Overview of Environmental and Hydrogeologic Conditions at Seven Federal Aviation Administration Facilities in Interior Alaska

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U.S. GEOLOGICAL SURVEY

Open-File Report 95-341

Prepared in cooperation with the

FEDERAL AVIATION ADMINISTRATION

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By Eppie V. Hogan and Joseph M. Dorava

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Anchorage, Alaska
1995

U.S. DEPARTMENT OF THE INTERIOR
BRUCE BABBITT, Secretary

U.S. GEOLOGICAL SURVEY
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CONVERSION FACTORS, VERTICAL DATUM, AND ABBREVIATED WATER-QUALITY UNITS

Multiply	By	To obtain
millimeter (mm)	0.03937	inch
centimeter (cm)	0.3937	inch
meter (m)	3.281	foot
kilometer (km)	0.6214	mile
square kilometer (km^2)	0.3861	square mile
meter per kilometer (m/km)	5.2801	foot per mile
liter (L)	0.2642	gallon
liter per second (L/s)	15.85	gallon per minute
liter per day (L/d)	0.2642	gallon per day
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)]	91.49	cubic foot per second per square mile
degree Celsius (°C)	°F = 1.8 x °C + 32	degree Fahrenheit (°F)

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 both the United States and Canada, formerly called Sea Level Datum of 1929.

Abbreviated water-quality units used in this report:

mg/L, milligram per liter

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ABSTRACT

The Federal Aviation Administration owns, operates, or leases airway support facilities near Nenana, Summit, Talkeetna, Sheep Mountain, Gulkana, Slana, and Northway in interior Alaska. Fuels and other potentially hazardous materials may have been used and disposed of at these facilities. The Federal Aviation Administration wishes to consider local environmental and hydrogeologic conditions near these facilities when evaluating options for remediation and compliance with environmental regulations. Interior Alaska has long cold winters and short summers that affect the hydrology of the area. Local residents currently obtain their drinking water from ground-water sources. Surface spills and disposal of hazardous materials may affect the quality of drinking water. Alternative drinking-water sources are available from surface water or possible undiscovered aquifers. This report describes the ground- and surface-water hydrology, geology, climate, vegetation, and flood potential of the areas surrounding these seven Federal Aviation Administration facilities in interior Alaska.

INTRODUCTION

The Federal Aviation Administration (FAA) owns and (or) operates airway support and navigational facilities throughout Alaska. At many of these facilities, fuels and potentially hazardous materials such as solvents, polychlorinated biphenyls, and pesticides may have been used and (or) disposed of. The FAA is conducting studies mandated by the Comprehensive Environmental Response, Compensation, and Liability Act and the Resource Conservation and Recovery Act to determine if environmentally hazardous materials are present. To complete these more comprehensive environmental studies, the FAA requires hydrologic and geologic information for areas surrounding the facilities. This report, the product of compilation, review, and summary of existing data by the U.S. Geological Survey (USGS), in cooperation with the FAA, provides such information for the FAA facilities and nearby areas at Nenana, Summit, Talkeetna, Sheep Mountain, Gulkana, Slana, and Northway, Alaska (fig. 1).

Description of Interior Alaska

The FAA facilities and surrounding areas described in this report are located in interior Alaska, near the foothills of the Alaska Range or the Talkeetna Mountains. Each facility is accessible by both the State highway system and by small aircraft.

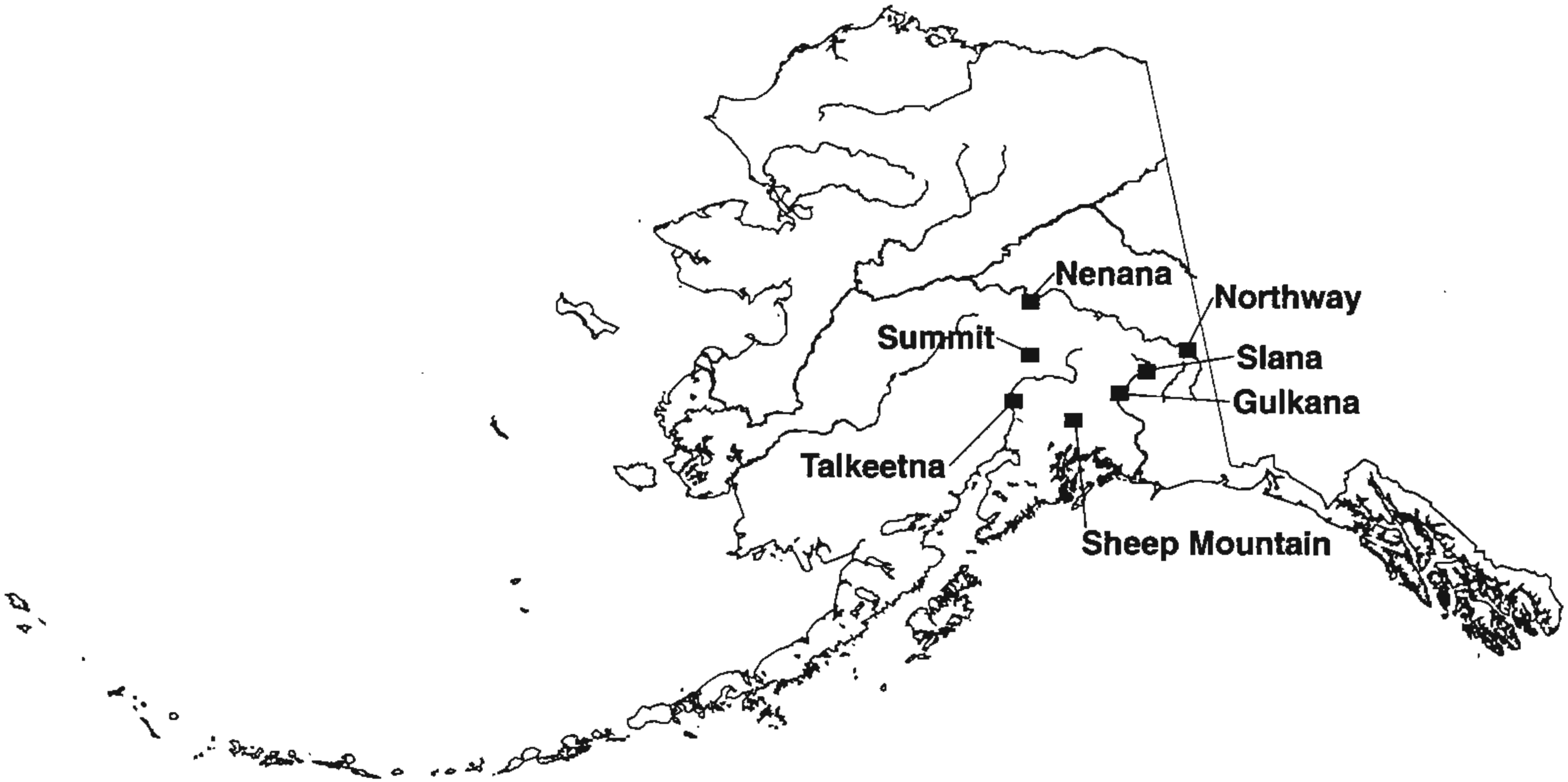


Figure 1. Location of seven Federal Aviation Administration facilities in interior Alaska.

Before the discovery of gold around 1900, people of interior Alaska were mostly Native Indians, Eskimos, or Aleuts. The gold rush brought the first large migration of people from the United States and Europe and by the time the Alaska Railroad was completed in 1920, many more settlers had arrived. A second major influx of people occurred during World War II with the establishment of military bases in the area. Interior Alaska was further developed by the building of the Alaska Highway in 1942 and the construction of the oil pipeline in the 1970's. Most of interior Alaska has a continental climate characterized by significant diurnal and annual temperature variations, low precipitation, and low humidity (Hartman and Johnson, 1984). This accounts for the area's long, cold winters and relatively short, warm summers. The mean annual temperature is typically below freezing; summer temperatures average about 20°C, and winter temperatures commonly reach -30°C.

Vegetation near the FAA facilities described in this report is dominated by open, low-growing spruce forests and alpine tundra (Viereck and Little, 1972). Areas adjacent to large rivers are subject to increased moisture availability and consist of a combination of closed spruce-hardwood forest and shrub thickets (Viereck and Little, 1972).

The bedrock of the Alaska Range and Talkeetna Mountains includes a variety of igneous sedimentary and metamorphic rocks that make up a collage of tectonic-stratigraphic terranes bounded by major faults (Nokleberg and others, 1994). Quaternary glaciation of this area greatly modified the landscape and distributed a variety of unconsolidated sediments over the valley floors and lowlands. Most soils are poorly drained and organic rich, especially in low-lying areas (Rieger and others, 1979). Much of this region is underlain by discontinuous permafrost (Ferrians, 1965).

Hydrology

Surface water is abundant in interior Alaska and each of the seven FAA facilities is located within a few kilometers of a river, stream, or lake. Some of the FAA facilities are located near rivers and streams where there is potential for flooding and erosion problems. Several rivers flood annually with the melting of snow in the spring or with heavy rainfall in autumn. Those rivers having glaciers in their basins carry large quantities of sediment in their channels. The channels are continuously moving back and forth across the flood plain, thereby increasing the potential for erosion. This migration poses a threat to structures built near the rivers.

Ground water is the principal source of drinking water for residents living near the FAA facilities in interior Alaska. More populated areas utilize public water-supply systems, whereas remote areas have only private wells. Ground water can be found in aquifers above the permafrost, within it, or below it (Selkregg, 1976). The susceptibility of the aquifers to contamination depends on the permeability of aquifer materials, the depth to the aquifer, and any impervious layers such as permafrost or clay between the aquifer and the land surface. On a regional scale, the direction of ground-water flow generally will follow that of surface-water drainages from the mountains to major rivers and then to the coast. Site-specific ground-water flow directions can only be determined through detailed mapping of the water table.

Most of the FAA facilities in Interior Alaska are near major rivers. Where permafrost does not confine flow to a narrow zone or strip adjacent to the river, shallow ground water flows into and out of the riverbanks as the elevation of the river rises and falls. Seasonally, discharges of local rivers fluctuate from a maximum in late July or early August to a minimum in late February or early

March. The water table generally rises and falls in response to these river fluctuations.Water-table fluctuations, however, are attenuated with distance from the river. The flow of water into and out of the aquifer in response to changing stage of the river is termed "bank-storage effects" (Linsley and others, 1982 (fig. 2).

Studies to determine the extent of ground-water and surface-water interaction at the seven FAA facilities have not been done, and no continuous records of water-table elevations exist. The water-table fluctuations generally will be an attenuated version of river-level fluctuations, which generally will follow fluctuations of the Tanana River at Nenana (fig. 3).

NENANA

Location and Background

Nenana is located in central-interior Alaska (fig. 1; fig. 4) at lat 64°34' N., long 149°06' W., on the south bank of the Tanana River, due east of the mouth of the Nenana River. Nenana is about 400 km north of Anchorage and 90 km southwest of Fairbanks. The village is in the northern part of the Tanana-Kuskokwim Lowland, a large depression bordering the Alaska Range to the north. Immediately west of Nenana are fields of stabilized sand dunes (Wahrhaftig, 1965). The FAA has facilities at Nenana and North Nenana (fig. 4). The Nenana facility is in the southern part of the village at the Nenana Municipal Airport and the North Nenana facility is 3.2 km north of this airport. A detailed list of FAA owned and operated facilities near Nenana and a list of suspected sources of contamination can be found in an Environmental Compliance Investigation Report by Ecology and Environment, Inc. (1992a).

Nenana is in the western part of traditional Tanana Athabaskan Indian territory. The village was an important steamboat station at the turn of the century and the discovery of gold in Fairbanks in 1902 brought much activity to Nenana. A trading post was established in 1903, an Episcopal mission in 1907, and a post office in 1908 (Fison and Associates, 1987). In 1915, construction of the Alaska Railroad began that linked Nenana with Fairbanks and Seward, and the population soon doubled.

In 1910, the population of Nenana was 190 and had grown to more than 600 by 1920. Since 1950, following periods of growth and decline, the population of Nenana has been steadily increasing. In 1950, the population was 242; in 1960 it was 319; in 1970 it was 373; and in 1990 it was 393 (Fison and Associates, 1987; U.S. Bureau of Census, 1991). According to the U.S. Bureau of Census (1991), 188 people were American Indian, Eskimo, or Aleut, 197 people were Caucasian, and the rest were of Asian, Pacific Islander, or Black origin. The current population in Nenana is about 500 people.

Nenana is on the George Parks Highways, linking Anchorage and Fairbanks. Transportation companies, fuel companies, and a small retail sector compose Nenana's private economy, which is supplemented by local subsistence activities including, hunting, fishing, and trapping (Fison and Associates, 1987).

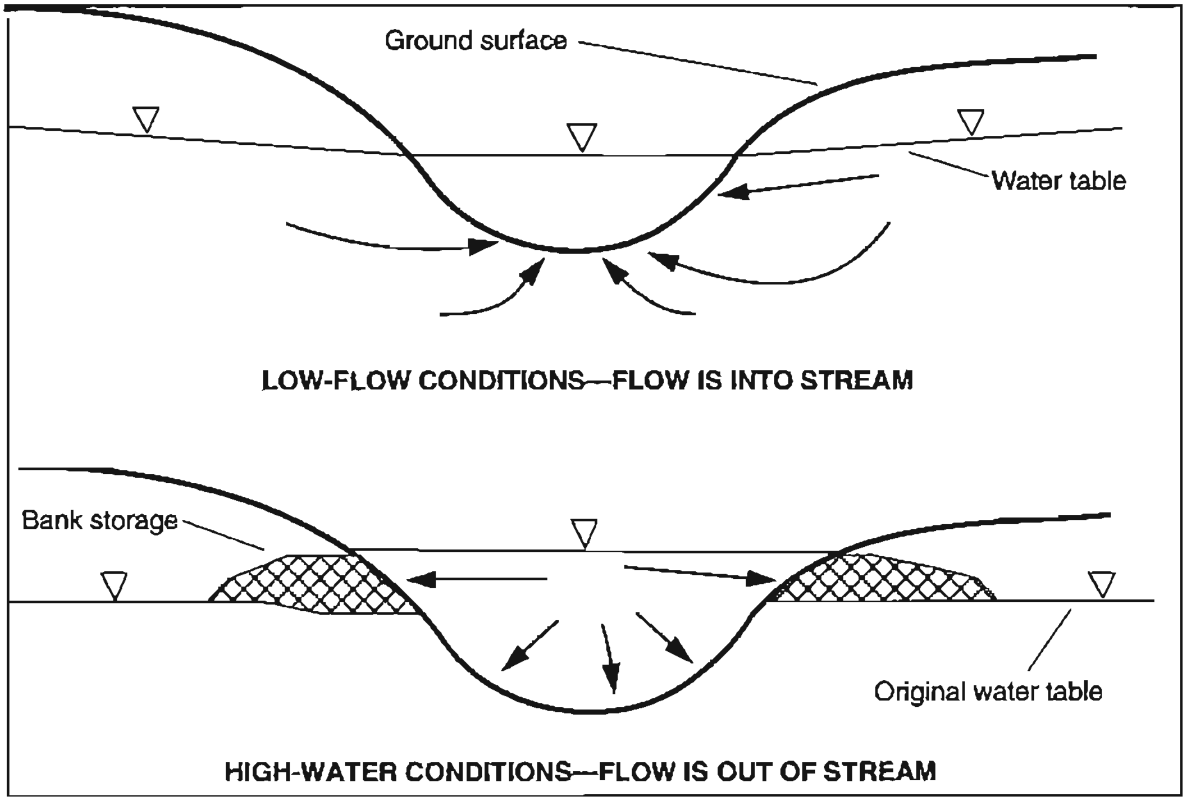


Figure 2. Ground-water/surface-water interactions.

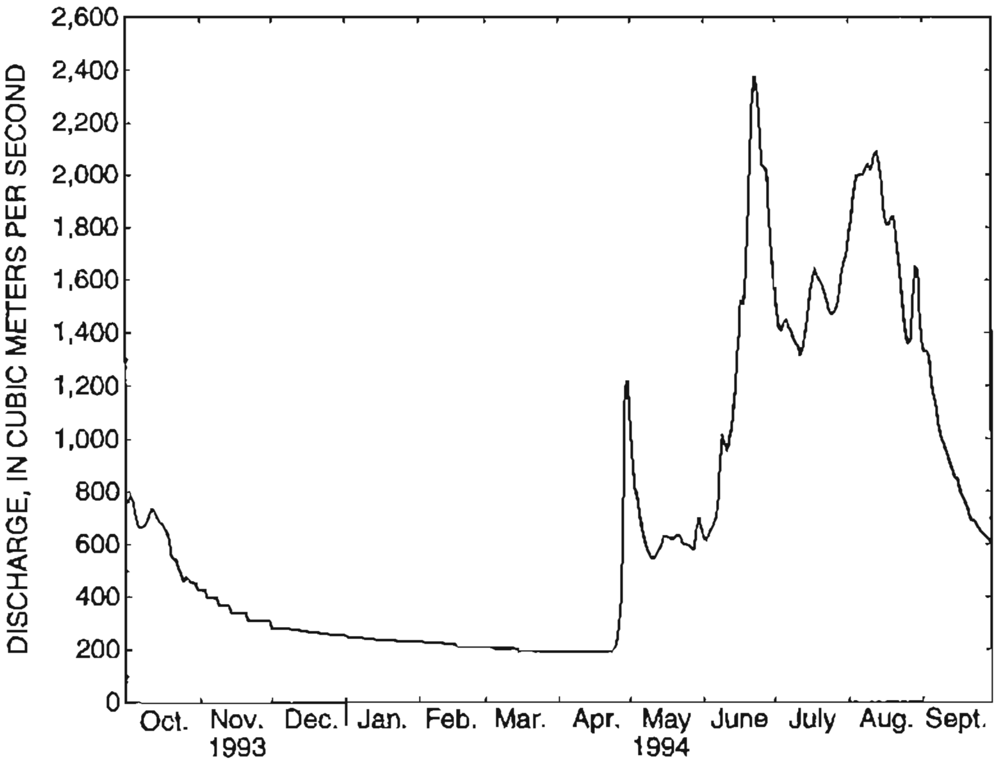


Figure 3. Discharge of the Tanana River at Nenana, 1994 water year.

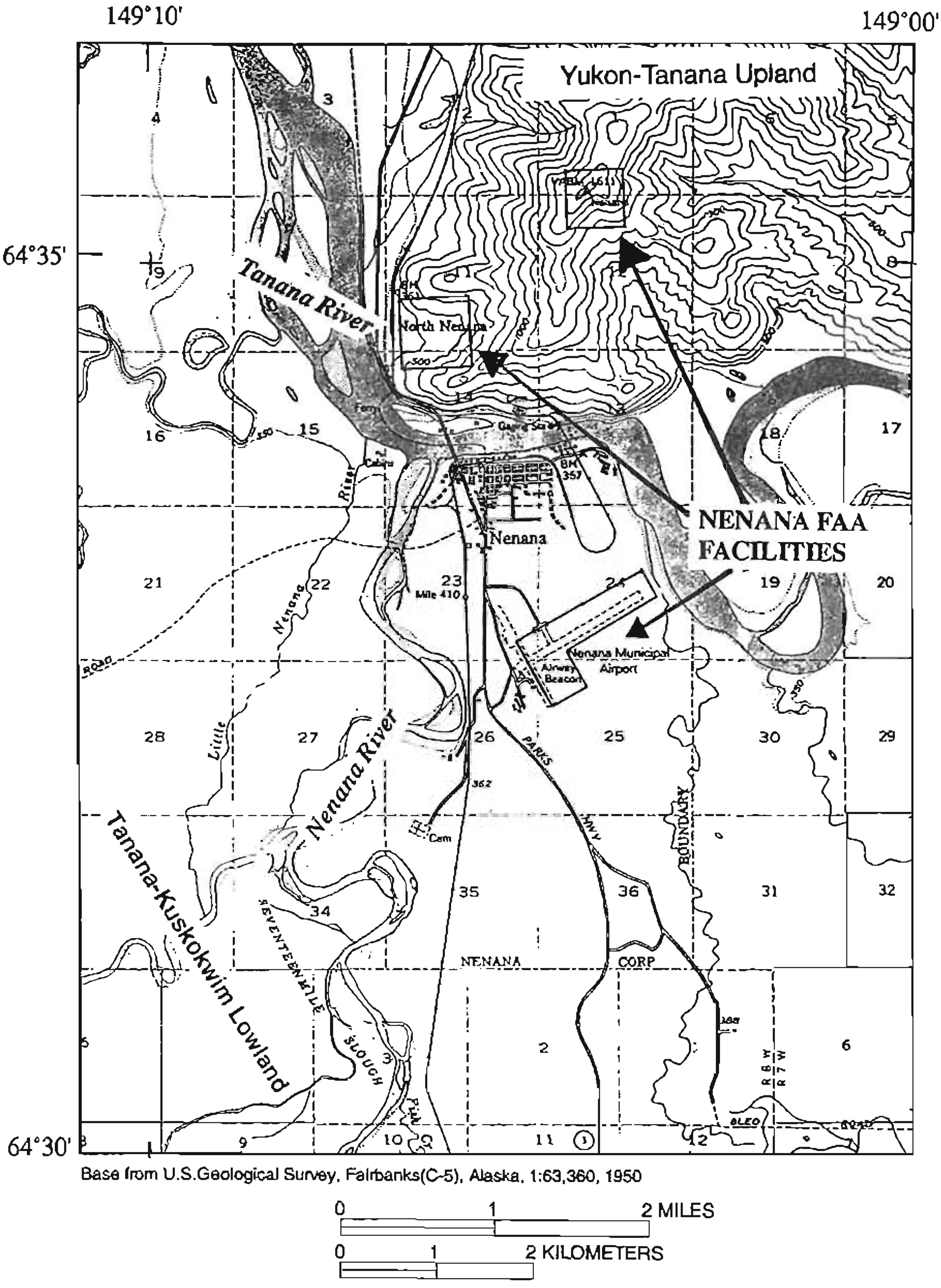


Figure 4. Location of Nenana, Alaska and the Federal Aviation Administration facilities.

During and immediately following World War II, the Civil Aeronautics Administration (predecessor to the FAA) operated the Nenana Airport (fig. 4). The FAA facilities included an omnidirectional range station, a tactical air-navigation station, a low-medium-frequency loop range facility, an approach lighting system, a flight-service station, and employee residences. The airport is presently owned and maintained by the village of Nenana, and the former FAA flight service station is utilized by the Yukon-Koyukuk School District (Fison and Associates, 1987).

Physical Setting

Climate

Nenana has a mean annual temperature of -3.6°C, and temperatures range from a July mean maximum of 21.9°C to a January mean minimum of about -27.9°C (Leslie, 1989; table 1, this report). Mean annual precipitation is 286 mm and mean annual snowfall is about 1,200 mm.

Table 1. Mean monthly and annual temperature, precipitation, and snowfall for 1922-25, 1930-76, and 1983-87, Nenana

[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	-17.4	-13.4	-6.2	3.4	14.3	21.2	21.9	18.6	12.0	0.7	-10.8	-17.0	2.3
	(Record maximum 36.7 °C, June 1934)												
Mean minimum	-27.9	-25.5	-20.8	-8.9	1.2	7.3	8.8	6.6	0.8	-8.2	-20.0	-27.0	-9.5
	(Record minimum -56.1 °C, December 1961)												
Mean	-22.7	-19.5	-13.5	-2.8	7.7	14.2	15.3	12.6	6.4	-3.7	-15.6	-22.0	-3.6
						Precipitation, in millimeters of moisture							
	17.5	11.7	9.4	6.9	15.2	34.3	55.1	61.5	31.0	16.5	13.7	13.2	Total 286.0
						Snowfall, in millimeters							
	236.2	170.2	142.2	73.7	7.6	0.0	0.0	0.0	15.2	170.2	203.2	185.4	Total 1204.0

Vegetation

Vegetation in the Nenana area consists primarily of bottomland spruce-poplar forest; expanses of wet bog are along the Tanana River to the north and spruce-hardwood forest are along the Nenana River to the west (Viereck and Little, 1972). Bottomland forests are primarily black spruce mixed with poplar, paper birch, and tamarack with an undergrowth of willow, rose, and Labrador tea. Mosses, sedges, and grasses make up bog areas; whereas white spruce and aspen are common to hardwood forests (Viereck and Little, 1972). The FAA facility at the airport is completely encompassed by bottomland spruce-poplar forest with areas of wet bog at each end of the runway.

Geology and Soils

Bedrock in the Nenana area is primarily schist of pre-Cambrian age (Foster and others, 1994). The schist is highly fractured however its properties as an aquifer are unknown. North of the Tanana River, in the Yukon-Tanana Upland (fig. 4), bedrock is commonly concealed by thick vegetation or surficial deposits. South of the Tanana River, near the village of Nenana, bedrock may be more than 90 m below land surface (Kachadoorian, 1960).

The village of Nenana is on the alluvial plain of the Tanana River, near the mouth of the Nenana River. Most of the surficial materials surrounding Nenana are flood-plain alluvium (Péwé and others, 1966; Rieger and others, 1979; Selkregg, 1976). These deposits are part of an extensive sequence of alluvial deposits that are more than 90 m thick and consist of interbedded lenses of silt, sand, gravel, and boulders, mixed with wood, peat, and other organic material. Flood plain deposits are poorly drained and usually are saturated above shallow permafrost (Kachadoorian, 1960; Selkregg, 1976). Surficial deposits at the Nenana FAA facility, south of the village consist of poorly drained silt and sand. The deposits contain about 95 percent silt and 5 percent fine-to-medium-grained sand. A layer of windblown silt, 15 to 45 cm thick, overlies most of the area.

The soils found in the Nenana area are similar to those occurring on the flood plains of streams and rivers in interior Alaska and are of two major types (Rieger and others, 1979). The first type which occupies about 50 percent of the area is poorly drained, stratified silty to sandy loam overlain by a thick layer of organic matter. The second type is well-drained, highly stratified fine sand and silt loam that has thin lenses of organic material throughout (Rieger and others, 1979).

Nenana is in the zone of discontinuous permafrost (Ferrians, 1965; Selkregg, 1976). The village and most of the area south of the Tanana River and east of the Nenana River are underlain by shallow permafrost that is within 1 to 2 m of the land surface. The maximum thickness of permafrost in this area is about 80 m (Kachadoorian, 1960). Permafrost generally is absent directly adjacent to and beneath the Tanana and Nenana Rivers (Ferrians, 1965).

Hydrology

Surface Water

The Tanana River flows from east to west along the northern edge of the village and the Nenana River flows from south to north about 0.5 km to the west (fig. 4). Flow at streamflow-gaging station 15515500, Tanana River at Nenana, was reported for 1962 to 1993 (table 2). During the open-water months from May to September, mean flow is about 1,300 m^3/s, and in the winter months, from November to March, mean flow is about 200 m^3/s (U.S. Geological Survey, 1994). The Tanana River drains an area of about 66,600 km^2 upstream from the village of Nenana (U.S. Geological Survey, 1994). The Tanana River at Nenana typically freezes in October and the ice melts in May. Although the river is important to residents of Nenana, it also can cause significant flooding and erosion.

Table 2. Mean monthly flow for 15515500, Tanana River at Nenana, 1962-93

[Values in cubic meters per second]

Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
190	185	180	240	900	1,400	1,700	1,600	940	470	260	200

Flow at streamflow-gaging station 15518300, Nenana River at Rex, about 40 km upstream from Nenana, was reported for 1964 to 1968. Monthly mean flow during open-water months is about 280 m^3/s, and mean flow during the winter is about 20 m^3/s. This river drains an area of about 6,300 km^2 (U.S. Geological Survey, 1976).

The topographical gradient between the Nenana Airport and the village of Nenana is about 2.5 m/km. The northward slope generally causes runoff to flow toward the Tanana River and its tributaries. Average runoff in the Nenana area is about 33 cm/yr (U.S. Geological Survey, 1994).

Floods and Erosion

The community of Nenana is flooded to some extent each year and is considered to have a high flood hazard (U.S. Army Corps of Engineers, 1993). Two types of flooding occur in the Nenana area: ice-jam floods and runoff floods (U.S. Army Corps of Engineers, 1993).

Floods caused by ice jams may occur in the Nenana area during spring breakup when ice begins to move in the river. As the ice breaks up it flows downstream until its movement is blocked. The blockage restricts water flow and produces a rise in water level or a "backwater" effect upstream from the ice jam. When the ice jam releases, a flood wave propagates downstream and large ice volumes are mobilized (Beltaos, 1990).

Runoff flooding is the predominant type of flooding in the Nenana area (U.S. Army Corps of Engineers, 1993). This type of flooding generally occurs in late spring or early fall and is caused by a combination of large amounts of rainfall on saturated soils. Natural obstructions such as beaver dams, trees, brush, and other vegetation, as well as manmade impediments such as bridges and culverts, can exacerbate local flooding especially in small creeks and ditches. These obstructions may result in overbank flows, unpredictable areas of flooding, and increased flow velocity directly downstream from a released obstruction.

Major flooding of the Tanana River system near Nenana occurred in 1967, 1971, and 1989. The largest known flood occurred on August 18, 1967 when measurements from streamflow-gaging station 15515500 Tanana River near Nenana indicated a maximum gage height of 5.7 m and a discharge of about 5,300 m^3/s (Jones and Fahl, 1994). Floodwaters on this date overtopped a low dike across the upper end of the village, thereby flooding the village of Nenana (U.S. Army Corps of Engineers, 1968).

Because of the frequent floods in Nenana, several flood-protection measures have been considered including dikes, levees, and a combined flood-protection and urban-development program (U.S. Army Corps of Engineers, 1968). As of 1987, no major flood-protection project had been undertaken in Nenana (Fison and Associates, 1987). Nenana is currently participating in the National Flood Insurance Program (U.S. Army Corps of Engineers, 1993).

Riverbank erosion is a major problem in the Nenana area and is particularly extensive near the airport (U.S. Army Corps of Engineers, 1993). As of 1987, no specific erosion-prevention measures had been constructed.

Ground Water

Ground water is abundant in the Nenana area. A northward-sloping piedmont of coalescing alluvial fans and outwash deposits, extending from the community of Delta Junction on the east to Nenana on the west, contains one of the major aquifers of Alaska. The alluvial aquifer is recharged by infiltration from rivers near the mountain fronts. Ground water flows northward from these recharge areas and discharges to the Tanana River and its tributaries. South of Nenana, the aquifer is locally recharged in the area between the mountain front and Clear Air Force Station. Ground-water discharge occurs between the community of Anderson, about 25 km south of Nenana, and the Tanana River. Local spring-fed streams are maintained by ground-water discharge from this aquifer. Additional discharge occurs to the Tanana River and the lower reaches of the Nenana River.

Two wells drilled near the Nenana Municipal Airport reached ground water between 2.4 and 3.4 m below land surface (Ecology and Environment Inc., 1992a). A well constructed in 1955 at the Nenana High School tapped into a sandy gravel aquifer at a depth of less than 6 m below land surface (Anderson, 1970).

Drinking Water

Present Drinking-Water Supplies

Public drinking water in Nenana comes from two wells: a 15.2-meter-deep well developed in 1977 and a 30.5-meter-deep well developed in 1984 (Fison and Associates, 1987). The public utility water is chlorinated and fluoridated. The water is stored in a 567,000-liter heated tank and then distributed to 140 connections by two circulating loops. Nenana residents outside the municipal water system use their own shallow wells for water supply (Fison and Associates, 1987; U.S. Bureau of Census, 1991). Wells in the alluvial deposits adjacent to the Tanana and Nenana Rivers generally have yields greater than 60 L/s (Anderson, 1970).

Quality of the Present Supply

With the exception of iron concentrations, major ions and water properties are within current U.S. Environmental Protection Agency (USEPA) and Alaska Department of Environmental Conservation (ADEC) drinking-water regulations (Appendix 1; ADEC, 1995). Analytical results of samples taken in 1970 from the well at Nenana High School indicated a dissolved iron concentration of 32 mg/L, a chloride concentration of 5 mg/L, and a sodium concentration of 9.4. mg/L (table 3; Anderson, 1970).

Table 3. Selected water-quality data from the alluvial aquifer near Nenana
[mg/L, milligrams per liter]

Constituent (or property)	USEPA Drinking-water regulation (mg/L)	Concentration in the aquifer (mg/L)
Chloride (Cl)	250	5
Iron (Fe)	.3	32
Sulfate (SO_4)	400	1
Fluoride (Fl)	2	0
Sodium (Na)	100	9.4
Total dissolved solids	500	370
pH (units)	6.5-8.5	7.2

Alternative Drinking-Water Sources

Nenana is in the discharge area of the regional aquifer. The net-vertical flow of ground water in a discharge area is upward. This upward flow will inhibit the downward migration of contaminants that are either soluble or lighter than water. Deep parts of the aquifer, especially areas beneath a confining layer of permafrost, may be an alternative water supply. The Tanana and Nenana Rivers represent abundant sources of drinking water for the foreseeable future. During months of low discharge, mean flows in the Tanana and Nenana Rivers are about 220 and 20 m^3/s respectively, and when combined are much more than the estimated water use in Nenana.

Quality of the Alternative Sources

The quality of water at streamflow-gaging station 15515500 Tanana River at Nenana was monitored intermittently from 1954 to 1993. Major ions, nutrients, trace metals, and water properties were analyzed (Appendix 1). The most recent water samples, taken in 1993, contained dissolved-iron concentrations that ranged from 0.02 to 0.04 mg/L, a sulfate concentration that ranged from 31 to 43 mg/L; and total dissolved solids concentrations that ranged from 127 to 190 mg/L (table 4; Appendix 1; U.S. Geological Survey, 1994).

The quality of the Nenana River also was monitored by the USGS intermittently from 1953 to 1968. The limited record of water quality indicated that, with the exception of iron in a few samples, major ions and measured water properties were within current USEPA and ADEC drinking-water regulations (table 4; Appendix 1). Water samples contained dissolved-iron concentrations that ranged from 0.02 to 0.55 mg/L (U.S. Geological Survey, 1969; Anderson, 1970).

Table 4. Selected water-quality data from the Tanana and Nenana Rivers near Nenana
[mg/L, milligrams per liter]

Constituent (or property)	Drinking-water regulation (mg/L)	Concentration (mg/L)	
		Tanana River	Nenana River
Chloride (Cl)	250	1.1-1.4	0-3.5
Iron (Fe)	.3	.02-.04	.02-.55
Sulfate (SO_4)	400	31-43	12-112
Fluoride (Fl)	2	.1	.1-.5
Sodium (Na)	100	3.6-4.5	.5-4.4
Total dissolved solids	500	127-190	62-219
pH (units)	6.5-8.5	7.8-8.0	7.0-8.0

SUMMIT

Location and Background

Summit is in the Alaska Range (fig. 1; fig. 5) at lat 63°20' N., long 149°08' W. Summit is about 14 km southwest of Cantwell at the summit of Broad Pass, marking the drainage divide between the Chulitna and Nenana Rivers. The village is in the northern part of the Broad Pass Depression, a wide trough characterized by a glaciated floor, drumlin-like hills, and long, narrow morainal lakes (Wahrhaftig, 1965). The FAA facilities are concentrated around a landing strip in Summit (fig. 5). A detailed list of FAA owned and operated facilities in Summit and a list of suspected sources of contamination can be found in an Environmental Compliance Investigation Report by Ecology and Environment, Inc. (1992b).

The Summit area was originally occupied by the Athabaskan-speaking Tanana Indians who utilized the rivers and streams of the Cook Inlet region for subsistence fishing (Selkregg, 1976). The village itself began as a camp formed during the construction of the Alaska Railroad over Broad Pass. Summit was established in 1919 and named "Summit Lake" (Orth, 1967). Since then, the only major undertakings in the area have been the opening of Denali National Park and Preserve and the construction of the George Parks Highway connecting Anchorage and Fairbanks. These activities opened the area to tourism, hunting, and fishing. There are no known permanent residents within a 6-kilometer radius of the Summit FAA facility (Ecology and the Environment Inc., 1992b). Cabins are occupied seasonally near Summit and Mirror Lakes. About 200 people live in Cantwell.

In 1939, the Civil Aeronautics Administration sequestered land from public domain to construct air-navigation facilities in Summit. In 1963, the FAA relinquished most of the land to the State of Alaska and in the 1970's, conveyed the rest to a local Native corporation. Current facilities (fig. 5) include a radio communications outlet, a nondirectional beacon, an airstrip, and former employee residences.

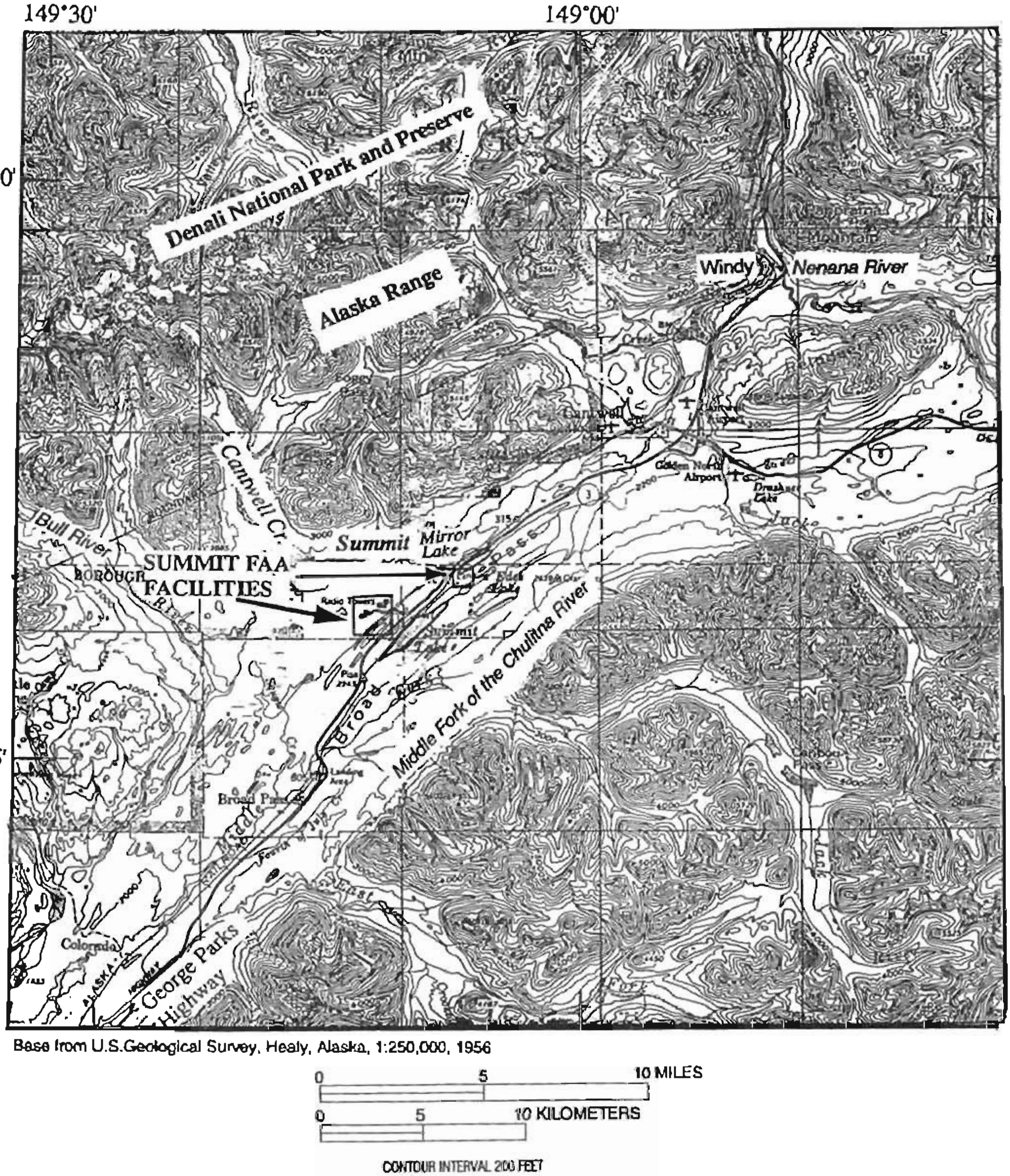


Figure 5. Location of Summit, Alaska and the Federal Aviation Administration facilities.

Physical Setting

Climate

Summit has a mean annual temperature of -3.7°C, but temperatures range from a July mean maximum of 15.7°C to a January mean minimum of about -21°C (Leslie, 1989; table 5, this report). Mean annual precipitation is about 495 mm and about 3,090 mm of snow falls annually.

Table 5. Mean monthly and annual temperature, precipitation, and snowfall for Summit, 1941-76

[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	-13.8	-10.5	-7.5	0.4	7.6	14.4	15.7	13.5	8.4	-1.1	-9.3	-12.7	0.4
(Record maximum 31.7 °C, June 1961)													
Mean minimum	-21.0	-18.2	-16.7	-10.0	-1.6	4.3	6.6	5.1	0.3	-8.2	-15.9	-19.7	-7.9
(Record minimum -42.8 °C, January 1971)													
Mean	-17.4	-14.3	-12.1	-4.8	3.0	9.3	11.2	9.3	4.4	-4.6	-12.6	-16.2	-3.7
Precipitation, in millimeters of moisture													
	24.1	29.0	25.9	16.3	19.6	54.4	75.2	79.8	70.6	40.4	30.5	29.7	Total 495.3
Snowfall, in millimeters													
	388.6	398.8	406.4	223.5	111.8	27.9	7.6	10.2	116.8	469.9	477.5	452.1	Total 3091.2

Vegetation

Vegetation surrounding the Summit area consists primarily of closed spruce-hardwood forest characterized by an overstory of white spruce, paper birch, poplar, and aspen, with an understory of berries, willows, and Labrador tea. Treeless bogs are in depressions near morainal lakes, and alpine tundra occupies the surrounding slopes and ridges (Viereck and Little, 1972). Sedges, mosses, and grasses are in bog areas on either side of the FAA facility; low heath shrubs, willows, and dwarf herbs are common to the alpine tundra in the Alaska Range to the north (Viereck and Little, 1972).

Geology and Soils

Bedrock is not exposed near the FAA facility at Summit. Bedrock in the nearby mountains is full of faults, folds, and juxtaposed rocks that are the result of a mid-Cretaceous collision of northward moving terrain onto the terrain of ancient North America (Cox and others, 1989). The Alaska Range consists of volcanic and sedimentary rocks that have been extensively metamorphosed.

Volcanic rocks in the Alaska Range are primarily andesitic and basaltic lava flows mixed with felsic pyroclastic rocks. Sedimentary bedrock consists of conglomerates, shale, and sandstone with thin beds of coal (Cox and others, 1989). Depth to bedrock in the Summit area is unknown; a well drilled in January 1966 at the FAA facility penetrated only unconsolidated material to a depth of 92 m (Appendix 2).

Summit is located in a broad glaciated valley formed by the southwestward flow of glacial ice of Pleistocene age (Cox and others, 1989). Surficial deposits are composed of well-drained glacial moraine and outwash. Such deposits are characterized by a complex mixture of coarse-grained gravel, mud, silt, and sand which are overlain by a thin mat of organic material capped with a mantle of silty loess.

Well-drained soils are found on hillsides in the Summit area and are formed in 25 to 50 cm of loamy silt and sand over gravelly glacial drift. These soils usually are free of permafrost. Poorly drained soils are common along the lower slopes of moraine ridges and are composed of a thick organic layer underlain by grey silty to gravelly loam. These soils are typically saturated above shallow permafrost, often less than 50 cm below land surface. A third type of soil is found in depressions and low-lying areas near Summit and consists of a thick layer of organic material, mostly fibrous sedges and mosses. These soils also are poorly drained and are saturated above shallow permafrost (Rieger and others, 1979).

The Summit area is in the zone of discontinuous permafrost (Selkregg, 1976; Ferrians, 1965). The FAA facility and most of the surrounding area are generally free of permafrost; a well drilled to a depth of 20.4 m near the FAA facility did not reach frozen ground (Ferrians, 1965). Shallow permafrost may exist in isolated low-lying areas where soils are fine grained (Rieger and others, 1979).

Hydrology

Surface Water

Broad Pass marks the divide between the drainage basins of the Nenana and Chulitna Rivers. Cantwell Creek is about 1 km north of the FAA facility and drains the lakes and small streams in this area. The creek flows from west to northeast and is a tributary of the Nenana River. The south side of Broad Pass is drained by Squaw Creek, the Bull River, and the Middle Fork of the Chulitna River. Squaw Creek and the Bull River, both tributaries of the Chulitna River, flow from northwest to southeast and pass Summit about 10 km to the southwest. The Middle Fork of the Chulitna River flows from northeast to southwest and passes about 4 km to the south of Summit. Surrounding the FAA facility are many elongated northeast, southwest-trending lakes common to the Broad Pass Depression. Summit is not on an identified flood plain, and flooding and erosion have not been reported in the area.

Streamflow and drainage-area data are not available for Cantwell Creek, Squaw Creek, Bull River, and the Middle Fork of the Chulitna River, whose flows depend on the amount of rainfall and snowmelt in the area as well as the degree of surface runoff. Data, however, are available for the Nenana River at Windy which is about 20 km north of the FAA facility, and for the Chulitna River near Talkeetna which is about 120 km to the south.

Flow at streamflow-gaging station 15516000 Nenana River at Windy was reported from 1950 to 1973. During the open-water months from May to September, mean flow is about 75 m^3/s, and in the winter months, from November to March, mean flow is about 8.4 m^3/s (U.S. Geological Survey, 1976). The Nenana River drains an area of about 1,800 km^2 upstream from Windy.

Flow at streamflow-gaging station Chulitna River near Talkeetna was reported from 1958 to 1972 and from 1980 to 1986. Mean flow at this site during open-water months is about 400 m^3/s, and in winter mean flow is about 37 m^3/s. The Chulitna River drains an area of about 6,600 km^2 upstream from Talkeetna (U.S. Geological Survey, 1987).

Several elongated northeast-southwest trending lakes near Summit occupy glacial depressions left after the southwestward advance of glaciers through the area during the Quaternary age. Summit Lake is about 2.8 km^2 in area and is 1.5 km south of the FAA facility. Edes Lake is about 0.6 km^2 in area and is 1 km to the southeast. Mirror Lake is about 0.3 km^2 in area and is 0.5 km to the east.

A topographic gradient of about 15 m/km is present between the Summit FAA facility and the drainages to the north and south. These northward and southward slopes generally cause runoff to flow towards tributaries that drain to the Nenana and Chulitna Rivers respectively. Mean annual runoff in the area is between 0.08 and 0.2 $(m^3/s)/km^2$ (Freethey and Scully, 1980). Data are not sufficient to determine the degree to which runoff is infiltrating the ground-water system.

Ground Water

Ground water in the Summit area is present within the deep unconsolidated deposits. In general, ground water will flow in the direction of topographic gradients to surface-water drainages such as Cantwell Creek to the north and Bull River and Squaw Creek to the south.

Data in USGS files indicate that three wells (wells 001, 002, and 003 in Appendix 2) were drilled in the vicinity of the Summit FAA facility in January 1966. Well 003 was drilled to a depth of 9 m, well 001 to a depth of 15.5 m, and well 002 to a depth of 92 m below land surface. Water was reached in well 003 at 5 m below land surface and in well 001 at 7.5 m below land surface. Water-level data were not recorded for well 002.

Drinking Water

Present Drinking-Water Supplies

Ground water is the main source of drinking water for seasonal residents in the Summit area. Individual private wells tap into the shallow ground water between 5 and 8 m below the land surface, and well yields range from 0.0 to 3.2 L/s (Freethey and Scully, 1980). Completion of three wells near the FAA facility indicates that ground water was used as a potable drinking-water source in the past.

Quality of the Present Supply

In 1966 and 1967, water-quality data were collected by the USGS for well 002 near the Summit FAA facility (Appendix 2). Major ions, nutrients, trace metals, and water properties were analyzed (table 6). These samples contained dissolved-iron concentrations that ranged from 0.55 to 0.73 mg/L, fluoride concentrations that ranged from 2.5 to 5.6 mg/L, and sodium concentrations that ranged from 180 to 190 mg/L (Appendix 2). Excessive amounts of fluoride have been reported to cause mottling of tooth enamel especially in children.

Table 6. Selected water-quality data from wells 001, 002, and 003 near Summit

[mg/L, milligrams per liter]

Constituent (or property)	Drinking-water regulation (mg/L)	Concentration (mg/L)	
		Well 002	Wells 001 and 003
Chloride (Cl)	250	0.4-0.7	0.0-0.7
Iron (Fe)	.3	.55-.73	.04-.25
Sulfate (SO_4)	400	0.0-13	4.3-19
Fluoride (Fl)	2	2.5-5.6	.1-.3
Sodium (Na)	100	180-190	2.1-8.9
Total dissolved solids	500	445-456	147-190
pH (units)	6.5-8.5	8.1-9.3	7.4-7.9

In 1967, the USGS collected water samples from wells 001 and 003 (Appendix 2). Analyses indicated that major ions and water properties were within current USEPA and ADEC drinking-water regulations (table 6; ADEC, 1995). The samples contained dissolved-iron concentrations that ranged from 0.04 to 0.25 mg/L, fluoride concentrations that ranged from 0.1 to 0.3 mg/L, sodium concentrations that ranged from 2.1 to 8.9 mg/L, and total dissolved-solids concentrations that ranged from 147 to 190 mg/L.

Alternative Drinking-Water Sources

Drinking-water alternatives for Summit include lakes, streams, and untapped areas of ground water. Summit Lake, Edes Lake, and Mirror Lake may be used to supplement the water supply; however, the quality of the water in these lakes is unknown.

During the winter and dry periods in the summer, flows of Cantwell and Squaw Creeks, the Bull River, and the Middle Fork of the Chulitna River may be inadequate to supply the estimated water use for residents in the Summit area. When runoff is abundant from snowmelt or rainfall, however, these sources may be used to augment present drinking-water supplies.

Additional drinking water may be available from untapped areas of the aquifer. Almost all of Summit's residents utilize the shallow unconfined aquifer for drinking water. Contamination of this supply is more likely than of deeper confined aquifers. Water-quality data are not available for Cantwell Creek, Squaw Creek, the Bull River, or the Middle Fork of the Chulitna River near Summit.

TALKEETNA

Location and Background

Talkeetna is in south-central interior Alaska (fig. 1; fig. 6) at lat 62°19' N., long 150°06' W., near the confluence of the Susitna, Chulitna, and Talkeetna Rivers about 160 km north of Anchorage. The village is in a glaciated area characterized by a rolling topography of ground moraine and stagnant ice having many lakes, drumlin fields, and outwash plains (Wahrhaftig, 1965). The Talkeetna area is drained by the Susitna River which flows south into Cook Inlet.

In 1939, the Civil Aeronautics Administration (predecessor to the FAA) sequestered land from public domain to construct air-navigation facilities in Talkeetna. Since then, the FAA has relinquished most of the land to the State of Alaska and to the local Native corporation. Current FAA facilities in Talkeetna (fig. 6) include a remote communications facility, a nondirectional beacon, a flight-service station, and omnidirectional range station, a tactical air navigation facility, and a visual approach slope indicator. The FAA facilities in Talkeetna are concentrated at the municipal airport, 1.6 km southeast of the village (fig. 6). A more detailed list of FAA owned and operated facilities in Talkeetna and a list of suspected sources of contamination can be found in an Environmental Compliance Investigation Report by Ecology and Environment, Inc. (1993a).

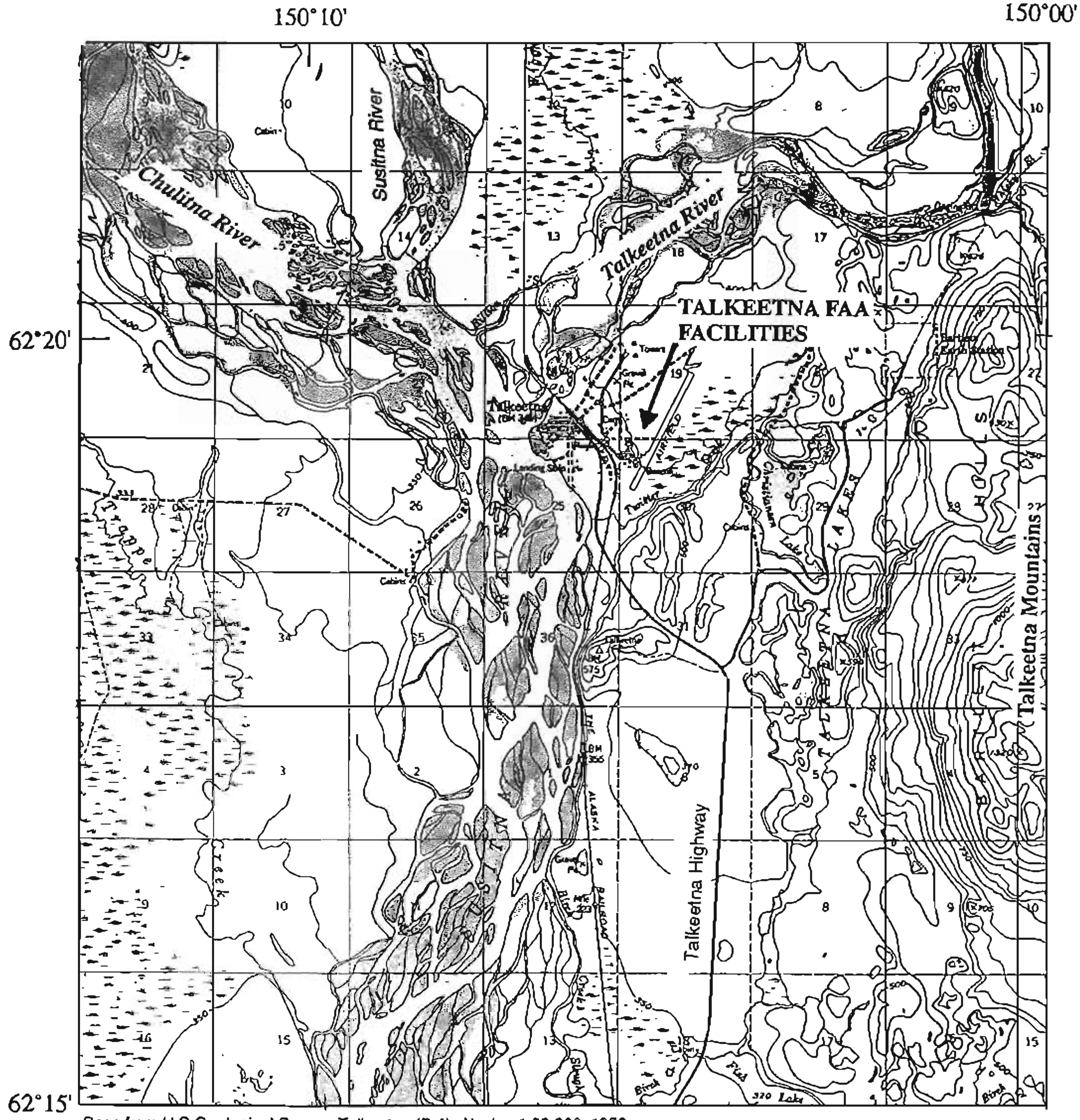
At the time of first western contact, the Talkeetna area was occupied by the Tanana Athabaskan Indians who utilized the rivers and streams of the Cook Inlet region for subsistence fishing (Selkregg, 1976). The village itself began as a camp formed during the construction of the Alaska Railroad through the area. A post office was opened in 1916, and the village was named "Talkeetna" after the nearby river (Orth, 1967). The completion of the George Parks Highway connecting Anchorage and Fairbanks, opened the area to tourism, hunting, and fishing.

During the last 70 years, Talkeetna has experienced a population growth of about 180 people. In 1920, the population was 70, in 1930 it was 89, in 1950 it was 106, in 1970 it was 182, and in 1990 it was 250 (Orth, 1967; Selkregg, 1976; U.S. Bureau of Census, 1991). According to the U.S. Bureau of Census (1991), 4 people were American Indian and 246 people were Caucasian. About 75 percent of the residents work in the private sector, engaging in retail trade and services, about 14 percent work in government, and about 10 percent are unemployed.

Physical Setting

Climate

Talkeetna has a mean annual temperature of 0.7°C, but temperatures range from a July mean maximum of 20.2°C to a December mean minimum of about -17.2°C (Leslie, 1989; table 7, this report). Mean annual precipitation is about 730 mm and about 2,900 mm of snow falls annually.



Base from U.S.Geological Survey, Talkeetna (B-1), Alaska, 1:63,360, 1958

0 1 2 MILES

0 1 2 KILOMETERS

CONTOUR INTERVAL 50 FEET

Figure 6. Location of Talkeetna, Alaska and the Federal Aviation Administration facilities.

Table 7. Mean monthly and annual temperature, precipitation, and snowfall, Talkeetna, 1922-87

[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	-6.9	-3.3	0.7	6.8	13.8	18.9	20.2	18.3	13.3	5.1	-2.8	-7.3	6.4
	(Record maximum 32.8 °C, June 1953)												
Mean minimum	-17.7	-15.1	-13.3	-5.8	0.4	6.3	8.6	7.1	2.3	-4.3	-12.2	-17.2	-5.1
	(Record minimum -47.2 °C, December 1961)												
Mean	-12.4	-9.2	-6.3	0.6	7.1	12.6	14.4	12.7	7.8	0.4	-7.5	-12.3	0.7
						Precipitation, in millimeters of moisture							
	40.9	40.1	40.4	29.9	35.1	54.1	90.9	122.4	112.5	76.7	45.2	40.9	Total 729.2
						Snowfall, in millimeters							
	492.8	490.2	485.1	264.4	20.3	0.0	0.0	0.0	10.2	254.0	421.6	495.3	Total 2,915.9

Vegetation

The principal vegetation in and around Talkeetna is a closed spruce-hardwood forest characterized by an overstory of white spruce, poplar, cottonwood, and aspen with an understory of willow, berries, and Labrador tea. Stands of bottomland, open-spruce forests are found surrounding the FAA facility at Talkeetna, where black spruce, tamarack, and paper birch dominate (Selkregg, 1976: Viereck and Little, 1972). Expanses of treeless bog, consisting of grasses, mosses, and sedges are on either side of the runway at the Talkeetna FAA facility.

Geology and Soils

Bedrock is not exposed near the FAA facility at Talkeetna but is exposed south and east in the Talkeetna Mountains. These rocks consist of igneous intrusive and sedimentary rocks (Reed and Nelson, 1977). The intrusive rocks are mainly granite; whereas, the sedimentary rock units include shale and conglomerate intermixed with minor amounts of volcanic rock (Reed and Nelson, 1977). The entire Cook Inlet-Susitna basin probably is underlain by these types of bedrock (Rieger and others, 1979). No data are available on the depth to bedrock near Talkeetna; wells drilled in the area to depths of 30 m did not reach bedrock (Feulner, 1968).

Talkeetna lies on a wide flood plain at the confluence of three rivers (fig. 6). Surficial deposits are mostly alluvium, with areas of slightly modified glacial drift (Selkregg, 1976). Alluvial deposits consist of sand, gravel, and boulders, sometimes mixed with silt and clay, and mantled with a thin layer of organic material (Reed and Nelson, 1977). Feulner (1968) gives the well log for a 14.3-m-deep well (well 3a; Appendix 3) drilled near the FAA facility at Talkeetna as: brown, silty soil for 1.2 m; gravel and sand to a depth of about 11.3 m; fine to medium sand, with some fine gravel to a depth of about 13.9 m; and medium sized gravel with a little sand to 14.3 m.

The most common soils near Talkeetna are formed in stratified, well-drained alluvial sediments. These soils are typically dark grey, silty and sandy loam, overlain by a thin mat of organic material and underlain by gravel, sand, and cobblestones (Rieger and others, 1979). Poorly drained soils in low-lying areas consist of mottled-grey, silty clay loam (Rieger and others, 1979).

The Talkeetna area is near the southern limit of discontinuous permafrost (Selkregg, 1976). Permafrost generally is absent beneath and adjacent to major streams and rivers (Ferrians, 1965). The village, the FAA facility, and most of the area west of the Susitna River and south of the Talkeetna River probably are free of permafrost.

Hydrology

Surface Water

Talkeetna is near the confluence of the Chulitna, Susitna, and Talkeetna Rivers (fig. 6). The Chulitna River flows northwest to southeast and is about 4 km northwest of the FAA facility, the Susitna River flows from north to south and is due east of the facility, and the Talkeetna River flows from northeast to southwest and is 1.5 km north of the facility. Christiansen Lake, which is 1 km^2 in area and is one of the Talkeetna Lakes, is about 1.5 km southeast of the FAA facility. Twister Creek, a small tributary of the Susitna River, flows about 1 km to the southeast (fig. 6).

Flow at streamflow-gaging station 15292780 Susitna River at Sunshine, which is about 20 km south of Talkeetna, was reported from 1981 to 1986. During the open-water months from May to September, mean flow is about 1,400 m^3/s and in the winter months, from November to March, mean flow is about 130 m^3/s (U.S. Geological Survey, 1987). The Susitna River drains an area of about 28,800 km^2 upstream from Talkeetna and an area of about 28,900 km^2 upstream from Sunshine (U.S. Army Corps of Engineers, 1972). Ice forms on the Susitna River in October and melts in May. Although the river is an important resource to residents of Talkeetna, flooding and riverbank erosion have caused problems.

Flow at streamflow-gaging station 15292700, Talkeetna River near Talkeetna, is about 250 m^3/s in open-water months and about 21 m^3/s in the winter (U.S. Geological Survey, 1987). Open-water flow during the summer for streamflow-gaging station 15292400, Chulitna River near Talkeetna, is about 410 m^3/s, and winter flow is about 56 m^3/s (U.S. Geological Survey, 1987). The Talkeetna River drains an area of about 5,200 km^2 upstream from streamflow-gaging station 15292700, and the Chulitna River drains an area of about 2,600 km^2 upstream from gaging station 15292400.

Streamflow and drainage-area data are not available for Twister Creek which flows from northeast to southwest and drains the southern end of the FAA facility. The area northwest of the facility probably drains to the Talkeetna River.

A topographical gradient of about 0.5 m/km between the Talkeetna FAA facility, and the Talkeetna River to the northwest and Twister Creek to the south causes runoff to flow towards tributaries that drain to these streams. Average annual runoff in the area is estimated to be between 0.02 and 0.05 $(m^3/s)/km^2$ (Freethey and Scully, 1980). Data are not available to determine how much runoff is infiltrating the ground-water system.

Floods and Erosion

Talkeetna is flooded to some extent annually and is considered to have a high flood hazard (U.S. Army Corps of Engineers, 1993). Two types of flooding occur in the Talkeetna area: ice-jam floods and runoff floods. Although Talkeetna is susceptible to flooding during spring breakup, concentrated spring and fall rain is the primary source of flooding (U.S. Army Corps of Engineers, 1972 and 1993).

Runoff flooding generally occurs in late August or September and is caused by a combination of large amounts of rainfall and minimal ground infiltration. Natural obstructions such as trees, brush, and other vegetation, as well as manmade impediments such as bridges and culverts, can restrict flood flows in small creeks, thereby creating backwater effects and increasing flood heights. This, in turn, may result in overbank flows, unpredictable areas of flooding, and increased flow velocity directly downstream from a released obstruction (U.S. Army Corps of Engineers, 1972).

Major flooding occurred in September 1942 as a result of a combination of heavy rain and melting snow. Flooding occurred to a lesser extent in August 1971 when measurements at streamflow-gaging station 15292780 Susitna River at Sunshine indicated a maximum gage height of 18.9 m and a discharge of about 5,700 m^3/s (Jones and Fahl, 1994). Flooding occurred on the Talkeetna River in early October 1986, when records at gaging station 15292700 indicated a maximum gage height of 5.3 m and a discharge of about 2,100 m^3/s (Jones and Fahl, 1994).

No specific flood-protection measures have been constructed in the Talkeetna area. A timber bulkhead, however, was constructed in 1951 by the U.S. Army Corps of Engineers to protect the river bank from erosion. The bulkhead appears to have reduced flooding in the area (U.S. Army Corps of Engineers, 1972).

The National Weather Service (NWS), the Alaska River Forecast Center (ARFC), and the Alaska Disaster Office of the Matanuska-Susitna Borough have set up warning systems, by telephone, television, and radio, to keep residents in Talkeetna informed of potential flooding (U.S. Army Corps of Engineers, 1972). Talkeetna also is a participant in the National Flood Insurance Program.

Riverbank erosion in Talkeetna has been a problem since the community was settled. Factors that may contribute to this erosion problems include a steep riverbank, wave action from prevailing winds and boat traffic, and a continuously migrating river channel. Since 1951, the U.S. Army Corps of Engineers has been working to stabilize the banks and reduce erosion. The Emergency Bank Protection Project, located on the left bank of the Talkeetna River just upstream from the mouth on the Susitna River, consists of a 305-meter-long timber and brush bulkhead. The bulkhead was constructed in the 1950's to arrest bank erosion. As of June 1972, erosion has been reduced (U.S. Army Corps of Engineers, 1972).

Ground Water

Ground water is abundant in the Talkeetna area, and the water table is at depths between 0.7 m and 2.5 m below land surface (Appendix 3; Feulner, 1968). Adequate data are not available to define shallow ground-water flow directions near Talkeetna. On a regional scale, however, ground-water flow is generally from north to south in the direction of topographic gradients.

Feulner (1968) reports that well 3a (Appendix 3) drilled at the Talkeetna Airport reached water at a depth of 2.4 m below the land surface. The well was pumped at a rate of 0.95 L/s which resulted in a 0.3 m drawdown. Four wells (wells 001, 002, 003, and 004, in Appendix 3) were drilled at the FAA facility in Talkeetna between 1961 and 1974. Depths of these wells range from 3.6 m to 9.0 m and water was reached at depths ranging from 0.7 to 0.9 m below land surface (Appendix 3). The shallow depth to ground water and the lack of overlying permafrost indicate that aquifers are vulnerable to contamination by surface spills and disposal of hazardous waste.

Drinking Water

Present Drinking-Water Supplies

Ground water is the main source of drinking water for residents in Talkeetna (U.S. Bureau of Census, 1991). Individual wells generally tap into the shallow ground water between 0.7 and 2.5 m below land surface, and well yields range from 1.0 to 9.0 L/s (Freethey and Scully, 1980). About 10 percent of local residents in Talkeetna receive their water from a 45-meter-deep municipal well located about 0.5 km northwest of the FAA facility (U.S. Bureau of Census, 1991). Four wells drilled near the FAA facility between 1961 and 1974 indicate that ground water may have been used as a drinking-water source in the past.

Quality of the Present Supply

From 1966 to 1972, water samples were collected by the U.S. Geological Survey from wells 001 and 002 (Appendix 3) at the Talkeetna FAA facility. Analyses of the samples indicated that, with the exception of iron, major ions and water properties were at concentrations acceptable for drinking water (Appendix 3). While humans suffer no known harmful effects from drinking water high in iron, it may oxidize and cause the water to become turbid. Iron also imparts a taste on water, even at low concentrations. Water samples contained dissolved-iron concentrations that ranged from 0.07 to 10.0 mg/L, dissolved-solids concentrations that ranged from 75 to 83 mg/L, chloride concentrations that ranged from 1.4 to 3.2 mg/L, and pH that ranged from 6.3 to 7.1 (table 8; Appendix 3; Feulner, 1968).

Table 8. Selected water-quality data from wells 001 and 002 near Talkeetna
[mg/L, milligrams per liter]

Constituent (or property)	Drinking-water regulation (mg/L)	Concentration in the ground water (mg/L)
Chloride (Cl)	250	1.4-3.2
Iron (Fe)	0.3	0.07-10
Sulfate (SO_4)	400	0.0-2.9
Fluoride (Fl)	2	0.1
Sodium (Na)	100	3.0-3.7
Total dissolved solids	500	75-83
pH (units)	6.5-8.5	6.3-7.1

Alternative Drinking-Water Sources

Drinking-water alternatives for Talkeetna include local lakes, Twister Creek, the Talkeetna, Susitna, and Chulitna Rivers, and untapped areas of the alluvial aquifer. Christiansen Lake and Twister Creek may be used to a limited degree to supplement the present drinking-water supply, but the quantity of available water has not been documented. Currently there is no evidence of confining layers, such as clay or permafrost, that may separate the unconfined aquifer from underlying aquifers. The Susitna, Talkeetna, and Chulitna Rivers represent abundant sources of drinking water for Talkeetna. During months of low discharge in the winter, mean flow of the Talkeetna River alone is about 21 m^3/s and is more than 2,000 times the yield of the most productive individual wells in the Talkeetna area.

Quality of the Alternative Sources

The quality of water in the Talkeetna River near Talkeetna was monitored intermittently at streamflow-gaging station 15292700 from 1954 to 1993. The record of water quality indicated that major ions, trace metals, and nutrients were within current USEPA and ADEC drinking-water regulations (Appendix 3; ADEC, 1995). The most recent water sample, taken in August 1993, had dissolved-iron concentration that ranged from 0.02 to 0.1 mg/L, chloride concentrations that ranged from 4.1 to 25 mg/L, and sulfate concentrations that ranged from 5.9 to 19 mg/L. Fecal coliform concentrations exceeded drinking-water regulations, reaching 40 colonies/100 mL of water (U.S. Geological Survey, 1994).

The quality of water at streamflow-gaging station 15292400, Chulitna River near Talkeetna, was measured intermittently from 1958 to 1970. The limited record of water quality indicates that dissolved-iron concentrations may exceed current drinking-water regulation of 0.3 mg/L (table 9). The most recent samples, taken in 1970, contained dissolved-iron concentrations that ranged from 0.07 to 0.49 mg/L, that ranged from 10 to 22 mg/L, and chloride concentrations that ranged from 0.0 to 1.8 mg/L (U.S. Geological Survey, 1971).

The quality of water at streamflow-gaging station 15292780 Susitna River at Sunshine was monitored intermittently from 1975 to 1986. Trace metals, nutrients, and major ions were analyzed (Appendix 3). Water samples taken in 1986 contained dissolved-iron concentrations that ranged from 0.01 to 0.13 mg/L, dissolved-solids concentrations that ranged from 59 to 130 mg/L, and chloride concentrations that ranged from 3.5 and 19 mg/L (table 9; Appendix 3; U.S. Geological Survey, 1987).

In 1973, water-quality samples were collected from Christiansen Lake near Talkeetna and analyzed for trace metals, major ions, and nutrients (Appendix 3). The samples had a chloride concentration of 1.2 mg/L, a sulfate concentration of 5 mg/L, and a dissolved-iron concentration of 0.04 mg/L (table 9; U.S. Geological Survey, 1974). The quality of water in Twister Creek has not been documented.

Table 9. Selected water-quality data from surface-water bodies near Talkeetna
[mg/L, milligrams per liter]

Constituent (or property)	Drinking-water regulation (mg/L)	Concentration (mg/L)			
		Talkeetna River(1993)	Chulitna River (1970)	Susitna River (1986)	Christiansen Lake(1973)
Chloride (Cl)	250	4.1-25	0.0-1.8	3.5-19	1.2
Iron (Fe)	.3	.02-.1	0.07-0.49	.01-.13	.04
Sulfate (SO_4)	400	5.9-19	10-22	9.7-18	5.0
Fluoride (Fl)	2	<01	.2-.3	<.1	.0
Sodium (Na)	100	4.0-14	1.2-2.7	2.9-10	1.3
Total dissolved solids	500	62-124	60-97	59-130	29
pH (units)	6.5-8.5	7.0-7.9	7.2-8.1	7.7-8.2	7.6

SHEEP MOUNTAIN

Location and Background

The Sheep Mountain FAA facility is in southeastern interior Alaska (fig. 1) at lat 61°47' N., long 147°41' W. It is in a glaciated valley at the base of an outcrop of rock known as Lion Head, about 170 km northeast of Anchorage on the Glenn Highway (fig. 7). The facility is situated near the northern border of the Lake Louise Plateau, a rolling upland characterized by morainal and stagnant-ice topography (Wahrhaftig, 1965). The confluence of Rock Glacier Creek, Caribou Creek, and the Matanuska River is located about 1 km southeast of the facility (fig. 7).

In 1942, the Civil Aeronautics Administration started operations at the Sheep Mountain facility. At that time, land was sequestered from public domain to construct a weather reporting station. In 1961, the FAA relinquished most of the land and in 1984, leased the remainder to Alascom, Inc. Currently, about 30 residences are within a 6.5-km radius of the facility and none are in the immediate vicinity. Maintenance of the facility is performed monthly by employees based at the Gulkana FAA facility. The only facility currently present at Sheep Mountain is an H-Marker facility, located at the end of an access road near Lion Head (fig. 7). A detailed account of FAA owned, leased, or transferred properties in or near Sheep Mountain and a listing of suspected sources of contamination near these facilities can be found in an Environmental Compliance Investigation Report by Ecology and Environment, Inc. (1993b).

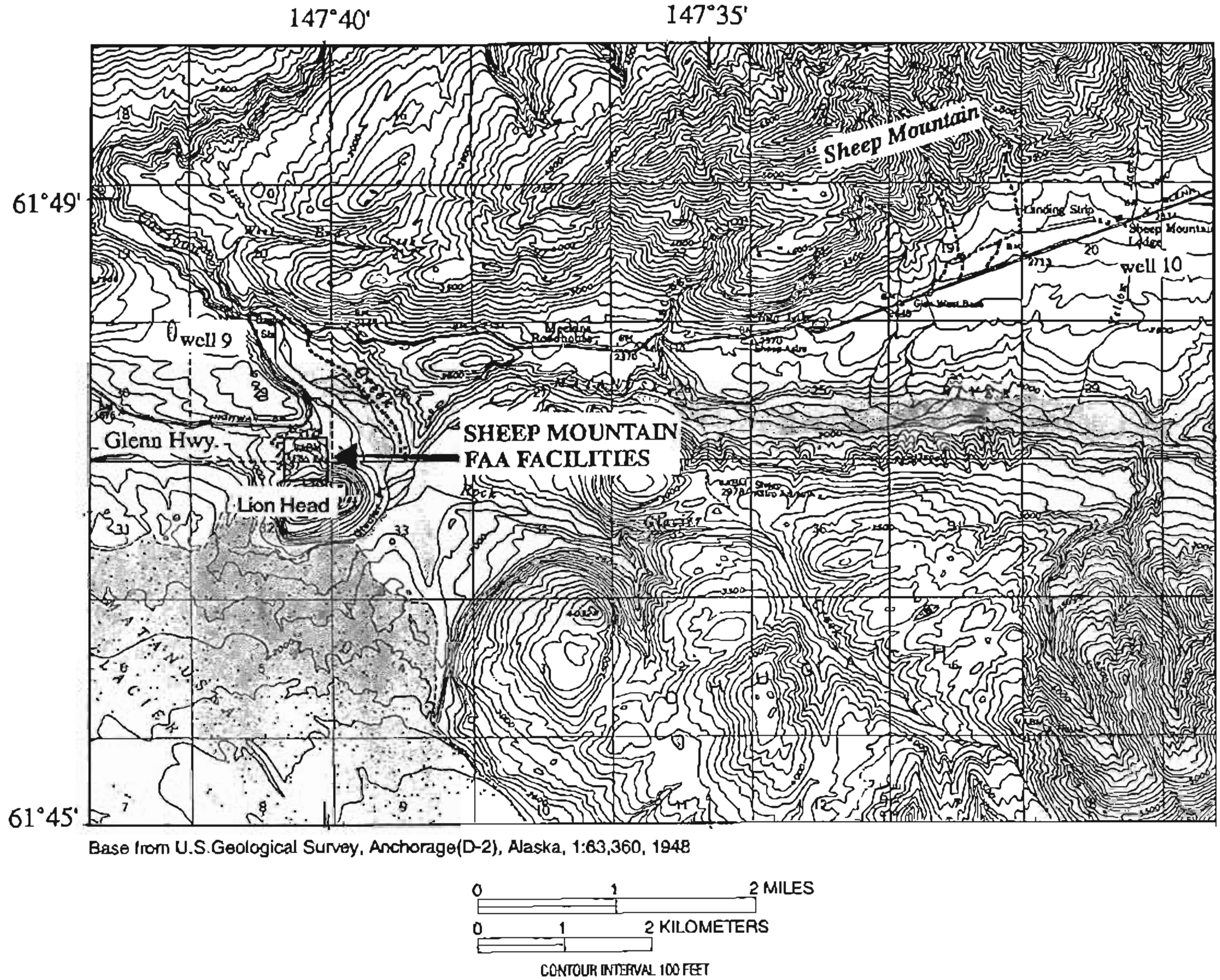


Figure 7. Location of the Sheep Mountain Federal Aviation Administration facilities.

Physical Setting

Climate

The Sheep Mountain area has a mean annual temperature of -2.0°C, but temperatures range from a July mean maximum of 16.8°C to a December mean minimum of about -17.7°C (Leslie, 1989). Mean annual precipitation is about 324 mm and about 1,200 mm of snow falls annually. Mean monthly temperature, precipitation, and snowfall are summarized in table 10.

Table 10. Mean monthly and annual temperature, precipitation, and snowfall for the period 1943 to 1966, Sheep Mountain

[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	-11.2	-8.8	-4.8	2.5	10.3	15.7	16.8	15.4	10.2	1.1	-7.5	-11.5	2.4
	(Record maximum 29.4 °C, June 1953)												
Mean minimum	-17.6	-16.0	-13.8	-7.2	-0.3	4.6	6.4	5.1	0.8	-6.5	-14.0	-17.7	-6.3
	(Record minimum -37.8 °C, February 1947)												
Mean	-14.4	-12.4	-9.3	-2.3	5.0	10.2	11.7	10.3	5.6	-2.7	-10.7	-14.6	-2.0
Precipitation, in millimeters of moisture													
	13.7	20.1	17.5	23.9	15.2	46.7	62.5	32.5	34.5	25.7	17.0	14.2	Total 323.9
Snowfall, in millimeters													
	188.0	157.5	104.1	38.1	17.8	2.5	0.0	0.0	17.8	246.4	205.7	205.7	Total 1186.2

Vegetation

Primary vegetation near the FAA facility at Sheep Mountain is closed spruce-hardwood forest consisting of an overstory of black and white spruce mixed with poplar, birch, and aspen, and an understory of berries, rose, willows, and Labrador tea (Viereck and Little, 1972). Tundra conditions exist in upland areas, such as Lion Head, where low heath shrubs, willows, and dwarf herbs may appear. (Viereck and Little, 1972).

Geology and Soils

Lion Head is a steep-sided outcrop of rock located immediately south of the FAA facility at Sheep Mountain (fig. 7). The rock is a felsic volcanic plug that has intruded the surrounding sedimentary rock (Clardy, 1984).

The bedrock of nearby Sheep Mountain is highly fractured, jointed, and sheared and consists of Jurassic age volcanic rocks that have been metamorphosed to greenstone, quartz and sericite rock (Ekhardt, 1953).

The Sheep Mountain FAA facility is situated in a glaciated valley formed by the Matanuska Glacier, located 1.1 km to the south (Clardy, 1984). Surficial deposits in the area are well-drained glacial sediments consisting of silt, sand, and gravel. These deposits are overlain by a thin mat of organic material and are capped with silty loess (Rieger and others, 1979). Depth to bedrock near the Sheep Mountain FAA facility is unknown. A well log in the area indicated saturated unconsolidated deposits to a depth of 9.5 m (Waller and Selkregg, 1962). The lithology of the sediments from this well is as follows: frozen muskeg for 0.3 m, frozen mud to a depth of about 1 m, unfrozen gravel to about 1.8 m, water to about 3.5 m, frozen sand and gravel to about 5.2 m, and more water to 9.5 m (Appendix 4).

The Sheep Mountain FAA facility lies within the discontinuous permafrost zone (Selkregg, 1976; Ferrians, 1965). A well log indicates a layer of permafrost 1.7 m thick, beginning 3.5 m below land surface (Waller and Selkregg, 1962). Areas underlying and adjacent to streams such as Rock Glacier Creek, Caribou Creek, and the Matanuska River are free of permafrost (Ferrians, 1965).

Hydrology

Surface Water

The Sheep Mountain FAA facility lies at an elevation about 120 to 150 m above Caribou Creek and the Matanuska River which are the principal fresh-water bodies in the area (fig. 7). Eastern parts of the facility are drained by Caribou Creek, a tributary of the Matanuska River, while the western parts are drained directly into the Matanuska River. No other surface-water bodies are in the immediate vicinity of the FAA facility, and flooding and erosion have not been reported near the facility.

Fairly steep topographical gradients of about 100 m/km are present between the Sheep Mountain FAA facility and the Matanuska River to the southwest, and Caribou Creek to the east. These slopes generally cause runoff to flow rapidly towards tributaries that drain into Caribou Creek and the Matanuska River. Mean annual runoff in the Sheep Mountain area is between 0.07 and 0.15 $(m^3/s)/km^2$ (Freethey and Scully, 1980). No data are available to determine the degree to which rainfall is infiltrating the aquifer.

Ground Water

Data in the U.S. Geological Survey files indicate that ground water near the FAA facilities at Sheep Mountain is found in unconsolidated surficial deposits at depths between 3.5 and 12 m below land surface (Waller and Selkregg, 1962). Confined and perched aquifers may exist under or over the discontinuous permafrost. Steep topographic relief is present near the Sheep Mountain FAA facility and ground-water movement, mirroring surface topography, is probably towards surface-water drainages such as Caribou Creek to the east and the Matanuska River to the west.

Waller and Selkregg (1962) report that a well was drilled to a depth of 9.5 m and reached water at a depth of 3.5 m below land surface. In October 1942, the reported yield of this well, which often ran dry during winter months, was 0.2 L/s.

The presence of many fractures, joints, and sheared zones in locally exposed bedrock may indicate that bedrock is a possible source of ground water. However, no data are available to support this hypothesis.

Drinking Water

Present Drinking-Water Supplies

Ground water is a source of drinking water for the residents living near the Sheep Mountain FAA facility: well yields range from 0.0 to 3.2 L/s (Freethey and Scully, 1980). Ground water is not utilized as a drinking-water source at the FAA facility (Ecology and Environment, Inc., 1993b). Data concerning the utilization of surface water as a drinking-water source are not available.

Quality of the Present Supply

Few data are available on the quality of ground water in the Sheep Mountain area. Major ions and water properties were analyzed in samples taken in February 1958 from a well at the Sheep Mountain Lodge, about 11 km east of the FAA facility (Appendix 4). These samples had dissolved iron concentrations of 0.0 mg/L, chloride concentrations 0.0 mg/L, sulfate concentrations of 194 mg/L, and dissolved-solids concentrations of 402 mg/L (table 11; Waller and Selkregg, 1962).

Table 11. Selected water-quality data from a well near Sheep Mountain Lodge

Constituent (or property)	Drinking-water regulation (mg/L)	Concentration in the ground water (1958) (mg/L)
Chloride (Cl)	250	0.0
Iron (Fe)	0.3	0.0
Sulfate (SO_4)	400	194
Fluoride (Fl)	2	0.2
Sodium (Na)	100	14
Total dissolved solids	500	402
pH (units)	6.5-8.5	7.2

Alternative Drinking-Water Sources

Drinking-water alternatives for the Sheep Mountain area include small streams, Caribou Creek, the Matanuska River, and undiscovered aquifers. Most of the local streams are small and often run dry or freeze solidly in the winter; however, during open-water months when water is abundant, local streams may be used to supplement the drinking-water supply.

The flow in Caribou Creek responds to snowmelt and rainfall events. During winter and dry periods in the summer, flow may be inadequate to supply local residents. However, when runoff is abundant from snowmelt or rainfall, this source may be used to augment the drinking water supply.

The Matanuska River represents an abundant source of drinking water for the Sheep Mountain area. During months of low discharge in the winter, mean flow of the river is about 10 m^3/s and is more than adequate to meet local drinking-water needs (U.S. Geological Survey, 1987).

Drinking water also may be available from undiscovered aquifers within the fractures and joints of underlying bedrock or from perched aquifers within unconsolidated deposits. Perched aquifers are present in areas where local permafrost and(or) layers of sediment act as low-permeability barriers, thereby allowing water to accumulate at their surfaces.

Quality of the Alternative Sources

The quality of Caribou Creek was monitored at USGS stream-gaging station number 15282000 Caribou Creek near Sutton (60 km west of the FAA facility) during various years from 1949 to 1976. The water samples were analyzed for field properties, major ions, and nutrients (Appendix 4). The most recent sample from Caribou Creek at Sutton, taken in 1976, contained a dissolved iron concentration of 0.08 mg/L, a sulfate concentration of 13 mg/L, a dissolved-solids concentration of 67 mg/L, and a chloride concentration of 1.2 mg/L, (table 12; U.S. Geological Survey, 1977).

The quality of the Matanuska River was monitored at Palmer (80 km southwest of the FAA facility) periodically from 1948 to 1968. The limited record of water quality indicates that the Matanuska River may have dissolved iron concentrations higher than the current USEPA drinking water regulations (table 12; Appendix 4; U.S. Geological Survey, 1969). Samples taken in 1968 contained dissolved iron concentrations ranging from 0.07 to 0.42 mg/L, chloride concentrations ranging from 5.7 to 13 mg/L, and dissolved solids concentrations ranging from 148 to 169 mg/L (U.S. Geological Survey, 1969).

In January 1960, water-quality samples were collected from the Matanuska River near Sheep Mountain by the U.S. Geological Survey (Appendix 4). The sample contained a chloride concentration of 3.0 mg/L, a dissolved-solids concentration of 189 mg/L, dissolved-iron concentration of 0.30 mg/L, and a sulfate concentration of 72 mg/L (table 12; U.S. Geological Survey, 1961).

Table 12. Selected water-quality data from surface-water bodies near Sheep Mountain

Constituent (or property)	Drinking-water regulation (mg/L)	Concentration (mg/L)		
		Caribou Creek (1976)	Matanuska River near Palmer (1968)	Matanuska River near Sheep Mountain (1960)
Chloride (Cl)	250	1.2	5.7-13	3.0
Iron (Fe)	0.3	0.08	0.07-0.42	0.3
Sulfate (SO_4)	400	13	41-51	72
Fluoride (Fl)	2	0.1	0.0-0.1	0.0
Sodium (Na)	100	5.2	6.2-8.9	4.1
Total dissolved solids	500	67	148-169	189
pH (units)	6.5-8.5	7.7	7.7-8.1	7.5

GULKANA

Location and Background

Gulkana is in southeastern interior Alaska (fig. 1; fig. 8) at approximate lat 62°16' N., long 145°23' W. The village is on the Richardson Highway about 260 km northeast of Anchorage and 390 km south of Fairbanks. It is part of the Copper River Lowland, a rolling plain trenched by the valleys of the Copper River and its tributaries (Wahrhaftig, 1965). The FAA facilities are concentrated at the Gulkana Airport, which is about 11 km south of the village near the Richardson Highway and the west bank of the Copper River (fig. 8).

At the time of first western contact, the Gulkana area was occupied by the Ahtna people who utilized the Copper River and its tributaries for subsistence fishing (Selkregg, 1976). The village itself was established in 1903 as a telegraph facility and named "Kulkana" after the nearby river (Orth, 1967). Since World War II, the only major undertaking in the area has been the construction of the Glenn Highway from Anchorage to join the Richardson Highway in nearby Glennallen. This opened the area to tourism, hunting, and fishing (Selkregg, 1976). Gulkana has experienced a population growth of about 50 people in the last 20 years. In 1970, the population was 53, in 1974 it was 57, and in 1990 it was 103 (Selkregg, 1976; U.S. Bureau of Census, 1991). According to the 1990 census, 61 people are American Indian or Aleut, and 42 people are Caucasian.

In years past, Gulkana residents have subsisted on fishing and hunting, but today more people rely on a cash economy. Employment is limited and many residents depend on subsistence activities to supplement their income. According to the 1990 U.S. Bureau of Census, Gulkana had a potential workforce of 79 people: 17 worked in the private sector, 12 for the Federal government, 3 were self employed, 12 were unemployed, and 35 were not in the labor force.

The Gulkana Airport was built by the United States Air Force during World War II. The location was deemed to be of strategic importance for war planes traveling between the interior areas of Alaska and the Aleutian Islands. In addition, the site allowed unobstructed landings from three directions and was close to the Glenn and Richardson Highways. Most of the properties and facilities at the airport are currently operated and maintained by the Alaska Department of Transportation and Public Facilities. The FAA began providing airway navigation and communication support at Gulkana in 1941. Current facilities (fig. 8) include a flight service station, a nondirectional beacon, remote communication facilities, a proposed approach lighting system, and employee residences. A detailed account of FAA owned, leased, or transferred properties in or near Gulkana and a listing of suspected sources of contamination near these facilities can be found in an Environmental Compliance Investigation Report by Ecology and Environment, Inc. (1992c).

Physical Setting

Climate

Gulkana has a mean annual temperature of -2.8°C, but temperatures range from a July mean maximum of 20.1°C to a January mean minimum of -25.9°C (Leslie, 1989). Mean annual precipitation is about 280 mm and about 1,190 mm of snow falls annually. Mean monthly temperature, precipitation, and snowfall are summarized in table 13.

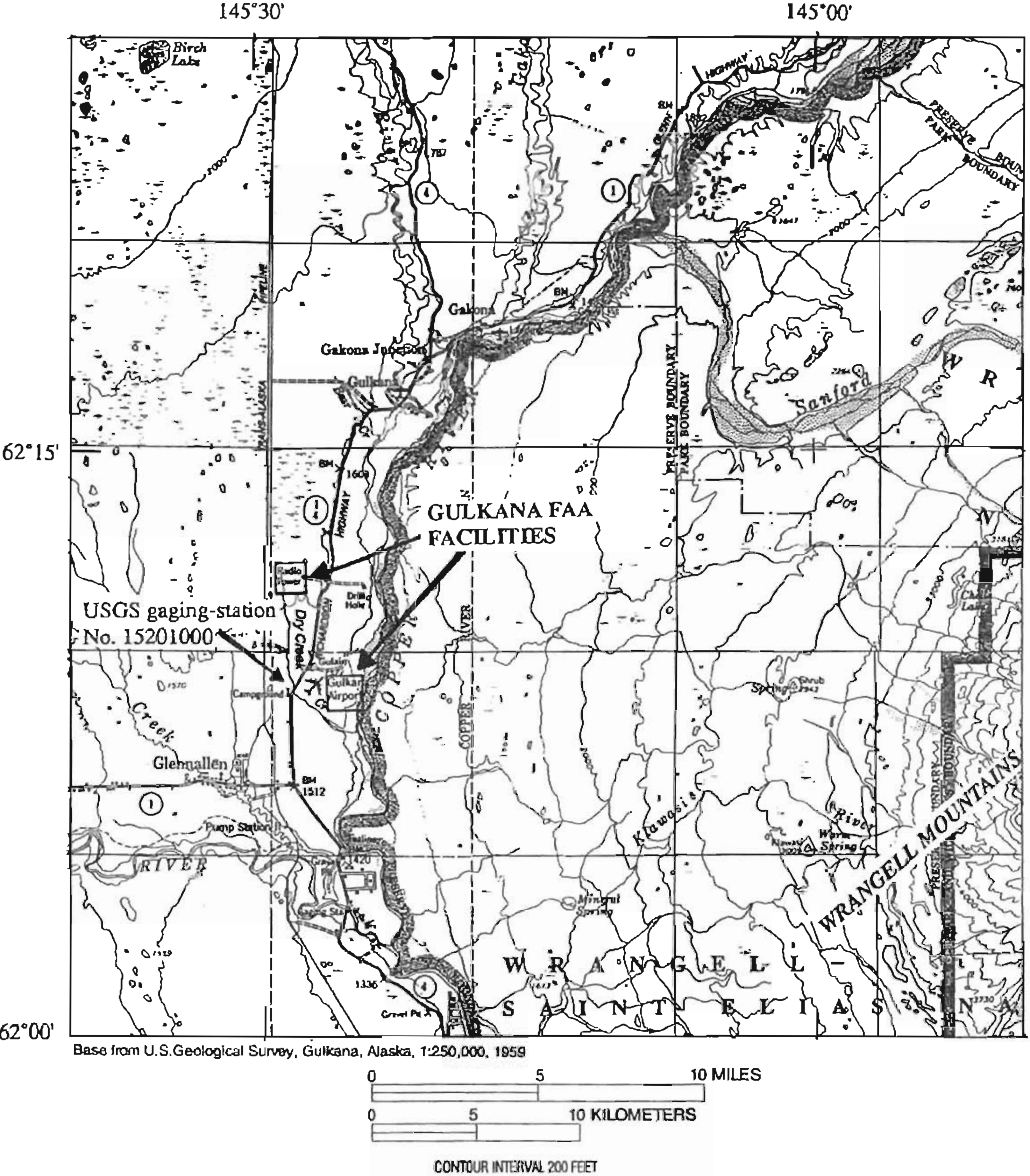


Figure 8. Location of Gulkana, Alaska and the Federal Aviation Administration facilities.

Table 13. Mean monthly and annual temperature, precipitation, and snowfall for the period 1942 to 1987, Gulkana

[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	-16.3	-10.1	-2.2	5.2	12.7	18.3	20.1	18.0	12.1	2.1	-9.9	-15.8	2.8
	(Record maximum 32.8 °C, July 1953)												
Mean minimum	-25.9	-22.0	-17.1	-7.4	0.3	5.7	7.8	5.6	0.7	-7.2	-18.3	-24.4	-8.5
	(Record minimum -53.9 °C, February 1947)												
Mean	-21.1	-16.0	-9.6	-1.1	6.6	12.0	13.9	11.8	0.7	-2.5	-14.1	-20.1	-2.8
Precipitation, in millimeters of moisture													
	12.7	12.2	8.6	5.6	13.2	36.1	48.5	40.1	38.6	22.1	17.8	22.1	Total 277.9
Snowfall, in millimeters													
	175.3	162.6	124.5	63.5	12.7	0.0	0.0	2.5	22.9	175.3	205.7	248.9	Total 1193.8

Vegetation

Vegetation in the Gulkana area consists primarily of lowland spruce-hardwood forests, with low-brush, treeless bog located southwest of the village (Viereck and Little, 1972). The forested areas are covered with black and white spruce interspersed with paper birch, willows, and poplar trees. Labrador tea, sphagnum mosses, grasses, and sedges appear as the subordinate forest vegetation. Bogs exist around Gulkana where conditions are too wet for tree growth; grasses, mosses, and sedges are common in these areas (Viereck and Little, 1972). Stands of black spruce, birch, and poplar encompass the FAA facility and an area of treeless bog exists due west of the runway.

Geology and Soils

No bedrock is exposed in the immediate area of the Gulkana FAA site. The Wrangell Mountains (fig. 8) are east of Gulkana. Volcanic rocks of Quaternary and Tertiary age and metamorphosed sedimentary rocks make up the low hills and ridges of the mountains (Selkregg, 1976). Depth to bedrock is unknown and unconsolidated deposits are at least 150 m thick (Wahrhaftig,1965).

Gulkana occupies the site of a Pleistocene glacial lake. Surficial deposits in the area include till, flood-plain alluvium, and lacustrine silt (Selkregg, 1976). Waller and Selkregg (1962) describe the lithology from a 100-m-deep well drilled in the vicinity of the FAA facility as follows: frozen glacial silt to 26 m, unfrozen glacial silt to 32 m, coarse sand and gravel to 38 m, glacial silt and gravel to 88 m, and coarse gravel and salt water to 100 m below land surface (Appendix 5).

Three major types of soil have been identified in the Gulkana area (Rieger and others, 1979). Poorly drained organic soils are typically found on slopes with gradients of 3 percent or less and cover 60 to 75 percent of the area. These soils have thick organic surface horizons and mottled clay subsoil horizons. Organic-rich soils derived from sedges and mosses are common in depressions. These soils are poorly drained and compose 10 to 15 percent of the area. Well-drained soils consisting of gravelly to silty loam can be found in the Wrangell Mountains east of Gulkana (Rieger and others, 1979).

Gulkana lies near the southern border of the zone of discontinuous permafrost (Hartman and Johnson, 1984). In fine-grained deposits, depth to permafrost is less than 50 cm, but may be considerably deeper in upland areas. The maximum depth to the base of the permafrost is about 180 m (Selkregg, 1976). Permafrost typically is absent directly adjacent to and beneath large streams and rivers (Ferrians, 1965).

Hydrology

Surface Water

The Copper River (fig. 8) passes 1.6 km east of the Gulkana FAA facility, flows south to southeast, and eventually drains into the Gulf of Alaska. Dry Creek, a small stream flowing to the south of the facility, is a tributary of the Copper River (fig. 8). A small, unnamed pond exists at the southern end of the facility. The village of Gulkana is 11 km upstream from the FAA facility and is probably unaffected hydrologically by activities at the facility; however, a campground and small number of residences lie within 1.5 km downstream from the facility.

Flow of the Copper River at Chitina, about 90 km downstream from the facility, was reported from 1955 to 1990 at USGS gaging-station number 15212000. The monthly mean flow of this glacier-fed river changes significantly from summer to winter.

During the open-water months from May to September, mean flow near Chitina is about 2,100 m^3/s and in the winter months, from November to March, mean flow is about 290 m^3/s (U.S. Geological Survey, 1991).

Flow of the Copper River near the Gulkana FAA facility should follow that recorded at the Chitina gaging-station (table 14). However, flow likely will be reduced proportionately by the decrease in drainage area between the two sites. The Copper River drains an area of about 53,500 km^2 upstream from Chitina, while it drains an area of about 20,680 km^2 upstream from the Gulkana FAA facility. The approximate 60 percent reduction in drainage area will likely result in a proportional decrease in streamflow. It can, therefore, be estimated that the mean open-water flow of the river near the FAA facility is about 840 m^3/s and the mean winter flow is about 80 m^3/s. Parts of the Copper River, a highly braided stream, typically freeze in October and break up in May.

Table 14. Monthly mean flow for the Copper River at Chitina, 1990 water year (USGS gaging-station number15212000)

[Values in cubic meters per second]

Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
190	180	185	315	1,300	3,200	3,900	3,600	2,700	710	410	250

Dry Creek, a small tributary draining the south end of the FAA facility, flows from northwest to southeast. This stream drains an area of about 30 km^2 upstream from USGS gaging-station number 15201000, where a partial record of discharge for a period from 1963 to 1993 has been collected. In the 1972 water year, rainfall runoff on May 12 caused a maximum creek discharge of 15.4 m^3/s. On the basis of reported values of 10 cm/yr of runoff for this area, mean annual flow for Dry Creek is estimated to be about 0.1 m^3/s (Emery and others, 1985). The stream is typically dry for many days in March and April (Emery and others, 1985; U.S. Geological Survey, 1994). No data are available for the small unnamed pond at the southern end of the facility. The pond is less than 0.5 km^2 in size.

Near the facility, a gradual topographical gradient with a southeast-trending slope generally causes runoff to flow towards tributaries that drain to the Copper River. No data are available to determine the degree to which rainfall is infiltrating to ground water.

Floods and Erosion

The potential for significant flooding of the Copper River in the Gulkana area is low. Flood stage is about 2.4 m above bankfull stage and the FAA facility is at an elevation several meters higher than bankfull stage (U.S. Army Corps of Engineers, 1993). Maximum known discharge of the Copper River at Chitina, USGS gaging-station 15212000, was recorded on August 8, 1981 at 10,800 m^3/s (Jones and Fahl, 1994). No flooding was reported near the Gulkana FAA facility at that time and no specific flood protection measures have been constructed in the area

Few data are available on erosion in the vicinity of the Gulkana FAA facility; however, channel erosion studies in the area indicate stable channel geometry and minimal bank erosion (Childers and Loeffler, 1977).

Ground Water

Ground water in the Gulkana area generally is present at depths greater than 70 m in unconsolidated deposits below the permafrost. Much of the subpermafrost ground water is salty. Smaller quantities of ground water may be found above the permafrost and in permafrost-free areas adjacent to the Copper River. The ground water in the confined aquifer below the permafrost, under considerable hydrostatic pressure, has been described as non-flowing artesian. Direction of ground-water flow is unknown, but it likely flows toward the southeast, matching the flow direction of the Copper River (Nichols, 1956). Shallow ground water above the permafrost probably flows in the direction of topographic gradients to surface-water drainages such as Dry Creek.

Waller and Selkregg (1962) report that between 1942 and 1956, three wells were drilled at the FAA facility. Depths of the wells were 88 m, 100 m, and 135 m, and water was reached at depths of 84 m, 87 m, and 128 m respectively (Appendix 5). The water, however, was saline and it was decided to seek a water supply from a higher horizon. The 135-m-deep well was plugged below 89 m and blasted, resulting in a water supply with lower salinity levels.

During World War II, the U.S. Army drilled two wells beside Dry Creek. Depths of these wells were about 60 m below land surface, and the water reached was reportedly a good supply (Nichols, 1956).

Drinking Water

Present Drinking-Water Supplies

Ground water is the main source of drinking water in the Gulkana area and is found under the permafrost at depths greater than 70 m, as well as in saturated soils above the permafrost (Nichols, 1956). Drinking water for residents in the vicinity of the FAA facility comes from individual wells, generally 3- to 12-m deep, that tap into the ground water above the permafrost (Nichols, 1956; Emery and others, 1985). These wells yield about 75 L/d, which is less than 4 percent of the average water use of 1,950 L/d per person for the State of Alaska (Solley and Pierce, 1993).

Quality of the Present Supply

Ground water of the Copper River Lowland is considered to be of poor quality, and, in general, its quality decreases with increasing depth (Emery and others, 1985; Nichols, 1956). The confined aquifer on the west side of the Copper River is highly saline and upward movement of water from older marine sedimentary rock has affected the water quality in overlying aquifers (Emery and others, 1985). Wells deeper than 60 m are generally nonpotable and shallow wells, like those used by individual residences in the area, are subject to contamination (Nichols, 1956).

Emery and others (1985) report that the ground water of the Copper River Lowland typically has iron concentrations higher than the current USEPA drinking-water regulations. Samples collected in 1956 from a well at the FAA facility contained dissolved-iron concentrations ranging from 0.9 to 5.4 mg/L, chloride concentrations ranging from 230 to 15,400 mg/L, and sodium concentrations ranging from 72 to 2,630 mg/L (table 15; Appendix 5; Waller and Selkregg, 1962).

Table 15. Selected water-quality data from a well at the Gulkana FAA facility

Constituent (or property)	Drinking-water regulation (mg/L)	Concentration in the ground water (1956) (mg/L)
Chloride (Cl)	250	230-15,400
Iron (Fe)	0.3	0.9-5.4
Sulfate (SO_4)	400	5-28
Fluoride (Fl)	2	0.0-0.3
Sodium (Na)	100	72-2,630
Total dissolved solids	500	—
pH (units)	6.5-8.5	7.4-8.4

Alternative Drinking-Water Source

Drinking-water alternatives for residents in the vicinity of the Gulkana FAA facility include Dry Creek, the Copper River, and the small pond. The pond could possibly be used to supplement present supplies.

The flow in Dry Creek near the facility, measured at USGS gaging-station number 15201000, responds to snowmelt and rainfall events. During winter and dry periods in the summer, flow may be inadequate to meet the needs of local residents. However, when runoff is abundant, this source may be used to augment the present drinking-water supply.

The Copper River represents an abundant source of drinking water for the area. During months of low discharge in the winter, mean flow of the Copper River above Chitina is about 80 m^3/s and is much greater than the water needs of local residents (Emery and others, 1985).

Quality of the Alternative Sources

Emery and others (1985) found that the water of the Copper River near Gulkana typically has iron and manganese concentrations higher than the current USEPA maximum contaminant levels of 0.30 mg/L and 0.05 mg/L, respectively. The 1988 water-quality records of the Copper River at Chitina indicated dissolved-iron concentrations ranging from 0.7 to 2.5 mg/L, chloride concentrations ranging from 2.2 to 5.7 mg/L, sulfate concentrations ranging from 14 to 25 mg/L, and dissolved-solids concentrations ranging from 90 to 124 mg/L (table 16; Appendix 5; U.S. Geological Survey, 1989). Data to determine the water quality of Dry Creek have not been obtained.

Table 16. Selected water-quality data from the Copper River near Gulkana

Constituent (or property)	Drinking-water regulation (mg/L)	Concentration in the Copper River (1988) (mg/L)
Chloride (Cl)	250	2.2-5.7
Iron (Fe)	0.3	0.07-0.25
Sulfate (SO_4)	400	14-25
Fluoride (Fl)	2	0.1-0.2
Sodium (Na)	100	3.5-6.0
Total dissolved solids	500	90-124
pH (units)	6.5-8.5	7.8-8.1

SLANA

Location and Background

Slana is in southeastern interior Alaska (fig. 1; fig. 9) at lat 62°43' N., long 143°57' W. It is on the north bank of the Slana River near its junction with the Copper River, about 360 km northeast of Anchorage. The village is in the northeastern part of the Copper River Lowland, a large, smooth plain furrowed by the valleys of the Copper River and its tributaries (Wahrhaftig, 1965). The Slana FAA facility is located about 6.5 km northeast of the village on the Glenn Highway and is bordered on the south by the Slana River and on the west by Porcupine Creek (fig. 9).

At the time of first western contact, the Slana area was occupied by the Ahtna people who utilized the Copper River and its tributaries for subsistence fishing (Selkregg, 1976). The village was named "Slana" after the nearby river (Orth, 1967). Since World War II, the only major undertaking in the area has been the construction of the Glenn Highway from Anchorage. This opened the area to tourism, hunting, and fishing (Selkregg, 1976). From 1967 to 1990, Slana experienced a population growth of 51 people. In 1967, the population was 12, and in 1990 it was 63 (Orth, 1967; U.S. Bureau of Census, 1991). According to the 1990 census, 4 people were American Indian or Eskimo, and 59 people were Caucasian.

In years past, Slana residents have subsisted on fishing and hunting, while today more people rely on a cash economy. Many residents depend on subsistence activities to supplement their income. According to the 1990 U.S. Bureau of Census, Slana had a potential workforce of 40 people: 7 worked in the private sector, 4 for the State government, 4 were self employed, 12 were unemployed, and 13 were not in the labor force.

The Slana FAA facility has about 20 year-round residences within a 6-km radius. The FAA became involved in the area in 1954, when land was sequestered from the Bureau of Land Management to establish an installation. The land was relinquished in the early 1970's and was transferred to the local Native corporation. The FAA facilities in Slana (fig. 9) currently include an H-Marker facility, a non-directional beacon, and an antenna tower. A detailed account of FAA owned, leased, or transferred properties in or near Slana and a listing of suspected sources of contamination near these facilities can be found in an Environmental Compliance Investigation Report by Ecology and Environment, Inc. (1993c).

Physical Setting

Climate

Slana has a mean annual temperature of -2.4°C, but temperatures range from a July mean maximum of 20.2°C to a January mean minimum of about -23.7°C (Leslie, 1989). Mean annual precipitation is about 405 mm and about 1,500 mm of snow falls annually. Mean monthly temperature, precipitation, and snowfall are summarized in table 17.

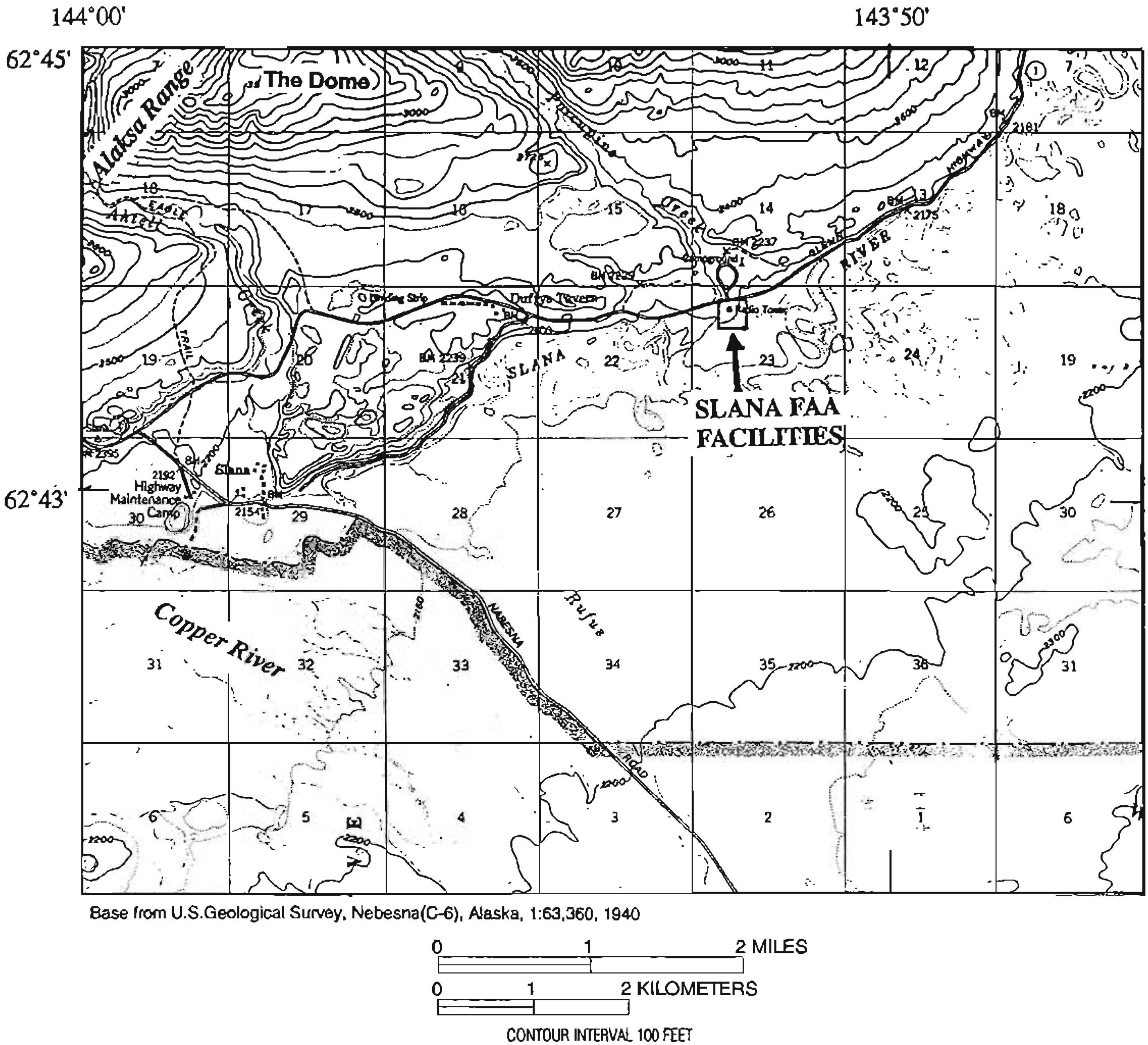


Figure 9. Location of Slana, Alaska and the Federal Aviation Administration facilities.

Table 17. Mean monthly and annual temperature, precipitation, and snowfall for the period 1957-75, 1978-87, Slana

[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	-14.3	-8.3	-2.1	5.2	13.4	19.1	20.2	18.4	12.1	1.9	-8.6	-13.8	3.6
	(Record maximum 33.9 °C, June 1969)												
Mean minimum	-23.7	-19.3	-15.8	-8.3	-0.7	4.6	6.8	4.1	-0.6	-8.5	-18.2	-22.7	-8.6
	(Record minimum -49.4 °C, January 1975)												
Mean	-19.0	-13.8	-9.0	-1.6	6.3	11.8	13.5	11.2	5.8	-3.2	-13.4	-18.2	-2.4
					Precipitation, in millimeters of moisture								
	19.1	21.8	16.4	11.7	24.1	57.2	71.6	55.1	55.6	30.5	19.3	22.4	Total 404.6
							Snowfall, in millimeters						
	210.8	203.2	139.7	124.5	55.9	2.5	0.0	0.0	73.7	233.7	238.8	246.4	Total 1529.1

Vegetation

Vegetation around the FAA facility in Slana is primarily open-spruce forest characterized by an overstory of black and white spruce, locally mixed with poplar, paper birch, and tamarack, and an understory of berries, willows, rose, and Labrador tea (Viereck and Little, 1972). Hardwood forests, with white spruce and aspen, and alpine tundra, with low heath shrubs and willows, exist in the Alaska Range directly north of Slana.

Geology and Soils

An outcrop of rock known as The Dome (fig. 9) is the principal bedrock exposure near Slana (Moffit, 1938). The Dome is composed of undifferentiated igneous rocks, including lava flows, tuff beds, and granite, that range in age from pre-Permian to post-Cretaceous (Moffit, 1938). Other rock units in the area include metamorphosed andesitic volcanics, clastic marine sediments, and limestone that have been intruded by diorite-quartz (Richter, 1966). A well in the Slana area reached bedrock at a depth of 74 m below land surface (Appendix 6; Waller and Selkregg, 1962).

Slana is located in a glaciated valley on the alluvial plain of the Copper and Slana Rivers. Surficial deposits surrounding Slana include till and alluvium (Moffit, 1938; Richter, 1966; Selkregg, 1976). These deposits consist of unconsolidated silt, sand, gravel, and minor amounts of clay, peat, and other organic material. Waller and Selkregg (1962) describe the lithology from an 87-m-deep well drilled in Slana vicinity as follows: frozen sand, clay, and gravel for 13 m; a "thaw streak" to a depth of 15 m; frozen sand and medium gravel to a depth of 22 m; water and fine sand to a depth of 24 m; muck and fine sand to a depth of 54 m; sticky clay to a depth of 74 m; and shale and clay to a depth of 87 m below land surface (Appendix 6).

Poorly drained loamy soils, typical of level topography, develop in the alluvium, and are overlain by a mat of decomposed organic matter. Such soils have a grey silt loam horizon that is typically saturated where it occurs above shallow permafrost (Rieger and others, 1979). Poorly drained organic soils, consisting of stratified layers of fibrous moss and peat, occupy depressions and meander scars and are also saturated above shallow permafrost (Rieger and others, 1979).

Slana lies in the zone of discontinuous permafrost (Ferrians, 1965; Selkregg, 1976). One well log indicated that permafrost is about 22.3 m thick (Ferrians, 1965). Areas underlying and directly adjacent to the Copper and Slana Rivers are typically free of permafrost.

Hydrology

Surface Water

Porcupine Creek is located about 100 m west of the facility (fig. 9). It flows from northwest to southeast and drains into the Slana River. The Slana River flows into the Copper River about 6.5 km southwest of the facility (fig. 9). The FAA facility near Slana is at an elevation about 60 m above the alluvial plain of the Slana River, and flooding and erosion have not been reported in the area.

Stream discharge and drainage-area data are not available for Porcupine Creek or for the Slana River near the FAA facility; however, partial records are available for the Slana River near Mentasta, about 30 km upstream, and for a tributary of the Copper River, about 20 km downstream. Streamflow data from these stations indicate an average annual runoff of about 0.01 to 0.03 m^3/s (Emery and others, 1985).

Flow of the Slana River near Mentasta changes significantly from summer to winter. During the open-water months from May to September, mean flow is about 22 m^3/s and in the winter months, from November to March, mean flow is about 5.5 m^3/s (Emery and others, 1985).

The Slana River drains an area of about 864 km^2 upstream from Mentasta (Emery and others, 1985). Parts of the Slana River typically freeze in October and break up in May.

Partial discharge records for gaging-station number 15199000, the Copper River tributary near Slana, were collected from 1963 to 1981. This station has a drainage area of 11.3 km^2. In June 1980, rainfall runoff caused a maximum stream discharge of 5.8 m^3/s. The tributary is dry for several months during the winter (Jones and Fahl, 1994). The topographical gradient present between the Slana FAA facility and Porcupine Creek is about 10 m/km and is toward the tributaries of the Slana River.

Ground Water

Ground water in the Slana area is present in unconsolidated deposits both above and below the permafrost. Suprapermafrost ground water can be found at depths between 1.5 m and 13 m below land surface, whereas depths to subpermafrost ground water are greater than 22 m below land surface (Appendix 6; Waller and Selkregg, 1962). Adequate data are not available to define flow directions of ground water near the Slana FAA facility.

Drinking Water

Present Drinking-Water Supplies

Ground water is the main source of drinking water in the Slana area (U.S. Bureau of Census, 1991). Most residents near the FAA facility use private wells that yield about 75 L/d, which is less than 4 percent of the average water use of 1,950 L/d per person for the State of Alaska (Emery and others, 1985; Solley and Pierce, 1993). Ground water is not currently used as a drinking-water source at the FAA facility near Slana.

Quality of the Present Supply

Few ground-water quality data are available for the Slana area. A deep confined aquifer in the Slana area is believed to have high salinity concentrations and, therefore, may not be potable (Selkregg, 1976). Most private wells tap into a shallow unconfined aquifer where water is reported to be of suitable quality (Selkregg, 1976).

Alternative Drinking-Water Sources

Drinking-water alternatives for the Slana area include Porcupine Creek, the Copper River tributary near Slana, the Slana River, small lakes and ponds, and undiscovered aquifers. Most of the local lakes and ponds are small, less than 0.5 km^2 in size, but could possibly be used to augment present drinking-water supplies.

The flows from Porcupine Creek and the Copper River tributary near Slana are controlled by snowmelt and rainstorms. During winter and dry periods in the summer, flow may be inadequate to supply the water needs in Slana; however, when runoff is abundant, these sources may be used to augment the drinking-water supply.

The Slana River represents an abundant source of drinking water for Slana. During months of low discharge in the winter, mean flow of the Slana River is about 5.5 m^3/s and is much more than residents near Slana need (U.S. Geological Survey, 1958).

Ground water may be present in fractured bedrock near the FAA facility. Drilling and testing would be necessary to define whether bedrock is a significant aquifer.

Quality of the Alternative Sources

The quality of the Slana River was monitored by the U.S. Geological Survey from 1953 to 1958. Samples were collected and analyzed for major ions and water properties (Appendix 6). Samples collected in 1957-58 contained iron concentrations ranging from 0.02 to 0.03 mg/L, dissolved-solids concentration ranging from 159 to 213 mg/L, and sulfate concentrations ranging from 35 to 62 mg/L (table 18).

Samples collected from Porcupine Creek from 1949 to 1955 indicated iron concentrations ranging from 0.0 to 0.01 mg/L, sulfate concentrations ranging from 14 to 63 mg/L, chloride concentrations ranging from 0 to 2.0 mg/L, and dissolved-solids concentrations ranging from 79 to 281 mg/L (table 18; Appendix 6).

Table 18. Selected water-quality data from the Slana River and Porcupine Creek near Slana

Constituent (or property)	Drinking-water regulation (mg/L)	Concentration (mg/L)	
		Slana River (1957-58)	Porcupine Creek (1949-55)
Chloride (Cl)	250	0.0-2.0	0.0-2.0
Iron (Fe)	0.3	0.02-0.3	0.0-0.01
Sulfate (SO_4)	400	35-62	14-63
Fluoride (Fl)	2	0.0-0.2	0.0-0.2
Sodium (Na)	100	1.5-4.5	1.5-2.9
Total dissolved solids	500	159-213	79-281
pH (units)	6.5-8.5	6.8-8.0	6.9-7.8

NORTHWAY

Location and Background

Northway is in central-interior Alaska (fig. 1; fig. 10) at lat 62°58' N., long 141°56' W. It is on the eastern bank of the Nabesna Slough, about 11 km southwest of the Alaska Highway, about halfway between Tok, Alaska and the Canadian border. The village is in the northeastern part of the Northway-Tanacross Lowland, an area of small basins partitioned by low rolling hills and drained by the Tanana River (Wahrhaftig, 1965).

The FAA facilities in Northway are concentrated at the municipal airport south of the village (fig. 10). The Nabesna River passes about 0.5 km west of the airport; Moose Creek passes immediately to the east (fig. 10).

Northway was originally settled on the Nabesna River as a traditional Athabaskan Indian subsistence village. Contact with western culture occurred in the late 1880's following the arrival of gold miners and the establishment of trading posts in the Yukon (Selkregg, 1976). Flooding in the 1940's led to the establishment of a new village across the river from the original site and a post office was opened in 1942. Residents of Northway consider the community to consist of three settlements: Northway Junction on the Alaska Highway, the airport, and the Native village (Darbyshire and Associates, 1980).

Northway's population has experienced periods of growth and decline during the last 40 years. In 1950, the population was 196, in 1960 it was 237, in 1970 it was 234, in 1980 it was 324, and in 1990 it was 123 (Darbyshire and Associates, 1980; U.S. Bureau of Census, 1991). According to the 1990 census, 79 people were American Indian or Eskimo, and 44 were Caucasian. Most employment in Northway is with the government or with service facilities associated with the airport. Many residents are seasonal workers and must supplement their income with subsistence activities (Darbyshire and Associates, 1980; U.S. Bureau of Census, 1991).

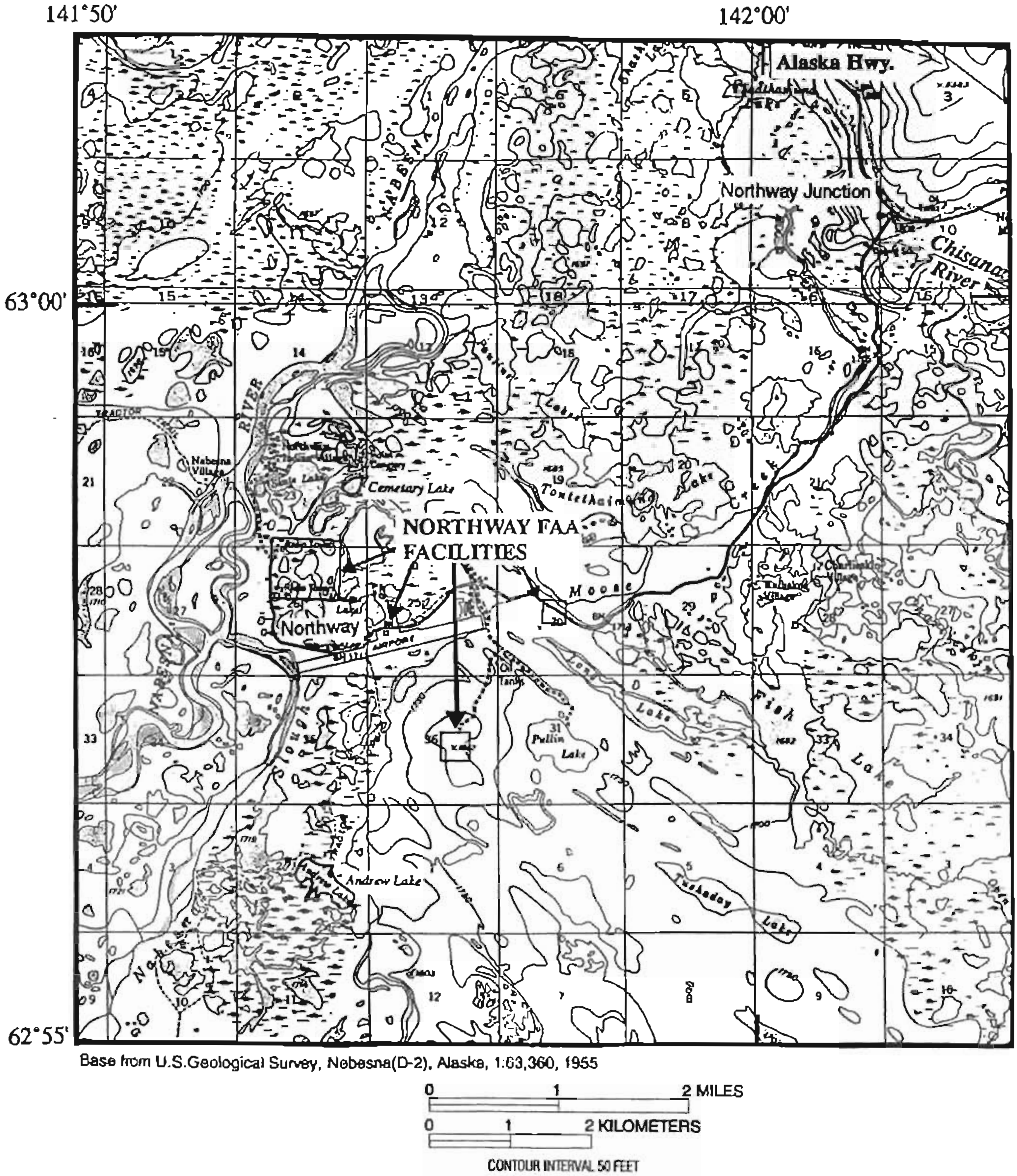


Figure 10. Location of Northway, Alaska and the Federal Aviation Administration facilities.

The Alaska Highway and the airport provide sources of transportation for Northway and the surrounding area. The community is served by buses traveling between Fairbanks and Whitehorse, and residents receive freight service from local trucking companies. Regular flights to Fairbanks and local charters are available (Darbyshire and Associates, 1980).

During and immediately following World War II, the Civil Aeronautics Administration (predecessor to the FAA) operated the Northway Airport. In 1966, ownership of most of the facilities was transferred to the State of Alaska, which currently operates and maintains them. Current FAA facilities near Northway (fig. 10) include a very high frequency omnidirectional range tactical air navigational facility, a non-directional beacon, a direction finder, a runway with identifier lights, and a wind indicator. A detailed account of FAA owned, leased, or transferred properties in or near Northway and a listing of suspected sources of contamination near these facilities can be found in an Environmental Compliance Investigation Report by Ecology and Environment, Inc. (1992d).

Physical Setting

Climate

Northway has a mean annual temperature of -5.7°C, but temperatures range from a July mean maximum of 20.6°C to a January mean minimum of -33.4°C (Leslie, 1989). Mean annual precipitation is about 242 mm and about 900 mm of snow falls annually. Mean monthly temperature, precipitation, and snowfall are summarized in table 19.

Table 19. Mean monthly and annual temperature, precipitation, and snowfall for the period 1951 to 1987, Northway

[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	-24.1	-16.9	-5.4	4.6	13.3	19.0	20.6	18.2	11.3	-1.3	-14.8	-17.9	0.2
	(Record maximum 32.8 °C, June 1969)												
Mean minimum	-33.4	-29.4	-22.8	-10.0	0.1	6.7	8.9	5.9	-0.4	-10.6	-23.7	-31.0	-11.7
	(Record minimum -57.8 °C, January 1952)												
Mean	-28.7	-23.2	-14.1	-2.7	6.7	12.9	14.7	12.1	5.4	-5.9	-19.2	-26.7	-5.7
						Precipitation, in millimeters of moisture							
	7.6	7.6	4.3	5.1	21.8	46.5	60.7	35.6	22.9	13.0	7.6	7.6	Total 241.6
						Snowfall, in millimeters							
	144.8	114.3	76.2	68.6	12.7	0.0	0.0	5.1	20.3	157.5	137.2	147.3	Total 886.5

Vegetation

Vegetation in the Northway area consists primarily of lowland spruce-hardwood forest and low brush-muskeg bog. Upland spruce-hardwood forests and alpine tundra are scattered in outlying areas (Viereck and Little, 1972). Lowland forested areas have an overstory of black spruce mixed with poplar, birch, and tamarack with an undergrowth of willow, rose, and Labrador tea. Mosses, sedges, and grasses make up bog areas, while alpine tundra regions are predominantly barren (Viereck and Little, 1972). The FAA facility at Northway is surrounded by stands of black spruce, birch, and willow, while expanses of treeless bog extends along either side of the runway.

Geology and Soils

Bedrock is not exposed in the vicinity of Northway. Bedrock exposures northeast of the village in the Yukon-Tanana Upland consist of granitic rocks and metasediments, mantled by thick deposits of colluvium (Selkregg, 1976; Anderson, 1970). Depth to bedrock at Northway is unknown. Surficial deposits are at least 90 m thick and wells drilled in the area have not reached bedrock.

Surficial deposits in the Northway area include alluvium and eolian sand (Anderson, 1970; Selkregg, 1976). Alluvial deposits of the Nabesna and Chisana Rivers consist of lenses of silt, sand, and minor amounts of outwash (Anderson, 1970). Such deposits are characterized by poor drainage and are usually saturated above shallow permafrost (Rieger and others, 1979). Longitudinal dune fields exist southeast of the village and are made up of well-sorted eolian sand and silt. Drainage is moderately good on the slopes of these sand dunes, but poor in depressions. Permafrost is generally absent in the dunes (Anderson, 1970).

Waller and Tolen (1962) described the lithology of sediments reached in a 74-m-deep well drilled in the vicinity of the FAA facility at Northway as follows: frozen sand, muck, and fine gravel for 14 m; muck, clay, and some water to a depth of 18 m; silt, sand, and fine gravel to a depth of 37 m; gravel, sand, and a "rush" of water at 38 m; and sand, gravel, and water to a depth of 74 m below land surface (Appendix 7). Northway lies in the zone of discontinuous permafrost (Ferrians, 1965; Selkregg, 1976).

Hydrology

Surface Water

Nabesna River and Moose Creek are the principal streams near Northway (fig. 10). Both flow from north to northeast at a gradient of about 10 m/km and empty into the Chisana River near Northway Junction. Surrounding the village are small lakes, ponds, and marshes along Nabesna Slough. Discharge and drainage area data are not available for the Nabesna River or Moose Creek; however, data are available for the Chisana River at Northway Junction, located about 8.5 km north of the FAA facility.

Flow of the Chisana River at Northway Junction, reported from 1949 to 1971 at USGS gaging-station number 15470000, changes significantly from summer to winter. During the open-water months from May to September, mean flow is about 120 m^3/s and in the winter months, from November to March, mean flow is about 24 m^3/s (table 20) (U.S. Geological Survey, 1972). The Chisana River drains an area of about 8,500 km^2 upstream from Northway Junction. Moose Creek and parts of the Chisana and Nabesna Rivers typically freeze in October and break up in May. Average runoff in the area is estimated to be greater than 24 cm/yr (Anderson, 1970).

Table 20. Monthly mean flow for the Chisana River at Northway Junction,1971 water year (USGS gaging-station number 15470000)

[Values in cubic meters per second]

Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
24	22	21	22	107	98	158	158	86	41	28	25

Floods and Erosion

Northway is flooded to some extent annually and low-lying areas are considered to have a high flood hazard (U.S. Army Corps of Engineers, 1993). Most of the village is located on a hill about 500 m in elevation and is not affected by flooding, but lower areas such as access roads are subject to some degree of flooding (Darbyshire and Associates, 1980). The principal type of flooding is stream overflow caused by surface runoff during snowmelt or rainfall.

Flooding in the Northway area occurred in 1946, 1948, 1964, and 1988. The most severe flood, measured at USGS gaging-station number 15470000 on June 28, 1964, reached a gage height of 4.0 m and had a discharge of about 340 m^3/s (U.S. Army Corps of Engineers, 1993).

Northway does not participate in the National Flood Insurance Program (U.S. Army Corps of Engineers, 1993).

Riverbank erosion does not pose an immediate threat to the village of Northway, but is a problem along the road linking the village to the FAA facility. Erosion may also occur on the outside bends of the Nabesna and Chisana River channels (Darbyshire and Associates, 1980). In addition, ice wedging around Cemetery Lake, causing the formation of deep trenches where land is sloughing into the lake, is considered to be a hazard (Darbyshire and Associates, 1980).

Ground Water

Ground water in the Northway area is present in the unconsolidated deposits below permafrost at depths greater than 15 m below land surface, but may be found to a lesser extent in unfrozen sediments above the permafrost and in permafrost-free, thaw areas adjacent to and beneath the Nabesna River, Moose Creek, and the many lakes in the area (Waller and Tolen, 1962).

On an area-wide basis, the discontinuous permafrost is not an effective confining layer. Virtually every lake and significant areas near major streams will have permafrost-free sediments underlying them. These thawed sediments allow easy exchange of water between the subpermafrost sediments and the lakes and suprapermafrost aquifer. The Northway area is an integrated ground-water/surface-water system such as occurs in numerous other basins in Alaska. In such basins, small clear-water creeks like Moose Creek are discharge boundaries for the ground-water system. Glacier-fed streams, such as the Nabesna River, are aggrading their flood plains and are topographically slightly higher than the clear-water streams. As a result of these slight differences in elevation, a cross-valley component of ground-water flow between the glacial river and the clear-water creek is common. The most well-documented example is at Fairbanks, where the Tanana River recharges the aquifer and the Chena River drains the aquifer (Nelson, 1978). There are no data to confirm an easterly component of flow toward Moose Creek near the airport, but such a component would not be hydrologically unusual.

Waller and Tolen (1962) reported that between 1942 and 1944 four wells were drilled at the FAA facility. Depths of the wells were 15 m, 63 m, 69 m, and 74 m below land surface, and water was reached at depths of 15 m, 18 m, 18 m, and 27 m respectively (Appendix 7). When a clay layer was penetrated at 18 m, water from the 74-m-deep well rose to a depth 1 m below the land surface indicating a confined aquifer under hydrostatic pressure. However, areal continuity of the clay layer is unknown.

Drinking Water

Present Drinking-Water Supplies

Ground water is the main source of drinking water in the Northway area, and is found under the permafrost at depths greater than 15 m below land surface and in saturated soils above the permafrost (Waller and Selkregg, 1962). Well water piped into a 3,780-L tank at the local laundry area provides a central public drinking-water source for residents in Northway (Darbyshire and Associates, 1980). Most homes near the FAA facility use private wells.

Quality of the Present Supply

In general, the quality of ground water reflects its geologic surroundings. The aquifer in the Northway area lies below the permafrost and water quality in such aquifers usually is similar to the water quality of nearby streams and rivers (Anderson, 1970). Ground water typically meets drinking-water regulations set by the USEPA (Anderson, 1970). In January 1964, water-quality analyses were completed on samples taken from the 74-m-deep well at the FAA facility. These samples contained dissolved-iron concentrations of 0.02 mg/L, a chloride of 4 mg/L, and a dissolved-solid concentration of 176 mg/L (table 21; Appendix 7; Anderson, 1970).

Table 21. Selected water-quality data from a well near Northway

Constituent (or property)	Drinking-water regulation (mg/L)	Concentrations in ground water (1964) (mg/L)
Chloride (Cl)	250	4.0
Iron (Fe)	0.3	0.02
Sulfate (SO_4)	400	12
Fluoride (Fl)	2	0.0
Sodium (Na)	100	4.7
Total dissolved solids	500	176
pH (units)	6.5-8.5	8.0

Alternative Drinking-Water Sources

Drinking-water alternatives for Northway include the Nabesna and Chisana Rivers, Moose Creek, the lakes and ponds of Nabesna Slough, and untapped areas of the alluvial aquifer. Cemetery Lake and Andrew Lake may be used to a limited degree to supplement the water supply, but the quality and quantity of available water have not been determined.

The flow from Moose Creek near the FAA facility is directly controlled by snowmelt, rainfall, and ground-water recharge; however, the quantity and quality of the stream have not been documented. The Nabesna and Chisana Rivers represent abundant sources of drinking water for Northway. During winter months, mean flow of the Chisana River at Northway Junction is about 24 m^3/s and is far greater than the quantity of water used in Northway.

There is no evidence of confining layers separating the subpermafrost aquifer underlying Northway from a deeper aquifer. Permafrost is found at depths ranging from 15 to 27 m below land surface and bedrock is at least 60 to 75 m deeper (Waller and Tolen, 1962). Drinking water may be available from untapped areas of the aquifer.

Quality of the Alternative Sources

The quality of the Chisana River water was monitored at USGS stream-gaging station number 1547000 near Northway Junction during various years, from 1950 to 1972. Major ions and water properties were analyzed (Appendix 7). The most recent water samples from the Chisana River at Northway Junction, taken in 1972, contained iron concentrations ranging from 0.12 to 0.14 mg/L, chloride concentrations ranging from 1.2 to 2.1 mg/L, and dissolved-solids concentrations of 114 to 173 mg/L (table 22; U.S. Geological Survey, 1973).

Anderson (1970) described the quality of the Nabesna River at Northway Junction as having a sulfate concentration of 29 mg/L, a chloride concentration of 7.8 mg/L, and a dissolved-solids concentration of 174 mg/L (table 22). Data to determine the water quality of Moose Creek, Cemetery Lake, and Andrew Lake have not been obtained.

Table 22. Selected water-quality data from the Chisana and Nabesna Rivers near Northway

Constituent (or property)	Drinking-water regulation (mg/L)	Concentration (mg/L)	
		Chisana River (1972)	Nabesna River (1966)
Chloride (Cl)	250	1.2-2.1	7.8
Iron (Fe)	0.3	0.12-0.14	---
Sulfate (SO_4)	400	18-27	29
Fluoride (Fl)	2	0.0-0.1	0.1
Sodium (Na)	100	4.3-5.1	11
Total dissolved solids	500	114-173	174
pH (units)	6.5-8.5	7.1-8.0	7.4

SUMMARY

The FAA facilities and surrounding areas described in this report—Nenana, Summit, Talkeetna, Sheep Mountain, Gulkana, Slana, and Northway—are located in interior Alaska, near the foothills of the Alaska Range or the Talkeetna Mountains. Each facility is accessible by both the State highway system and by small aircraft. Local residents often rely on a subsistence lifestyle to supplement their income. This makes them dependent on a sustainable environment.

Most of interior Alaska has a continental climate characterized by significant diurnal and annual temperature variations, low precipitation, and low humidity (Hartman and Johnson, 1984). This accounts for the area's long, cold winters and relatively short, warm summers. Vegetation in interior Alaska is dominated by open, low-growing spruce forests and alpine tundra (Viereck and Little, 1972). Areas adjacent to large rivers are subject to increased moisture availability and consist of a combination of closed spruce-hardwood forest and shrub thickets (Viereck and Little, 1972).

The bedrock of the Alaska Range and Talkeetna Mountains includes a variety of igneous sedimentary and metamorphic rocks that make up a collage of tectonic-stratigraphic terranes bounded by major faults (Nokleberg and others, 1994). Quaternary glaciation of this area greatly modified the landscape and distributed a variety of unconsolidated sediments over the valley floors and lowlands. Most soils are poorly drained and organic rich, especially in low-lying areas (Rieger and others, 1979). Much of this region is underlain by discontinuous permafrost (Ferrians, 1965).

Surface water is abundant in interior Alaska and each of the seven FAA facilities is located within a few kilometers of a river, stream, or lake. Some of the FAA facilities are located near rivers and streams where there is potential for flooding and erosion problems. Several rivers flood annually with the melting of snow in the spring or with heavy rainfall in autumn. Those rivers having glaciers in their basins carry large quantities of sediment in their channels.

Ground water is the principal source of drinking water for residents living near the FAA facilities in interior Alaska. More populated areas utilize public water-supply systems, whereas remote areas have only private wells. Aquifers can be found above the permafrost, within it, or below it (Selkregg, 1976). The susceptibility of the ground water to contamination depends on the permeability of aquifer materials, the depth to the aquifer, and any impervious layers such as permafrost or clay between the aquifer and the land surface. On a regional scale, the direction of ground-water flow generally will follow that of surface-water drainages from the mountains to major rivers and then to the coast. Site-specific ground-water flow directions can only be determined through detailed mapping of the water table.

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APPENDIX 1

Hydrologic data for the Nenana area, Alaska

15515500 TANANA RIVER AT NENANA--Continued

WATER-QUALITY RECORDS

PERIOD OF RECORD.--Water years 1954-57, 1963-64, 1966-75, and 1978 to current year.

PERIOD OF DAILY RECORD.--
WATER TEMPERATURE: 1954 to 1956 (seasonal).

WATER-QUALITY DATA, WATER YEAR OCTOBER 1992 TO SEPTEMBER 1993

DATE	TIME	STREAM WIDTH (FT) (00004)	GAGE HEIGHT (FEET) (00065)	DIS-CHARGE, INST. CUBIC FEET PER SECOND (00061)	SAM-PLING METHOD, CODES (82398)	SPE-CIFIC CON-DUCT-ANCE (US/CM) (00095)	PH WATER WHOLE FIELD (STAND-ARD UNITS) (00400)	TEMPER-ATURE AIR (DEG C) (00020)	TEMPER-ATURE WATER (DEG C) (00010)	TUR-BID-ITY (NTU) (00076)	BARO-METRIC PRES-SURE (MM OF HG) (00025)
DEC											
31...	1430	850	--	7490	10	305	7.8	-4.0	0.0	6.0	752
MAR											
10...	1300	850	--	8140	10	295	7.8	-7.0	0.0	2.5	762
JUN											
17...	1545	708	7.51	44000	20	218	8.1	21.0	16.5	230	749
SEP											
01...	1520	741	7.07	41200	20	247	7.9	13.0	11.0	280	744

DATE	OXYGEN, DIS-SOLVED (MG/L) (00300)	OXYGEN, DIS-SOLVED (PER-CENT SATUR-ATION) (00301)	COLI-FORM, FECAL, 0.7 UM-MF (COLS./ 100 ML) (31625)	STREP-TOCOCCI FECAL, KF AGAR (COLS. PER 100 ML) (31673)	HARD-NESS TOTAL (MG/L AS CACO3) (00900)	CALCIUM DIS-SOLVED (MG/L AS CA) (00915)	MAGNE-SIUM, DIS-SOLVED (MG/L AS MG) (00925)	SODIUM, DIS-SOLVED (MG/L AS NA) (00930)	POTAS-SIUM, DIS-SOLVED (MG/L AS K) (00935)	BICAR-BONATE WATER DIS IT FIELD MG/L AS HCO3 (00453)
DEC										
31...	8.1	56	<1	K6	160	48	9.4	4.5	2.4	154
MAR										
10...	8.9	61	<1	<1	150	45	9.0	4.5	2.4	155
JUN										
17...	9.2	96	87	57	120	35	7.0	3.6	2.0	93
SEP										
01...	9.0	84	57	83	120	34	8.0	3.6	1.7	100

DATE	ALKA-LINITY WAT WH TOT FET FIELD MG/L AS CACO3 (00410)	ALKA-LINITY WAT DIS TOT IT FIELD MG/L AS CACO3 (39086)	SULFATE DIS-SOLVED (MG/L AS SO4) (00945)	CHLO-RIDE, DIS-SOLVED (MG/L AS CL) (00940)	FLUO-RIDE, DIS-SOLVED (MG/L AS F) (00950)	SILICA, DIS-SOLVED (MG/L AS SIO2) (00955)	SOLIDS, RESIDUE AT 180 DEG. C DIS-SOLVED (MG/L) (70300)	SOLIDS, SUM OF CONSTI-TUENTS, DIS-SOLVED (MG/L) (70301)	NITRO-GEN, NITRITE DIS-SOLVED (MG/L AS N) (00613)	NITRO-GEN, NO2+NO3 DIS-SOLVED (MG/L AS N) (00631)
DEC										
31...	126	126	31	1.4	0.10	17	190	190	0.020	0.200
MAR										
10...	127	127	31	1.2	<0.10	15	187	186	<0.010	0.210
JUN										
17...	76	76	37	1.4	0.10	7.3	127	140	<0.010	0.099
SEP										
01...	82	82	43	1.1	0.10	8.0	154	149	0.030	0.120

DATE	NITRO-GEN, AMMONIA DIS-SOLVED (MG/L AS N) (00608)	NITRO-GEN,AM-MONIA + ORGANIC TOTAL (MG/L AS N) (00625)	PHOS-PHORUS TOTAL (MG/L AS P) (00665)	PHOS-PHORUS DIS-SOLVED (MG/L AS P) (00666)	PHOS-PHORUS ORTHO, DIS-SOLVED (MG/L AS P) (00671)	ALUM-INUM, DIS-SOLVED (UG/L AS AL) (01106)	BARIUM, DIS-SOLVED (UG/L AS BA) (01005)	COBALT, DIS-SOLVED (UG/L AS CO) (01035)	IRON, DIS-SOLVED (UG/L AS FE) (01046)	LITHIUM DIS-SOLVED (UG/L AS LI) (01130)
DEC										
31...	0.070	<0.20	0.010	0.010	<0.010	--	--	--	--	--
MAR										
10...	0.050	<0.20	0.020	<0.010	<0.010	<10	53	<3	38	6
JUN										
17...	0.020	<0.20	<0.010	<0.010	<0.010	40	44	<3	34	5
SEP										
01...	0.040	<0.20	0.020	<0.010	<0.010	20	41	<3	16	7

DATE	MANGA-NESE, DIS-SOLVED (UG/L AS MN) (01056)	MOLYB-DENUM, DIS-SOLVED (UG/L AS MO) (01060)	NICKEL, DIS-SOLVED (UG/L AS NI) (01065)	SELE-NIUM, DIS-SOLVED (UG/L AS SE) (01145)	SILVER, DIS-SOLVED (UG/L AS AG) (01075)	STRON-TIUM, DIS-SOLVED (UG/L AS SR) (01080)	VANA-DIUM, DIS-SOLVED (UG/L AS V) (01085)	SEDI-MENT, SUS-PENDED (MG/L) (80154)	SEDI-MENT, DIS-CHARGE, SUS-PENDED (T/DAY) (80155)	SED. SUSP. SIEVE DIAM. % FINER THAN .062 MM (70331)
DEC										
31...	--	--	--	--	--	--	--	68	1380	81
MAR										
10...	85	<10	<1	<1	<1.0	190	<6	41	901	78
JUN										
17...	12	<10	1	<1	<1.0	140	<6	887	105000	77
SEP										
01...	18	<10	<1	<1	<1.0	140	<6	1020	113000	57

K Non-ideal colony count.

30-5180. NENANA RIVER NEAR HEALY

LOCATION.--Lat 63°50'40", long 148°56'35", at gaging station on right bank 0.5 mile upstream from Healy Creek, 1.1 miles southeast of Healy, and 1.2 mile upstream from railroad bridge.
DRAINAGE AREA.--1,910 square miles, approximately.
RECORDS AVAILABLE.--Chemical analyses: June to December 1949, October 1953 to October 1954, May to September 1955, May to October 1956, January 1957 to September 1966.
Water temperatures: June to October 1949, August 1957 to September 1966.
Sediment records: June 1953 to September 1966.
EXTREMES, 1965-66.--Water temperatures: Maximum, 55°F July 17, 25.
Sediment concentrations: Maximum daily, 1,900 ppm June 5.
Sediment loads: Maximum daily, 100,000 tons June 12.
EXTREMES, 1953-66.--Water temperatures (1957-66)): Maximum, 56°F Aug. 9, 1957.
Sediment concentrations: Maximum daily, 8,330 ppm July 11, 1963.
Sediment loads: Maximum daily, 585,000 tons June 25, 1953.

Chemical analyses, in parts per million, water year October 1965 to September 1966

Date of collection	Mean discharge (cfs)	Silica (SiO_2)	Iron (Fe)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Dissolved solids (residue at 180°C)	Hardness as $CaCO_3$: Calcium, magnesium	Hardness as $CaCO_3$: Non-carbonate	Specific conductance (micromhos at 25°C)	pH	Color
June 1-10, 1966..	13700	3.7	0.12	15	3.5	0.9	1.0	52	12	0.0	0.1	0.0	62	52	26	118	7.8	10
June 11-20.......	13900	4.1	.02	18	.4	1.1	1.0	56	18	.0	.1	.0	71	62	34	135	7.9	5
June 21-30.......	9720	4.6	.04	19	6.2	2.2	1.3	69	19	.7	.3	.2	88	73	39	160	7.9	5
July 1-5.........	7670	4.4	.10	22	6.6	1.4	1.7	66	31	.0	.2	.5	101	82	25	170	7.6	5
July 6-14........	6920	4.5	.10	25	4.9	1.5	1.1	70	28	1.1	.1	.0	100	83		210	8.0	5
July 15-22.......	7860	4.5	.04	23	7.2	1.5	1.6	74	30	1.1	.2	.0	105	87	51	188	8.0	0
July 23-31.......	8050	4.5	.35	23	5.7	1.7	2.1	70	31	.7	.1	.2	103	81	47	183	7.8	10
Aug. 1-5.........	8490	4.7	.06	18	9.0	1.4	1.7	68	32	.7	.2	.5	102	82	26	173	7.8	10
Aug. 6-17........	6380	5.1	—	26	8.0	2.0	1.5	75	38	.7	.2	.2	119	196	126	195	7.7	5
Aug. 18-31.......	9200	5.3	—	24	8.0	1.8	.8	70	35	1.4	.3	.1	111	93	36	192	7.8	5
Sept. 1-11.......	4830	5.7	—	29	7.2	2.5	.8	80	41	1.1	.5	.2	126	102	36	209	7.9	5

CHEMICAL ANALYSES, IN PARTS PER MILLION, WATER YEAR OCTOBER 1967 TO SEPTEMBER 1968

15-5160. NENANA RIVER NEAR WINDY (LAT 63°50'40", LONG 148°56'35")

DATE	DIS-CHARGE (CFS)	SILICA (SIO2)	TOTAL IRON (FE)	CAL-CIUM (CA)	MAG-NE-SIUM (MG)	SODIUM (NA)	PO-TAS-SIUM (K)	BICAR-BONATE (HCO3)	SULFATE (SO4)	CHLO-RIDE (CL)	FLUO-RIDE (F)	NITRATE (NO3)	DIS-SOLVED SOLIDS (SUM OF CONSTI-TUENTS)	HARD-NESS (CA,MG)	NON-CAR-BONATE HARD-NESS	SPECI-FIC CONDUCTANCE (MICRO-MHOS)	PH
MAR., 1968 27...	212	9.4	.06	32	4.4	3.6	2.0	105	18	3.5	.1	.0	125	98	12	214	7.7

SELECTED CHEMICAL ANALYSES OF SURFACE WATER

Chemical analyses in parts per million except conductance, pH, and color

Date of collection	Location	Mean discharge (cfs)	Silica (SiO_2)	Iron (Fe)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Dissolved solids (residue on evaporation at 180°C)	Hardness as $CaCO_3$: Carbonate	Hardness as $CaCO_3$: Non-carbonate	Specific conductance (micromhos at 25°C)	pH	Color
6/18/65	Lake (no name) near Northway Junction	—	4.3	0.73	36	14	5.2	2.1	181	4.3	2.8	0.4	1.0	160	149	1	275	7.5	120
6/17/65	Scottie Creek near Northway Junction	—	6.2	0.41	15	6.4	3.2	1.3	70	8.6	2.1	0.3	0.5	78	64	7	134	7.5	120
7/27/53	Chisana River near Northway Junction	—	7.1	0.00	26	4.2	0.8		90	13	2.0	0.1	0.3	102	85	11	185	8.0	0
12/30/57	Chisana River near Northway Junction	827	15	0.05	44	13	6.9	2.9	183	24	4.0	0.2	0.4	200	163	13	328	7.3	0
10/20/66	Nabesna River near Northway Junction	620	14	—	45	8.9	11	2.0	165	29	7.8	0.1	1.7	174	149	14	331	7.4	5
2/17/53	Tanana River near Tok Junction	1,600	17	0.03	49	10	6.8	2.2	182	24	2.0	0.0	1.5	202	164	15	316	7.2	5
2/11/58	Tok River near Tok Junction	—	30	0.02	111	32	8.3	3.6	416	89	1.5	0.1	3.2	484	408	68	751	7.6	5
12/10/52	Little Tok River near Tok Junction	—	18	0.01	88	20	5.1	2.1	271	92	1.0	0.1	1.3	361	303	81	545	7.2	5
6/21-30/57	Tanana River near Tanacross	23,700	12	0.00	29	4.1	5.6	1.3	102	17	2.5	0.2	0.9	123	89	6	202	7.8	10
5/25-31/64	Tanana River near Tanacross	7,710	12	0.00	36	7.8	5.5	1.2	127	22	2.5	0.1	0.6	151	122	18	266	6.9	10
4/8/59	Tanana River near Tanacross	1,960	17	0.02	46	10	5.5	2.0	168	26	3.0	0.1	0.6	193	156	18	322	6.6	0
12/31/57	Robertson River near Tanacross	—	6.3	0.02	77	27	3.5	3.2	217	131	1.5	0.0	1.4	358	303	125	578	8.2	0
2/5/52	Berry Creek near Dot Lake	—	17	0.01	20	3.6	4.9		75	8.5	2.2	0.4	1.0	95	65	3	143	7.5	10
11/21/57	Johnson River near Dot Lake	—	4.5	0.02	40	16	3.4	3.9	119	73	1.0	0.2	0.2	202	166	68	333	7.4	0
8/20/55	Gerstle River near Big Delta	—	5.6	0.00	47	12	3.7	2.7	117	74	1.2	0.4	0.5	205	167	71	340	7.6	5
7/14/51	Healy Lake near Big Delta	—	6.2	—	12	6.3	3.9		46	23	1.5	—	1.1	77	56	—	97	7.2	30
6/22/51	Clear Creek near Rapids	—	4.2	0.01	34	40	6.4		143	138	0.4	0.0	2.3	296	249	132	495	7.9	5
1/5/58	Delta River near Rapids	—	5.7	0.02	39	12	5.3	2.5	121	55	3.0	0.0	0.6	183	147	48	308	7.5	0
12/11-20/50	Tanana River near Big Delta	6,160	15	0.01	44	9.3	4.9	0.8	154	30	1.5	—	0.6	187	148	22	305	7.4	5
2/5/52	Banner Creek near Richardson	—	18	0.60	32	17	3.4		100	70	0.8	0.1	1.2	207	150	68	301	7.1	55
12/9/52	Salcha River near Salchaket	360	9.2	0.03	20	5.6	2.2	1.2	67	25	0.2	0.1	1.5	98	74	18	156	6.5	5
10/3/48	Salcha River near Salchaket	1,880	10	—	19	5.7	1.8		66	18	1.0	0.0	1.5	90	71	17	141	—	—
5/10/50	Salcha River near Salchaket	8,800	4.9	0.12	7.6	2.7	0.8		28	7.0	0.2	—	1.4	60	30	7	66	—	—
6/17/55	Chena River at Fairbanks	6,920	6.7	0.14	13	2.9	1.1	0.8	43	11	0.2	0.0	1.3	72	44	9	94	6.8	—
10/10/54	Chena River at Fairbanks	1,440	9.4	0.19	24	5.4	2.4	0.8	81	19	1.0	—	1.4	104	82	16	170	7.1	10
2/13/58	Chena River at Fairbanks	170	21	0.02	34	7.9	4.0	2.0	134	14	1.0	0.2	1.4	152	118	8	241	6.8	20
7/28/57	Chatanika River near Fairbanks	140	7.7	0.12	19	7.2	1.6	0.9	60	28	0.2	0.1	0.3	95	77	28	159	7.0	10
6/16/56	Tolovana River near Livengood	—	6.6	—	8.3	5.0	1.8	0.3	36	9.6	0.0	—	0.6	—	41	12	82	7.6	165
4/4/58	Nenana River near Healy	416	3.0	0.02	40	16	4.4	1.9	80	112	1.5	0.2	0.6	219	166	100	349	7.6	0
9/21-30/63	Nenana River near Healy	4,100	5.9	0.02	33	7.5	3.3	1.6	90	43	2.0	0.1	0.5	141	113	39	234	7.7	5
6/21-30/62	Nenana River near Healy	15,700	5.0	0.02	25	5.7	1.9	1.4	70	32	0.0	0.1	0.2	105	86	29	176	7.7	5
7/5/60	Seattle Creek near Windy	—	11	0.04	13	2.8	2.4	0.9	45	13	1.0	0.1	0.2	66	44	7	88	7.5	0
9/7/66	Jack River near Cantwell	610	7.0	0.00	13	7.2	5.0	1.2	50	27	0.7	0.2	1.1	87	62	21	160	6.4	0
9/7/66	Riley Creek near Mt. McKinley	200	5.7	0.06	36	18	6.4	1.2	138	57	1.4	0.1	1.5	195	164	51	316	6.9	0
9/7/66	Sanctuary River near Mt. McKinley	214	5.3	0.06	34	17	7.0	1.3	154	49	1.4	0.1	0.1	191	154	28	325	7.0	0
9/7/55	Teklanika River near Mt. McKinley	123	5.5	0.00	44	16	11	1.6	174	53	6.4	0.1	0.5	224	176	33	385	7.1	0
9/6/66	Toklat River near Mt. McKinley	100	5.6	0.04	58	33	10	2.3	204	120	11	0.3	0.7	341	280	113	559	7.4	0
9/6/66	Moose Creek near Kantishna	162	10	0.02	20	5.1	4.7	0.9	79	12	0.7	0.1	1.5	94	71	6	175	6.7	0

SELECTED CHEMICAL ANALYSES OF GROUND WATER

Chemical analyses in parts per million except conductance, pH, and color

Owner or user	Major aquifer	Depth of well (feet)	Silica (SiO_2)	Iron (Fe)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Dissolved solids (residue on evaporation at 180°C)	Hardness as $CaCO_3$		Specific conductance (micromhos at 25°C)	pH	Color
															Carbonate	Non-carbonate			
Custom Station, Internat. Border	schist	297	9.0	0.02	37	335	66	1.8	494	1120	8.9	0.1	0.0	1820	1560	1155	2440	7.6	-
Border Trading Post	gravelly-sand	175	36	2.20	135	25	17	7.9	602	5.3	2.8	0.4	0.8	529	438	0	859	7.6	140
Northway Motel	granite	206	29	Tr.	27	12	17		-	56	10	-	0.6	244	90	26	283	7.4	-
Northway ACS	granite	90	30	2.69	103	39	18	0.2	404	97	9.2	0.3	9.4	508	418	87	722	6.6	200
Northway FAA	gravelly-sand	237	33	0.03	56	19	8.5	2.7	288	2.0	2.0	0.2	0.6	266	220	-	415	8.1	5
Tetlin Junction 40-mi. Road House	silty-sand	250	31	0.87	52	12	6.0		217	4.0	6.5	-	-	-	178	0	336	7.2	
Tok ACS	gravel	115	15	0.05	55	10	5.6	0.3	203	28	3.0	0.3	0.4	218	180	14	355	7.8	0
Tanacross Preposition Storage	sandy-gravel	100	3.0	Tr.	47	21	3.0		-	39	2.0	-	1.2	255	206	65	397	7.6	-
Sears Creek Pump Station	sandy-gravel	67	13	0.05	64	14	13	1.0	241	41	3.5	0.8	1.0	269	219	21	459	8.2	5
Donnelly Flats AFB	sandy-gravel	102	11	0.02	46	20	5.1	1.9	210	31	5.3	0.3	1.3	225	197	25	377	8.0	5
U.S. Army Black Rapids Tr. Center	sandy-gravel	110	4.3	0.02	35	16	3.2	2.3	124	59	2.5	0.2	0.0	184	154	52	312	7.5	10
Fort Greely	sandy-gravel	198	10	0.04	46	10	4.4		146	36	2.8	0.1	4.8	186	156	36	313	-	-
Bert & Mary's Road House	bedrock	230	13	-	31	9.4	7.4		112	33	3.5	-	0.9	153	116	-	248	7.1	5
Eielson AFB	gravel	115	28	7.11	38	9.7	7.5	0.8	166	15	4.6	0.1	0.0	135	135	0	290	7.5	15
Fort Wainwright	gravel	105	19	12	61	11	5.2	3.4	229	19	3.5	0.0	0.3	197	188	9	382	7.4	5
Linsey	weath. bedrock	200	35	25	83	30	15	2.6	484	0.0	0.0	0.4	0.2	429	332	-	649	7.8	10
James Day	weath. bedrock	137	8.5	0.02	115	14	17	4.1	425	15	0.0	0.1	28	411	343	0	681	7.4	5
Don Peterson	schist	175	18	0.00	189	0.4	30	3.6	559	32	0.0	0.1	51	599	473	15	865	7.3	5
Richard Wein	schist	325	16	0.30	84	60	11	1.6	442	72	2.1	0.3	0.4	465	456	94	811	7.1	0
Murphy Dome AC & W	bedrock	130	8.9	0.10	6.4	3.5	0.8	0.3	28	8.0	1.0	0.0	1.2	44	32	8	70	6.5	0
Ester Community	bedrock	100+	18	1.67	46	78	11	2.9	423	125	0.7	0.2	0.3	492	437	90	740	7.5	0
D. Becker	schist	260	5.5	6.60	43	27	4.4	3.5	189	77	0.7	0.2	3.8	265	218	63	430	8.1	0
Minto PHS	sandy-gravel	40	24	0.10	87	26	5.2	4.8	413	0.0	1.0	0.2	0.3	335	325	0	599	7.3	5
Nenana High School	sandy-gravel	20	20	32	95	24	9.4	5.7	427	1.0	5.0	0.0	0.2	370	336	0	655	7.2	0
Clear AFB	gravel	65	13	0.02	47	11	0.5		155	31	2.0	0.1	0.6	182	162	35	305	7.4	-
Alaska Railroad	bedrock	148	17	0.02	70	179	5.1	8.2	836	166	5.0	0.6	1.1	893	912	177	1410	7.6	-
State Highway Department	gravel	-	4.2	0.51	20	3.9	2.0	0.5	50	28	1.8	0.2	0.3	86	66	15	153	7.9	0
Summit FAA	bedrock	-	6.2	0.87	4.0	0.2	188	2.7	500	9.6	0.0	5.8	0.6	463	11	0	760	7.6	-
Minchumina FAA	bedrock	210	7.8	0.10	21	11	6.0	0.7	166	20	2.0	0.2	0.2	121	98	10	207	7.0	0

Chemical analyses, in parts per million, water year October 1966 to September 1967--Continued

Date of collection	Mean discharge (cfs)	Silica (SiO_2)	Iron (Fe)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Dissolved solids (residue at 180°C)	Hardness as $CaCO_3$		Specific conductance (micromhos at 25°C)	P
														Calcium, magnesium	Non-carbonate		
15-5160. NENANA RIVER NEAR WINDY (Lat 63°27'15", long 148°48'10")																	
July 21, 1967.......	5330	4.4	1.4	13	2.3	1.6	1.2	40	13	0.4	0.1	0.8	58	42	9	96	6
Sept. 21...........	1320	6.8	.41	25	4.9	2.4	.5	80	14	2.8	.1	1.0	98	84	18	154	7
15-5180. NENANA RIVER NEAR HEALY (Lat 63°50'40", long 148°56'35")																	
Oct. 6-18, 1966.....	2897	6.7	0.00	33	7.2	3.7	0.6	96	40	1.4	0.0	0.8	140	111	32	235	7
Sept. 11, 1967......	5010	6.2	.54	30	7.3	3.0	1.2	89	35	.4	.0	.6	128	104	31	219	7

APPENDIX 2

Hydrologic data for the Summit area, Alaska

LOCAL WELL NUMBER	PRIMARY USE OF WATER	DEPTH OF WELL (FEET)	WATER LEVEL (FEET)	DATE WELL CONSTRUCTED	OWNER	ASSIGNOR OF OTHER IDENTIFIER	OTHER IDENTIFIER	TYPE OF LOG AVAILABLE
FC01500607BADA1 001	H	240.	210.	08-12-83	DANE RON	WINDY PASS ACRE	L04	D
					--	PARKS HIGHWAY	MILE 229	-
FC01800829ABDC1 003	T	30.0	16.50	01-01-66	ARR SUMMIT	--	--	-
FC01800829BDBD1 001	T	51.0	25.00	01-01-66	FAA SUMMIT	--	--	-
FC01800829BDCA1 002	T	299	--	01-01-66	FAA SUMMIT	--	--	-

STATION NUMBER	DATE	LAT-I-TUDE	LONG-I-TUDE	LOCAL IDENT-I-FIER	
631940149074601	08-26-66	63 19 40 N	149 07 46 W	FC01800829BDCA1	002
631940149074601	03-15-67	63 19 40 N	149 07 46 W	FC01800829BDCA1	002
631945149074501	11-02-66	63 19 45 N	149 07 45 W	FC01800829BDBD1	001
631950149071501	10-14-66	63 19 50 N	149 07 15 W	FC01800829ABDC1	003

★

STATION NUMBER	DATE	TEMPER-ATURE WATER (DEG C) (00010)	COLOR (PLAT-INUM-COBALT UNITS) (00080)	SPE-CIFIC CON-DUCT-ANCE (US/CM) (00095)	SAMPLE TREAT-MENT (CODES) (00115)	PH WATER WHOLE FIELD (STAND-ARD UNITS) (00400)	CARBON DIOXIDE DIS-SOLVED (MG/L AS CO2) (00405)	ALKA-LINITY WAT WH TOT FET FIELD MG/L AS CACO3 (00410)	BICAR-BONATE WATER WH FET FIELD MG/L AS HCO3 (00440)
631940149074601	08-26-66	--	10	760	2	9.3	0.4	389	400
631940149074601	03-15-67	2.0	5	740	2	8.1	6.3	407	500
631945149074501	11-02-66	--	5	325	--	7.9	4.0	162	200
631950149071501	10-14-66	9.0	5	260	1	7.4	10	133	160

STATION NUMBER	DATE	CAR-BONATE WATER WH FET FIELD MG/L AS CO3 (00445)	NITRO-GEN, NITRATE DIS-SOLVED (MG/L AS N) (00618)	HARD-NESS TOTAL (MG/L AS CACO3) (00900)	HARD-NESS NONCARB WH WAT TOT FLD MG/L AS CACO3 (00902)	CALCIUM DIS-SOLVED (MG/L AS CA) (00915)	MAGNE-SIUM, DIS-SOLVED (MG/L AS MG) (00925)	SODIUM, DIS-SOLVED (MG/L AS NA) (00930)	SODIUM AD-SORP-TION RATIO (00931)
631940149074601	08-26-66	35	0.050	12	0	4.8	0.0	190	24
631940149074601	03-15-67	0	0.020	11	0	2.0	1.5	180	24
631945149074501	11-02-66	0	0.140	160	0	32	19	8.9	0.3
631950149071501	10-14-66	0	0.300	130	0	48	2.9	2.1	0.1

STATION NUMBER	DATE	SODIUM PERCENT (00932)	POTAS-SIUM, DIS-SOLVED (MG/L AS K) (00935)	CHLO-RIDE, DIS-SOLVED (MG/L AS CL) (00940)	SULFATE DIS-SOLVED (MG/L AS SO4) (00945)	FLUO-RIDE, DIS-SOLVED (MG/L AS F) (00950)	SILICA, DIS-SOLVED (MG/L AS SIO2) (00955)	SOLIDS, SUM OF CONSTI-TUENTS, DIS-SOLVED (MG/L) (70301)	SOLIDS, DIS-SOLVED (TONS PER AC-FT) (70303)
631940149074601	08-26-66	96	4.0	0.70	0.0	5.6	6.7	445	0.61
631940149074601	03-15-67	97	1.3	0.40	13	2.5	6.6	456	0.62
631945149074501	11-02-66	11	2.6	0.70	19	0.30	9.5	190	0.26
631950149071501	10-14-66	3	0.90	0.0	4.3	0.10	7.6	147	0.20

STATION NUMBER	DATE	NITRO-GEN, NITRATE DIS-SOLVED (MG/L AS NO3) (71851)	MANGA-NESE (UG/L AS MN) (71883)	IRON (UG/L AS FE) (71885)	ELEV. OF LAND SURFACE DATUM (FT. ABOVE NGVD) (72000)	DEPTH OF HOLE, TOTAL (FEET) (72001)	SAMPLE SOURCE (72005)	SAM-PLING CONDI-TION (72006)	DEPTH OF WELL, TOTAL (FEET) (72008)
631940149074601	08-26-66	0.20	0	730	2280	299	44	1.00	299.00
631940149074601	03-15-67	0.10	--	550	2280	299	44	1.00	299.00
631945149074501	11-02-66	0.60	--	250	2380	51	--	1.00	51.00
631950149071501	10-14-66	1.3	--	40	2340	30	44	1.00	30.00

APPENDIX 3

Hydrologic data for the Talkeetna area, Alaska

Wells within a

LOCAL WELL NUMBER	PRIMARY USE OF WATER	DEPTH OF WELL (FEET)	WATER LEVEL (FEET)	DATE WELL CONSTRUCTED	OWNER	ASSIGNOR OF OTHER IDENTIFIER	OTHER IDENTIFIER	TYPE OF LOG AVAILABLE
SB02200406ADCC1 001	H	70.	45.	04-02-86	BRYANT HALLIE&ETHEL	CHANDALAR SUB	L07B03	D
					--	LAS	002211	-
SB02200410DBCB1 001	H	27.0	--	01-01-72	PSIKAS HARRY	--	--	-
SB02200411DCAB1 002	H	51.0	--	01-01-76	HEFTY	--	--	-
SB02200411DCAD1 001	H	51.0	38.00	08-27-75	MCCORMICK ROBERT N	CASWELL LAKES	L0662	D
SB02200412BCBA1 001	H	47.0	25.00	08-26-75	RADFORD BILL	CASWELL LAKES	L0092	D
SB02200412BCCB1 002	H	55.0	30.00	08-27-75	SMART GLENN	CASWELL LAKES	L0106	D
SB02200412CBDA1 003	H	64.0	--	04-05-77	JACKSON PHILLIP	CASWELL LAKES	L0400	D
SB02200414CADA1 001	H	86.0	30.00	05-23-76	WARD JIM	CASWELL LAKES	L1078	D
SB02200417CDAA1 001	P	36.0	--	01-01-65	SHEEP CK LODGE	FEULNER1968 OFR	025	-
SB02200417DCCC1 002	H	61.0	--	--	SANDERS RALPH	--	--	D
SB02200420CABA1 003	H	124	43.00	09-25-78	WHITTENBURG JOE & RU	--	--	D
SB02200420CBCA1 002	H	102	23.49	--	LUND FRED	LAS	002311	-
SB02200420CBCD1 001	H	58.0	20.72	01-01-69	YOUNG	--	--	D
SB02200429BBAC1 001	H	58.0	30.00	05-24-76	WILKINS DENNIS	--	--	D
SB02200429BBBB1 004	H	72.0	29.81	01-01-75	LEWIS	--	--	-
SB02200429BBBC1 003	H	58.0	--	--	HOAG	--	--	-
SB02200429CBAC1 005	H	55.0	10.25	07-01-65	KING JEAN	FEULNER1968 OFR	026	D
SB02200429CCBB1 002	H	27.0	17.00	01-01-76	KOPSACK RICHARD T	--	--	D
SB02200429CCBB2 002	H	23.0	15.00	01-01-76	KOPSACK RICHARD T	--	--	D
SB02200430ADAD1 001	H	68.0	18.10	07-01-65	BUNKER DEAN	FEULNER1968 OFR	027	D
SB02300403CAAA1 001	H	64.0	--	--	BUSBY TROY	--	--	D
					RIDDLE BOB	--	--	-
SB02300404AAAB1 002	H	77.0	--	--	DAVIES LEROY J	--	--	D
SB02300404CADC1 001	H	29.0	--	--	ALDRICH RONALD N	--	--	D
SB02300405DCCC1 001	H	60.0	--	--	GIBSON SIDNEY	--	--	D
SB02300408BBAC1 001	C	40.0	--	01-01-63	MONTANA CK LODGE	FEULNER1968 OFR	022	-
SB02300408CBAC1 002	H	26.0	21.65	--	NIX TERRY	--	--	-
SB02300417BADD1 004	H	60.0	--	01-01-61	LAKFORD LLOYD	FEULNER1968 OFR	023	-
SB02300417BCCC1 001	H	48.0	--	--	BECKER WM	--	--	D
SB02300417CDCB1 003	H	28.0	8.97	--	ADKINS MELVIN	--	--	-
SB02300417CDCC1 002	H	47.0	9.31	01-01-75	FROST JOHN W	--	--	D
SB02300417CDDD1 005	H	60.	42.	03-16-83	AISENBREY DAVE	SECTION 17 LOTS	C06	D
					--	LAS	004267	-
SB02300420DCBC1 001	H	30.0	--	--	BECKER WAYNE	FEULNER1968 OFR	028	D
SB02300429BBBA1 001	H	74.0	15.78	--	TISCHER A F	FEULNER1968 OFR	024	D
SB02300429CAAA1 002	H	90.0	16.36	08-01-75	BARNETTE MARK	SPORTSMEN ACRES	L18B01	-
SB02300429CABA1 003	H	73.0	--	08-01-75	MOORE BILL	SPORTSMEN ACRES	L15B01	-
SB02300431AAAA1 002	H	50.0	--	01-01-74	HANRATH	--	--	-
SB02300431AAAB1 003	H	70.0	--	--	RIEM RENTAL	--	--	-

LOCAL WELL NUMBER	PRIMARY USE OF WATER	DEPTH OF WELL (FEET)	WATER LEVEL (FEET)	DATE WELL CONSTRUCTED	OWNER	ASSIGNOR OF OTHER IDENTIFIER	OTHER IDENTIFIER	TYPE OF LOG AVAILABLE
SB02300431DABC1 001	H	44.0	--	01-01-70	RIEM HERB	--	--	-
SB02400408BBDB1 002	H	70.0	--	--	WALSTAD JOSEPH L	--	--	D
SB02400408BDAA1 001	H	62.0	35.00	05-01-66	HECK JOE	FEULNER1968 OFR	014	D
SB02400409BCAB1 002	H	76.0	--	--	BOWERSOX DARRELL R	--	--	D

SB02400409CCDC1	001	H	107	--	--	KOSLOSKY JAN	--	--	D
SB02400417ACCA1	001	-	50.0	42.00	10-16-76	HOPPER JAMES D	--	--	D
SB02400417ACCA2	001	-	62.0	52.00	10-19-76	HOPPER JAMES D	--	--	D
SB02400417ACCA3	001	-	48.0	--	10-21-76	HOPPER JAMES D	--	--	D
SB02400420AAAB1	003	U	80.0	--	--	HANKINS ALFRED	FEULNER1968 OFR	015	D
SB02400420AABC1	004	H	78.7	--	09-21-77	PIERCE PHILLIP R	TALKEETNA TWNST	L10A	D
SB02400420CCCB1	002	H	52.0	--	--	FREESE L R	FEULNER1968 OFR	020	D
SB02400420DDDC1	001	H	53.0	--	--	SHAD JIM	FEULNER1968 OFR	016	D
SB02400421BDBA1	002	U	60.0	--	--	HEIN ARNOL	FEULNER1968 OFR	021	D
SB02400421CCCC1	001	H	55.0	--	--	TODD ROBERT	--	--	D
SB02400428BAAD1	002	H	38.0	12.00	07-26-82	TRAVIS JIM	BIRCH TERRCE	L1AAD001	D
SB02400428CCBB1	001	U	53.0	--	--	KOLB FARRON A	FEULNER1968 OFR	018	D
SB02400429AABD1	002	U	52.0	--	--	NICHOLS DOROTHY	FEULNER1968 OFR	017	D
SB02400429CABC1	001	H	38.0	18.00	01-01-65	H&H GROCERY	FEULNER1968 OFR	019	D
SB02400432ABDC1	001	T	120	34.60	04-22-72	SUSITNA VY HIGH SCH	--	--	-
SB02400433BACC1	004	H	80.0	10.87	01-01-75	TASSEL	MONTANA CK SUB	L05AD01	-
SB02400433BBBB1	002	H	105	50.00	10-05-74	JOHNSON GUST	MONTANA CK SUB	L01&02AD01	D
SB02400433BCAB1	001	N	48.0	25.00	10-03-74	OHANAN LOGGING	--	--	D
SB02400433BCAB2	001	N	69.0	5.00	10-04-74	OHANAN LOGGING	--	--	D
SB02400433BCBB1	003	H	90.0	--	01-01-70	FOSTER ROBERT	--	--	-
SB02400513BBDD1	001	U	42.	25.92	02-06-86	MAT-SU BOROUGH	SUNSHINE	LF-2	D
						--	USGS	SUNSHINE LF-2	-
						--	PARKS HIGHWAY	MILE 102	-
SB02400513BCCA1	002	U	70.	50.27	02-06-86	MAT-SU BOROUGH	SUNSHINE	LF-1	D
						--	USGS	SUNSHINE LF-1	-
						--	PARKS HIGHWAY	MILE 102	-
SB02400513BCDD1	003	U	33.	25.	02-07-86	MAT-SU BOROUGH	SUNSHINE	LF-3	D
						--	USGS	SUNSHINE LF-3	-
						--	PARKS HIGHWAY	MILE 102	-
SB02400514ADDA1	001	H	94.0	--	--	MILLER DENNIS R	ANCH FBKS HWY	MI 102	D
SB02400515ACBA1	002	H	47.0	25.00	06-01-73	FARRBER GEORGE	WHEATLEY SUB	L01&04B01	D
SB02400515BADC1	001	P	25.5	--	01-01-64	JONES PATSY L	--	--	D
						AK DIV PKS SUSNA CP	--	--	-
SB02500406ABBB1	001	H	72.0	--	--	STEVENS JAMES H	PAPER SUB	L33	D
SB02500430ABCC1	001	T	64.0	40.00	06-16-75	TALKTN ASB GOD CHUR	--	--	D
SB02500431ACDC1	001	H	51.	20.	06-17-75	MELNICK HARRY	SECTION 31 LOTS	A5	D

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LOCAL WELL NUMBER		PRIMARY USE OF WATER	DEPTH OF WELL (FEET)	WATER LEVEL (FEET)	DATE WELL CONSTRUCTED	OWNER	ASSIGNOR OF OTHER IDENTIFIER	OTHER IDENTIFIER	TYPE OF LOG AVAILABLE
SB02500431ACDC1	001	H	51.	20.	06-17-75	--	LAS	007587	-
SB02500503CBCD1	001	H	20.0	--	--	ROBSON KEITH E	SECTION 03 LOTS	B02	-
SB02600419CBAD1	001	H	30.	9.5	06-25-84	HENRY WARREN	DENALI SUB NO 2	L01B02	D
						--	LAS	011070	-
SB02600420DADB1	001	H	130.	--	10-23-84	RICHARDSON PHIL	TALKEETNA	RAVEN POND JELL	D
						--	SECTION 20 LOTS	221	-
						--	LAS	003872	-
SB02600430BBBC1	004	T	30.0	--	01-01-74	FAA TALKETNA	--	--	-
SB02600430BBCA1	001	T	11.8	--	09-01-61	FAA TALKETNA	--	--	-
SB02600430BBCC1	003	T	15.8	2.80	09-01-61	FAA TALKETNA	--	--	-
SB02600430BBDB1	002	T	16.4	2.20	09-01-61	FAA TALKETNA	--	--	-
SB02600431DACD1	001	U	42.	27.	02-11-86	MAT-SU BOROUGH	TALKEETNA	LF-1	D
						--	USGS	TALKEETNA LF-1	-
						--	TALKEETNA SPUR	MILE 2.5 SO.	-

LOCAL WELL NUMBER	PRIMARY USE OF WATER	DEPTH OF WELL (FEET)	WATER LEVEL (FEET)	DATE WELL CONSTRUCTED	OWNER	ASSIGNOR OF OTHER IDENTIFIER	OTHER IDENTIFIER	TYPE OF LOG AVAILABLE
SB02600431DDAC1 002	U	58.	25.	02-12-86	MAT-SU BOROUGH	TALKEETNA	LF-2	D
					--	USGS	TALKEETNA LF-2	-
					--	TALKEETNA SPUR	MILE 2.5 SO.	-
SB02600524CDDD1 001	C	70.0	--	01-01-60	TALKEETNA MOTEL	FEULNER1968 OFR	001	-
SB02600524DBAA1 005	H	27.0	--	01-01-59	ARR TALKETNA	FEULNER1968 OFR	006	D
SB02600524DCCA1 002	C	26.0	--	01-01-67	TALKEETNA GROCERY	FEULNER1968 OFR	002	-
SB02600524DCCA2 002	H	21.0	--	01-01-53	TALKEETNA AIR SERV	FEULNER1968 OFR	005	-
SB02600524DCCA3 002	C	20.0	--	01-01-21	FAIRVIEW INN	FEULNER1968 OFR	004	-
SB02600524DCCB1 006	C	20.0	--	01-01-66	TALKEETNA ROADHSE	FEULNER1968 OFR	003	-
SB02600524DCDB1 008	C	14.0	--	01-01-62	HUT CAFE THE	FEULNER1968 OFR	007	-
SB02600524DCDC1 003	U	47.0	8.38	09-18-67	USGS TALKETNA	USGS	TEST 3	-
					--	FEULNER1968 OFR	003A	-
SB02600524DCDC2 003	H	24.0	--	--	FISHER MICHAEL J	TALKEETNA TWNST	L03B19	D
SB02600524DCDC3 003	H	20.0	15.00	10-22-76	TWIGG FRANCIS L	TALKEETNA TWNST	L02B19	D
SB02600524DDBD1 010	C	17.0	--	01-01-62	RAINBOW LODGE	--	--	-
SB02600524DDDC1 009	H	18.0	--	--	SWANDA&ANDERSON TRLR	FEULNER1968 OFR	010	-
SB02600525AACD1 003	P	100	11.00	03-13-81	TALKEETNA FIRE HALL	--	--	D
SB02600525ADBA1 001	T	28.0	12.50	01-01-67	TALKEETNA SCHOOL	FEULNER1968 OFR	011	-
SB02600525BAAA1 002	H	26.5	--	--	HOLLAND KEN	--	--	D
SB02600530CDDD1 001	H	53.5	7.00	07-25-75	FOX CLAYTON	--	--	D
SB02600625BCCB1 001	T	125	45.00	06-18-82	TRAPPER CREEK ELEM S	--	--	D
SB02600626ABDB1 001	H	54.5	41.00	06-08-82	KRAFT JIM	USS 4668	L02	D
SB02600626DDBB1 002	H	80.	40.	09-18-83	SMITH RICHARD	USS 4658	L13B02	D
					--	LAS	000952	-
SB02600722AAAA1 001	H	60.	25.	05-14-86	MORGAN JC&LOIS	GATE CREEK EST	L17B02	D
					--	LAS	011090	-

LOCAL WELL NUMBER	PRIMARY USE OF WATER	DEPTH OF WELL (FEET)	WATER LEVEL (FEET)	DATE WELL CONSTRUCTED	OWNER	ASSIGNOR OF OTHER IDENTIFIER	OTHER IDENTIFIER	TYPE OF LOG AVAILABLE
SB02600803ACCD1 001	C	50.0	20.00	09-01-76	FORKS ROAD HOUSE	--	--	-
SB02600803ACCD1S	C	--	--	--	AK STATE	--	--	-
SB02600803DBDA1S	H	--	--	--	ROBSON DUSTY	--	--	-
					DONALDSON D	--	--	-
					ZEEK GARY	--	--	-
SB02700530AACD1 002	P	183	110.00	08-02-72	ADH	--	--	-
SB02700530ADBA1 001	T	43.0	32.00	10-05-69	ADH	--	--	D
SB02900504CDAB1 001	P	97.8	74.8	11-10-83	AK DIV PKS TROUBLESO	TRAILHEAD	TROUBLESOME CK	D
					TROUBLESOME CK AK DI	TROUBLESOME CK	TRAILHEAD	-
					--	LAS	001293	-

STATION NUMBER	DATE	TIME	LAT-I-TUDE	LONG-I-TUDE	LOCAL IDENT-I-FIER	
621913150054601	09-20-66	--	62 19 13 N	150 05 46 W	SB02600430BBCA1	001
621914150053701	05-12-67	0800	62 19 14 N	150 05 37 W	SB02600430BBDB1	002
621914150053701	05-12-67	0900	62 19 14 N	150 05 37 W	SB02600430BBDB1	002
621914150053701	01-21-72	--	62 19 14 N	150 05 37 W	SB02600430BBDB1	002
621920150060101	07-27-67	--	62 19 20 N	150 06 01 W	SB02600524DDDC1	009
621921150065101	09-20-66	--	62 19 21 N	150 06 51 W	SB02600524CDDD1	001
621923150062801	09-20-66	--	62 19 23 N	150 06 28 W	SB02600524DCDB1	008
621923150063501	09-15-67	--	62 19 23 N	150 06 35 W	SB02600524DCDC1	003
621923150063901	09-20-66	--	62 19 23 N	150 06 39 W	SB02600524DCCB1	006
621926150063601	09-21-66	--	62 19 26 N	150 06 36 W	SB02600524DCCA3	002
621930150061501	09-20-66	--	62 19 30 N	150 06 15 W	SB02600524DDBD1	010
621944150062401	09-21-66	--	62 19 44 N	150 06 24 W	SB02600524DBAA1	005

STATION NUMBER	DATE	TEMPER-ATURE WATER (DEG C) (00010)	COLOR (PLAT-INUM-COBALT UNITS) (00080)	SPE-CIFIC CON-DUCT-ANCE (US/CM) (00095)	SAMPLE TREAT-MENT (CODES) (00115)	PH WATER WHOLE FIELD (STAND-ARD UNITS) (00400)	CARBON DIOXIDE DIS-SOLVED (MG/L AS CO2) (00405)	ALKA-LINITY WAT WH TOT FET FIELD MG/L AS CACO3 (00410)	BICAR-BONATE WATER WH FET FIELD MG/L AS HCO3 (00440)	CAR-BONATE WATER WH FET FIELD MG/L AS CO3 (00445)
621913150054601	09-20-66	8.0	0	140	1	6.3	62	63	77	0
621914150053701	05-12-67	--	10	116	1	7.1	8.1	52	64	0
621914150053701	05-12-67	--	20	115	2	7.1	8.4	54	66	0
621914150053701	01-21-72	8.0	0	123	1	6.4	38	49	60	0
621920150060101	07-27-67	7.0	--	82	--	--	--	--	--	--
621921150065101	09-20-66	9.0	0	155	1	6.8	14	46	56	0
621923150062801	09-20-66	5.0	--	115	1	6.7	--	--	--	--
621923150063501	09-15-67	4.5	0	156	1	7.5	3.4	55	67	0
621923150063901	09-20-66	8.5	--	158	1	6.9	--	--	--	--
621926150063601	09-21-66	5.0	--	141	1	6.8	--	--	--	--
621930150061501	09-20-66	8.0	--	124	1	6.7	--	--	--	--
621944150062401	09-21-66	11.5	0	142	1	6.9	12	48	58	0

STATION NUMBER	DATE	NITRO- GEN, NITRATE DIS- SOLVED (MG/L AS N) (00618)	HARD- NESS TOTAL (MG/L AS CACO3) (00900)	HARD- NESS NONCARB WH WAT TOT FLD MG/L AS CACO3 (00902)	CALCIUM DIS- SOLVED (MG/L AS CA) (00915)	MAGNE- SIUM, DIS- SOLVED (MG/L AS MG) (00925)	SODIUM, DIS- SOLVED (MG/L AS NA) (00930)	SODIUM AD- SORP- TION RATIO (00931)	SODIUM PERCENT (00932)	POTAS- SIUM, DIS- SOLVED (MG/L AS K) (00935)
621913150054601	09-20-66	0.020	60	0	15	5.4	3.7	0.2	12	0.90
621914150053701	05-12-67	0.280	50	0	16	2.4	3.2	0.2	12	1.1
621914150053701	05-12-67	0.210	50	0	16	2.4	3.1	0.2	12	1.0
621914150053701	01-21-72	0.840	53	4	17	2.5	3.0	0.2	11	1.0
621920150060101	07-27-67	--	--	--	--	--	--	--	--	--
621921150065101	09-20-66	1.10	59	13	16	4.6	6.4	0.4	19	1.4
621923150062801	09-20-66	--	--	--	--	--	--	--	--	--
621923150063501	09-15-67	0.250	64	9	24	1.0	4.5	0.2	13	2.0
621923150063901	09-20-66	--	--	--	--	--	--	--	--	--
621926150063601	09-21-66	--	--	--	--	--	--	--	--	--
621930150061501	09-20-66	--	--	--	--	--	--	--	--	--
621944150062401	09-21-66	1.30	52	4	8.4	7.5	5.4	0.3	18	1.0

STATION NUMBER	DATE	CHLO- RIDE, DIS- SOLVED (MG/L AS CL) (00940)	SULFATE DIS- SOLVED (MG/L AS SO4) (00945)	FLUO- RIDE, DIS- SOLVED (MG/L AS F) (00950)	SILICA, DIS- SOLVED (MG/L AS SIO2) (00955)	BORON, TOTAL RECOV- ERABLE (UG/L AS B) (01022)	SOLIDS, SUM OF CONSTI- TUENTS, DIS- SOLVED (MG/L) (70301)	SOLIDS, DIS- SOLVED (TONS PER AC-FT) (70303)	NITRO- GEN, NITRATE DIS- SOLVED (MG/L AS NO3) (71851)	MANGA- NESE (UG/L AS MN) (71883)
621913150054601	09-20-66	3.2	0.0	0.10	17	--	83	0.11	0.10	--
621914150053701	05-12-67	1.4	2.0	0.10	16	--	75	0.10	1.2	--
621914150053701	05-12-67	1.4	2.0	0.10	16	--	75	0.10	0.90	--
621914150053701	01-21-72	3.0	2.9	0.10	16	--	79	0.11	3.7	360
621920150060101	07-27-67	--	--	--	--	--	--	--	--	--
621921150065101	09-20-66	11	9.1	0.10	14	--	95	0.13	5.0	--
621923150062801	09-20-66	--	--	--	--	--	--	--	--	--
621923150063501	09-15-67	11	6.0	0.10	13	0	96	0.13	1.1	--
621923150063901	09-20-66	--	--	--	--	--	--	--	--	--
621926150063601	09-21-66	--	--	--	--	--	--	--	--	--
621930150061501	09-20-66	--	--	--	--	--	--	--	--	--
621944150062401	09-21-66	6.4	6.2	0.10	12	--	81	0.11	5.7	--

STATION NUMBER	DATE	IRON (UG/L AS FE) (71885)	ELEV. OF LAND SURFACE DATUM (FT. ABOVE NGVD) (72000)	DEPTH OF HOLE, TOTAL (FEET) (72001)	DEPTH TO TOP OF WATER-BEARING ZONE (FT) (72002)	SAMPLE SOURCE (72005)	SAM-PLING CONDI-TION (72006)	DEPTH OF WELL, TOTAL (FEET) (72008)	DEPTH TO TOP OF SAMPLE INTER-VAL (FT) (72015)	DEPTH TO BOT-TOM OF SAMPLE INTER-VAL (FT) (72016)
621913150054601	09-20-66	70	345	17	--	46	--	11.80	12	17
621914150053701	05-12-67	250	345	16	--	46	--	16.40	16	16
621914150053701	05-12-67	1000	345	--	--	46	--	16.40	--	--
621914150053701	01-21-72	280	345	--	--	46	--	16.40	--	--
621920150060101	07-27-67	--	345	18	--	--	1.00	18.00	--	--
621921150065101	09-20-66	710	345	70	--	46	--	70.00	--	--
621923150062801	09-20-66	--	345	14	--	46	1.00	14.00	4.0	14
621923150063501	09-15-67	100	340	47	44	7	--	47.00	44	47
621923150063901	09-20-66	--	345	20	--	46	--	20.00	20	20
621926150063601	09-21-66	--	345	20	--	46	1.00	20.00	--	--
621930150061501	09-20-66	--	345	17	--	46	--	17.00	--	--
621944150062401	09-21-66	5400	345	27	22	28	--	27.00	27	27

Table 1.--Records of wells in the Matanuska-Susitna Borough area

Well no.	Owner or name	Well depth (feet)	Well diameter (inches)	Depth to water (feet)	Pumping rate (gallons per min.)	Drawc (feet
1	Talkeetna Motel (Alice Powell)	40	6	-	-	-
2	Talkeetna Grocery	18	-	-	-	-
3	Talkeetna Roadhouse	20	6	-	5	-
3a	USGS Test Well 3 at Airport	47	2	8	15	1
4	Fairview Inn	20	2	-	5	-
5	Talkeetna Air Service	21	36	-	-	-
6	Alaska Railroad Repeater Station	27	6	-	-	-
7	The Hut Cafe	14	1 1/4	-	-	-
9	Federal Aviation Agency Sta., Talkeetna	70	4	-	-	-
9a	State of Alaska	100	6	-	250	-
10	Swanda and Anderson Trailer Court	18	1 1/2	-	5	-
11	Talkeetna High School	-	-	-	-	-
14	Joe Heck	62	6	35	11	13
15	Alfred Hankins	80	6	61	10	5

Table 2.--Logs of wells in the Matanuska-Susitna Borough area

Material	Thickness (feet)	Depth (feet)
Well 3a - USGS Test well 3 at Airport		
Soil, brown, silty	4	4
Gravel and sand	33	37
Sand, fine to medium, some fine gravel	3	40
Gravel, gray, medium, little sand	12	52
Well 6 - Alaska Railroad Repeater Station, Talkeetna		
Gravel fill	20	20
Hardpan (gravel, sand, and clay)	2	22
Gravel, medium	5	27
Well 14 - Joe Heck		
Soil and gravel.	12	12
Sand and gravel.	12	24
Sand, fine	12	36
Till (sand, gravel, and clay).	10	46
Gravel and sand	16	62

Chemical Analyses of well water in the Matanuska-Susitna Borough area

[mg/L, milligrams per liter]

Well No.	Owner or name	Date sampled	Silica (SiO_2)	Iron (Fe)	Manganese (Mn)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Solids (residue on evaporation at 180°C)	Hardness as $CaCO_3$: Carbonate	Hardness as $CaCO_3$: Noncarbonate	Specific conductance (micromhos at 25°C)	pH	Color
1	Talkeetna Hotel	9-20-66	14	0.71		16	4.6	6.4	1.4	56	9.1	11	0.1	5.0	94	59	13	155	6.8	0
3a	USGS Test Well 3	9-15-67	13	0.10		24	1.0	4.5	2.0	67	6.0	11	0.1	1.1	96	64	9	156	7.5	0
8a	State of Alaska		16	1.23		20	1.8	8.2	3.2	92	0	0	0.2	0.1	99	58	6	146	7.8	5
14	Joe Heck	7-27-67	18	0.13		5.0	1.7	3.1	1.0	34	3.0	2.8	0.0	0.5	55	27	0	71	6.8	0
19	H & H Grocery Store	7-27-67	20	0.69		7.6	1.5	2.3	0.9	30	3.0	2.5	0.0	0.8	54	25	0	65	6.1	0
31	Arnold Echola	7-28-67	17	1.01		33	5.6	4.9	2.3	161	2.5	1.4	0.3	0.2	153	119	0	245	7.8	0
33	Willow Elem. School	7-23-67	23	7.0		44	6.4	5.1	2.2	150	5.0	0.7	0.3	0.3	177	136	0	263	7.7	0
[illegible]	Big Lake School	11-15-63	12	0.02	0.02	13	1.9	1.7	0.5	51	1.0	1.5	0.0	1.0	58	40	42	85	7.7	5
84	Dennis Crawford	8-03-67	15	0.12		57	6.6	2.6	0.8	164	17	7.4	0.0	22	209	170	46	329	8.0	0
112	Tyson Country Club	8-05-67	12	0.03		40	5.0	3.2	0.3	142	8.0	0.4	0.5	1.4	141	120	4	221	8.0	0
117	Barry's Finger Lake Res	8-01-66	10	0.00		36	12	3.5	1.0	155	17	1.4	0.1	1.9	159	140	13	260	7.4	10
121	City of Palmer Well 1	11-01-52	13	0.06		34	9.1	6.2	1.2	160	9.9	2.5	0.2	0.2	155	122	0	261	7.5	-
122	City of Palmer Well 2	7-22-66	11	0.02		37	6.7	5.7	1.8	162	5.8	2.1	0.1	0.0	150	120	0	253	8.0	5
123	City of Palmer Well 3	5-23-67	12	0.00		13	4.5	51	1.1	153	34	4.6	0.2	0.1	195	51	0	303	8.2	5

CHRISTIANSEN LAKE NEAR TALKEETNA (LAT 62 18 57 LONG 150 03 49)

WATER QUALITY DATA, WATER YEAR OCTOBER 1972 TO SEPTEMBER 1973

DATE	TIME	DEPTH (FT)	DISSOLVED SILICA (SIO2) (MG/L)	DISSOLVED IRON (FE) (UG/L)	DISSOLVED MANGANESE (MN) (UG/L)	DISSOLVED CALCIUM (CA) (MG/L)	DISSOLVED MAGNESIUM (MG) (MG/L)	DISSOLVED SODIUM (NA) (MG/L)	DISSOLVED POTASSIUM (K) (MG/L)	BICARBONATE (HCO3) (MG/L)	CARBONATE (CO3) (MG/L)	DISSOLVED SULFATE (SO4) (MG/L)	DISSOLVED CHLORIDE (CL) (MG/L)	DISSOLVED FLUORIDE (F) (MG/L)	DISSOLVED NITRITE PLUS NITRATE (N) (MG/L)	AMMONIA NITROGEN (N) (MG/L)	ORGANIC NITROGEN (N) (MG/L)	TOTAL KJELDAHL NITROGEN (N) (MG/L)
JUNE 07...	1300	3.0	2.4	40	10	6.0	1.0	1.3	.5	24	0	5.0	1.2	.0	.00	.06	.17	.23

TOTAL PHOSPHORUS (P) (MG/L)	DISSOLVED ORTHO. PHOSPHORUS (P) (MG/L)	DISSOLVED SOLIDS (SUM OF CONSTITUENTS) (MG/L)	HARDNESS (CA,MG) (MG/L)	NONCARBONATE HARDNESS (MG/L)	SPECIFIC CONDUCTANCE (MICROMHOS)	PH (UNITS)	TEMPERATURE (DEG C)	COLOR (PLATINUM-COBALT UNITS)
.02	.00	29	19	0	40	7.6	8.0	3

15292700 TALKEETNA RIVER NEAR TALKEETNA--Continued

WATER-QUALITY RECORDS

PERIOD OF RECORD.--Water years 1954, 1966 to current year.

PERIOD OF DAILY RECORD.--
WATER TEMPERATURE: April 1954 to September 1954.

WATER-QUALITY DATA, WATER YEAR OCTOBER 1992 TO SEPTEMBER 1993

DATE	TIME	SAMPLE LOC-ATION, CROSS SECTION (FT FM R BK) (72103)	SPE-CIFIC CON-DUCT-ANCE (US/CM) (00095)	PH WATER WHOLE FIELD (STAND-ARD UNITS) (00400)	TEMPER-ATURE WATER (DEG C) (00010)	BARO-METRIC PRES-SURE (MM OF HG) (00025)	OXYGEN, DIS-SOLVED (MG/L) (00300)	OXYGEN, DIS-SOLVED (PER-CENT SATUR-ATION) (00301)
OCT								
01...	1701	65.0	146	7.7	1.0	741	13.4	97
01...	1702	175.0	162	7.7	0.5	741	14.2	101
01...	1703	225.0	173	7.7	0.5	741	14.3	102
01...	1704	265.0	173	7.7	0.5	741	14.1	101
01...	1705	295.0	176	7.3	0.5	741	14.3	102
MAR								
11...	1350	27.0	193	6.8	0.0	762	14.0	96
11...	1352	50.0	218	6.9	0.0	762	14.6	100
11...	1354	69.0	205	7.5	0.0	762	14.4	99
JUL								
08...	1455	70.0	106	7.3	11.0	--	--	--
08...	1457	220.0	103	7.5	11.0	--	--	--
08...	1459	310.0	107	7.5	10.5	--	--	--
AUG								
19...	1501	72.0	94	7.7	8.5	748	10.8	94
19...	1502	228.0	108	7.8	9.0	748	10.6	93
19...	1503	312.0	114	7.8	9.0	748	10.7	94

DATE	TIME	STREAM WIDTH (FT) (00004)	GAGE HEIGHT (FEET) (00065)	DIS-CHARGE, INST. CUBIC FEET PER SECOND (00061)	SAM-PLING METHOD, CODES (82398)	SAMPLER TYPE (CODE) (84164)	SPE-CIFIC CON-DUCT-ANCE (US/CM) (00095)	PH WATER WHOLE FIELD (STAND-ARD UNITS) (00400)	TUR-BID-ITY (NTU) (00076)	COLI-FORM, FECAL, 0.7 UM-MF (COLS./ 100 ML) (31625)	STREP-TOCOCCI FECAL, KF AGAR (COLS. PER 100 ML) (31673)	HARD-NESS TOTAL (MG/L AS CACO3) (00900)
OCT												
01...	1706	325	7.23	2110	20	3007	159	7.9	1.0	<1	K1	57
MAR												
11...	1400	85.0	--	521	20	8010	212	7.0	1.4	40	<1	74
JUL												
08...	1500	345	--	8800	20	3007	107	7.5	28	1	1	45
AUG												
19...	1511	342	--	6800	20	3007	105	7.7	21	K13	K3	42

DATE	CALCIUM DIS-SOLVED (MG/L AS CA) (00915)	MAGNE-SIUM, DIS-SOLVED (MG/L AS MG) (00925)	SODIUM, DIS-SOLVED (MG/L AS NA) (00930)	POTAS-SIUM, DIS-SOLVED (MG/L AS K) (00935)	ALKA-LINITY WAT WH TOT FET FIELD MG/L AS CACO3 (00410)	ALKA-LINITY WAT DIS TOT IT FIELD MG/L AS CACO3 (39086)	SULFATE DIS-SOLVED (MG/L AS SO4) (00945)	CHLO-RIDE, DIS-SOLVED (MG/L AS CL) (00940)	FLUO-RIDE, DIS-SOLVED (MG/L AS F) (00950)	SILICA, DIS-SOLVED (MG/L AS SIO2) (00955)	SOLIDS, RESIDUE AT 180 DEG. C DIS-SOLVED (MG/L) (70300)
OCT											
01...	19	2.4	7.1	1.0	43	42	17	10	<0.10	7.8	105
MAR											
11...	25	2.8	14	1.5	50	48	19	25	<0.10	8.9	124
JUL											
08...	15	1.7	4.0	2.9	33	34	12	5.9	<0.10	6.2	80
AUG											
19...	14	1.7	4.4	0.80	32	32	5.9	4.1	0.10	6.4	62

K Non-ideal colony count

15292700 TALKEETNA RIVER NEAR TALKEETNA--Continued

WATER-QUALITY DATA, WATER YEAR OCTOBER 1992 TO SEPTEMBER 1993

DATE	SOLIDS, SUM OF CONSTI-TUENTS, DIS-SOLVED (MG/L) (70301)	NITRO-GEN, NITRITE TOTAL (MG/L AS N) (00615)	NITRO-GEN, NITRITE DIS-SOLVED (MG/L AS N) (00613)	NITRO-GEN, NO2+NO3 TOTAL (MG/L AS N) (00630)	NITRO-GEN, NO2+NO3 DIS-SOLVED (MG/L AS N) (00631)	NITRO-GEN, AMMONIA TOTAL (MG/L AS N) (00610)	NITRO-GEN, AMMONIA DIS-SOLVED (MG/L AS N) (00608)	NITRO-GEN,AM-MONIA + ORGANIC TOTAL (MG/L AS N) (00625)	PHOS-PHORUS TOTAL (MG/L AS P) (00665)	PHOS-PHORUS DIS-SOLVED (MG/L AS P) (00666)	PHOS-PHORUS ORTHO TOTAL (MG/L AS P) (70507)
OCT											
01...	92	<0.010	<0.010	0.290	0.370	<0.010	<0.010	<0.20	<0.010	<0.010	<0.010
MAR											
11...	128	--	<0.010	--	0.430	--	0.030	<0.20	<0.010	<0.010	--
JUL											
08...	69	--	<0.010	--	0.150	--	0.040	<0.20	0.040	<0.010	--
AUG											
19...	58	--	<0.010	--	0.200	--	0.030	<0.20	<0.010	<0.010	--

DATE	PHOS-PHORUS ORTHO, DIS-SOLVED (MG/L AS P) (00671)	ALUM-INUM, DIS-SOLVED (UG/L AS AL) (01106)	BARIUM, DIS-SOLVED (UG/L AS BA) (01005)	COBALT, DIS-SOLVED (UG/L AS CO) (01035)	IRON, DIS-SOLVED (UG/L AS FE) (01046)	LITHIUM DIS-SOLVED (UG/L AS LI) (01130)	MANGA-NESE, DIS-SOLVED (UG/L AS MN) (01056)	MOLYB-DENUM, DIS-SOLVED (UG/L AS MO) (01060)	NICKEL, DIS-SOLVED (UG/L AS NI) (01065)	SELE-NIUM, DIS-SOLVED (UG/L AS SE) (01145)	SILVER, DIS-SOLVED (UG/L AS AG) (01075)
OCT											
01...	<0.010	30	14	<3	61	10	9	<10	<1	<1	<1.0
MAR											
11...	<0.010	20	17	<3	16	17	4	<10	<1	<1	<1.0
JUL											
08...	<0.010	250	16	<3	100	7	6	<10	1	<1	1.0
AUG											
19...	0.010	100	12	<3	59	8	7	<10	<1	<1	<1.0

DATE	STRON-TIUM, DIS-SOLVED (UG/L AS SR) (01080)	VANA-DIUM, DIS-SOLVED (UG/L AS V) (01085)	GROSS ALPHA, DIS-SOLVED (UG/L AS U-NAT) (80030)	ALPHA, COUNT, 2 SIGMA WAT DIS AS NAT U (UG/L) (75986)	ALPHA RADIO. WATER DISS AS TH-230 (PCI/L) (04126)	ALPHA COUNT, 2 SIGMA WAT DIS AS TH-230 (PCI/L) (75987)	GROSS ALPHA, SUSP. TOTAL (UG/L AS U-NAT) (80040)	ALPHA SED SUSP DRY WGH AS TH-230 (PCI/L) (04127)	ALPHA, 2 SIGMA SED SUS TOT DRY AS TH-230 (PCI/L) (76004)	GROSS BETA, DIS-SOLVED (PCI/L AS CS-137) (03515)	BETA, 2 SIGMA WATER, DISS, AS CS-137 (PCI/L) (75989)
OCT											
01...	100	<6	--	--	--	--	--	--	--	--	--
MAR											
11...	150	<6	<0.6	0.60	<0.6	0.45	<0.6	<0.6	0.15	1.4	0.68
JUL											
08...	73	<6	<0.6	0.39	<0.6	0.27	1.2	1.2	1.3	3.0	0.94
AUG											
19...	80	<6	--	--	--	--	--	--	--	--	--

DATE	GROSS BETA, DIS-SOLVED (PCI/L AS SR/YT-90) (80050)	BETA, 2 SIGMA WATER, DISS, AS SR90/Y90 (PCI/L (75988)	GROSS BETA, SUSP. TOTAL (PCI/L AS CS-137) (03516)	GROSS BETA, SUSP. TOTAL (PCI/L AS SR/YT-90) (80060)	BETA, 2 SIGMA SED, SUSP, TOT DRY SR90Y90 (PCI/L) (76005)	RADIUM 226, DIS-SOLVED, RADON METHOD (PCI/L) (09511)	RA-226 2 SIGMA WATER, DISS, (PCI/L) (76001)	URANIUM NATURAL DIS-SOLVED (UG/L AS U) (22703)	URANIUM NATURAL 2 SIGMA WATER, DISS, (UG/L) (75990)	SEDI-MENT, SUS-PENDED (MG/L) (80154)	SEDI-MENT, DIS-CHARGE, SUS-PENDED (T/DAY) (80155)
OCT											
01...	--	--	--	--	--	--	--	--	--	8	46
MAR											
11...	1.1	0.51	<0.6	<0.6	0.44	0.02	0.020	0.19	<1.0	22	31
JUL											
08...	2.7	0.76	1.9	1.7	0.74	0.04	0.010	0.16	<1.0	164	3900
AUG											
19...	--	--	--	--	--	--	--	--	--	138	2530

15292400 - CHULITNA RIVER NEAR TALKEETNA (LAT 62 33 31 LONG 150 14 02)

DATE	DIS-CHARGE (CFS)	SILICA (SIO2) (MG/L)	TOTAL IRON (FE) (UG/L)	DIS-SOLVED IRON (FE) (UG/L)	CAL-CIUM (CA) (MG/L)	MAG-NE-SIUM (MG) (MG/L)	SODIUM (NA) (MG/L)	PO-TAS-SIUM (K) (MG/L)	BICAR-BONATE (HCO3) (MG/L)	SULFATE (SO4) (MG/L)	CHLO-RIDE (CL) (MG/L)	FLUO-RIDE (F) (MG/L)	NITRATE (NO3) (MG/L)	DIS-SOLVED SOLIDS (SUM OF CONSTI-TUENTS) (MG/L)	HARD-NESS (CA,MG) (MG/L)	NON-CAR-BONATE HARD-NESS (MG/L)	SPECI-FIC COND-UCTANCE (MICRO-MHOS)	P (UNI
MAR., 1970																		
31...	1170	3.0	--	490	24	4.4	2.7	1.3	73	22	1.8	.3	1.0	97	77	17	178	7.
JULY																		
15...	22300	4.7	--	70	14	2.6	1.3	2.2	46	11	.0	.3	.8	60	46	8	101	8.
AUG.																		
12...	22000	2.2	290	--	17	3.2	1.2	1.7	54	10	.5	.2	1.6	65	55	11	124	7.
SEP.																		
16...	11000	4.5	30	--	16	3.2	1.7	1.7	47	14	1.8	.3	.8	66	53	14	117	7.

15292780 SUSITNA RIVER AT SUNSHINE--Continued

WATER-QUALITY RECORDS

PERIOD OF RECORD.--Water years 1971, 1975, 1977, and 1981 to current year.

PERIOD OF DAILY RECORD.--
WATER TEMPERATURE: May 1981 to September 1985 (discontinued).

WATER QUALITY DATA, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

DATE	TIME	SAMPLE LOC-ATION, CROSS SECTION (FT FM L BANK) (00009)	SPE-CIFIC CON-DUCT-ANCE (US/CM) (00095)	PH (STAND-ARD UNITS) (00400)	TEMPER-ATURE (DEG C) (00010)	BARO-METRIC PRES-SURE (MM OF HG) (00025)	OXYGEN, DIS-SOLVED (MG/L) (00300)	OXYGEN, DIS-SOLVED (PER-CENT SATUR-ATION) (00301)
MAR								
18...	1520	125	221	7.80	0.0	753	12.1	84
18...	1525	175	221	7.80	0.0	753	12.2	84
18...	1530	225	221	7.80	0.0	753	12.3	85
18...	1535	275	221	8.00	0.0	753	12.3	85
18...	1540	300	221	8.00	0.0	753	12.4	86
MAY								
22...	0905	90.0	--	7.80	3.5	755	12.4	--
22...	0910	140	--	7.80	3.5	755	12.4	--
22...	0915	215	--	7.70	3.5	755	12.4	--
22...	0920	290	--	7.70	3.5	755	12.4	--
22...	0925	365	--	7.70	3.5	755	12.4	--
JUN								
25...	1210	70.0	118	8.20	9.0	764	10.5	91
25...	1211	145	119	8.10	9.0	764	10.8	93
25...	1212	220	121	8.20	8.5	764	10.8	92
25...	1213	295	121	8.20	8.0	764	11.1	94
25...	1214	395	122	8.20	8.0	764	11.2	94

DATE	TIME	STREAM WIDTH (FT) (00004)	STREAM-FLOW, INSTAN-TANEOUS (CFS) (00061)	TUR-BID-ITY (NTU) (00076)	HARD-NESS (MG/L AS CACO3) (00900)	HARD-NESS NONCARB WH WAT TOT FLD MG/L AS CACO3 (00902)	CALCIUM DIS-SOLVED (MG/L AS CA) (00915)	MAGNE-SIUM, DIS-SOLVED (MG/L AS MG) (00925)	SODIUM, DIS-SOLVED (MG/L AS NA) (00930)	POTAS-SIUM, DIS-SOLVED (MG/L AS K) (00935)
MAR										
18...	1545	425	2860	1.0	90	26	29	4.3	10	1.9
MAY										
22...	0930	595	30700	45	40	7	13	1.9	3.5	1.4
JUN										
25...	1215	645	46600	190	52	11	17	2.4	2.9	1.6

DATE	ALKA-LINITY WH WAT TOTAL FIELD MG/L AS CACO3 (00410)	ALKA-LINITY, CARBON-ATE IT-FLD (MG/L - CACO3) (99430)	BICAR-BONATE IT-FLD (MG/L AS HCO3) (99440)	CAR-BONATE IT-FLD (MG/L AS CO3) (99445)	SULFATE DIS-SOLVED (MG/L AS SO4) (00945)	CHLO-RIDE, DIS-SOLVED (MG/L AS CL) (00940)	FLUO-RIDE, DIS-SOLVED (MG/L AS F) (00950)	SILICA, DIS-SOLVED (MG/L AS SIO2) (00955)	SOLIDS, RESIDUE AT 180 DEG. C DIS-SOLVED (MG/L) (70300)	SOLIDS, SUM OF CONSTI-TUENTS, DIS-SOLVED (MG/L) (70301)
MAR										
18...	66	64	79	0	18	19	0.10	9.4	132	130
MAY										
22...	34	33	40	0	9.7	4.9	<0.10	5.0	77	59
JUN										
25...	41	41	50	0	14	3.5	0.10	4.7	77	71

DATE	NITRO-GEN, NITRITE DIS-SOLVED (MG/L AS N) (00613)	NITRO-GEN, NO2+NO3 TOTAL (MG/L AS N) (00630)	NITRO-GEN, NO2+NO3 DIS-SOLVED (MG/L AS N) (00631)	NITRO-GEN, AMMONIA TOTAL (MG/L AS N) (00610)	NITRO-GEN, AMMONIA DIS-SOLVED (MG/L AS N) (00608)	NITRO-GEN, ORGANIC TOTAL (MG/L AS N) (00605)	NITRO-GEN, ORGANIC DIS-SOLVED (MG/L AS N) (00607)	NITRO-GEN,AM-MONIA + ORGANIC TOTAL (MG/L AS N) (00625)	NITRO-GEN,NH4 + ORG. SUSP. TOTAL (MG/L AS N) (00624)
MAR									
18...	--	0.300	0.260	<0.010	<0.010	--	--	0.20	0.0
MAY									
22...	<0.010	--	0.160	0.050	0.030	0.45	--	0.50	--
JUN									
25...	--	<0.100	<0.100	0.050	0.010	0.35	0.19	0.40	0.20

15292780 SUSITNA RIVER AT SUNSHINE--Continued

WATER QUALITY DATA, WATER YEAR OCTOBER 1985 TO SEPTEMBER 1986

DATE	NITRO-GEN,AM-MONIA + ORGANIC DIS. (MG/L AS N) (00623)	NITRO-GEN, TOTAL (MG/L AS N) (00600)	NITRO-GEN DIS-SOLVED (MG/L AS N) (00602)	PHOS-PHORUS, TOTAL (MG/L AS P) (00665)	PHOS-PHORUS, DIS-SOLVED (MG/L AS P) (00666)	PHOS-PHORUS, ORTHO, TOTAL (MG/L AS P) (70507)	PHOS-PHORUS, ORTHO, DIS-SOLVED (MG/L AS P) (00671)	CARBON, ORGANIC DIS-SOLVED (MG/L AS C) (00681)	CARBON, ORGANIC SUS-PENDED TOTAL (MG/L AS C) (00689)
MAR 18...	0.30	0.50	0.56	0.010	<0.010	<0.010	<0.010	1.1	0.1
MAY 22...	--	--	--	0.220	0.010	0.020	<0.010	--	--
JUN 25...	0.20	--	--	0.380	0.010	0.030	<0.010	1.3	0.5

DATE	TIME	ARSENIC TOTAL (UG/L AS AS) (01002)	ARSENIC SUS-PENDED TOTAL (UG/L AS AS) (01001)	ARSENIC DIS-SOLVED (UG/L AS AS) (01000)	BARIUM, TOTAL RECOV-ERABLE (UG/L AS BA) (01007)	BARIUM, SUS-PENDED RECOV-ERABLE (UG/L AS BA) (01006)	BARIUM, DIS-SOLVED (UG/L AS BA) (01005)	CADMIUM TOTAL RECOV-ERABLE (UG/L AS CD) (01027)	CADMIUM DIS-SOLVED (UG/L AS CD) (01025)	CHRO-MIUM, TOTAL RECOV-ERABLE (UG/L AS CR) (01034)	CHRO-MIUM, DIS-SOLVED (UG/L AS CR) (01030)	COBALT, TOTAL RECOV-ERABLE (UG/L AS CO) (01037)
MAR 18...	1545	2	1	1	100	60	41	<1	<1	<10	<10	<1
JUN 25...	1215	8	7	1	200	200	27	5	<1	40	<10	8

DATE	COBALT, DIS-SOLVED (UG/L AS CO) (01035)	COPPER, TOTAL RECOV-ERABLE (UG/L AS CU) (01042)	COPPER, DIS-SOLVED (UG/L AS CU) (01040)	IRON, TOTAL RECOV-ERABLE (UG/L AS FE) (01045)	IRON, SUS-PENDED RECOV-ERABLE (UG/L AS FE) (01044)	IRON, DIS-SOLVED (UG/L AS FE) (01046)	LEAD, TOTAL RECOV-ERABLE (UG/L AS PB) (01051)	LEAD, DIS-SOLVED (UG/L AS PB) (01049)	MANGA-NESE, TOTAL RECOV-ERABLE (UG/L AS MN) (01055)	MANGA-NESE, SUS-PENDED RECOV. (UG/L AS MN) (01054)	MANGA-NESE, DIS-SOLVED (UG/L AS MN) (01056)	MERCURY TOTAL RECOV-ERABLE (UG/L AS HG) (71900)
MAR 18...	<1	5	<1	170	160	12	1	<1	20	20	3	<0.10
JUN 25...	<1	55	<1	20000	20000	130	13	<5	370	360	8	<0.10

DATE	MERCURY DIS-SOLVED (UG/L AS HG) (71890)	NICKEL, TOTAL RECOV-ERABLE (UG/L AS NI) (01067)	NICKEL, SUS-PENDED RECOV-ERABLE (UG/L AS NI) (01066)	NICKEL, DIS-SOLVED (UG/L AS NI) (01065)	SELE-NIUM, TOTAL (UG/L AS SE) (01147)	SELE-NIUM, SUS-PENDED TOTAL (UG/L AS SE) (01146)	SELE-NIUM, DIS-SOLVED (UG/L AS SE) (01145)	SILVER, TOTAL RECOV-ERABLE (UG/L AS AG) (01077)	SILVER, DIS-SOLVED (UG/L AS AG) (01075)	ZINC, TOTAL RECOV-ERABLE (UG/L AS ZN) (01092)	ZINC, SUS-PENDED RECOV-ERABLE (UG/L AS ZN) (01091)	ZINC, DIS-SOLVED (UG/L AS ZN) (01090)
MAR 18...	<0.1	7	--	<1	1	0	1	<1	<1	20	0	31
JUN 25...	<0.1	28	27	1	1	--	<1	<1	<1	70	--	<3

DATE	TIME	STREAM WIDTH (FT) (00004)	STREAM-FLOW, INSTAN-TANEOUS (CFS) (00061)	SEDI-MENT, SUS-PENDED (MG/L) (80154)	SEDI-MENT, DIS-CHARGE, SUS-PENDED (T/DAY) (80155)	SED. SUSP. FALL DIAM. % FINER THAN .002 MM (70337)	SED. SUSP. FALL DIAM. % FINER THAN .004 MM (70338)
MAR 18...	1545	425	2860	4	31	--	--
MAY 22...	0930	595	30700	582	48200	7	11
JUN 25...	1215	645	46600	488	61400	27	37

DATE	SED. SUSP. FALL DIAM. % FINER THAN .008 MM (70339)	SED. SUSP. FALL DIAM. % FINER THAN .016 MM (70340)	SED. SUSP. FALL DIAM. % FINER THAN .031 MM (70341)	SED. SUSP. FALL DIAM. % FINER THAN .062 MM (70342)	SED. SUSP. FALL DIAM. % FINER THAN .125 MM (70343)	SED. SUSP. FALL DIAM. % FINER THAN .250 MM (70344)	SED. SUSP. FALL DIAM. % FINER THAN .500 MM (70345)
MAR 18...	--	--	--	--	--	--	--
MAY 22...	16	19	33	47	59	70	100
JUN 25...	47	56	63	72	78	92	100

APPENDIX 4

Hydrologic data for the Sheep Mountain area, Alaska

LOCAL WELL NUMBER	PRIMARY USE OF WATER	DEPTH OF WELL (FEET)	WATER LEVEL (FEET)	DATE WELL CONSTRUCTED	OWNER	ASSIGNOR OF OTHER IDENTIFIER	OTHER IDENTIFIER	TYPE OF LOG AVAILABLE
CB00200903DAAA2 001	J	100	--	01-01-65	ADH NELCHINA	--	--	-
CB00200904ADBB1 001	H	47.0	--	05-08-78	VIRGIN JOSEPH	--	--	-
CB00201018ADAB1 001	U	450	--	10-11-58	AK DPW	HYD.DATA15,1962	14	D
CB00201018BDCA1 002	-	717	--	12-01-53	AK OIL&GAS DEVEL CO	--	--	D
SA02000713ABCB1 001	U	1819	--	01-01-32	USGS	HYD.DATA15,1962	07C	-
SA02000713DCDC1 002	H	206	39.00	08-01-77	WILLOW BARK INV	LAND O LAKES SB	L13B01	D
SA02000714DACA1 002	U	793	--	01-01-32	USGS	HYD.DATA15,1962	07B	-
SA02000722ACBC1 002	H	86.0	9.00	06-30-82	SIMPSON V M	--	--	D
SA02000722BBDD1S	P	--	--	--	AK STATE	--	--	-
SA02000823CBBD1S	P	--	--	--	AK STATE VICTRY BIBL	--	--	-
SA02000825CAAC1 001	C	40.0	--	--	WATCHTOWER INN	HYD.DATA15,1962	07D	-
SA02000827ABBB1 002	H	40.0	8.00	09-25-81	DYKSTRA GARY	--	--	D
SA02000827BCCB1 001	T	65.0	23.00	01-01-63	CASCADE SCHOOL	--	--	D
SA02000827BCCB2 001	H	83.0	20.00	10-15-83	DENBLEYKER MIKE	--	--	D
SA02000925ACBC1 001	H	100	--	01-01-66	REESE ELDEN&NANCY	SECTION 25 LOTS	B05	-
SA02000926BCAD1 001	H	93.0	33.00	05-19-78	LABELL MR&MRS	--	--	D
SA02001021DCCB1 001	U	102	--	--	US ARMY	HYD.DATA15,1962	08	-
SA02001022DDCD1S	C	--	--	--	MEEKINS LODGE	--	--	-
SA02001025AAAA1 001	H	100.	86.	07-07-83	MEEKIN DONNA L	SECTION 25 LOTS	A06	D
					--	LAS	001238	-
SA02001027AACD1 001	H	50.0	35.00	07-05-83	DIETRICH DWIGHT	LAS	000885	D
SA02001029DDCC1 002	T	31.0	11.00	10-01-42	US ARMY	HYD.DATA15,1962	09	D
SA02001030CBBB1 001	T	90.0	44.00	05-30-80	GLACIER VIEW ELEM SC	--	--	D
SA02001032AABC1S	T	--	--	--	SHEEP MTN ACS SITE	--	--	-
SA02001120ACAB1 001	C	32.0	8.	01-01-66	SHEEP MTN LODGE	--	--	-
SA02001120ACAB2 001	U	11.0	--	01-01-52	SHEEP MTN LODGE	--	--	-
SA02001120ACBB1 002	H	33.0	6.00	01-01-60	ENGDAHL DOUGLAS B	--	--	D
SA02101136ADBB1 001	U	180.	--	06- -84	USGS TACT/TALI	TACT/TALI	CRB 84-13	-
					--	GLENN HWY	MI 069 W G	-
SA02101201DBBA1 001	C	5.0	--	01-01-59	ADH	HYD.DATA15,1962	13	-
SA02101217CCCC1S	U	--	--	--	GUNSIGHT MTN LODGE	--	--	-
SA02101217DABD1 001	U	51.7	2.39	01-01-52	BABLER BRS ROGR PAU	HYD.DATA15,1962	12	-

Well No.	Mile-post	Owner or User	Year Drilled	Topography	Type of Well & Diameter (in.)	Depth of Well (ft)	Water level (feet)	Water level Date	Use	Remarks
				GLENN HIGHWAY--Continued						
7b	N of 90	U. S. Geological Survey	1932	Hill-slope	Dr	793	F	1932	T	Coal test; reported flow 8 gpm.
7c	N of 90	do	1932	do	Dr	1819	F	1932	T	Coal test; 0-75 gravel (water at unknown depth).
7d	97	Hicks Creek Inn		Valley floor	Dr 6	40				----
8	106	U.S. Army (ACS)		Hill-top	Dr	102?	Dry			0-82 gravel and muck (frozen), 82-102 (no water).
☆ 9	106	do Sheep Mt.	1942	Hill-slope	Dr 4	31	11	10- ?-42	Dm	L; water at 6 and 17 ft; repeatedly goes dry in winter.
☆10	113	Sheep Mt. Lodge		Hill-slope	Dn				PS	C; lodge burned 1961.

Material	Thickness (feet)	Depth (feet)
Sheep Mountain Well 9. U. S. Army. Reported yield: 3.1 gpm. 4-inch casing.		
Muskeg (frozen)	1	1
Mud (frozen)	2.5	3.5
Gravel (thawed)	2.5	6
Water	5.5	11.5
Sand and gravel (frozen)	5.5	17
Second water	14	31

Table 3.--Chemical analyses of water from selected wells and springs along the Glenn Highway

(In parts per million)

Well No.	Date of collection	Manganese (Mn)	Temperature (°F)	Silica (SiO_2)	Iron (Fe)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Dissolved solids (residue at 180°C)	Hardness as $CaCO_3$ Calcium, Magnesium	Hardness as $CaCO_3$ Non-carbonate	Specific conductance (micromhos at 25°C)	pH
Sheep Mt Lodge 10	2/2/55	.02		13	.00	94	16	14	.1	136	194	.0	.2	3.5	402	300	189	605	7.2

15-2840. MATANUSKA RIVER NEAR PALMER (LAT 61°36'35", LONG 149°04'15")

CHEMICAL ANALYSES, IN PARTS PER MILLION, WATER YEAR OCTOBER 1967 TO SEPTEMBER 1968

DATE	DIS-CHARGE (CFS)	SILICA (SIO2)	TOTAL IRON (FE)	CAL-CIUM (CA)	MAG-NE-SIUM (MG)	SODIUM (NA)	PO-TAS-SIUM (K)	BICAR-BONATE (HCO3)	SULFATE (SO4)	CHLO-RIDE (CL)	FLUO-RIDE (F)	NITRATE (NO3)	DIS-SOLVED SOLIDS (SUM OF CONSTI-TUENTS)	HARD-NESS (CA,MG)	NON-CAR-BONATE HARD-NESS	SPECI-FIC COND-UCTANCE (MICRO-MHOS)	PH	COLOR	TEMP-ERATURE (DEG C)
OCT., 1967																			
06...	2340	5.4	.42	36	4.4	6.2	.5	89	44	5.7	.0	.9	148	109	36	246	7.8	10	--
NOV.																			
16...	1080	5.7	.09	40	5.3	7.2	.9	96	51	7.4	.1	.7	165	120	41	267	7.7	0	--
MAR., 1968																			
05...	566	6.3	.07	44	4.8	8.9	.9	100	41	13	.0	1.1	169	129	47	293	8.1	0	1

MISCELLANEOUS ANALYSES OF STREAMS IN ALASKA—Continued

Chemical analyses, in parts per million, water year October 1959 to September 1960—Continued

Location	Date of collection	Silica (SiO_2)	Iron (Fe)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Dissolved solids (residue on evaporation at 180°C)	Hardness as $CaCO_3$: Calcium, magnesium	Hardness as $CaCO_3$: Noncarbonate	Specific conductance (micromhos at 25°C)	pH	Color
Ship Creek near Anchorage	2- 5-60	--	0.10	--	--	--	--	83	--	--	--	--	--	78	26	150	7.4	--
	4-13-60	--	.00	--	--	--	--	66	--	--	--	--	--	71	17	148	7.5	--
	4-26-60	--	.05	--	--	--	--	108	--	--	--	--	--	110	22	210	7.6	--
	7- 6-60	--	--	--	--	--	--	50	--	--	--	--	--	51	--	125	7.5	0
Bear Lake near Chugiak	3-30-60	12	.04	45	9.3	4.7	1.4	164	24	1.0	0.2	1.9	a160	150	16	307	7.6	10
Matanuska River, one fourth mile below Glacier, near Sutton	1-25-60	5.3	.10	45	9.0	4.1	1.0	99	72	3.0	.0	.2	a189	149	68	307	7.5	5
2910. Susitna River near Denali	7- 5-60	7.3	.04	18	2.4	3.4	2.8	60	14	3.0	.1	.4	a 81	55	6	129	7.8	0
2912. MacLaren River near Paxson	7- 5-60	5.0	.37	13	4.3	1.8	2.6	44	15	3.0	.2	.4	a 68	50	14	103	7.8	20
Barrier Glacier Creek, Chakachamna near Tyonek	8- 8-60	2.4	.03	2.4	.0	.1	.5	6.0	.0	.0	.1	.1	a 10	6	0	10	6.8	0
Barrier Glacier Creek on west side of Chakachamna Lake, near Tyonek	8-15-60	.5	.00	1.6	--	.4	.2	6.0	.0	.5	--	--	a 6	4	0	9	6.8	20
Nagishlamina River near Tyonek	8-12-60	7.6	.00	25	3.5	2.2	2.1	24	57	4.0	.2	.0	a114	77	58	173	7.0	0
Chilligan River at Chakachamna Lake, near Tyonek	8-12-60	6.6	.14	6.4	1.0	1.1	1.0	22	4.0	1.0	--	--	32	20	2	46	7.0	20
Shamrock Glacier Creek-Chakachamna, near Tyonek	8-14-60	1.2	--	2.4	.5	1.6	.8	10	--	3.5	--	--	16	8	0	34	6.9	20
Shamrock Glacier Creek-Chakachamna Lake, near Tyonek	8-14-60	2.8	.02	2.4	.0	.4	1.3	8.0	.0	1.5	.0	.2	13	6	0	12	6.8	--
Moore Glacier Creek-Chakachamna Lake, near Tyonek	8-14-60	1.8	.40	.8	.2	.2	1.3	6.0	.0	.5	--	--	8	3	0	8	7.0	20
	8-14-60	2.2	.31	2.4	.7	.3	1.2	7.0	1.0	3.5	--	--	15	9	4	15	7.1	20
Chakachatna River near Tyonek	8-11-60	5.5	.17	8.7	1.0	1.3	1.6	25	7.0	2.0	--	--	39	26	5	64	7.0	20

a Calculated from determined constituents.

15282000 CARIBOU CREEK NEAR SUTTON--Continued

WATER-QUALITY RECORDS

PERIOD OF RECORD.--Water years 1949, 1951-69, 1972, and 1976.

WATER QUALITY DATA, WATER YEAR OCTOBER 1975 TO SEPTEMBER 1976

DATE	TIME	INSTAN-TANEOUS DIS-CHARGE (CFS)	SPE-CIFIC CON-DUCT-ANCE (MICRO-MHOS)	PH (UNITS)	TEMPER-ATURE (DEG C)	COLOR (PLAT-INUM-COBALT UNITS)	TUR-BID-ITY (JTU)	HARD-NESS (CA,MG) (MG/L)	NON-CAR-BONATE HARD-NESS (MG/L)	DIS-SOLVED CAL-CIUM (CA) (MG/L)	DIS-SOLVED MAG-NE-SIUM (MG) (MG/L)	DIS-SOLVED SODIUM (NA) (MG/L)
JUN 14...	2330	2720	105	7.7	4.5	23	1400	43	0	14	1.9	5.2

DATE	DIS-SOLVED PO-TAS-SIUM (K) (MG/L)	BICAR-BONATE (HCO3) (MG/L)	CAR-BONATE (CO3) (MG/L)	CARBON DIOXIDE (CO2) (MG/L)	DIS-SOLVED SULFATE (SO4) (MG/L)	DIS-SOLVED CHLO-RIDE (CL) (MG/L)	DIS-SOLVED FLUO-RIDE (F) (MG/L)	DIS-SOLVED SILICA (SIO2) (MG/L)	DIS-SOLVED SOLIDS (RESI-DUE AT 180 C) (MG/L)	DIS-SOLVED SOLIDS (SUM OF CONSTI-TUENTS) (MG/L)	DIS-SOLVED NITRITE PLUS NITRATE (N) (MG/L)	DIS-SOLVED ORTHO. PHOS-PHORUS (P) (MG/L)
JUN 14...	.4	56	0	1.8	13	1.2	.1	3.5	61	67	.06	.00

DATE	TIME	DIS-SOLVED IRON (FE) (UG/L)	DIS-SOLVED MAN-GANESE (MN) (UG/L)
JUN 14...	2330	80	20

SUSPENDED SEDIMENT ANALYSES, WATER YEAR OCTOBER 1975 TO SEPTEMBER 1976

DATE	TIME	INSTAN-TANEOUS DIS-CHARGE (CFS)	TEMPER-ATURE (DEG C)	TUR-BID-ITY (JTU)	SUS-PENDED SEDI-MENT (MG/L)	SUS-PENDED SEDI-MENT DIS-CHARGE (T/DAY)	SUS. SED. FALL DIAM. % FINER THAN .002 MM	SUS. SED. FALL DIAM. % FINER THAN .004 MM
JUN 14...	2330	2720	4.5	1400	7220	53000	16	24

DATE	SUS. SED. FALL DIAM. % FINER THAN .008 MM	SUS. SED. FALL DIAM. % FINER THAN .016 MM	SUS. SED. FALL DIAM. % FINER THAN .031 MM	SUS. SED. SIEVE DIAM. % FINER THAN .062 MM	SUS. SED. SIEVE DIAM. % FINER THAN .125 MM	SUS. SED. SIEVE DIAM. % FINER THAN .250 MM	SUS. SED. SIEVE DIAM. % FINER THAN .500 MM	SUS. SED. SIEVE DIAM. % FINER THAN 1.00 MM
JUN 14...	33	46	59	70	83	93	98	100

APPENDIX 5

Hydrologic data for the Gulkana area, Alaska

LOCAL WELL NUMBER	PRIMARY USE OF WATER	DEPTH OF WELL (FEET)	WATER LEVEL (FEET)	DATE WELL CONSTRUCTED	OWNER	ASSIGNOR OF OTHER IDENTIFIER	OTHER IDENTIFIER	TYPE OF LOG AVAILABLE
CA00600103DACD1 001	U	55.0	-14.00	01-01-71	THAMES KEN	CC-SLOAN	CC-070	D
CA00600117BBCC1 007	H	30.0	--	01-01-72	SMITH DIXIE	--	--	-
CA00600117BBDD1 009	H	28.0	--	01-01-76	BERGEY ROLAND	--	--	-
CA00600117BCBB1 008	H\	30.0	--	01-01-71	SMITH DIXIE	--	--	-
CA00600117BCBC1 001	H	28.0	20.00	--	FALK HAROLD	CC-SLOAN	CC-069	-
CA00600117BCCC1 004	H	14.0	--	01-01-76	BERGEY EARL	--	--	-
CA00600117BCCC2 004	U	20.0	--	01-01-75	BERGEY EARL	--	--	-
CA00600117BCCD1 005	H	20.0	--	--	BERGEY EARL	--	--	-
					TROLL MARK	--	--	-
CA00600117BCDB1 006	H	21.0	--	01-01-71	FLINT'S YAMAHA	--	--	-
CA00600117BDAC1 002	H	19.8	9.50	10-25-75	TYONE NICK	USPHS-COPPERVAL	GAKONA 11	D
CA00600117BDAD1 003	H	20.8	9.50	10-22-75	GENE BUSTER	AANHS-COPPERVAL	GAKONA 12	-
CA00600118BDCB1 001	C	16.0	--	--	GAKONA LODGE	CC-SLOAN	CC-068	-
CA00600118CAAD1S	U	--	--	--	PUBLIC DOMAIN	AAPG BULLV46,11	14	-
CA00600118CABB1 003	T	60.0	9.00	01- -74	GAKONA NEW SCHL	CC-SLOAN	CC-067	D
CA00600118CBAA1 002	U	20.0	12.00	10- -58	GAKONA OLD SCHL	CC-SLOAN	CC-066	D
					--	HYD.DATA15,1962	GH-63	-
CA00600118CBBA1 004	H	25.0	--	01-01-74	MCMAHON HARLEY	--	--	-
CB00400105BCCD1 002	T	293	243.00	06-27-45	FAA GULKANA 2	CC-SLOAN	CC-055	D
					--	HYD.DATA15,1962	GH-58	-
					--	USFAA	NO.2	-
					--	HYD.DATA16,1962	RH-30	-
					--	AAPG BULLV46,11	11	-
CB00400105BCDD1 001	U	325	284.00	07-01-42	FAA GULKANA 1	CC-SLOAN	CC-054	D
					--	HYD.DATA15,1962	GH-57	-
					--	USFAA	NO.1	-
					--	HYD.DATA16,1962	RH-29	-
CB00400105BCDD2 001	U	293	282.00	09-28-56	FAA GULKANA 3	CC-SLOAN	CC-056	D
					--	HYD.DATA15,1962	GH-58A	-
					--	NICHOLS1956PRLM	GLE-6	-
					--	USFAA	NO.3	-
					--	HYD.DATA16,1962	RH-31	-
CB00400105CBCA1 004	U	35.0	--	--	FAA GULKANA	CC-SLOAN	CC-053	D
					--	AGC	T.B. D-4	-
CB00400105CBCD1 003	C	32.0	20.00	07-05-71	WILSON AIR SERVICE	CC-SLOAN	CC-052	D
CB00400106DCAD1 001	U	200	6.60	01-01-42	US ARMY DRY CRK	CC-SLOAN	CC-051	-
					--	HYD.DATA15,1962	GH-55	-
					--	HYD.DATA15,1962	GH-56	-
					--	HYD.DATA16,1962	RH-25	-
					--	HYD.DATA16,1962	RH-26	-

1DATE: 04/13/94 GULKANA - 12.5 MILE RADIUS PAGE 2

LOCAL WELL NUMBER	PRIMARY USE OF WATER	DEPTH OF WELL (FEET)	WATER LEVEL (FEET)	DATE WELL CONSTRUCTED	OWNER	ASSIGNOR OF OTHER IDENTIFIER	OTHER IDENTIFIER	TYPE OF LOG AVAILABLE
CB00400107ACBC1 001	U	374	--	--	COUNTRY STORE	CC-SLOAN	CC-050	-
CB00400119ACBA1 004	C	157	153.00	08-01-58	GATEWAY LODGE	CC-SLOAN	CC-049	D
					--	HYD.DATA15,1962	GH-54	-
					--	HYD.DATA16,1962	RH-24	-

LOCAL WELL NUMBER		PRIMARY USE OF WATER	DEPTH OF WELL (FEET)	WATER LEVEL (FEET)	DATE WELL CONSTRUCTED	OWNER	ASSIGNOR OF OTHER IDENTIFIER	OTHER IDENTIFIER	TYPE OF LOG AVAILABLE
CB00400119ACBA2	004	C	321	282.00	01-01-57	GATEWAY LODGE	CC-SLOAN	CC-049A	D
						--	HYD.DATA15,1962	GH-53	-
						--	NICHOLS1956PRLM	GLE-5	-
						--	HYD.DATA16,1962	RH-23	-
						--	AAPG BULLV46,11	10	-
CB00400119CCDD1	002	U	437	--	--	C BISHOP FUEL	CC-SLOAN	CC-046	-
CB00400119CDBD1	003	U	327	--	09-22-72	WILLIAMS BILL	CC-SLOAN	CC-047	D
CB00400119DCBD1	001	C	321	319.00	09-01-59	ROSENTS CAFE	CC-SLOAN	CC-048	-
						--	HYD.DATA15,1962	GH-52	-
						--	HYD.DATA16,1962	RH-22	-
CB00400223ADBB1	020	T	142	--	01-01-80	CENTRAL AK MISSION	--	--	-
CB00400223ADBD1	021	T	182	30.00	01-01-80	CENTRAL AK MISSION	--	--	-
CB00400223CADC1	018	T	90.0	--	01-22-81	USBLM GLENNALLEN	--	--	-
CB00400223CBDC1	006	P	205	75.00	05-08-50	ADH GLENALLEN 2	CC-SLOAN	CC-027	D
						--	HYD.DATA15,1962	GH-36	-
						--	NICHOLS1956PRLM	GLE-3	-
						--	USGS	GLE-09	-
						--	ADH	NO.2	-
CB00400223CCBA1	011	T	179	91.00	10-01-60	GLENALLEN SCHOOL	USGS	GH-48A	D
						--	USGS	GLE-22	-
CB00400223CDAB1	003	T	175	65.00	09-22-58	USBLM GLENALLN	CC-SLOAN	CC-029	D
						--	HYD.DATA15,1962	GH-38	-
						--	USGS	GLE-11	-
CB00400223CDBB1	008	T	186	64.00	12-01-62	USAF GLENALLN 2	CC-SLOAN	CC-028	D
						ALASCOM	USGS	GLE-29	-
CB00400223CDBB2	008	U	111	--	05-18-63	US ARMY GLENALLN	HYD.DATA15,1962	GH-37	D
						--	USGS	GLE-10	-
CB00400223DAAA1	012	T	182	96.00	06-12-76	COPPER VAL SCHL DST	--	--	D
CB00400223DABD1	026	P	180	113.30	06-30-76	COPPER VAL SCHL DST	--	--	D
CB00400223DACC1	028	U	80.0	44.90	01-01-76	HEARTBREAK MOTEL	--	--	-
CB00400223DBCB1	013	T	220	150.00	01-01-70	CENTRAL AK MISSION	--	--	D
CB00400223DBCC1	014	T	222	109.00	01-01-70	CENTRAL AK MISSION	--	--	D
CB00400223DBDD1	015	T	87.0	60.00	04-02-71	CENTRAL AK MISSION	--	--	D
CB00400223DBDD2	015	P	82.0	--	01-01-76	HEARTBREAK MOTEL	--	--	-
CB00400223DCAA1	024	H	80.0	--	01-01-69	SPEERSTRA HARRY	--	--	-
CB00400223DCAD1	027	H	80.0	--	01-01-77	SPEERSTRA HARRY	--	--	-

LOCAL WELL NUMBER		PRIMARY USE OF WATER	DEPTH OF WELL (FEET)	WATER LEVEL (FEET)	DATE WELL CONSTRUCTED	OWNER	ASSIGNOR OF OTHER IDENTIFIER	OTHER IDENTIFIER	TYPE OF LOG AVAILABLE
CB00400223DCBC1	004	T	182	--	01-01-52	FAITH HOSPITAL	CC-SLOAN	CC-030	-
						--	HYD.DATA15,1962	GH-39	-
						--	USGS	GLE-12	-
CB00400223DCBC2	004	U	100	--	01-01-54	GLENALLEN MISS HSP	HYD.DATA15,1962	GH-40	D
						--	USGS	GLE-13	-
						--	DRILLER	HOLE 1	-
CB00400223DCBC3	004	U	50.0	--	--	GLENALLEN MISS HSP	USGS	GH-41	D
						--	USGS	GLE-14	-
						--	DRILLER	HOLE 2	-
CB00400223DCBC4	004	U	50.0	--	01-01-54	GLENALLEN MISS HSP	USGS	GH-42	D
						--	USGS	GLE-15	-
						--	DRILLER	HOLE 3	-
CB00400223DCBC5	004	U	50.0	--	01-01-54	GLENALLEN MISS HSP	USGS	GH-43	D
						--	USGS	GLE-16	-

LOCAL WELL NUMBER		PRIMARY USE OF WATER	DEPTH OF WELL (FEET)	WATER LEVEL (FEET)	DATE WELL CONSTRUCTED	OWNER	ASSIGNOR OF OTHER IDENTIFIER	OTHER IDENTIFIER	TYPE OF LOG AVAILABLE
						--	USGS	HOLE 4	-
CB00400223DCBC6	004	U	49.0	--	01-01-54	GLENALLEN MISS HSP	USGS	GH-44	D
						--	USGS	GLE-17	-
						--	DRILLER	HOLE 5	-
CB00400223DCBC7	004	U	33.0	17.00	01-01-54	GLENALLEN MISS HSP	USGS	GH-45	D
						--	USGS	GLE-18	-
						--	DRILLER	HOLE 6	-
CB00400223DCBC8	004	U	50.0	--	01-01-54	GLENALLEN MISS HSP	USGS	GH-46	D
						--	USGS	GLE-19	-
						--	DRILLER	HOLE 7	-
CB00400223DCBD1	019	H	160	--	01-01-80	CENTRAL AK MISSION	USS 3197	L07	-
CB00400223DCCA1	022	H	186	--	01-01-60	STRUNK ED	--	--	-
CB00400223DCDA1	016	U	68.0	--	07-01-58	HEINTZ GROC STR	HYD.DATA15,1962	GH-27	-
						SANTAS CLOTHING	USGS	GLE-20	-
CB00400223DCDA3	016	P	175	--	01-01-72	CARIBOU CAFE & MOTEL	--	--	-
CB00400223DCDB1	023	C	185	--	01-01-77	CRACKER BARRELL	--	--	-
CB00400223DDAA1	007	T	81.0	--	--	CHURCH GLENALLN	CC-SLOAN	CC-035	D
						US POST OFFICE GLENN	USGS	GLE-01	-
CB00400223DDAD1	025	U	100	--	01-01-62	NEELEY CY	--	--	-
CB00400223DDAD2	025	P	100	--	01-01-66	NEELEY CY	--	--	-
CB00400223DDBD1	005	T	81.0	--	--	CATHOLIC CHURCH	CC-SLOAN	CC-031	D
CB00400223DDBD2	005	C	70.0	60.00	08-01-71	GLENALLEN AUTO SUP	CC-SLOAN	CC-032	D
CB00400223DDCD1	017	T	66.0	--	07-06-58	US POST OFFICE GLENN	HYD.DATA15,1962	GH-51	-
						CHURCH CATHOLIC	USGS	GLE-25	-
CB00400223DDDB1	010	N	85.0	--	01-01-58	REA COPP VLY	HYD.DATA15,1962	GH-48	-
						--	USGS	GLE-21	-
CB00400223DDDB2	010	-	86.0	--	01-01-58	REA COPP VLY	HYD.DATA15,1962	GH-49	-
						--	USGS	GLE-23	-
CB00400223DDDB3	010	H	98.0	--	--	BISHOP SAM	--	--	-
CB00400223DDDD1	001	H	96.0	55.00	01-01-72	REED WILLIAM	CC-SLOAN	CC-033	D
CB00400224BBBB1	020	H	161	--	06-01-77	HUGHES JACK	--	--	-
CB00400224BBBC1	017	H	156	130.00	04-05-75	ADLER LEE	--	--	D
CB00400224BCAA1	019	H	164	--	01-01-75	MAJOR MARTHA & WM	--	--	-
CB00400224BCAB1	014	P	160	--	08-27-79	BLAIR PAUL	--	--	-
CB00400224BCAC1	006	H	171	--	--	GLENALLEN CHAPEL	CC-SLOAN	CC-041	D
CB00400224BCAC2	006	H	151	35.00	11-01-71	SPEERSTRA TERRY	GLENNALLEN AK	T00D	-
CB00400224BCCA1	005	-	--	--	--	SCRIBNER	CC-SLOAN	CC-040	-
CB00400224BCCC1	004	H	168	--	--	HIGHBARGIN	CC-SLOAN	CC-039	-
CB00400224BCDB1	007	-	--	--	--	WILSON JACK	CC-SLOAN	CC-042	-
CB00400224CBAC1	008	H	157	--	--	PETERSON ROBERT	CC-SLOAN	CC-043	D
CB00400224CBBB1	016	P	176	129.00	11-12-76	AHTNA NAT CORP	GLENNALLEN SUB	T00P	D
						ALPS	--	--	-
CB00400224CBBB2	016	P	175	129.00	11-23-76	AHTNA NAT CORP	GLENNALLEN SUB	L01T00P	D
						ALPS	--	--	-
CB00400224CBBC1	011	H	160	128.50	04-16-71	SAILORS DAN	CC-SLOAN	CC-037	D
CB00400224CCBB1	021	N	98.0	44.90	01-01-66	NEELEY CY	--	--	-
CB00400224CDDD1	015	U	110	--	01-01-62	TIBBITS GLENN	--	--	-
CB00400224DCBC1	018	H	110	--	01-01-68	WELLS FRED	--	--	-
						BOUERS CARL J	--	--	-
CB00400224DCCC1	009	C	127	--	--	LAUNDROMAT GLENNALLE	CC-SLOAN	CC-044	-

CB00400224DCCC2	009	C	103	--	01-01-74	BISHOP SAM	--	--	-
CB00400224DDCC1	001	C	197	--	--	GLENALLEN HDW LUMB	--	--	-
						SPENARD BLDRS SUPPLY	--	--	-
CB00400224DDDD1	012	U	50.0	19.00	10-21-69	TAPS TH13-006	CC-SLOAN	CC-045	-
						--	TAPS	TH-013-006	-
CB00400225BBBC1	001	H	67.0	--	--	MCLEOD BILL	CC-SLOAN	CC-034	D
CB00400226ABBD1	001	U	18.0	--	--	HEATON	--	--	-
CB00400226ABDA1	002	H	190	--	--	RICHCREEK PEG & RAY	--	--	-
CB00400230BAAB1	004	H	27.0	--	01-01-58	MITCHELL ESSIE	--	--	-
CB00500132CBBB1	001	U	354	280.00	01-01-54	US ARMY GULKANA	CC-SLOAN	CC-057	D
						--	HYD.DATA15,1962	GH-59	-
						--	NICHOLS1956PRLM	GLE-4	-
						--	HYD.DATA16.1962	RH-33	-
						--	AAPG BULLV46,11	12	-
CB00500133DAAD1S		-	--	--	--	PUBLIC DOMAIN	NICHOLS1956PRLM	GLE-9	-
						--	AAPG BULLV46,11	15	-

LOCAL WELL NUMBER		PRIMARY USE OF WATER	DEPTH OF WELL (FEET)	WATER LEVEL (FEET)	DATE WELL CONSTRUCTED	OWNER	ASSIGNOR OF OTHER IDENTIFIER	OTHER IDENTIFIER	TYPE OF LOG AVAILABLE
CB00500133DCAC1	001	U	150.	--	06- -84	USGS TACT/TALI	TACT/TALI	CRB 84-7A	-
						--	RICHARDSON HWY	MI 119 N V	-
CB00500133DCAC2	001	U	150.	--	06- -84	USGS TACT/TALI	TACT/TALI	CRB 84-7B	-
						--	RICHARDSON HWY	MI 119 N V	-
CB00500133DCAC3	001	U	132.	--	06- -84	USGS TACT/TALI	TACT/TALI	CRB 84-7C	-
						--	RICHARDSON HWY	MI 119 N V	-
CB00500212DABC1	001	U	31.5	8.00	02-05-70	TAPS TH11-096	CC-SLOAN	CC-059	-
						--	TAPS	TH-011-096	-
CB00500213DBDD1	001	U	36.5	13.00	02-08-70	TAPS TH13-061	CC-SLOAN	CC-058	-
						--	TAPS	TH-013-061	-
CB00600113CACB1	001	U	450	--	01-01-80	SAILORS KEN	--	--	-
CB00600113CBCD1	002	H	210	--	01-01-80	MCMAHON CHUCK	--	--	-
CB00600123AAAB1	004	H	314	--	01-01-76	LAPPI LOGAN	--	--	-
CB00600123ACAA1	005	P	202	--	01-01-74	LAPPI FRED O	--	--	-
CB00600123ACAC1	002	C	280	--	01-01-73	GLENN-RICH MOTEL	CC-SLOAN	CC-065	-
CB00600123ACAC2	002	C	212	--	--	GLENN-RICH MOTEL	HYD.DATA15,1962	GH-62	-
CB00600123ACAC3	002	U	275	--	01-01-76	GLENN-RICH MOTEL	--	--	-
CB00600123ADDC1	001	H	254	--	--	HENDRICKS LARRY	CC-SLOAN	CC-064	D
CB00600127DBAC1	003	U	90.0	--	07-09-70	ADH GLK BRDG	ADH	TEST HOLE3	D
CB00600127DBDA1	004	C	89.0	--	--	GULKANA ROADHOUSE	HYD.DATA15,1962	GH-61	-
						--	HYD.DATA16,1962	RH-35	-
CB00600127DBDA2	004	-	25.0	--	--	GULKANA ROADHSE	USGS	GH-61B	-
						--	HYD.DATA16,1962	RH-35A	-
0700212AACD1	001	U	31.5	15.00	09-27-69	TAPS TH12-002	CC-SLOAN	CC-071	-
						--	TAPS	TH-012-002	-
0800236ADCA1	001	U	36.0	13.50	10-12-69	TAPS TH12-016	CC-SLOAN	CC-072	-
						--	TAPS	TH-012-016	-
1I00116BCDC1	002	U	36.0	6.50	02-27-72	TAPS TH73-002	CC-SLOAN	CC-093	-
						--	TAPS	TH-073-002	-

	Well No.	Mile-post	Owner or User	Year Drilled	Topography	Type of Well & Diameter (in.)	Depth of Well (ft)	Water level (feet)	Water level Date	Use	Remarks
											GLENN-RICHARDSON HIGHWAY
	57	117.4	U. S. Federal Aviation Agency	1942	Level	Dr 6	330	283	1942	U	C; L; highly mineralized; capped and covered over.
	58	117.4	do	1945	do	Dr 6	293	243	6-28-45	PS	C; L; drilled to 443, salty water; plugged back and blasted at 293; better water.
GULKANA	58a	117.4	do	1956	do	Dr 6	303	282	1956	U	C; brackish water.
	59	118.3	U. S. Army	1954	Level	Dr 6	354	280	12-28-54	U	C; L; highly mineralized.
	60	126	Schoonover		Creek Bank	Dr	50	Dry			L; no water.
	61	124	Gulkana Road House		Valley floor	Dr	89			PS	Reportedly water very hard; iorn and salty.
	62	202.5	Junction Inn (Big Timber Lodge)		Edge of Bluff	Dr	?212 245	124		PS	Permafrost to 155; good water at 155.

Table 3.--Chemical analyses of water from selected wells and springs along the Glenn Highway

(In parts per million)

	Well No.	Date of collection	Manganese (Mn)	Temperature (°F)	Silica (SiO_2)	Iron (Fe)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Dissolved solids (residue at 180° C)	Hardness as $CaCO_3$: Calcium, Magnesium	Hardness as $CaCO_3$: Non-carbonate	Specific conductance (micromhos at 25°C)	pH
					44	.08	681	206	491		260		2,400			3,960	2,540	2,320		
GULKANA	58	1945 4/					4,780	984	2,630	82	84	5	15,400			24,400	1,600			
	58	1/12/56 5/			39	1.6	181	48	72	8.0	402	40	305	.0	.4			320	1,570	8
	58a	9/16/56			34	5.4	854	214	480	21	308	18	2,620	.0				2,750	8,080	7.4
	58	7/51 5/			42	.86					265	28	230	.3	4.6		465		1,370	8.4
	59	12/28/54			19	2.2	1,900	520	1,180	44	53	.0	6,470					6,840	18,000	7.4

Material	Thickness (feet)	Depth (feet)

GULKANA

Well 57. U. S. Federal Aviation Agency. U. S. Army. 6-inch casing. Reported yield: 9 gpm.

Clay, gray glacial silt (dry frost)	45	45
Clay, gray glacial silt	39	84
Gray glacial silt	23	107
Coarse gravel 1/8-to 3-inch diameter.	10	117
Sand and gravel	6	123
Soft gray shale	5	128
Glacial silt and gravel	122	250
Glacial silt, sand and gravel	5	255
Glacial silt	17	272
Coarse gravel, water 1/2-3 inch diameter pebbles	16	288
Coarse gravel, sand (water)	42	330

GULKANA

Well 58. U. S. Federal Aviation Agency. Drilled by U. S. Army. 6-inch casing.

Clay, blue	26	26
Clay, blue (frozen)	6	32
Clay, blue	60	92
Clay, some gas	7	99
Clay, blue	140	239
Clay, blue, trace of gravel	41	280
Sand and gravel	7	287
Quicksand	14	301
Quicksand (water)	28	329
Clay, blue	87	416
Sand (water)	7	423
? (salt water)	13	436
Gravel, fine	7	443

15212000 COPPER RIVER NEAR CHITINA--Continued

WATER-QUALITY RECORDS

Period of Record.--Water years 1950-58, 1963-72, 1974-75, and 1978 to current year.

WATER QUALITY DATA, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988

DATE	TIME	SAMPLE LOC- ATION, CROSS SECTION (FT FM R BK) (72103)	SPE- CIFIC CON- DUCT- ANCE (US/CM) (00095)	PH (STAND- ARD UNITS) (00400)	TEMPER- ATURE WATER (DEG C) (00010)	BARO- METRIC PRES- SURE (MM OF HG) (00025)	OXYGEN, DIS- SOLVED (MG/L) (00300)	OXYGEN, DIS- SOLVED (PER- CENT SATUR- ATION) (00301)
MAY								
24...	0754	290.0	154	7.50	7.0	750	11.5	96
24...	0755	370.0	156	7.70	7.0	750	11.1	93
24...	0756	450.0	156	7.80	7.0	750	11.4	95
24...	0757	530.0	156	7.80	7.0	750	11.3	94
24...	0758	610.0	158	8.00	7.0	750	11.2	94
JUN								
15...	1625	150.0	150	7.50	8.5	746	10.6	93
15...	1626	300.0	153	8.20	8.0	746	11.4	98
15...	1627	450.0	158	8.20	5.5	746	11.4	93
15...	1628	550.0	160	8.30	5.0	746	12.0	96
15...	1629	650.0	160	8.40	5.0	746	11.8	94
JUL								
28...	1354	160.0	--	8.00	8.5	748	10.8	94
28...	1355	260.0	165	8.00	8.0	748	11.0	95
28...	1356	360.0	--	8.20	6.5	748	11.5	95
28...	1357	460.0	--	8.20	5.0	748	11.8	94
28...	1358	560.0	156	7.80	5.0	748	10.6	85
SEP								
29...	1854	400.0	210	8.00	3.0	742	13.6	104
29...	1855	450.0	240	8.00	3.0	742	13.7	104
29...	1856	500.0	213	8.00	3.0	742	13.8	106
29...	1857	550.0	212	7.80	3.0	742	13.9	106
29...	1858	600.0	210	7.70	3.0	742	13.6	104

DATE	TIME	STREAM WIDTH (FT) (00004)	STREAM- FLOW, INSTAN- TANEOUS (CFS) (00061)	SPE- CIFIC CON- DUCT- ANCE (US/CM) (00095)	PH (STAND- ARD UNITS) (00400)	TUR- BID- ITY (NTU) (00076)	COLI- FORM, FECAL, 0.7 UM-MF (COLS./ 100 ML) (31625)	STREP- TOCOCCI FECAL, KF AGAR (COLS. PER 100 ML) (31673)	HARD- NESS TOTAL (MG/L AS CACO3) (00900)	HARD- NESS NONCARB WH WAT TOT FLD MG/L AS CACO3 (00902)	CALCIUM DIS- SOLVED (MG/L AS CA) (00915)	MAGNE- SIUM, DIS- SOLVED (MG/L AS MG) (00925)
MAY												
24...	0800	655	36200	156	7.80	66	K4	K2	73	11	22	4.3
JUN												
15...	1630	740	135000	156	8.10	700	K43	K20	70	14	22	3.7
JUL												
28...	1400	730	123000	--	8.00	420	<3	K27	67	12	21	3.5
SEP												
29...	1900	400	22000	217	7.90	44	<3	<3	95	23	29	5.4

DATE	SODIUM, DIS- SOLVED (MG/L AS NA) (00930)	POTAS- SIUM, DIS- SOLVED (MG/L AS K) (00935)	ALKA- LINITY WAT WH TOT FET FIELD MG/L AS CACO3 (00410)	ALKA- LINITY WAT WH TOT IT FIELD MG/L AS CACO3 (00419)	BICAR- BONATE WATER WH IT FIELD MG/L AS HCO3 (00450)	SULFATE DIS- SOLVED (MG/L AS SO4) (00945)	CHLO- RIDE, DIS- SOLVED (MG/L AS CL) (00940)	FLUO- RIDE, DIS- SOLVED (MG/L AS F) (00950)	SILICA, DIS- SOLVED (MG/L AS SIO2) (00955)	SOLIDS, RESIDUE AT 180 DEG. C DIS- SOLVED (MG/L) (70300)	SOLIDS, SUM OF CONSTI- TUENTS, DIS- SOLVED (MG/L) (70301)	NITRO- GEN, NITRITE DIS- SOLVED (MG/L AS N) (00613)
MAY												
24...	5.1	1.3	--	--	--	14	5.7	0.20	7.3	111	97	<0.01
JUN												
15...	3.6	1.4	56	55	67	15	5.6	0.20	5.6	93	91	<0.01
JUL												
28...	3.5	1.3	55	54	66	19	2.2	0.20	5.4	89	90	<0.01
SEP												
29...	6.0	1.6	72	70	86	25	5.7	0.10	7.6	131	124	<0.01

15212000 COPPER RIVER NEAR CHITINA--Continued

WATER QUALITY DATA, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988

DATE	NITROGEN, NO2+NO3 DISSOLVED (MG/L AS N) (00631)	NITROGEN, AMMONIA TOTAL (MG/L AS N) (00610)	NITROGEN, AMMONIA DISSOLVED (MG/L AS N) (00608)	NITROGEN, ORGANIC TOTAL (MG/L AS N) (00605)	NITROGEN, AMMONIA + ORGANIC TOTAL (MG/L AS N) (00625)	PHOSPHOROUS TOTAL (MG/L AS P) (00665)	PHOSPHOROUS DISSOLVED (MG/L AS P) (00666)	PHOSPHOROUS ORTHO, DISSOLVED (MG/L AS P) (00671)	PHOSPHOROUS ORGANIC TOTAL (MG/L AS P) (00670)	PHOSPHOROUS ORGANIC DISSOLVED (MG/L AS P) (00673)	ALUMINUM, DISSOLVED (UG/L AS AL) (01106)
MAY											
24...	<0.100	0.030	0.010	0.27	0.30	0.030	0.020	<0.010	0.03	0.02	110
JUN											
15...	0.100	0.020	0.040	0.28	0.30	0.050	0.030	<0.010	0.05	0.03	--
JUL											
28...	<0.100	0.150	0.140	0.05	0.20	0.250	0.030	0.010	0.25	0.02	290
SEP											
29...	<0.100	0.040	0.030	--	<0.20	0.040	0.030	<0.010	0.04	0.03	80

DATE	ARSENIC DISSOLVED (UG/L AS AS) (01000)	BARIUM, DISSOLVED (UG/L AS BA) (01005)	BERYLLIUM, DISSOLVED (UG/L AS BE) (01010)	CADMIUM DISSOLVED (UG/L AS CD) (01025)	CHROMIUM, DISSOLVED (UG/L AS CR) (01030)	COBALT, DISSOLVED (UG/L AS CO) (01035)	COPPER, DISSOLVED (UG/L AS CU) (01040)	* IRON, DISSOLVED (UG/L AS FE) (01046)	LEAD, DISSOLVED (UG/L AS PB) (01049)	LITHIUM DISSOLVED (UG/L AS LI) (01130)	MANGANESE, DISSOLVED (UG/L AS MN) (01056)
MAY											
24...	2	18	<0.5	<1	<1	<3	8	110	<5	6	10
JUN											
15...	--	--	--	--	--	--	--	--	--	--	--
JUL											
28...	1	19	<0.5	<1	<1	<3	4	250	<5	5	11
SEP											
29...	3	25	<0.5	<10	<1	<3	6	68	<5	9	7

DATE	MERCURY DISSOLVED (UG/L AS HG) (71890)	MOLYBDENUM, DISSOLVED (UG/L AS MO) (01060)	NICKEL, DISSOLVED (UG/L AS NI) (01065)	SELENIUM, DISSOLVED (UG/L AS SE) (01145)	SILVER, DISSOLVED (UG/L AS AG) (01075)	STRONTIUM, DISSOLVED (UG/L AS SR) (01080)	VANADIUM, DISSOLVED (UG/L AS V) (01085)	ZINC, DISSOLVED (UG/L AS ZN) (01090)	SEDIMENT, SUSPENDED (MG/L) (80154)	SEDIMENT, DISCHARGE, SUSPENDED (T/DAY) (80155)	SED. SUSP. SIEVE DIAM. % FINER THAN .062 MM (70331)
MAY											
24...	<0.1	<10	<1	<1	<1.0	120	<6	<3	401	38200	50
JUN											
15...	--	--	--	--	--	--	--	--	3130	1140000	70
JUL											
28...	<0.1	<10	1	<1	<1.0	110	<6	9	2230	675000	62
SEP											
29...	<0.1	<10	<1	<1	<1.0	160	<6	7	184	10900	48

APPENDIX 6

Hydrologic data for the Slana area, Alaska

Material	Thickness (feet)	Depth (feet)
Well 67. State of Alaska Slana		
Coarse gravel and fill (frozen)	8	8
Fine sand and med. gravel (frozen)	4	12
Coarse gravel (frozen)	13	25
Fine sand and clay (frozen)	6	31
Fine sand and med. gravel (frozen)	5.5	36.5
Seepage water in sand (thaw streak)	6	42.5
Coarse sand and med. gravel (frozen)	6	48.5
Med. gravel and fine sand (frozen)	6	54
Coarse sand and clay (frozen)	7	63
Fine sand with seep from above (frozen) . . .	10	73
Glacier mud and fine sand (some water) . . .	6	79
Fine sand (bailed down to water level 27 ft).	12	91
Fine sand (running in with water)	6	97
Fine sand (bailed down to water level at 35 feet)	7	104
Fine sand - run in of fine sand	13	117.5
Fine sand (water level 60 feet-holds level after bailing)	4.5	122
Fine sand with some muck and clay	4	126
Muck and med. sand, some gravel	4.5	130.5
Muck and fine sand	11	141.5
Fine sand - Rising core at 144 feet	7	148.5
Black muck (drilled below 3 feet)	2	150.5
Muck in sand	1.5	152
Muck (drilled below shoe)	2.5	154.5
Muck (water).	16	170.5
Muck and fine sand	6.5	177
Fine sand and muck (water came up overnight 15 feet)	6	183
Sticky clay and fine sand (bailed down to 55 feet)	7	190
Sticky clay	7	197
Sticky clay and muck	8	205
Sticky clay and broken up wood	14	219
Sticky clay	24	243
Shale and clay - pulled pipe to 148 feet Water level 60 feet from surface Water level 40 feet on 5/19/53 . . .	41	284

MISCELLANEOUS ANALYSES OF STREAMS IN ALASKA

Chemical analyses, in parts per million, water year October 1957 to September 1958

Date of collection	Mean discharge (cfs)	Silica (SiO_2)	Iron (Fe)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Dissolved solids (calculated)	Hardness as $CaCO_3$: Calcium, magnesium	Hardness as $CaCO_3$: Noncarbonate	Specific conductance (micromhos at 25°C)	pH	Color
1980. SLANA RIVER NEAR SLANA																		
Oct. 17, 1957		11	0.02	--	--	2.6	1.3	136	44	1.5	0.2	0.6	174	183	42	299	7.8	3
Nov. 20		--	--	46	14	3.8	1.7	161	43	1.0	--	--	--	172	40	339	8.0	0
Dec. 29		13	.06	44	16	4.6	2.1	160	52	1.5	.2	.4	218	176	44	341	7.6	0
May 6, 1958..........		8.3	.17	40	10	2.4	1.3	131	35	.0	.0	.4	164	141	32	278	7.6	0
June 3..............		9.4	.30	42	8.4	1.5	1.1	119	40	1.0	.1	.1	159	140	42	268	6.8	0
June 23		6.1	.07	40	11	2.3	1.1	112	49	2.0	.2	.0	167	145	63	276	7.0	0
Aug. 27		6.8	.06	42	12	2.2	1.0	118	62	1.5	.1	.2	186	154	58	312	7.6	0

LOCAL WELL NUMBER		PRIMARY USE OF WATER	DEPTH OF WELL (FEET)	WATER LEVEL (FEET)	DATE WELL CONSTRUCTED	OWNER	ASSIGNOR OF OTHER IDENTIFIER	OTHER IDENTIFIER	TYPE OF LOG AVAILABLE
CA01100830ADBA1	001	H	38.	23.	04-14-87	RICKMAN H T	NABESNA ROAD	MILE 0.5	D
						--	SECTION 30 LOTS	UNSUB AREA	-
CA01100834BDAD1	001	H	40.	4.5	04-05-85	CARPENTER RUSTY	SECTION 34 LOTS	UNSUB AREA	D
CA01100834CCCA1	002	H	60.	6.	04-04-87	AMES PEGGY	NABESNA ROAD	MILE 3.5	D
						--	SECTION 34 LOTS	UNSUB AREA	-
CA01100835CCCD1	001	H	40.	6.	04-04-87	ENZLER WARREN	SECTION 35 LOTS	UNSUB AREA	D
CA01100835CDCA1	002	H	40.	8.	04-05-87	SCHLUTZ DAN	HOMESITE	AA53129	D
CA01200903ACAA1	001	U	180.	--	06- -84	USGS TACT/TALI	TACT/TALI	CRB 84-16A	-
						--	GLENN HWY	MI 050 SWT	-
CA01200903ACAA2	001	U	180.	--	06- -84	USGS TACT/TALI	TACT/TALI	CRB 84-16B	-
						--	GLENN HWY	MI 050 SWT	-
CA01300801DDAD1	001	H	61.0	38.00	09-05-81	JOHN FRED	USS 4362	TRACT C	D
CA01300801DDDB1	002	H	178	17.00	09-08-81	JOHN KATIE	USS 4362	TRACT C	D
CA01300801DDDD1	003	C	217	--	09-21-81	MENTASTA HEALTH CLNI	USS 4362	L02B05TA	D
CA01300801DDDD2	003	H	236	15.00	09-17-81	SANFORD FRANK	USS 4362	L02B03TA	D
CA01300812AAAA1	001	H	187	--	09-12-81	JOHN EVA	USS 4362	L06B03TA	D
CA01300905BBDA1	001	H	72.0	36.00	09-01-81	WOLF LOTHA	--	--	D
CA01300906CBDC1	001	H	218	56.00	09-03-81	MURPHY HELEN	USS 4362	L01B07TA	D
CA01300906CCCB1	002	H	58.0	40.00	09-19-81	SANFORD HUSTON	USS 4362	L01B03TA	D
CA01300906CCCC1	003	H	214	--	09-15-81	JOHN BEN	USS 4362	L11B03TA	D

PORCUPINE CREEK

STATION NUMBER	DATE	TIME	LAT-I-TUDE	LONG-I-TUDE	MEDIUM CODE	SAMPLE TYPE	RECORD NUMBER	TEMPER-ATURE WATER (DEG C) (00010)	COLOR (PLAT-INUM-COBALT UNITS) (00080)
624335143521000	07-22-49	1230	62 43 35 N	143 52 10 W	9	9	94900222	9.5	--
624335143521000	06-22-51	--	62 43 35 N	143 52 10 W	9	9	95100334	--	110
624335143521000	02-06-52	1300	62 43 35 N	143 52 10 W	9	9	95200475	0.0	10
624335143521000	06-04-52	1500	62 43 35 N	143 52 10 W	9	9	95200476	--	10
624335143521000	07-27-53	2100	62 43 35 N	143 52 10 W	9	9	95300650	13.0	5
624335143521000	09-20-55	--	62 43 35 N	143 52 10 W	9	9	95500432	--	0

DATE	SPE-CIFIC CON-DUCT-ANCE (US/CM) (00095)	PH WATER WHOLE FIELD (STAND-ARD UNITS) (00400)	CARBON DIOXIDE DIS-SOLVED (MG/L AS CO2) (00405)	ALKA-LINITY WAT WH TOT FET FIELD MG/L AS CACO3 (00410)	BICAR-BONATE WATER WH FET FIELD MG/L AS HCO3 (00440)	CAR-BONATE WATER WH FET FIELD MG/L AS CO3 (00445)	NITRO-GEN, NITRATE DIS-SOLVED (MG/L AS N) (00618)	HARD-NESS TOTAL (MG/L AS CACO3) (00900)	HARD-NESS NONCARB WH WAT TOT FLD MG/L AS CACO3 (00902)
07-22-49	235	6.9	21	86	100	0	0.290	120	30
06-22-51	125	6.9	11	43	53	0	0.090	62	19
02-06-52	445	7.5	11	178	220	0	0.360	230	56
06-04-52	215	7.2	11	87	110	0	0.270	110	23
07-27-53	260	7.8	3.1	101	120	0	0.090	130	29
09-20-55	266	7.6	4.9	100	120	0	0.230	130	28

DATE	CALCIUM DIS-SOLVED (MG/L AS CA) (00915)	MAGNE-SIUM, DIS-SOLVED (MG/L AS MG) (00925)	SODIUM, DIS-SOLVED (MG/L AS NA) (00930)	SODIUM AD-SORP-TION RATIO (00931)	SODIUM PERCENT (00932)	SODIUM+ POTAS-SIUM DIS-SOLVED (MG/L AS NA) (00933)	POTAS-SIUM, DIS-SOLVED (MG/L AS K) (00935)	CHLO-RIDE, DIS-SOLVED (MG/L AS CL) (00940)	SULFATE DIS-SOLVED (MG/L AS SO4) (00945)
07-22-49	37	5.6	--	--	--	3.0	--	0.20	33
06-22-51	14	6.6	2.9	0.2	9	--	0.70	0.20	14
02-06-52	74	12	--	--	--	6.2	--	2.0	63
06-04-52	34	6.2	--	--	--	4.4	--	2.0	28
07-27-53	44	5.0	1.5	0.1	2	--	1.2	0.0	37
09-20-55	40	6.9	2.8	0.1	4	--	1.0	0.20	34

DATE	FLUO-RIDE, DIS-SOLVED (MG/L AS F) (00950)	SILICA, DIS-SOLVED (MG/L AS SIO2) (00955)	SOLIDS, RESIDUE AT 180 DEG. C DIS-SOLVED (MG/L) (70300)	SOLIDS, SUM OF CONSTI-TUENTS, DIS-SOLVED (MG/L) (70301)	SOLIDS, DIS-SOLVED (TONS PER AC-FT) (70303)	NITRO-GEN, NITRATE DIS-SOLVED (MG/L AS NO3) (71851)	MANGA-NESE (UG/L AS MN) (71883)	IRON (UG/L AS FE) (71885)
07-22-49	--	8.2	--	140	0.19	1.3	--	--
06-22-51	0.20	14	113	79	0.15	0.40	--	10
02-06-52	0.0	15	295	281	0.40	1.6	--	10
06-04-52	0.10	9.4	--	138	0.19	1.2	--	10
07-27-53	0.0	8.8	--	158	0.22	0.40	--	10
09-20-55	0.0	9.6	--	156	0.21	1.0	0	0

APPENDIX 7

Hydrologic data for the Northway area, Alaska

Material	Thickness (feet)	Depth (feet)
Well 16. U. S. Federal Aviation Agency. NORTHWAY Developed 8½ hours. Yield 30 gpm.		
Sand, fine gravel (frozen)	19	19
Sand, fine gravel, ice (frozen)	12	31
Muck and ice (frozen)	4	35
Muck, ice, and clay (frozen)	10	45
Muck and clay (broke through frost at 46 feet. Water level 25 feet)	14	59
Silt and sand (water level 34 feet)	21	80
Silt and sand	13	93
Sand	6	99
Sand, small gravel	12	111
Sand (water level 40 feet)	12	123
Gravel, sand (rush of water at 124 feet. Water level 16 feet below surface)	11	134
Gravel and sand (water level 12 feet)	39	173
Fine sand (water level 3 feet)	11	184
Gravel and coarse sand (water level 12 feet)	53	237
Coarse gravel (water)	6	243 -@ 74 m

Well 17. MHKCB at Northway Airport. Perforated casing 45-50 feet. Developed 12 hours. Yield 27½ gpm; drawdown 5½ feet after 8 hours pumping.

Surface sand and muck	3	3
Sand (frozen) - thawing and caving	3	6
Sand (frozen) - no caving	32	38
Blue clay (frozen)	4	42
Blue, hard, sandy clay (frozen)	6	48
Sand (water)	2	50 @ 15 m

Well 18. U. S. Army Air Corps at Northway Airport. Yield 40 gpm; drawdown 2 feet after 2 hours.

Silt	5	5
Silt (frozen)	55	60
Sand	20	80
"Shale" = silt	15	95
"Sandy shale" = silt and sand	11	106
Silt and gravel	102	208 @ 63m
95-205 also reported as quicksand		

LOCAL WELL NUMBER	PRIMARY USE OF WATER	DEPTH OF WELL (FEET)	WATER LEVEL (FEET)	DATE WELL CONSTRUCTED	OWNER	ASSIGNOR OF OTHER IDENTIFIER	OTHER IDENTIFIER	TYPE OF LOG AVAILABLE
CA01402033AAAB1 001	Z	250	98.00	06-12-62	US ARMY LAKEVIEW	--	--	D

Table 1.--Records of wells and test holes along the Alaska Highway, Alaska--Continued

Well no.	Milepost or location	Owner or user	Year drilled	Topography	Type of well & diameter (in.)	Depth of well (ft)	Water level (feet)	Water level date	Use	Remarks
16		U. S. Federal Aviation Agency	1944	River terrace	Dr	243	16 20	2-23-44 1- 8-60	PS	C; L; drawdown 40 feet at 30 gpm reported 1-8-60.
17		Metcalfe, Hamilton, Kansas City Bridge Company	1943		Dr 4?	50	5.5?	1943		L; location unknown.
18		formerly U. S. Army Air Corps (Engineer Troops)	±1942	River terrace	Dr 5	208	12	1942?		L; well 1; location unknown.
19	Hangar	do	1943	do	Dr 6	246	7	2-16-44	D	L; well 2; water hardness 120 ppm; temperature 40°F.

15470000 - CHISANA RIVER AT NORTHWAY JUNCTION (LAT 63 00 23 LONG 141 48 17)

WATER QUALITY DATA, WATER YEAR OCTOBER 1971 TO SEPTEMBER 1972

DATE	TIME	DIS-CHARGE (CFS)	DIS-SOLVED SILICA (SIO2) (MG/L)	TOTAL IRON (FE) (UG/L)	DIS-SOLVED IRON (FE) (UG/L)	TOTAL MAN-GANESE (MN) (UG/L)	DIS-SOLVED MAN-GANESE (MN) (UG/L)	DIS-SOLVED CAL-CIUM (CA) (MG/L)	DIS-SOLVED MAG-NE-SIUM (MG) (MG/L)
OCT. 14...	1115	1500	12	120	--	20	--	44	8.0
JULY 31...	1130	5680	7.7	--	120	--	0	29	5.1
AUG. 23...	1200	6490	6.9	--	140	--	0	28	4.7

DATE	DIS-SOLVED SODIUM (NA) (MG/L)	DIS-SOLVED PO-TAS-SIUM (K) (MG/L)	BICAR-BONATE (HCO3) (MG/L)	CAR-BONATE (CO3) (MG/L)	DIS-SOLVED SULFATE (SO4) (MG/L)	DIS-SOLVED CHLO-RIDE (CL) (MG/L)	DIS-SOLVED FLUO-RIDE (F) (MG/L)	DIS-SOLVED NITRATE (N) (MG/L)	DIS-SOLVED NITRITE PLUS NITRATE (N) (MG/L)
OCT. 14...	4.7	1.1	150	0	27	1.2	.1	.16	--
JULY 31...	5.1	2.4	99	0	19	2.1	.1	--	.00
AUG. 23...	4.3	1.2	99	0	18	1.9	.0	--	.02

DATE	DIS-SOLVED ORTHO. PHOS-PHORUS (P) (MG/L)	DIS-SOLVED SOLIDS (SUM OF CONSTI-TUENTS) (MG/L)	HARD-NESS (CA,MG) (MG/L)	NON-CAR-BONATE HARD-NESS (MG/L)	SPE-CIFIC CON-DUCT-ANCE (MICRO-MHOS)	PH (UNITS)	TEMPER-ATURE (DEG C)	COLOR (PLAT-INUM-COBALT UNITS)
OCT. 14...	--	173	143	20	288	8.0	.0	10
JULY 31...	.14	120	93	12	200	7.7	13.5	5
AUG. 23...	.10	114	89	8	197	7.1	11.5	10

SELECTED CHEMICAL ANALYSES OF GROUND WATER

Chemical analyses in parts per million except conductance, pH, and color

Owner or user	Major aquifer	Depth of well (feet)	Silica (SiO_2)	Iron (Fe)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Dissolved solids (residue on evaporation at 180°C)	Hardness as $CaCO_3$: Carbonate	Hardness as $CaCO_3$: Non-carbonate	Specific conductance (micromhos at 25°C)	pH	Color
Custom Station, Internat. Border	schist	297	9.0	0.02	37	335	66	1.8	494	1120	8.9	0.1	0.0	1820	1560	1155	2440	7.6	-
Border Trading Post	gravelly-sand	175	36	2.20	135	25	17	7.9	602	5.3	2.8	0.4	0.8	529	438	0	859	7.6	140
Northway Motel	granite	206	29	Tr.	27	12	17		-	56	10	-	0.5	244	90	26	283	7.4	-
Northway ACS	granite	90	30	2.69	103	39	18	0.2	404	97	9.2	0.3	9.4	508	418	87	722	6.6	200
Northway FAA	gravelly-sand	237	33	0.03	56	19	8.5	2.7	288	2.0	2.0	0.2	0.6	266	220	-	415	8.1	5

SELECTED CHEMICAL ANALYSES OF SURFACE WATER

Chemical analyses in parts per million except conductance, pH, and color

Number	Date of collection	Location	Mean discharge (cfs)	Silica (SiO_2)	Iron (Fe)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Dissolved solids (residue on evaporation at 180°C)	Hardness as $CaCO_3$: Carbonate	Hardness as $CaCO_3$: Non-carbonate	Specific conductance (micromhos at 25°C)	pH	Col
S-1	6/18/65	Lake (no name) near Northway Junction	—	4.3	0.73	36	14	5.2	2.1	181	4.3	2.8	0.4	1.0	160	149	1	275	7.5	12
S-2	6/17/65	Scottie Creek near Northway Junction	—	6.2	0.41	15	6.4	3.2	1.3	70	8.6	2.1	0.3	0.5	78	64	7	134	7.5	12
S-3	7/27/53	Chisana River near Northway Junction	—	7.1	0.00	26	4.2	0.8		90	13	2.0	0.1	0.3	102	85	11	185	8.0	
S-4	12/30/57	Chisana River near Northway Junction	827	15	0.05	44	13	6.9	2.9	183	24	4.0	0.2	0.4	200	163	13	328	7.3	
S-5	10/20/66	Nabesna River near Northway Junction	620	14	—	45	8.9	11	2.0	165	29	7.8	0.1	1.7	174	149	14	331	7.4	

Material	Thickness (feet)	Depth (feet)
Well 19. U. S. Army Air Corps, well 2. Drilled by Mike Erceg. Yield 30 gpm; drawdown 0 after 24 hours.		
Muck	3	3
Muck and ice (frozen)	22	25
Sand, ice, and slide rock	15	40
Silt, ice, some sand	37	77
Sand and ice (broken through frost) (at 90 feet water struck)	13	90
? (Water level at 15 feet from surface)	14	104
Sand and fine gravel	16	120
Soft clay	5	125
Muck	15	140
Sand, firmer	5	145
Fine gravel	11	156
Gravel and sand (water level 14 feet)	71	227

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Table 3.--Chemical analyses of water from wells along the Alaska Highway, Alaska

(In parts per million)

Well No.	Date of collection	U. S. Geological Survey Laboratory Number	Manganese (Mn)	Silica (SiO_2)	Iron (Fe)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Dissolved solids (Calculated)	Hardness as $CaCO_3$: Calcium, Magnesium	Hardness as $CaCO_3$: Non-carbonate	Specific conductance (micromhos at 25°C)	pH
7	11-21-59[1/]		1.4	21.0	0.1	35.4	22.9	19			46.0	12.0		0.3	366	182.7	0	470[2/]	7.63
6	11-21-59[1/]		0	29.0	Trace	27.2	11.8	17			56.0	10.4		0.6	244	90.0	28.3	283	7.43
16	11-10-59	5585		25	0.02	40	10	4.7	2.7	159	12	4.0	.0	.0	176	141	10	272	8.0

NORTHWAY