Overview of Environmental and Hydrogeologic Conditions at Sand Point, Alaska

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U.S. GEOLOGICAL SURVEY

Open-File Report 95-408

Prepared in cooperation with the

FEDERAL AVIATION ADMINISTRATION

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CONVERSION FACTORS AND VERTICAL DATUM

Multiply	By	To obtain
millimeter (mm)	0.03937	inch
meter (m)	3.281	foot
kilometer (km)	0.6214	mile
square kilometer (km^2)	0.3861	square mile
kilometer per hour (km/hr)	0.6214	mile per hour
cubic meter per second (m^3/s)	35.31	cubic foot per second
cubic meter per second per square kilometer [$(m^3/s)/(km^2)$]	91.4	cubic foot per second per square mile

In this report, temperature is reported in degrees Celsius (°C), which can be converted to degrees Fahrenheit (°F) by the following equation:

$$°F = 1.8\ (°C) + 32$$

Sea level: In this report, "sea level" refers to the National Geodetic Vertical Datum of 1929—A geodetic datum derived from a general adjustment of the first-order level nets of the United States and Canada, formerly called Sea Level Datum of 1929.

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By James R. Cowan

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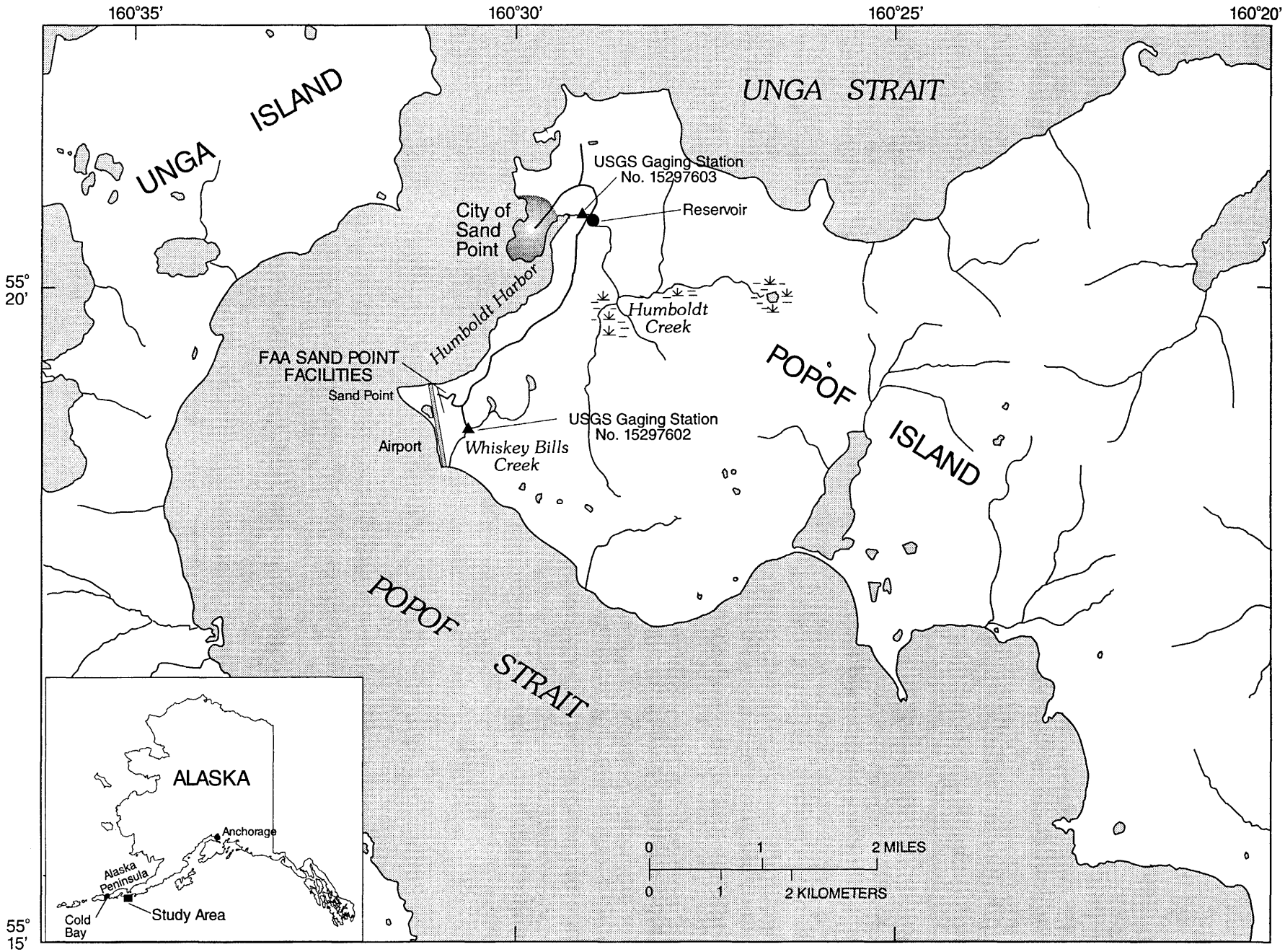
ABSTRACT

The Federal Aviation Administration Sand Point facilities are on the west coast of Popof Island, about 3 kilometers south-southwest of the city of Sand Point, in southwest Alaska. The Federal Aviation Administration owns or operates airway support facilities at the Sand Point airport and is considering the severity of contamination and the current environmental setting near the Sand Point facilities when evaluating options for compliance with environmental regulations. The area is in the maritime climate zone and is subject to small temperature variation, heavy precipitation, and frequent fog and cloudiness. Wet tundra is the dominant vegetation system near the facilities. Popof Island is of volcanic origin and soils are derived from ash, cinders, and tills. There is no drinking-water source at the FAA facilities and water is supplied by the Sand Point public water system. The city of Sand Point relies on surface water as the source of its public water supply. It is not likely that surface spills and disposal of hazardous materials at the Sand Point FAA facilities will affect the quality of the city water supply. The facilities have no history of flooding but may be exposed to storm-surge and tsunami waves. Data concerning the quantity and quality of potential alternative drinking-water sources for use at the FAA facilities are not adequate to evaluate these sources.

INTRODUCTION

The Federal Aviation Administration (FAA) owns and (or) operates airway support and navigational facilities throughout Alaska. At many of these sites, fuels and other potentially hazardous materials such as solvents, polychlorinated biphenyls, and pesticides may have been used and (or) disposed of. To determine if environmentally hazardous materials have been spilled or disposed of at the sites, the FAA is conducting environmental studies mandated under the Comprehensive Environmental Response, Compensation, and Liability Act and the Resource Conservation and Recovery Act. To complete these more comprehensive environmental studies, the FAA requires information on the hydrology and geology of areas surrounding the sites. This report, the product of compilation, review, and summary of existing hydrologic and geologic data by the U.S. Geological Survey (USGS), in cooperation with the FAA, provides supplemental information for the FAA Sand Point facilities. Also presented in this report is a description of the history, socioeconomics, and physical setting of the Sand Point area.



Base from U.S.Geological Survey, Port Moller (B-2), Alaska, 1:63,360, 1963

Figure 1. Location of Sand Point, Alaska and the Federal Aviation Administration facilities.

BACKGROUND

Location

The city of Sand Point is at the head of Humboldt Harbor on the west coast of Popof Island, one of the Shumagin Islands in southwest Alaska (fig.1). The FAA Sand Point facilities are at the Sand Point airport, about 3 km south-southwest of the city, near lat 55°19'N., long 160°31'W. A gravel road links the airport and the city. The facilities, at about 7 m elevation, are about 900 km southwest of Anchorage and about 140 km east of the community of Cold Bay.

History and Socioeconomics

The city of Sand Point, named for the geologic character of the spit near the western tip of Popof Island, was founded as a trading post and fishing port in 1887 (Bomhoff and Associates Inc., 1977). Today, fishing is the primary economic activity and Sand Point is the home of the largest fishing fleet in the Aleutian Chain (Alaska Department of Community and Regional Affairs, 1994). The airport and city boat harbor allow access to the city by air, ship, and barge services. Sand Point was incorporated as a first-class city in 1966 and, in 1994, had a population of 1,095 (Alaska Department of Community and Regional Affairs, 1994). The city has modern water, sewer, and electric utility systems. Community water is obtained from a nearby reservoir on Humboldt Creek and is chlorinated prior to use (Ecology and Environment, 1992).

The FAA Sand Point facilities, operational since 1977, are not permanently staffed by FAA personnel but are operated remotely from the Cold Bay FAA Flight Service Station (Ecology and Environment Inc., 1992). The FAA facilities include navigational aids, lighting systems, an Automated Weather Observing System, and associated structures. There is no water supply at the FAA facilities. Water is transported from the Sand Point public water system as needed (Ecology and Environment Inc., 1992). A detailed description of FAA properties at the Sand Point facilities and a listing of suspected sources of contamination near the facilities are in the Environmental Compliance Investigation Report of the FAA Sand Point facilities prepared by Ecology and Environment, Inc. (1992).

Climate

Sand Point is in the maritime climate zone (Hartman and Johnson, 1978). The climate of the area is characterized by small temperature variation, high humidity, heavy precipitation, persistent moderate wind, and frequent fog and cloudiness. Wind speed averages about 20 km/hr and extensive fog frequently disrupts air transportation from July through September (Bomhoff and Associates, Inc., 1977). The mean annual temperature is 4.7 °C (table 1). August is typically the warmest month of the year and has a mean temperature of 11.5 °C (Leslie, 1989). February is normally the coldest month and has a mean temperature of -0.9 °C. The total annual precipitation is about 1,200 mm. December and September are typically the months having the highest precipitation with about 160 mm and 150 mm of precipitation, respectively. Precipitation as snow is about 280 mm each year, most of which (about 140 mm) occurs in January. Mean monthly and annual temperature, precipitation, and snowfall are summarized in table 1.

Table 1. Mean monthly and annual temperature, precipitation, and snowfall for the period 1980 to 1987, Federal Aviation Administration Sand Point facilities
[Modified from Leslie (1989); °C, degree Celsius; mm, millimeter]

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
						Temperature (°C)							
Mean maximum	2.9	1.6	3.7	4.1	7.7	10.9	14.4	14.6	12.2	8.3	5.2	3.8	7.4
	(Record maximum 21.7 °C, July 1986)												
Mean minimum	-1.7	-3.5	-0.5	-1.6	1.5	4.3	7.8	8.3	6.1	2.4	0.4	-0.6	1.9
	(Record minimum -16.1 °C, February 1986)												
Mean	0.6	-0.9	1.8	1.3	4.6	7.6	11.1	11.5	9.2	5.3	2.8	1.6	4.7
						Precipitation (mm of moisture)							Total
	93	63	93	72	77	88	81	106	153	97	118	161	1,202
						Snowfall (mm)							Total
	140	41	28	25	0	0	0	0	0	0	20	23	277

Vegetation

Vegetation near Sand Point is described by Viereck and Little (1972) as a wet tundra system. Sedge and grass mats are the dominant vegetative cover, but willow-alder thickets are found in drainages and protected low areas below an elevation of about 275 m (Selkregg, 1976). The eastern part of Popof Island is more mountainous than the area near Sand Point and is characterized by an alpine vegetation system that is composed of areas of barren rocks and rubble interspersed with low plant mats (Viereck and Little, 1972). Local growths of crowberry, blueberry, cranberry, and prostrate willows are found in protected areas at the higher elevations.

GEOLOGY

Wahrhaftig (1965) includes the region surrounding Sand Point and Popof Island in the Alaska-Aleutian Physiographic Province of the Pacific Mountain System Division. Extensively glaciated folded and faulted sedimentary rocks of Mesozoic and Cenozoic age intruded by volcanoes of Tertiary and Holocene age form the Aleutian Range, the dominant physiographic feature of the Alaska Peninsula. Popof Island is about 13 km south of the Alaska Peninsula and is separated from the peninsula by Unga Strait (fig. 1). Bedrock on Popof Island is composed of basaltic and andesitic lava flows of Tertiary age with interbedded layers of volcanic ash and tuff (Selkregg, 1976). Surface exposures, similar to those on the south side of the neighboring Alaska Peninsula, include shallow-marine and continental deposits rich in volcanic or plutonic detritus (Bruns and others, 1985). On much of the island, particularly in low-lying areas, the unconsolidated surficial and shallow deposits consist of layers of ash and tuff up to 9 m thick.

Depth to bedrock at the FAA facilities is not documented. Aerial photographs of the Sand Point airport indicate that some building sites may have been excavated. If so, some structures may be on bedrock. FAA facility components are often so widely dispersed at a facility that shallow geological conditions may differ at different sites.

Soils on western Popof Island are typically highly acidic, well-drained, dark soils derived from volcanic ash, cinders, and till (Rieger and others, 1979). Poorly drained peat mats are found in depressions. The underlying unconsolidated sediments may be cinder and ash deposits, sandy or gravelly alluvium, gravelly till, or till.

HYDROLOGY

Surface Water

Surface-water resources near the FAA Sand Point facilities consist of several small streams, a few small lakes and ponds, and a boggy upland area about 2 km northeast of the airport (fig. 1). The largest nearby stream system is Humboldt Creek which drains the upland bog and flows north and west into Humboldt Harbor near the city of Sand Point. A small reservoir on Humboldt Creek serves as the source of the Sand Point public water supply (Ecology and Environment Inc., 1992). Whiskey Bills Creek drains a small basin east of the Sand Point airport and flows into Popof Strait near the south end of the runway (fig. 1). The USGS operated streamflow-gaging stations at both creeks for the period of August 1983 through March 1984 (U.S. Geological Survey, 1985). Hydrographs showing the discharge of each creek for the period of record are shown in figures 2 and 3. Streamflow-gaging station 15297603 on Humboldt Creek (fig. 2) has a drainage area of about 13 km^2. About 30 m downstream from the water-supply reservoir, discharge at the streamflow-gaging station is partially regulated by a reservoir headgate and by city water withdrawals (U.S. Geological Survey, 1985). Discharge at Whiskey Bills Creek streamflow-gaging station 15297602 (fig. 3) is also partially controlled by an unused reservoir about 300 m upstream. The drainage area above the streamflow-gaging station is about 0.8 km^2. The respective mean discharges for the 8 month period of record at the Humboldt Creek and Whiskey Bills Creek streamflow-gaging stations are about 0.6 m^3/s and 0.04 m^3/s. The calculated mean unit-area discharge for each drainage basin is about 0.05 $(m^3/s)/km^2$.

No water-quality information was collected at these streamflow-gaging stations by the USGS (U.S. Geological Survey, 1989) and none was recovered from other potential sources. Surface runoff in the vicinity of the FAA facilities flows directly into Popof Strait north, west, and south of the facilities (Ecology and Environment Inc., 1992). The lagoon immediately west of the runway is also a probable receptor of surface runoff.

The FAA Sand Point facilities are not on the flood plain of a large river and there is no recorded history of floods at the facilities. The flood hazard at the nearby city of Sand Point is considered to be low (U.S. Army Corps of Engineers,1993; Paul Meyer, National Weather Service, oral commun., 1995). Like the city of Sand Point, the FAA facility's low elevation and proximity to the shoreline of Popof Strait may expose the FAA facilities to coastal flooding by storm surges and by local or teleseismic tsunamis (U.S. Army Corps of Engineers, 1993). Brower and others (1977) calculate that the 100-year extreme wave height in the open-water marine setting in the Gulf of Alaska near Sand Point is about 39 m. However, Popof Island is in the lee of several other islands and somewhat protected from Gulf of Alaska storms. Ecology and Environment, Inc. (1992) reports that the city of Sand Point is subject to coastal and tsunami flooding at a frequency of less than 100 years. Aerial photographs of the Sand Point airport indicate that the areas of the airport and spit exposed to coastal erosion processes have been armored with riprap.

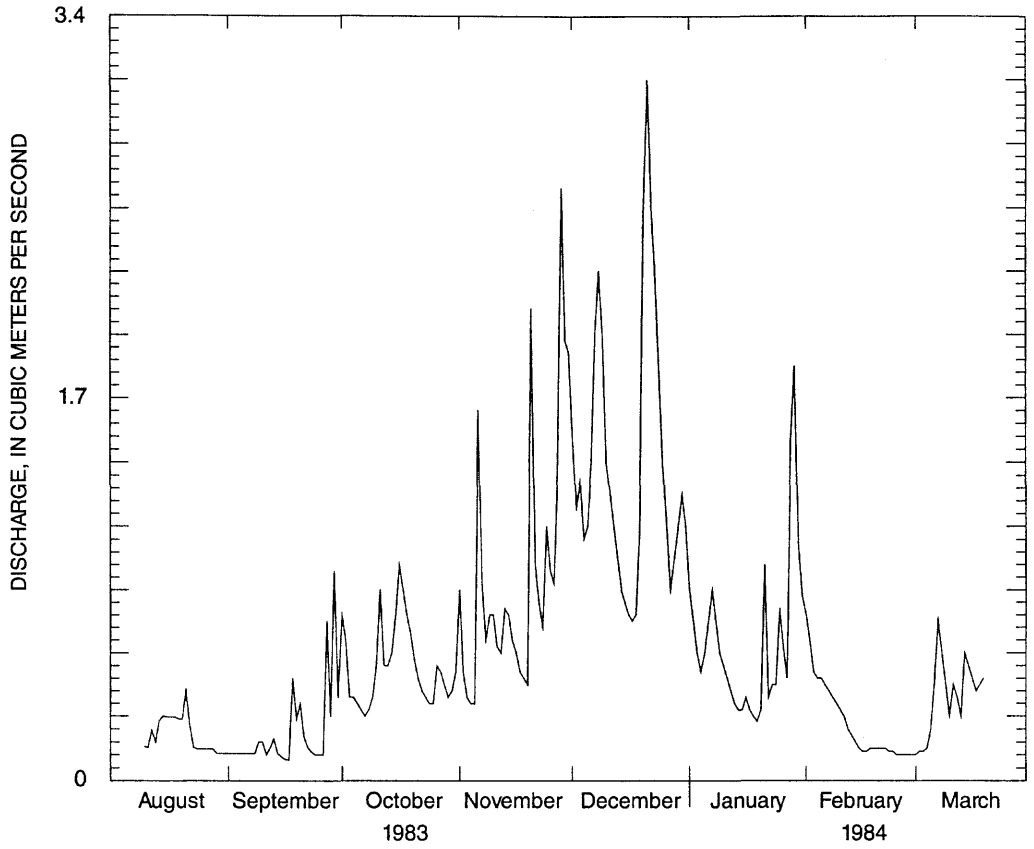


Figure 2. Hydrograph showing discharge of Humboldt Creek at Sand Point, Alaska.

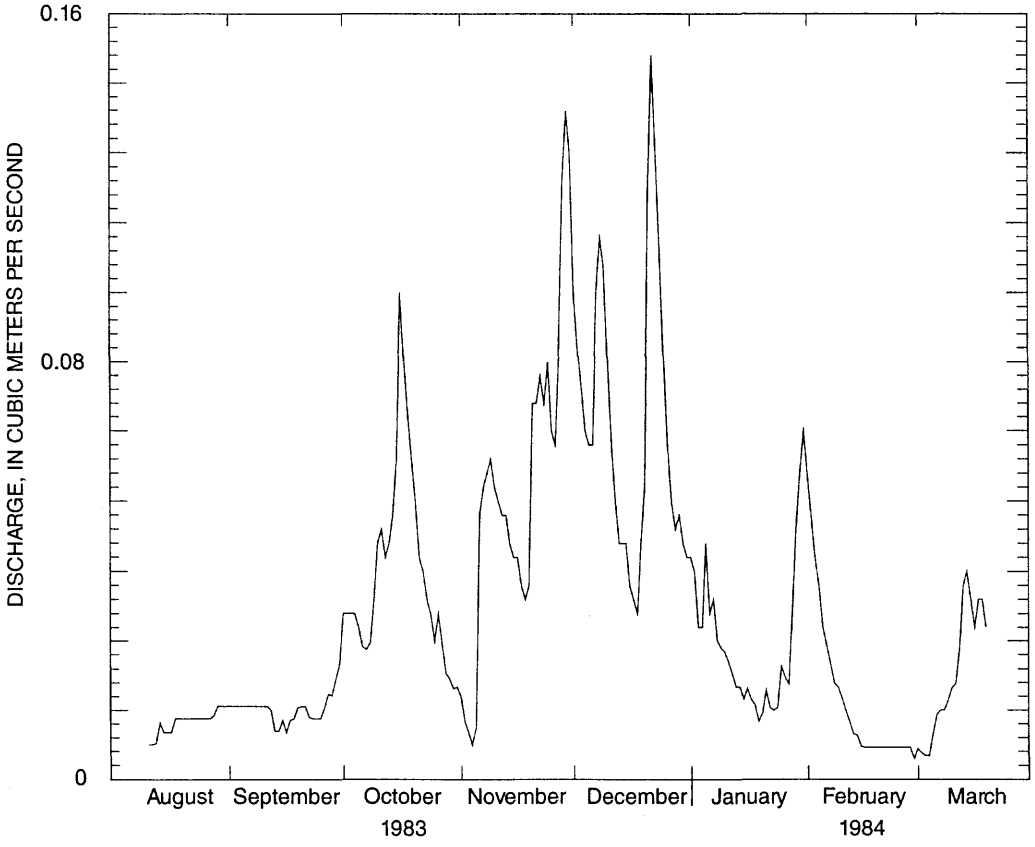


Figure 3. Hydrograph showing discharge of Whiskey Bills Creek near Sand Point, Alaska.

Ground Water

There are no records of water wells at the FAA Sand Point facilities or in the nearby city of Sand Point (Ecology and Environment Inc., 1992; Alaska Department of Community and Regional Affairs, 1994), and the local ground-water system and ground-water quality cannot be adequately evaluated. Aerial photographs of the Sand Point airport indicate that surficial and shallow sediments at the FAA facilities may have been disturbed by construction activity which may have locally altered the shallow ground-water system. Aquifers may exist in the sand and gravel forming the spit at Sand Point and in similar sediments that might underlie the FAA facilities. If so, they may be subject to contamination by surface spills and hazardous-material disposal and by saltwater intrusion from nearby Popof Strait. Ground-water-flow direction in aquifers beneath the FAA facilities is probably west and north toward Popof Strait. Shallow aquifers might also discharge into the lagoon immediately west of the runway.

Drinking-Water Sources

At the present time, there are no operational drinking-water sources at the FAA Sand Point facilities. When water is required at the facilities, it is hauled from the city's water reservoir (Ecology and Environment, Inc., 1992). The drainage basin supplying the city's water reservoir on Humboldt Creek is several kilometers east of, and at an elevation several meters higher than, the FAA facilities. Consequently, surface contamination at the FAA facilities is not likely to contaminate drinking-water supplies presently in use by residents of the area.

Alternative drinking-water sources for the FAA facilities might include Whiskey Bills Creek near the airport's southeastern boundary and unmapped aquifers. However, no data are available to characterize the quality and quantity of aquifers in the area.

SUMMARY

The FAA Sand Point facilities are at the Sand Point airport about 3 km south-southwest of the city of Sand Point, Alaska. The facilities are on Popof Island, one of the Shumagin Islands, in southwest Alaska. Located in the maritime climate zone, the facilities are subject to abundant precipitation, persistent wind, and frequent fog. Vegetation near the facilities consists primarily of sedge and grass mats with scattered stands of low willows and alders. Bedrock near the facilities is composed of Tertiary volcanic rocks and soils are derived from ash, cinder, and till. Flood hazard is low, although the low-lying coastal location of the FAA facilities may be subject to storm-surge and tsunami flooding. Unstaffed and remotely operated, the facilities do not have an FAA-owned drinking-water system. When needed, water is transported from Sand Point's public water system. Because of its location, surface contamination at the FAA facilities is not likely to contaminate drinking-water supplies for the city of Sand Point. Data concerning the current quantity and quality of potential alternate sources of drinking water for use at the FAA facilities are not adequate to characterize these sources.

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