on Moen, March 2, 3, 1982

[U.S. Geological Survey]

A. Analyses of well water

Constituents	Units	Well 1	4	7	9	10	12	13	14	15	Power plant	Pou Reservoir outflow[1/]
Date	--	3/2	3/2	3/2	3/2	3/2	3/2	3/2	3/2	3/2	3/3	3/3
Time	--	1030	1200	1300	1350	1010	1315	1215	1330	1250	1120	1030
Pumping rate	gal/min	40	12	45	31	43	61	37	30	31	--	--
Water pressure	psi	155	62	85	64	30	112	110	76	110	--	--
Depth to water (pumping level	feet	40.70	64.60	32.51	76.63	±40	54.92	68.19	52.96	38.71	--	--
Specific conductance	µmho	170	205	285	1,070	175	295	180	907	107	[2/]250	[2/]280
Temperature, water	°C	28.5	29.5	28.5	29.0	28.5	29.0	28.5	28.5	29.0	29.5	28.5
Chloride (dissolved)[2/]	mg/L	10	--	28	140	28	49	14	210	14	20	55

[1/] Location of Pou Reservoir: lat 7°26'35" N., long 151°50'57" E., at altitude 230 ft (from topographic map).

[2/] Determined by U.S. Geological Survey laboratory in Denver, Colorado.

Note: Total pumpage, 475,000 gal/d (330 gal/min); weighted average chloride concentration, 55 mg/L.

B. Depth to water, in feet, of wells not in operation

	Well 2	3	5	6	8	11	16	17	18
Date	3/2	3/2	3/2	3/2	3/2	3/3	3/3	3/3	3/3
Time	1040	1415	1240	1105	1055	1105	1200	1310	1315
Depth to water static level)	19.31	44.36	8.19	29.75	30.91	27.41	11.34	24.57	8.98

Table 85. Depth to water of wells on Moen, June 4, 1982

[U.S. Geological Survey]

A. Depth to water (pumping level) of wells in operation

Constituents	Units	Well											
		1	2	4	7	9	10	12	13	14	15	17	18
Time	--	1012	1003	1040	--	1115	1345	1325	1020	1305	1130	1450	1520
Pumping rate	gal/min	51	36	23	43	27	47	71	47	16	36	34	10
Water pressure	psi	--	--	±65	--	±60	±25	±90	88	140	±130	±25	--
Depth to water (pumping level)	feet	35.08	41.00	65.00	--	76.90	36.30	42.21	54.21	32.38	33.50	±42	7.03
Specific conductance	µmho	--	--	--	--	[1/] 1,060	--	--	--	--	--	--	183
Chloride (dissolved)	mg/L	--	--	--	--	[1/] 240	--	--	--	--	--	--	7.0

[1/] Determined in U.S. Geological Survey laboratory in Honolulu, Hawaii.

Note: Total pumpage, 621,000 gal/d (431 gal/min).

B. Depth to water (static water level) of wells not in operation

Well 3 at 1050, 30.27 ft; well 5 at 1125, 5.53 ft; well 6 at 0930, 27.15 ft; well 8 at 1100, 21.93 ft.

Table 86. Analyses of well water and depth to water of wells on Moen, September 15, 16, 1982

[U.S. Geological Survey]

A. Analyses of well water

Constituents	Units	Well 1	2	4	7	9	10	12	13	14	15	17	18
Date	--	9/15	9/15	9/15	9/15	9/15	9/15	9/15	9/15	9/15	9/15	9/16	9/16
Time	--	1013	1047	1428	1243	1152	0940	1303	1405	1222	1320	1138	1220
Pumping rate	gal/min	38	34	80	52	27	47	71	49	30	36	34	9
Water pressure	psi	52	54	65-70	58-65	39-46	21-24	94	90	112	130	20-30	16
Depth to water (pumping level)	feet	21.45	35.75	1/ 23.28	--	--	46.35	34.57	46.62	49.35	28.94	--	2/ 14.39
Specific conductance	umho	160	180	225	350	1,200	195	340	230	440	225	160	200
pH	--	5.9	5.5	5.6	6.0	6.3	5.9	5.8	5.9	5.6	5.7	6.3	6.2
Temperature, water	°C	27.5	28.0	28.5	27.5	28.0	28.0	28.0	27.5	28.0	28.0	28.0	28.0
Chloride, dissolved 3/	mg/L	14	13	28	30	340	20	40	18	81	15	10	9.5
Fecal coliform	per 100 mL	0	7	149	21	0	0	7	4	0	12	0	--
Fecal streptococci	per 100 mL	10	14	TNTC	61	4	1	9	3	7	40	3	--

TNTC - Too numerous to count.

1/ Static water level while pump was off.

2/ After pump had been turned on and operated for 10 minutes.

3/ Determined in U.S. Geological Survey laboratory in Honolulu, Hawaii.

Note: High bacterial count of well 4 probably because pump was off initially.

B. Depth to water, in feet, of wells not in operation

	Well 3	5	6	8	11	16	18
Date	9/15	9/15	9/15	9/15	9/15	9/16	9/16
Time	1422	1350	1032	1115	1435	1009	1212
Depth to water (static level)	27.34	5.11	26.34	17.25	21.59	9.40	6.65

Table 87. Analyses of well water and depth to water of wells on Moen, March 11, 1983

[U.S. Geological Survey]

A. Analyses of well water

Constituents	Units	Well										
		1	2	4	7	9	10	12	13	14	15	17
Time	--	0945	1005	1040	1255	1200	0925	1100	1030	1240	1300	0840
Pumping rate	gal/min	15	[1]/39	10	40	16	37	43	14	25	13	20
Water pressure	psi	40	37-38	42	74-76	16-20	15	76-77	70-72	87-89	84-120	10
Depth to water (pumping level)	feet	--	34.04	--	--	--	39.58	[1]/70	67.20	[1]/80	--	56.40
Specific conductance	µmho	185	152	273	400	500	231	2,600	236	2,350	233	183
Temperature, water	°C	28.0	29.5	29.0	28.5	28.5	28.5	28.0	28.5	28.5		
Chloride, dissolved[2]	mg/L	11	8.5	27	34	60	29	780	15	710		
Fecal coliform	per 100 mL	5	0	0	3	0	1	0	0	0	6	--
Fecal streptococci	per 100 mL	40	0	1	4	0	1	0	7	4	51	--

[1] About.

[2] Determined in U.S. Geological Survey laboratory in Honolulu, Hawaii.

Note: Total pumpage, 392,000 gal/d (272 gal/min); weighted average chloride concentration, 206 mg/L.

B. Depth to water (static water level) of wells not in operation

Well 3 at 1335, 65.63 ft; well 5 at 1305, 11.72 ft;
well 11 at 1350, 32.82 ft; well 16 at 1315, 13.94 ft;
well 18 at 0850, 14.82 ft.

Table 88. Specific conductance and chloride concentrations of water from wells on Moen, April 1983

[U.S. Geological Survey]

Well No.	Pumping rate (gal/min)			Specific conductance (µmho)		Chloride (mg/L)		
	4-1	4-13	4-20	4-1	4-13	4-1	4-13	4-20
1	14	15	15	180	180	--	--	20
2	0	0	0	--	--	--	--	--
4	0	(1)	(1)	--	290	--	--	32
7	40	40	40	410	420	--	--	62
9	--	[2] 14	18	1,600	2,450	420	[3] 730	700
10	33	35	34	270	275	--	[3] 34	52
12	39	40	40	3,200	3,100	960	--	1,250
13	(2)	[2] 8.5	[2] 46	240	230	--	--	22
14	28	27	28	2,000	3,000	900	--	1,200
15	(2)	[2] 14	17	230	240	--	[3] 18	35
17	(2)	0	[2] 19	360	--	--	--	46
18	0	25	0	--	[3] 4,840	--	[3] 1,400	--

[1] Pumping, but meter broken.

[2] Pumping intermittently.

[3] Determined in U.S. Geological Survey laboratory in Honolulu, Hawaii.

Note: Total pumpage on April 20, 1983, about 360,000 gal/d (250 gal/min); weighted average chloride concentration, 410 mg/L.

WELL 1

Location: Lat 7°26'46" N., long 151°50'56" E., Moen.

Depth of well: 127 ft.

Altitude of measuring point: 78.35 ft.

Table 89. Summary of production and quality-of-water data of well 1, Moen

[U.S. Geological Survey]

Date	See table No.	Pumping rate (gal/min)	Water pressure (psi)	Depth to water (ft)		Specific conductance (µmho)	Chloride (mg/L)	pH (unit)	Analyses available
				Static	Pumping				
1980									
May 6	78	55	120	--	41.15	194	11	6.3	Chemical.
Nov. 25	79	43	78-82	--	>42	--	--	--	Do.
1981									
Apr. 17	80	33	--	--	40.52	194	10	--	
June 23	81	54	--	--	--	170	10	6.7	
Nov. 11	82	--	--	--	--	173	9.5	--	
1982									
Mar. 2	84	40	155	--	40.70	170	10	--	
June 4	85	51	--	--	35.08	--	--	--	
Sept. 15	86	38	52	--	21.45	160	--	5.9	Bacteria.
1983									
Mar. 11	87	15	40	--	--	185	11	--	Do.
Apr. 1	88	14	--	--	--	180	--	--	
Apr. 13	88	15	--	--	--	180	--	--	
Apr. 20	88	15	--	--	--	--	20	--	

For water levels when pumping during August to October 1976, see table 15.

WELL 2

Location: Lat 7°26'50" N., long 151°50'55" E., Moen.

Depth of well: 127 ft.

Altitude of measuring point: 62.20 ft.

Table 90. Summary of production and quality-of-water data of well 2, Moen

[U.S. Geological Survey]

Date	See table No.	Pumping rate (gal/min)	Water pressure (psi)	Depth to water (ft)		Specific conductance (µmho)	Chloride (mg/L)	pH (unit)	Analyses available
				Static	Pumping				
1980									
May 6	78	31	120	--	--	165	11	6.8	Chemical.
Nov. 24	79	37	50-56	--	--	164	10	6.5	Do.
1981									
Apr. 17	80	24	59-53	--	--	198	10	--	
June 23	81	36	--	--	--	158	11	6.7	
Nov. 11	82	--	--	--	--	153	9.5	--	
1982									
Mar. 2	84	--	--	19.31	--	--	--	--	
June 4	85	36	--	--	41.00	--	--	--	
Sept. 15	86	34	54	--	35.75	180	13	--	Bacteria.
1983									
Mar. 11	87	39	40	--	34.04	152	8.5	--	Do.

For water levels when pumping during August to October 1976, see table 15.
No pumping in April 1983.

WELL 3

Location: Lat 7°27'02" N., long 151°50'54" E., Moen.

Depth of well: 110 ft.

Altitude of measuring point: 61.68 ft.

Table 91. Summary of production and quality-of-water data of well 3, Moen

[U.S. Geological Survey]

Date	See table No.	Pumping rate (gal/min)	Water pressure (psi)	Depth to water (ft)		Specific conductance (µmho)	Chloride (mg/L)	pH (unit)	Analyses available
				Static	Pumping				
1980									
May 7	78	--	--	--	72.17	--	--	--	
Nov. 19	79	40	52	--	50.40	200	12	7.0	Chemical.
1981									
Apr. 15	80	--	--	57.66	--	--	--	--	
Apr. 15	80	--	--	56.60	--	--	--	--	
Apr. 18	80	--	--	56.31	--	--	--	--	
Nov. 11	82	--	--	29.32	--	--	--	--	
1982									
Mar. 2	84	--	--	44.36	--	--	--	--	
June 4	85	--	--	30.27	--	--	--	--	
Sept. 15	86	--	--	27.34	--	--	--	--	
1983									
Mar. 11	87	--	--	65.63	--	--	--	--	

For water levels when pumping during August to October 1976, see table 15.

WELL 4

Location: Lat 7°26'59" N., long 151°50'56" E., Moen.

Depth of well: 108 ft.

Altitude of measuring point: 38.17 ft.

Table 92. Summary of production and quality-of-water data of well 4, Moen

[U.S. Geological Survey]

Date	See table No.	Pumping rate (gal/min)	Water pressure (psi)	Depth to water (ft)		Specific conductance (µmho)	Chloride (mg/L)	pH (unit)	Analyses available
				Static	Pumping				
1980									
May 6	78	13	65	--	65.10	--	38	6.7	Chemical.
Nov. 24	79	24	60-63	--	54.84	283	33	6.7	Do.
1981									
Apr. 15	80	--	--	42.53	--	--	--	--	
Nov. 11	82	--	--	21.58	--	--	--	--	
1982									
Mar. 2	84	12	62	--	64.60	205	--	--	
June 4	85	23	+65	--	65.0	--	--	--	
Sept. 15	86	80	65-70	23.28	--	225	28	5.6	Bacteria.
1983									
Mar. 11	87	10	52	--	--	273	27	--	Do.
Apr. 13	88	--	--	--	--	290	--	--	
Apr. 20	88	--	--	--	--	--	32	--	

For water levels when pumping during August to October 1976, see table 15.

WELL 7

Location: Lat 7°26'54" N., long 151°51'01" E., Moen.

Depth of well: 105 ft.

Altitude of measuring point: 28.33 ft.

Table 93. Summary of production and quality-of-water data of well 7, Moen

[U.S. Geological Survey]

Date	See table No.	Pumping rate (gal/min)	Water pressure (psi)	Depth to water (ft)		Specific conductance (µmho)	Chloride (mg/L)	pH (unit)	Analyses available
				Static	Pumping				
1980									
May 6	78	53	80	--	31.9	371	31	7.2	Chemical.
Nov. 19	79	50	25-27	--	--	354	34	7.2	Do.
1981									
Apr. 17	80	--	--	27.60	--	--	--	--	
Apr. 18	80	55	80-83	--	--	364	29	--	
June 23	81	53	--	--	--	347	33	7.4	
Nov. 11	82	--	--	--	--	350	31	--	
1982									
Mar. 2	84	45	85	--	32.51	285	28	--	
June 4	85	--	--	--	43	--	--	--	
Sept. 15	86	52	58-65	--	--	350	30	--	Bacteria.
1983									
Mar. 11	87	40	74-76	--	--	400	34	--	Do.
Apr. 1	88	40	--	--	--	410	--	--	
Apr. 13	88	40	--	--	--	420	--	--	
Apr. 20	88	40	--	--	--	--	62	--	

For water levels when pumping during August to October 1976, see table 15.

WELL 8

Location: Lat 7°26'54" N., long 151°50'56" E., Moen.
Depth of well: 65 ft.
Altitude of measuring point: 39 ft.

Table 94. Summary of production and quality-of-water data of well 8, Moen

[U.S. Geological Survey]

Date	See table No.	Pumping rate (gal/min)	Water pressure (psi)	Depth to water (ft)		Specific conductance (µmho)	Chloride (mg/L)	Analyses available
				Static	Pumping			
1980								
May 7	78	--	--	31.06	--	--	--	
Nov. 25	79	10	65	--	> 47	387	72	Chemical.
1981								
Apr. 15	80	--	--	38.32	--	--	--	
Apr. 17	80	--	--	--	--	--	--	
Apr. 18	80	--	--	--	--	--	--	
June 23	81	27	--	--	--	398	87	
Nov. 11	82	--	--	16.45	--	--	--	
1982								
Mar. 2	84	--	--	30.91	--	--	--	
June 4	85	--	--	21.93	--	--	--	
Sept. 15	86	--	--	17.25	--	--	--	

WELL 9

Location: Lat 7°26'55" N., long 151°51'03" E., Moen.

Depth of well: 110 ft.

Altitude of measuring point: 28.42 ft.

Table 95. Summary of production and quality-of-water data of well 9, Moen

[U.S. Geological Survey]

Date	See table No.	Pumping rate (gal/min)	Water pressure (psi)	Depth to water (ft)		Specific conductance (µmho)	Chloride (mg/L)	pH (unit)	Analyses available
				Static	Pumping				
1980									
May 6	78	28	70	--	77.95	1,450	370	7.2	Chemical.
Nov. 19	79	27	70	--	79.05	2,220	590	7.2	Do.
1981									
Apr. 18	80	30-32	66-72	--	--	2,950	800	--	
June 23	81	26	--	--	--	1,560	390	7.3	
Nov. 11	82	--	--	--	--	2,090	550	--	
1982									
Mar. 2	84	31	64	--	76.63	1,070	140	--	
June 4	85	27	±60	--	76.90	1,060	240	--	
Sept. 15	86	27	39.46	--	--	1,200	340	6.3	Bacteria.
1983									
Mar. 11	87	16	16-20	--	--	500	60	--	Do.
Apr. 1	88	--	--	--	--	1,600	420	--	
Apr. 13	88	14	--	--	--	2,450	730	--	
Apr. 20	88	18	--	--	--	--	700	--	

For water levels when pumping during August to October 1976, see table 15.

1/ Pumping intermittently.

WELL 10

Location: Lat 7°26'57" N., long 151°50'47" E., Moen.

Depth of well: 57 ft.

Altitude of measuring point: 12 ft.

Table 96. Summary of production and quality-of-water data of well 10, Moen

[U.S. Geological Survey]

Date	See table No.	Pumping rate (gal/min)	Water pressure (psi)	Depth to water (ft)		Specific conductance (µmho)	Chloride (mg/L)	pH (unit)	Analyses available
				Static	Pumping				
1980									
Mar. 25	77	--	--	--	--	--	23	--	
May 6	78	60	30	--	32.8	220	25	6.8	Chemical.
Nov. 19	79	48	75	--	41.6	197	18	7.3	Do.
1981									
June 23	81	40	--	--	--	216	27	7.1	
Nov. 11	82	--	--	--	--	197	20	--	
1982									
Mar. 3	84	43	30	--	±40	175	28	--	
June 4	85	47	±25	--	36.30	--	--	--	
Sept. 15	86	47	21-24	--	46.35	195	20	5.9	Bacteria.
1983									
Mar. 11	87	37	15	--	39.58	±70 [1]	29	--	Do.
Apr. 1	88	33	--	--	--	270	--	--	
Apr. 13	88	35	--	--	--	275	44	7.0	Chemical and metals in table 83.
Apr. 20	88	34	--	--	--	--	52	--	

[1] About.

WELL 11

Location: Lat 7°27'01" N., long 151°50'46" E., Moen.

Depth of well: 70 ft.

Altitude of measuring point: 34.95 ft.

Table 97. Summary of production and quality-of-water data of well 11, Moen

[U.S. Geological Survey]

Date	See table No.	Pumping rate (gal/min)	Water pressure (psi)	Depth to water (ft) Static	Depth to water (ft) Pumping	Specific conductance (µmho)	Chloride (mg/L)	pH (unit)	Analyses available
1980									
May 6	78	27	60	--	57.8	148	7.7	6.7	Chemical.
Nov. 19	79	--	--	22.98	--	--	--	--	
1981									
Apr. 17	80	--	--	27.83	--	--	--	--	
Apr. 18	80	--	--	27.65	--	--	--	--	
Nov. 11	82	--	--	23.04	--	--	--	--	
1982									
Mar. 3	84	--	--	27.41	--	--	--	--	
Sept. 15	86	--	--	21.59	--	--	--	--	
1983									
Mar. 11	87	--	--	32.82	--	--	--	--	

For water levels when pumping during August to October 1976, see table 15.

WELL 12

Location: Lat 7°26'58" N., long 151°51'00" E., Moen.

Depth of well: 74 ft.

Altitude of measuring point: 22 ft.

Table 98. Summary of production and quality-of-water data of well 12, Moen

[U.S. Geological Survey]

Date	See table No.	Pumping rate (gal/min)	Water pressure (psi)	Depth to water (ft)		Specific conductance (µmho)	Chloride (mg/L)	pH (unit)	Analyses available
				Static	Pumping				
1980									
Mar. 25	77	--	--	--	--	--	50	--	
Mar. 27	77	--	--	--	--	--	53	--	
May 6	78	68	90	--	48.9	352	41	7.0	Chemical.
Nov. 19	79	66	82-83	--	38.03	349	43	7.2	Do.
1981									
Apr. 18	80	58	80-84	--	--	370	46	--	
June 23	81	26	--	--	--	436	76	7.5	
Nov. 11	82	--	--	11.16	--	--	--	--	
1982									
Mar. 2	84	61	112	--	54.92	295	49	--	
June 4	85	71	+90	--	42.21	--	--	--	
Sept. 15	86	71	94	--	34.57	340	40	5.8	Bacteria.
1983									
Mar. 11	87	43	76-77	--	±70 [1]	2,600	780	--	Do.
Apr. 1	88	39	--	--	--	3,200	960	--	
Apr. 13	88	40	--	--	--	3,100	--	--	
Apr. 20	88	40	--	--	--	--	1,250	--	

WELL 13

Location: Lat 7°27'01" N., long 151°50'56" E., Moen.

Depth of well: 80 ft.

Altitude of measuring point: 38 ft.

Table 99. Summary of production and quality-of-water data of well 13, Moen

[U.S. Geological Survey]

Date	See table No.	Pumping rate (gal/min)	Water pressure (psi)	Depth to water (ft)		Specific conductance (µmho)	Chloride (mg/L)	pH (unit)	Analyses available
				Static	Pumping				
1980									
Mar. 25	77	--	--	--	--	--	25	--	
May 6	78	45	80	--	68.19	247	17	7.0	Chemical.
Nov. 19	79	--	--	22.98	--	--	--	--	
1981									
Apr. 17	80	43	80-84	--	--	--	17	--	
June 23	81	51	--	--	--	217	19	6.9	
Nov. 11	82	--	--	--	--	224	17	--	
1982									
Mar. 2	84	37	110	--	68.19	180	14	--	
June 4	85	47	88	--	54.21	--	--	--	
Sept. 15	86	49	90	--	46.62	230	18	5.9	Bacteria.
1983									
Mar. 11	87	14	70-72	--	67.20	236	15	--	Do.
Apr. 1	88	--	--	--	--	240	--	--	
Apr. 13	88	1/ 8.5	--	--	--	230	--	--	
Apr. 20	88	1/ 46	--	--	--	--	22	--	

1/ Pumping intermittently.

WELL 14

Location: Lat 7°26'58" N., long 151°51'02" E., Moen.

Depth of well: 74 ft.

Altitude of measuring point: 15 ft.

Table 100. Summary of production and quality-of-water data of well 14, Moen

[U.S. Geological Survey]

Date	See table No.	Pumping rate (gal/min)	Water pressure (psi)	Depth to water (ft) Static	Depth to water (ft) Pumping	Specific conductance (µmho)	Chloride (mg/L)	pH (unit)	Analyses available
1980									
Mar. 25	77	--	--	--	--	--	45	--	
Mar. 27	77	--	--	--	--	--	46	--	
May 6	78	34	75	--	54.0	379	49	7.0	Chemical.
Nov. 19	79	35	70-85	--	54.80	341	40	6.9	Do.
1981									
Apr. 17	80	--	--	--	18.93	--	--	--	
Apr. 18	80	--	--	--	18.24	--	--	--	
Nov. 11	82	--	--	--	--	405	60	--	
1982									
Mar. 2	84	30	76	--	52.96	907	210	--	
June 4	85	16	140	--	32.38	--	--	--	
Sept. 15	86	30	112	--	49.35	440	81	5.6	Bacteria.
1983									
Mar. 11	87	25	87-89	--	1/ 80	2,350	710	--	Do.
Apr. 1	88	28	--	--	--	2,000	900	--	
Apr. 13	88	27	--	--	--	3,000	--	--	
Apr. 20	88	28	--	--	--	--	1,200	--	

1/ About.

WELL 15

Location: Lat 7°27'03" N., long 151°51'01" E., Moen.

Depth of well: 68 ft.

Altitude of measuring point: 22 ft.

Table 101. Summary of production and quality-of-water data of well 15, Moen

[U.S. Geological Survey]

Date	See table No.	Pumping rate (gal/min)	Water pressure (psi)	Depth to water (ft)		Specific conductance (µmho)	Chloride (mg/L)	pH (unit)	Analyses available
				Static	Pumping				
1980									
Mar. 25	77	--	--	--	--	--	20	--	
Mar. 27	77	--	--	--	--	--	27	--	
May 6	78	35	--	--	41.0	198	13	6.9	Chemical.
Nov. 19	79	51	81-84	--	47.7	222	21	6.9	Do.
1981									
Apr. 15	80	--	--	24.21	--	--	--	--	
Apr. 17	80	--	--	21.63	--	--	--	--	
Apr. 18	80	--	--	20.92	--	--	--	--	
June 23	81	33	--	--	--	196	14	7.2	
Nov. 11	82	--	--	--	--	201	15	--	
1982									
Mar. 2	84	31	110	--	38.71	170	14	--	
June 4	85	36	±130	--	33.50	--	--	--	
Sept. 15	86	36	130	--	28.94	225	15	5.0	Bacteria.
1983									
Mar. 11	87	13	84-120	--	--	233	17	--	Do.
Apr. 1	88	--	--	--	--	230	--	--	
Apr. 13	88	1/ 14	--	--	--	240	18	--	
Apr. 20	88	17	--	--	--	--	35	--	

1/ Pumping intermittently.

WELL 17

Location: Lat 7°25'10" N., long 151°50'33" E., Moen.

Depth of well: 47 ft.

Altitude of measuring point: 23 ft.

Table 102. Summary of production and quality-of-water data of well 17, Moen

[U.S. Geological Survey]

Date	See table No.	Pumping rate (gal/min)	Water pressure (psi)	Depth to water (ft) Static	Depth to water (ft) Pumping	Specific conductance (µmho)	Chloride (mg/L)	pH (unit)	Analyses available
1980									
Mar. 25	77	--	--	--	--	--	15	--	
May 7	78	--	--	21.41	--	--	--	--	
May 8	78	--	--	--	46.8	165	8.6	6.7	Chemical.
Nov. 26	79	38	--	--	--	164	5.5	--	
1981									
Nov. 12	82	--	--	--	--	159	7.5	--	
1982									
Mar. 3	84	--	--	24.57	--	--	--	--	
June 4	85	34	±25	--	±42	--	--	--	
Sept. 16	86	34	20-30	--	--	160	10	6.3	Bacteria.
1983									
Mar. 11	87	20	10	--	56.4	183	10	--	
Apr. 1	88	1/	--	--	--	360	--	--	
Apr. 20	88	19	--	--	--	--	46	--	

1/ Pumping intermittently.

WELL 18

Location: Lat 7°25'04" N., long 151°50'33" E., Moen.

Depth of well: 75 ft.

Altitude of measuring point: 9 ft.

Table 103. Summary of production and quality-of-water data of well 18, Moen

[U.S. Geological Survey]

Date	See table No.	Pumping rate (gal/min)	Water pressure (psi)	Depth to water (ft)		Specific conductance (µmho)	Chloride (mg/L)	pH (unit)	Analyses available
				Static	Pumping				
1980									
Mar. 29	77	--	--	--	--	--	610	--	
May 7	78	--	--	7.30	--	--	--	--	
May 8	78	--	--	7.19	--	--	--	--	
Nov. 26	79	30	13	--	--	2,500	700	--	
1981									
Nov. 12	83	17	--	6.64	--	164	7.8	6.9	Chemical.
1982									
Mar. 3	84	--	--	8.98	--	--	--	--	
June 4	83	10	--	7.03	--	183	7.0	--	
Sept. 16	86	9	16	6.65	14.39	200	9.5	6.2	Bacteria.
1983									
Mar. 11	87	--	--	--	14.82	--	--	--	
Apr. 13	88	25	--	--	--	4,840	1,400	--	

Table 104. Summary of depths to water, in feet, of wells not in operation on Moen

[U.S. Geological Survey]

Well 5		Well 6		Well 16[1/]	
May 7, 1980 ----	6.24	May 6, 1980 ----	30.24	May 7, 1980 ----	11.44
Nov. 19, 1980 --	6.61	Nov. 25, 1980 --	28.69	Apr. 18, 1981 --	11.19
Apr. 15, 1981 --	8.85	Apr. 17, 1981 --	30.92	Mar. 3, 1982 ---	11.34
Apr. 18, 1981 --	6.62	Nov. 11, 1981 --	27.44	Sept. 16, 1982 -	9.40
Nov. 11, 1981 --	5.42	Mar. 2, 1982 ---	29.75	Mar. 11, 1983 --	13.94
Mar. 2, 1982 ---	8.19	June 4, 1982 ---	27.15		
June 4, 1982 ---	5.53	Sept. 15, 1982 -	26.34		
Sept. 15, 1982 -	5.11				
Mar. 11, 1983 --	11.72				

[1/] For water levels when pumping during August to October 1976, see table 15.

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