Overview of Environmental and Hydrogeologic Conditions near Homer, Alaska

By James D. Hall

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BRUCE BABBITT, Secretary

U.S. GEOLOGICAL SURVEY
Gordon P. Eaton, Director

For additional information write to:

District Chief
U.S. Geological Survey
4230 University Drive, Suite 201
Anchorage, AK 99508-4664

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CONVERSION FACTORS, VERTICAL DATUM, AND ABBREVIATED WATER-QUALITY UNIT

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
cubic meter (m^3)	264.2	gallon
cubic meter (m^3)	0.0008107	acre foot
centimeter per year (cm/yr)	0.3937	inch per year
cubic meter per second (m^3/s)	35.31	cubic foot per second
liters per second (L/s)	15.85	gallons per minute
liters per day (L/d)	0.2642	gallons per day
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:

Chemical concentration and water temperature are given only in metric units. Chemical concentration in water is given in milligrams per liter (mg/L). Milligrams per liter is a unit expressing the solute mass per unit volume (liter) of water. For concentrations less than 7,000 milligrams per liter, the numerical value is about the same as for concentrations in parts per million. Specific conductance is given in microsiemens per centimeter (µS/cm) at 25°C.

Overview of Environmental and Hydrogeologic Conditions near Homer, Alaska

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Abstract

The Federal Aviation Administration is conducting environmental assessments at most of its present or former facilities in Alaska. The Federal Aviation Administration has facilities near Homer, a small city on the southern end of the Kenai Peninsula facing Kachemak Bay near the mouth of Cook Inlet. The climate near Homer is transitional between maritime and continental and has cool summers and moderately cold winters. Vegetation consists of coastal spruce-hemlock forest which opens up at higher elevations into meadows of shrubs and grasses. Homer was inundated with glacial ice as little as 14,000 to15,000 years ago and much of the topography is a result of glaciation. Bedrock consists of consolidated sand, silt, and clay interbedded with layers of coal and volcanic ash. Surficial materials consist of glacial and alluvial deposits. Homer is in an active geologic zone; numerous faults and four volcanoes are within 100 kilometers of the city. Ground water is available in at least two aquifers near Homer. An unconfined aquifer is composed of alluvial fan deposits and Quaternary age glacial deposits. A bedrock aquifer extends to more than 3,200 meters below land surface. Surface water from the Bridge Creek Reservoir is the principal source of drinking water for Homer. Alternative sources of drinking water include non-brackish ground water and nearby streams and lakes.

INTRODUCTION

The Federal Aviation Administration (FAA) owns and (or) operates airway support and navigational facilities throughout Alaska. Fuels and potentially hazardous materials such as solvents, polychlorinated biphenyls, and pesticides may have been used or disposed of at many of these sites. To determine if environmentally hazardous materials have been spilled or disposed of, the FAA is conducting environmental studies mandated under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and the Resource Conservation and Recovery Act (RCRA). To complete these more comprehensive environmental studies, the FAA requires information on the hydrology and geology of areas surrounding the sites. This report, the product of compilation, review, and summary of existing hydrologic and geologic data by the U.S. Geological Survey (USGS) in cooperation with the FAA, describes general hydrologic and geologic characteristics, flood hazards, and other environmental conditions for the FAA facilities and nearby areas at Homer, Alaska (figs. 1, 2).

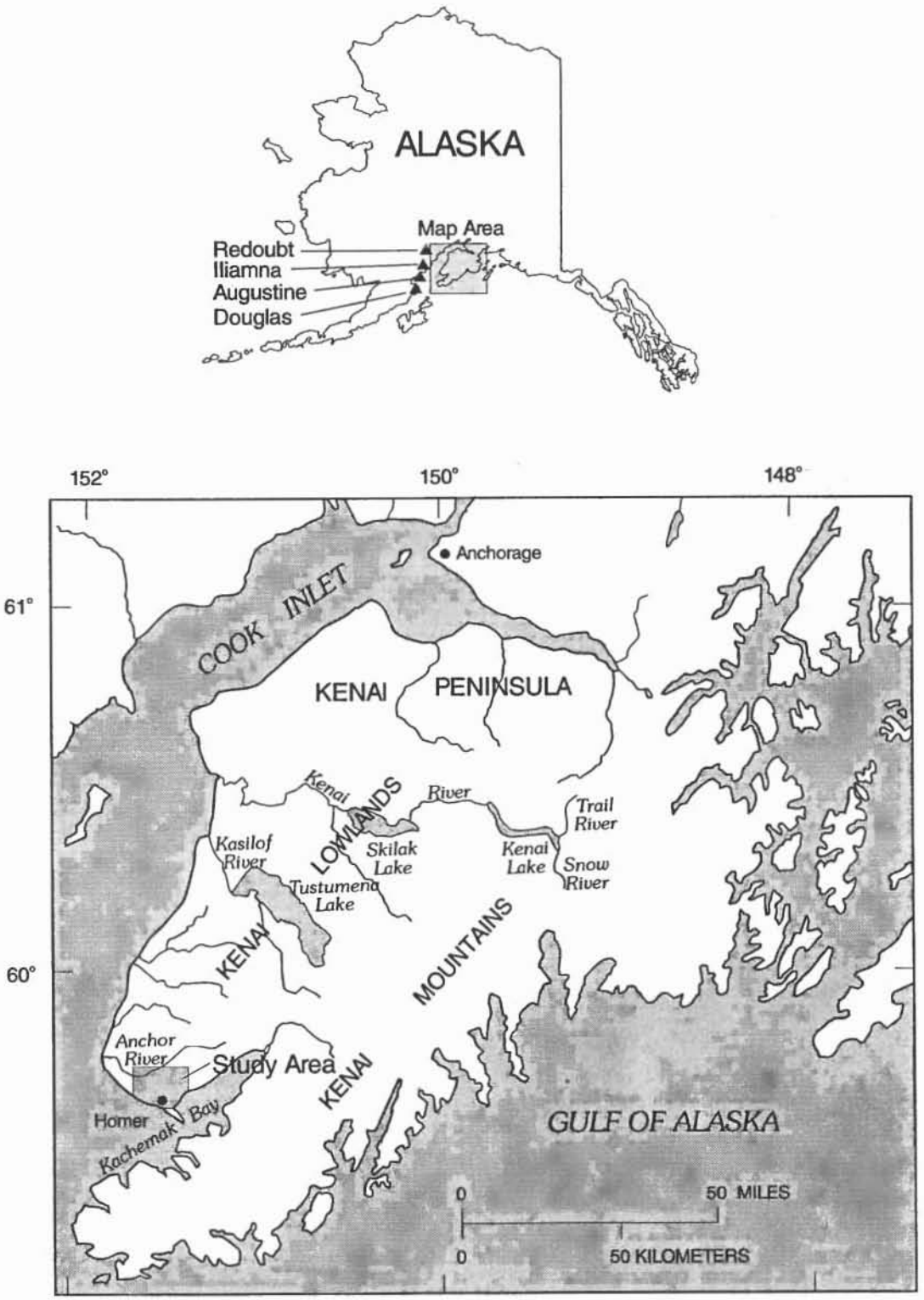

Figure 1. Location of Homer, Alaska and the Kenai Peninsula.

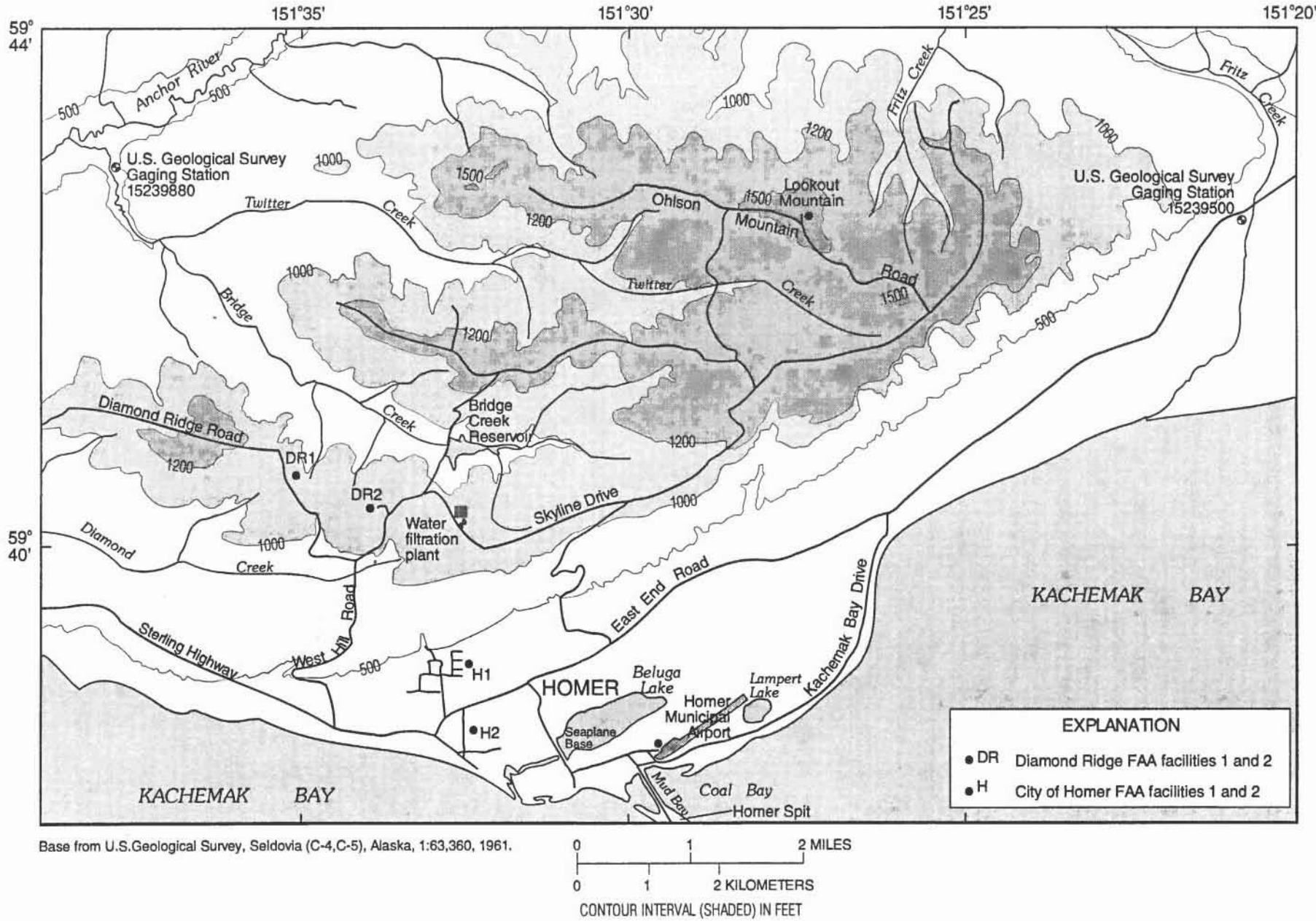

Figure 2. Location of the Federal Aviation Administration facility sites at Homer, Alaska.

Background

Location

Homer is in south-central Alaska near lat 59°39' N., long 151°30' W. It is near the southwestern end of the Kenai Peninsula about 200 km south of Anchorage (fig. 1). Homer, a city with about 3,700 residents, is on the north side of Kachemak Bay, an embayment of Cook Inlet (fig. 1; U.S. Census Bureau, 1991). Access is provided by the Sterling Highway, air services, and ferry services. The FAA has provided airway support to pilots through navigational and communication aids at six sites near Homer (fig. 2). The primary FAA facilities are at the Municipal airport near the southern end of Homer (Ecology and Environment, 1993). Other FAA facilities are located on Lookout Mountain, at two sites on Diamond Ridge (DR1 and DR2), and at two sites within the city of Homer (H1 and H2) (fig. 2). The Lookout Mountain site is about 9 km north of the airport; DR1 and DR2 are 7 and 6 km northwest of the airport respectively; and H1 and H2 are about 3.5 km northwest and 3 km west of the airport, respectively (fig. 2). A detailed description of the FAA facilities in and around Homer is given in an Environmental Compliance Investigation Report by Ecology and Environment, Inc. (1993).

History and Socioeconomics

During the late 1800's, Europeans moved into the Kenai Lowland near Homer, a region previously occupied by the Dena'ina Indians (Klein, 1987; Selkregg, 1976). In 1939, 1950, and 1960, the population of Homer was 325, 307, and 1,247 respectively (Rollins, 1978). The population boom of the 1950's resulted from the discovery of oil in the Cook Inlet region (Rollins, 1978; Selkregg, 1976). In 1990, 5 percent of the population was Native American Indian, Eskimo, or Aleut (U.S. Census Bureau, 1991). Industry is diverse and retail trade and natural-resource production provide most employment (Alaska Department of Community and Regional Affairs, 1993). The FAA first began acquiring land and building facilities near Homer in 1941, during the World War II defense buildup in Alaska (Ecology and Environment, 1993). About 3 percent of the Homer workforce is employed in transportation-related activities, including FAA services (Alaska Department of Community and Regional Affairs, 1993).

Climate

Homer has a climate that is transitional between maritime and continental, with cool summers and moderately cold winters (Hartman and Johnson, 1984). The mean annual temperature is 2.9 °C, but temperatures range from a July mean maximum of 15.8 °C to a January mean minimum of -8.7 °C (Leslie, 1989). Mean annual precipitation is about 630 mm and about 1,400 mm of snow falls annually (Leslie, 1989). Mean monthly and annual temperature, precipitation, and snowfall from 1932 to 1987 are summarized in table 1.

Table 1. Mean monthly and annual temperature, precipitation, and snowfall,1932-1987, Homer, Alaska.
[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	-1.7	0.0	2.0	5.8	10.1	13.7	15.8	15.7	12.6	6.9	1.7	-1.5	6.7
	(Record maximum 26.7 °C, June 1953)												
Mean minimum	-8.7	-7.5	-6.1	-2.1	1.7	5.2	7.4	7.4	4.3	-0.4	-5.1	-8.2	-1.0
	(Record minimum -29.4 °C, March 1971)												
Mean	-5.2	-3.7	-2.1	1.8	5.9	9.5	11.7	11.6	8.4	3.2	-1.8	-4.8	2.9
						Precipitation, in millimeters of moisture							
	57	45	40	32	27	25	41	65	75	87	70	69	Total 633
						Snowfall, in millimeters							
	244	285	236	84	10	0.0	0.0	0.0	0.0	51	196	297	Total 1,403

Vegetation

The vegetation near Homer consists primarily of coastal spruce-hemlock forest (Viereck and Little, 1972; Selkregg, 1976). The forested areas are composed of Sitka spruce and western hemlock, with an understory of various forms of lichens, ferns, and mosses (Viereck and Little, 1972; Selkregg, 1976). Open areas of muskeg contain low shrubs such as devils club and salmonberry, sedges, grasses, and sphagnum (Viereck and Little, 1972). Low shrubs and grasses are the primary vegetation surrounding the airport. Upland areas such as Lookout Mountain and Diamond Ridge are covered by open-canopy spruce forest with meadows of shrubs and grasses.

PHYSIOGRAPHY AND GEOLOGY

Physiography

The city of Homer and the surrounding area are in the Kenai Lowland, a broad low shelf with undulating hills rising to the south (Karlstrom, 1964). Along the northern edge of the city, a bluff rises to more than 300 m above sea level. A hilly region on the north side of the bluff includes Lookout Mountain and Diamond Ridge. The city of Homer lies on an irregular terrace and alluvial fan complex between the bluff and Kachemak Bay, hereafter referred to as the "Homer bench." Homer Spit is a submerged moraine that has been partially reworked by wave action. It extends 7.2 km southeastward into Kachemak Bay.

Surficial Geology

The glacial history and surficial geology near Homer are discussed by Karlstrom (1964) and Reger and Pinney (1995). The topography of the area is largely the result of Pleistocene glaciation. Surficial deposits on the Homer bench consist of drift overlain by fan alluvium. Alluvial fans are present at the mouths of short, steep bedrock canyons. The fan sediments form a continuous apron along the base of the bluff northeast of Homer and contain varying amounts of sand, silt, and gravel. Glacial ice is thought to have last invaded the Kenai Lowland near Homer about 14,000 to 15,000 years ago, during the Skilak stade of the Naptowne Glaciation.

Morainal deposits that were formed during the Knik Glaciation are found at higher elevations on Lookout Mountain and Diamond Ridge (Karlstrom, 1964). These deposits are overlain by thin layers of tephra interbedded with peat and organic silt (R.D. Reger, Alaska Division of Geological and Geophysical Surveys, oral commun., 1995). Till, also from the Knik Glaciation, was deposited at FAA facility sites DR1 and DR2 (R.D. Reger, Alaska Division of Geological and Geophysical Surveys, oral commun., 1995). These deposits are overlain by silt loam (loess) interbedded with thin layers of volcanic ash (Hinton, 1971). Surficial deposits near FAA facilities H1 and H2 include layered silt loam and fine sandy loam or silt loam overlying silty clay loam (Hinton, 1971). Surficial deposits near the airport are primarily silty loams, with areas of gravelly sand, silt clay loams, and peat as individual deposits or in layers (Hinton, 1971).

Surficial deposits near Homer generally are free of permafrost (Ferrians, 1965; Hopkins and others, 1955). Permafrost is present as small isolated masses at high elevations and in lowland areas where insolation (solar warming of the ground) is low and the insulating properties of the surficial sediments are high (Ferrians, 1965). It is unlikely that permafrost is present at any of the Homer FAA facilities (Hopkins and others, 1955).

Bedrock Geology

Barnes and Cobb (1959) describe the bedrock geology near Homer as moderately indurated sandstone, siltstone, and claystone. These rock units generally are intergraded and locally interbedded with thin lenses of fine conglomerate, volcanic ash, and beds of subbituminous and lignitic coal. The beds of coal range in thickness from 2 to 200 cm. Distinct bands and scattered nodules of concretionary ironstone and other iron-bearing materials are found throughout the bedrock. Fossil flora in these rocks indicate that they are of Tertiary age (Wolfe and others, 1955).

Bedrock thickness near Homer is unknown. A test well drilled by Occidental Petroleum Corporation about 4 km west of the Homer FAA facility DR1 reached a depth of 3,225 m and did not penetrate the entire sequence of Tertiary age rocks (McGee, 1977; Magoon and others, 1976; Waller and others, 1968). The sedimentary bedrock exposed near Homer is similar to that found throughout the Kenai Lowland (Adkison and others, 1975; Barnes and Cobb, 1959; Karlstrom, 1964; McGee, 1977; Magoon and others, 1976; Waller and others, 1968). In general, the bedrock near Homer strikes east-west and dips gently to the north (Magoon and others, 1976).

Homer lies in an active geologic region that has produced numerous earthquakes and volcanic eruptions within this century (Kienle and Swanson, 1985). Four thrust faults and

numerous normal faults which generally strike northeast lie within 100 km of Homer (Magoon and others, 1976). One normal fault is believed to extend through Homer near the airport. Four volcanoes, Douglas, Augustine, Iliamna, and Redoubt, lie within 100 km of Homer (fig. 1; Wood and Kienle, 1992). Two of those volcanoes, Redoubt and Augustine, have erupted within the last 10 years. Although Homer is separated from the volcanoes by Cook Inlet, it has received ash fallout from numerous historic eruptions (Brantley, 1990).

HYDROLOGY

Surface water is the primary source of public drinking water. Ground water is available at most locations, but the potential for high capacity municipal wells is uncertain. Thus, ground water has not been developed as a public drinking-water supply. Streamflow is generated by snowmelt and rainfall runoff. Ground water is recharged by infiltration of precipitation and surface water. It is discharged into streams as base flow or as springs and seeps along the bluff north of Homer.

Surface Water

The dominant surface-water body near Homer is Kachemak Bay which borders Homer on the south and is the final receptor of local surface drainage. Kachemak Bay provides ship and ferry access to Homer and is used extensively for commercial and recreational fishing. The tides near Homer generally range from a mean high-water elevation of 5.2 m above sea level to a mean low-water elevation of 0.5 m above sea level (Chu and others, 1987; National Oceanic and Atmospheric Administration, 1993). The FAA facilities are not affected by tidal influences. Two inland lakes, Beluga Lake and Lampert Lake, collect much of the surface drainage from the municipal airport and the city of Homer. Because of its size and proximity to the airport, Beluga Lake is used as a seaplane base.

Numerous small streams drain Homer and the upland area to the north (fig. 2). Fritz Creek originates on the eastern slopes of Lookout Mountain and drains part of the Lookout Mountain FAA facility. Fritz Creek drains into Kachemak Bay about 9 km northeast of the airport. A USGS gaging-station, 15239500 Fritz Creek near Homer, operated from 1986 to 1992 about 6 km east of the Lookout Mountain facility (fig. 2; U.S. Geological Survey, 1994). The area of the drainage basin upstream from the gaging station is about 27 km^2 (U.S. Geological Survey, 1994). Mean monthly and annual flow, as well as the daily maximum and minimum streamflow, for the period of record are summarized in table 2. Mean monthly discharge ranged from a May 1988 maximum of about 1.7 m^3/s to a February 1991 minimum of 0.06 m^3/s. The mean annual discharge for the period of record was about 0.35 m^3/s. The station currently operates as a partial record station and only peak flows are reported.

Table 2. Mean monthly and annual flow at stream-gaging station 15239500, Fritz Creek near Homer, water years 1986-1992.

[Values in cubic meters per second]

	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Annual
Mean	0.56	0.22	0.21	0.23	0.15	0.14	0.53	1.0	0.40	0.17	0.18	0.36	0.35
Monthly mean maximum	0.97	0.49	0.52	0.48	0.23	0.21	0.73	1.7	0.81	0.26	0.26	0.61	0.52
Monthly mean minimum	0.26	0.13	0.07	0.07	0.06	0.06	0.26	0.56	0.21	0.10	0.10	0.21	0.26
	(Record maximum 2.3 m^3/s, October 15, 1986)												
	(Record minimum 0.06 m^3/s, August 15, 1990)												

Twitter Creek originates on the southwestern slopes of Lookout Mountain and drains part of the FAA facility on Lookout Mountain. Twitter Creek also receives runoff from the FAA facilities on Diamond Ridge through its tributary Bridge Creek, downstream from the Bridge Creek Reservoir (fig. 2, appendix 1). Twitter Creek flows into the Anchor River which empties into Cook Inlet about 12 km northwest of Homer. A USGS gaging-station, 15239880 Twitter Creek near Homer, operated from 1971 to 1973 about 6 km east of the Lookout Mountain facility (fig. 1; U.S. Geological Survey, 1994). The area of the drainage basin upstream from the gaging station is about 42 km^2 (U.S. Geological Survey, 1994). Mean monthly and annual flows for the period of record are summarized in table 3. Mean monthly discharge ranged from a May 1973 maximum of about 2.5 m^3/s to a March 1973 minimum of about 0.12 m^3/s. The mean annual discharge for the period of record was 0.60 m^3/s.

Table 3. Mean monthly and annual flow at stream-gaging station 15239880, Twitter Creek near Homer, water years 1971-1973.

[Values in cubic meters per second (m^3/s)]

	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Annual
Mean	1.2	0.30	0.17	0.14	0.13	0.13	0.23	2.3	1.0	0.33	0.53	0.68	0.60
Monthly mean maximum	1.2	0.31	0.19	0.16	0.14	0.13	0.34	2.5	1.1	0.33	0.70	1.1	0.61
Monthly mean minimum	1.1	0.29	0.15	0.13	0.12	0.12	0.13	2.2	0.91	0.33	0.42	0.43	0.57
	(Record maximum 10.9 m^3/s, May 15, 1973)												
	(Record minimum 0.11 m^3/s, April 4, 1973)												

Diamond Creek originates on the southern slopes of Diamond Ridge and receives part of the runoff from the FAA facilities at Diamond Ridge. Diamond Creek drains into Kachemak Bay about 10 km west of Homer. Between May 4, 1962 and September 10, 1975, 66 intermittent discharge measurements were taken on Diamond Creek about 7 km northwest of Homer (Scully and others, 1978). The mean discharge was 0.63 m^3/s, the maximum discharge was 4.2 m^3/s, and the minimum

discharge was 0.02 m^3/s. Diamond Creek has a drainage area of about 14 km^2. Discharge and drainage area records for smaller streams near Homer may be found in a report by Scully and others (1978).

Surface-Water Quality

Recent water-quality data for surface-water sources near Homer are shown in table 4 (U.S. Geological Survey, 1995). Where only one sample has been analyzed, one number is presented. Table 4 shows that very few water-quality data are available for Twitter Creek.

Table 4. Water-quality data from surface-water sources near Homer.

(Values in milligrams per liter unless otherwise indicated; µS/cm, microsiemens per centimeter at 25°C)

Constituent (or property)	Regulated Level[a]	Fritz Creek	Twitter Creek	Diamond Creek	Bridge Creek	Beluga Lake
Sulfate (SO_4)	250[b]	0 - 12	—	0 - 4.9	0.60 - 2.6	46
Fluoride (F)	2.0[c]	<0.10 - 0.30	—	<0.10 - 0.40	<0.10 - 0.30	0.30
Chloride (Cl)	250[d]	3.2 - 6.1	—	2.5 - 13	3.0 - 6.4	600
Iron (dissolved; Fe)	0.3[d]	0.17 - 0.54	—	0.32 - 2.5	0.20	<0.01
Total dissolved solids	500[d]	37 - 120	—	45 -77	0.19 - 0.44	1080
pH (units)	6.5 - 8.5[d]	6.6 - 7.9	—	6.7 - 7.8	6.3 - 7.5	7.4
Specific conductance (µS/cm)	—	43 - 155	<25 - 85	45 - 98	40 -78	2060

[a]From U.S. Environmental Protection Agency, May 1995.
[b]Maximum Contaminant Level.
[c]Maximum Contaminant Level-Under Review
[d]Secondary Maximum Contaminant Level.

Floods and Hydrologic Hazards

Flood hazards in Homer were rated low by the U.S. Army Corps of Engineers (1993). The Federal Emergency Management Agency (1980) also evaluated the flood hazards of the Kenai Peninsula including Homer. This study indicated that localized flooding may occur in smaller streams and drainage ditches in the city of Homer. Flooding of the low-lying coastal areas at Homer could also be caused by storm surge waves during high tides or by seismic or volcanogenic tsunamis (Federal Emergency Management Agency, 1980: Kienle and others, 1987; Kienle and Swanson, 1985). Although areas such as Homer Spit may be directly affected by storm surges or tsunamis, the FAA facilities are likely at sufficient elevations to avoid them.

Hydrologic hazards of concern near the FAA facilities include those that are caused by earthquakes. Waller (1966) reports that the March 27, 1964 earthquake shook Homer and the surrounding area for about 3 minutes and caused 0.6 to 1.8 m of subsidence of the mainland and Homer Spit. The earthquake caused several landslides along sea bluffs and at least one submarine landslide at the end of the Homer Spit. Inland hydrologic hazards caused by this earthquake

included ice breakage on Beluga Lake, sanding of some wells, and a temporary loss of water in some wells.

Ground Water

Ground water near Homer has been reported at depths ranging from just below land surface to more than 3,200 m below land surface (Waller, 1963). Two aquifers are present: an unconfined aquifer within surficial deposits of Quaternary age and a bedrock aquifer (Waller and others, 1968). The unconfined aquifer is bounded on the west by Cook Inlet, on the south and east by Kachemak Bay, and on the north by bedrock ridges and streams. Ground-water boundaries at greater depths are unknown. Total recharge to these aquifers is estimated to be about 13 cm/yr (Waller and others, 1968).

Wells that draw from the surficial aquifer generally yield between 0.32 and 1.6 L/s (Waller and others, 1968). One well (Well 51 in Waller, 1963; Waller and others, 1968) was reported to have yielded 4.4 L/s. Wells at lower elevations on the Homer bench generally have higher yields than wells at higher elevations in the same surficial materials.

Waller and others (1968) believe that bedrock constitutes the most productive aquifer system near Homer. Wells drilled into bedrock north of the bluff have considerably larger yields than wells drilled in Quaternary age surficial deposits (Waller and others, 1968). One bedrock well adjacent to Bridge Creek yielded more than 5 L/s and had a specific capacity of about 0.2 L/s per 1 m of drawdown (Waller and others, 1968). Other bedrock wells near Homer yield between 3.6 and 6.3 L/s (Waller and others, 1968). The deepest well yielding water near Homer is a 3,225 m-deep oil exploration well (McGee, 1977; Magoon and others, 1976; Waller and others, 1968).

Data from a salinity study of the Cook Inlet region indicate the presence of a lens of fresh water about 90 m thick near the Homer shore (McGee, 1977). The salinity of the brackish water found beneath the freshwater lens increases with depth from about 3,425 mg/L at 25 m above sea level to more than 17,100 mg/L at 2,000 m below sea level (McGee, 1977). The Homer area is underlain by brackish water at a relatively shallow depth, and the use of fresh water at high rates may cause salt water to enter the wells (McGee, 1977).

A well (Well 17 in Waller, 1963) was drilled for the FAA facilities at the Homer Municipal Airport, to a depth of about 150 m but was abandoned after drilling through a layer of sand carrying salt water. Another well (Well 5 in Waller, 1963) was drilled to a depth of about 150 m near the Homer FAA facilities H1 and H2. This well was also abandoned after it was determined to yield an inadequate supply of water (Waller, 1963). No salt water was discovered in this well, which is evidence that the lens of fresh water grows thicker inland.

Between April 1962 and July 1963, water levels were intermittently recorded for a well between the Homer FAA facilities H1 and H2 (appendix 2; fig. 3). Water levels fluctuated between 0.8 and 3.3 m below land surface (appendix 2). Water-level data also were collected for a domestic well on Diamond Ridge (fig. 4). Water levels from June 1978 to August 1993 ranged from about 2 to 3.7 m below land surface (U. S. Geological Survey, 1994).

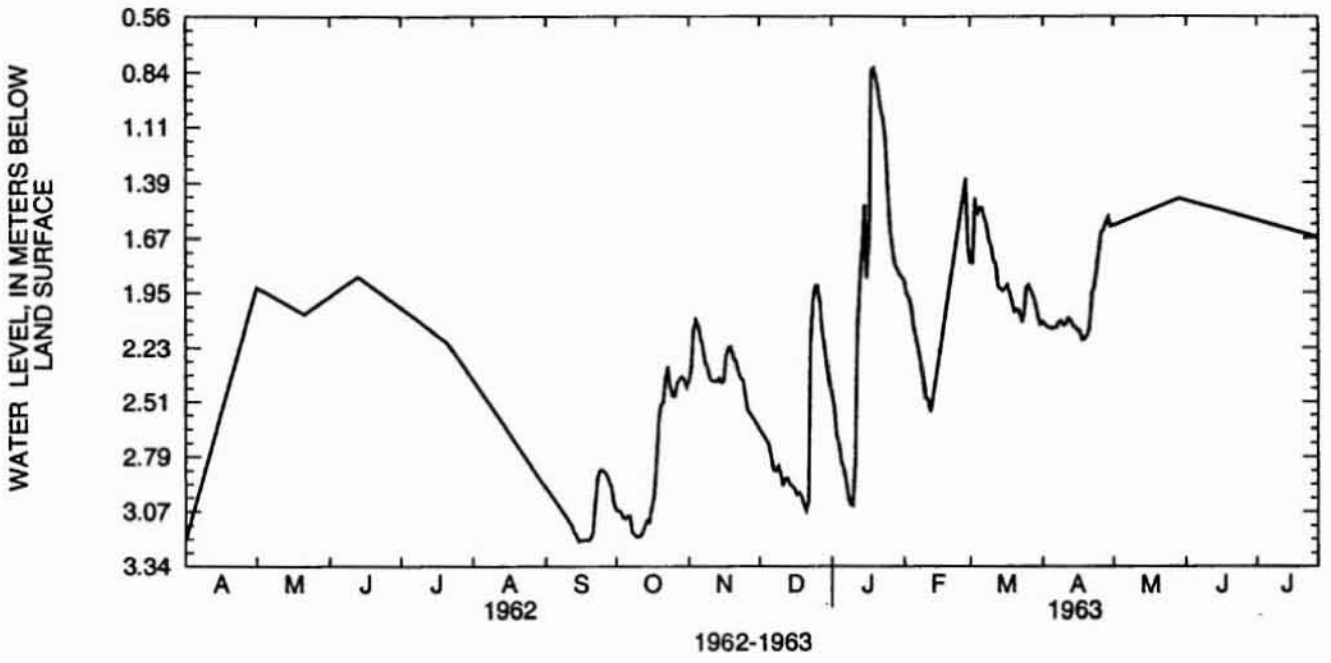

Figure 3. Daily water levels for a well near Homer, April 1962 to July 1963.

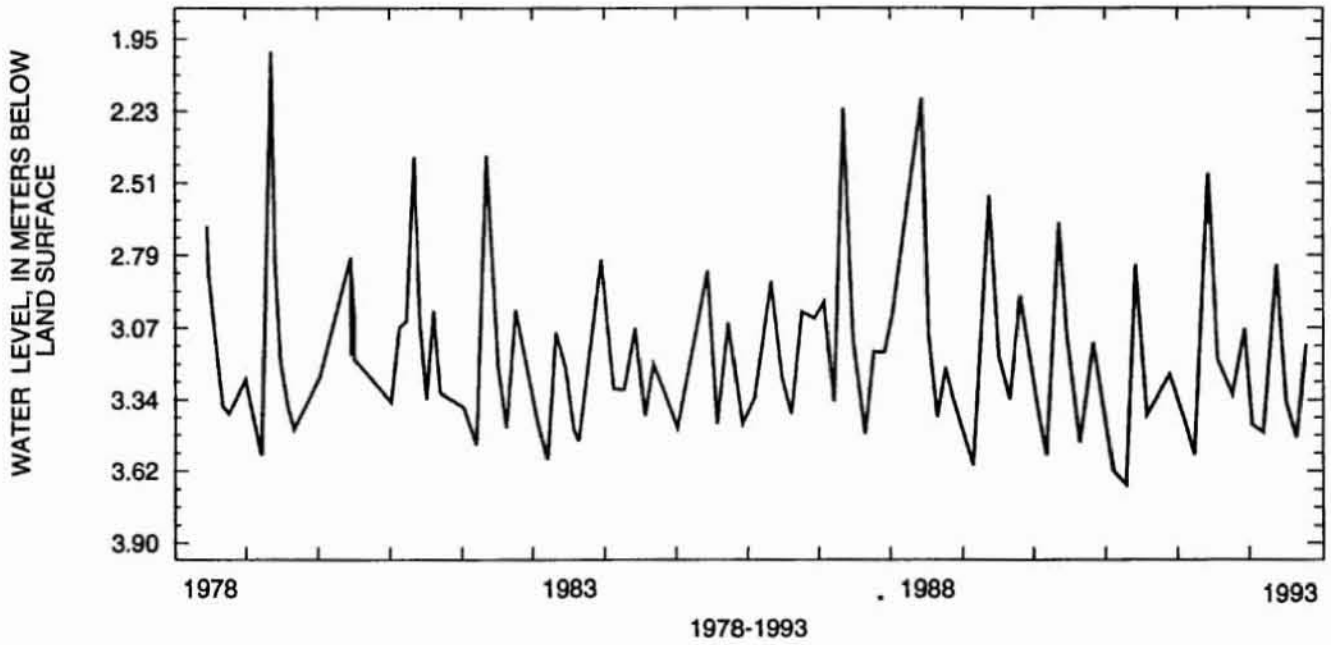

Figure 4. Water levels for a well on Diamond Ridge near Homer, June 1978 to August 1993.

Ground-Water Quality

The quality of ground water near Homer was discussed by Waller and others (1968). Ground water near Homer typically is of sodium bicarbonate or calcium bicarbonate type. Hardness as $CaCO_3$ and $MgCO_3$ ranges from about 4 mg/L to more than 200 mg/L. Softer water generally is from bedrock and harder water generally is from surficial deposits. The pH of the water ranges from 6.7 to 8.5. Concentrations of iron average about 4 mg/L but may be as high as 30 mg/L. These values are higher than the U.S. Environmental Protection Agency Secondary Maximum Contaminant Level of 0.3 mg/L for drinking water and may result in staining of plumbing fixtures

or poor taste in the water, but generally do not prohibit the water from being used for drinking (U.S. Environmental Protection Agency, 1995). There are some indications of seasonal variations in iron concentrations and possible decreases in concentration with pumping (Waller and others, 1968).

Water-quality data from wells near Homer are shown in table 5. Well 110 (table 5; Waller, 1963) serves the Homer FAA facilities at the airport. Four additional wells were drilled for the FAA to augment the supply of Well 110. Two wells, 17 and 17a (Waller, 1963) were abandoned due to high sodium concentrations. A third well 17b was drilled to a depth of about 5.5 m, and was abandoned due to insufficient yield. The fourth well 17c was dug to a depth of 5.5 m and reportedly yielded water of poor quality.

Table 5. Water-quality data from wells near Homer.

(Values in milligrams per liter unless otherwise indicated; µS/cm, microsiemens per centimeter at 25°C)

Constituent (or property)	USEPA (1995) Drinking water regulations	Well number (Waller, 1963)				
		Well 13	Well 21a	Well 49a	Well 73	Well 110
Sulfate (SO_4)	250[a]	72	5.0	1.0	3.5	7.0
Fluoride (F)	2.0[b]	0.1	.2	.2	.3	0.1
Chloride (Cl)	250[c]	16	16	19	7.8	41
Iron (dissolved; Fe)	0.3[e]	1.9	.2	11[d]	2.0	0.0[e]
Total dissolved solids	500[e]	130	442	154	156	175
pH (units)	6.5 - 8.5[e]	6.9	7.7	6.7	7.0	8.2
Specific conductance (µS/cm)	—	177	691	201	223	296

[a]Maximum Contaminant Level.
[b]Maximum Contaminant Level-Under Review.
[c]Secondary Maximum Contaminant Level.
[d]Total iron content.
[e]Less than detectable quantity

Drinking-Water Sources and Water Use

The Bridge Creek Reservoir is the principal source of public drinking water for Homer, including the FAA facilities (Ecology and Environment, 1992). No other public water source has been developed (Jim Hobbs, City of Homer Public Works, oral commun, 1995). The reservoir has a maximum storage capacity of about 1,163,000 m^3 and a normal storage capacity of about 678,000 m^3 (appendix 1). The maximum safe discharge over the spillway is 4.3 m^3/s (appendix 1). Aerial photographs and topographic maps indicate that failure of the Bridge Creek Dam would cause the loss of the public water supply, but would not cause flooding in the city of Homer or at any of the Homer FAA facilities. The city of Homer presently uses about 3,800,000 L/d from the Bridge Creek Reservoir and has applied to the State of Alaska for a permit to obtain an additional 3,400,000 L/d (Jim Hobbs, City of Homer Public Works, oral commun, 1995). Water from the Bridge Creek reservoir is chemically treated, filtered, and distributed to local residents and businesses (Jim Hobbs, City of Homer Public Works, oral commun, 1995). Private wells may augment or replace the public supply.

Four streams within 8 km of Homer—Fritz, Twitter, Diamond, and Bridge Creeks—could be used as alternative sources of drinking water. Beluga Lake and Lampert Lake also might be used;

however, Lampert Lake is near the coast and may be affected by tides. Potable ground water is plentiful between the land surface and about 90 m depth. Many private residences and some FAA facilities have wells which yield adequate drinking water. However, ground water should be considered a secondary water source for the city supply because the use of fresh water at high rates may cause salt water to enter the wells (McGee, 1977).

SUMMARY

Homer is near the southern end of the Kenai Peninsula facing Kachemak Bay. North of Homer, a bluff rises to more than 300 m elevation. The Homer FAA facilities are on the slopes below the bluff and on ridges and mountains north of the bluff. Surficial materials at the FAA facilities consist of glacial and alluvial deposits. Bedrock consists of consolidated sand, silt, and clay interbedded with layers of coal and volcanic ash. Ground water is available in a shallow surficial aquifer and a deeper bedrock aquifer. Salt water may enter wells and local aquifers if fresh ground water is used at high rates. The city of Homer obtains its drinking water from the Bridge Creek Reservoir. Alternative sources of drinking water include non-brackish ground water, the streams surrounding Homer, as well as Beluga Lake and Lampert Lake. Private wells may individually augment or replace the public supply.

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APPENDIX 1

Alaska Inventory of Dams: Inventory data for the Bridge Creek Dam

ALASKA INVENTORY OF DAMS
INVENTORY DATA

BRIDGE CREEK DAM
KENAI PENINSULA COUNTY

DAM INFORMATION
NATIONAL INVENTORY FIELDS

1.	DAM NAME	BRIDGE CREEK DAM
2.	OTHER DAM NAMES	BRIDGE CREEK DAM
3.	STATE ID	00101
4.	NATIONAL ID	AK00101
5.	LATITUDE DEG	59
6.	LATITUDE MIN	39
7.	LATITUDE SEC	0
8.	LONGITUDE DEG	150
9.	LONGITUDE MIN	31
10.	LONGITUDE SEC	0
11.	SECTION,TOWNSHIP,RANGE	
12.	COUNTY	KENAI PENINSULA
13.	RIVER OR STREAM	BRIDGE CREEK
14.	NEAREST CITY-TOWN	HOMER
15.	DISTANCE CITY-TWN (MILE)	2
16.	OWNER NAME	CITY OF HOMER
17.	OWNER TYPE	LOCAL GOVERNMENT
18.	NONFED DAM ON FED PROP	NO
19.	DAM TYPE	EARTH
20.	PURPOSE	WTR SUPPLY
21.	YEAR COMPLETED	1975
22.	DAM LENGTH (FT)	1200
23.	DAM HEIGHT (FT)	65
24.	STRUCTURAL HEIGHT (FT)	65
25.	HYDRAULIC HEIGHT (FT)	52
26.	MAXIMUM DISCHARGE (CU FT)	150
27.	MAXIMUM STORAGE (ACRE FT)	943
28.	NORMAL STORAGE (ACRE FT)	550
29.	SURFACE AREA (ACRES)	36
30.	DRAINAGE AREA (SQ MILES)	3
31.	DOWNSTREAM HAZARD	SIGNIFICANT
32.	EMERGENCY ACTION PLAN	NO
33.	PHASE I INSPECTION	YES
34.	INSPECTION DATE	10/11/89

6/22/95 7:19 am
DAMS/R Pg 1

DAM INFORMATION
ADDITIONAL STATE FIELDS

35.	NEXT INSPECTION DATE.....	10/10/92
36.	PERMAFROST Y/N.....	NO
37.	FOUNDATION.....	
38.	METHOD OF ACCESS.....	
39.	ENGINEERING COMPANY.....	SHANNON & WILSON

OWNER INFORMATION

1.	OWNER NAME.....	CITY OF HOMER
2.	OWNER TYPE.....	LOCAL GOVERNMENT
3.	CONTACT NAME.....	JIM HOBBS
4.	CONTACT TITLE.....	
5.	CONTACT SALUTATION.....	
6.	ADDRESS1.....	CITY OF HOMER
7.	ADDRESS2.....	3575 HEATH STREET
8.	ADDRESS3.....	
9.	CITY.....	HOMER
10.	STATE.....	AK
11.	ZIP.....	99603
12.	PHONE.....	(907) 235-3170
13.	FAX.....	
14.	EMERGENCY CONTACT NAME.....	
15.	EMERGENCY CONTACT PHONE....	
16.	OWNER NOTE.....	
17.	DATE.....	5/29/90

ENGINEERING CO. INFORMATION

1.	ENGINEERING COMPANY.....	SHANNON & WILSON
2.	CONTACT NAME.....	FRED R. BROWN, P.E.
3.	CONTACT TITLE.....	SENIOR ASSOCIATE
4.	CONTACT SALUTATION.....	
5.	ADDRESS1.....	SHANNON & WILSON
6.	ADDRESS2.....	5621 ARCTIC BLVD
7.	ADDRESS3.....	
8.	CITY.....	ANCHORAGE
9.	STATE.....	AK
10.	ZIP.....	99518
11.	PHONE.....	(907) 561-2120
12.	FAX.....	
13.	ENGINEER NOTE.....	
14.	DATE.....	

DAM NAME: BRIDGE CREEK DAM
COUNTY: KENAI PENINSULA
NATIONAL ID: AK00101

INSPECTION INFORMATION

1.	GENERAL CONDITION.....	GOOD

DAM NOTE

APPENDIX 2

A well log and water-level data for one well in Homer

[Data from this well have been previously unpublished whereas all other wells mentioned in this report were published by Waller (1963).]

CANDIDATE, FED OBS. WELL.

FORM 9-146

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

Report Page No. 1

WATER RESOURCES DIVISION
GROUND WATER BRANCH

AREA
~~COUNTY~~ Homer

STATE Alaska

WATER LEVELS IN OBSERVATION WELLS

Hom 39. Harry Gregoire. NE¼NE¼ sec. 19, T. 6 S., R. 13 W, Bartlett St. Drilled unused artesian well in sand to Tertiary age, diam 6 in, depth 66 ft, cased to 60. Lsd 225 ft above msl. MP top of casing, 2.00 ft above lsd.

Highest water level 6.13 June 13, 1962; lowest 10.54 April 11, 1962
Records available 1962- Water level below lsd

Date	Water level	Date	Water level	Date	Water level	Date	Water level
1962							
Apr. 11	10.54						
May 1	6.31						
May 21	6.76						
June 13	6.13						
July 21	7.22						
Sept. 12	10.29						
Recorder Installed							

GPO 908536

FORM NO. 9—1904—E

U.S. DEPT. OF INTERIOR
GEOLOGICAL SURVEY
WATER RESOURCES DIVISION

GROUND WATER SITE INVENTORY
WATER-LEVEL DATA

WELL NO. SC-6-13-19-11
MP HEIGHT -2
AK-10764

Site Ident. No. 593857151324701 (5 … 19) | R = 234 * | T = A *

DATE	WATER LEVEL (BELOW LSD)	STATUS	METHOD	HOLD	CUT	DEPTH BELOW MP	REMARKS	DATE PUNCHED	DATE ENTERED
235 # 04/11/1962 *	237 = 10.54 *	238 = *	239 = S *						
235 # 05/01/1962 *	237 = 6.31 *	238 = *	239 = S *						
235 # 05/21/1962 *	237 = 6.76 *	238 = *	239 = S *						
235 # 06/13/1962 *	237 = 6.13 *	238 = *	239 = S *						
235 # 07/21/1962 *	237 = 7.22 *	238 = *	239 = S *						
235 # 09/12/1962 *	237 = 10.29 *	238 = *	239 = S *						
235 # 10/17/1962 *	237 = 9.81 *	238 = *	239 = S *						
235 # 12/05/1962 *	237 = 8.93 *	238 = *	239 = S *						
235 # 12/13/1962 *	237 = 9.50 *	238 = *	239 = S *						
235 # 03/30/1963 *	237 = 6.79 *	238 = *	239 = S *						
235 # 04/24/1963 *	237 = 6.92 *	238 = *	239 = S *						
235 # 05/29/1963 *	237 = 4.84 *	238 = *	239 = S *						
235 # 07/27/1963 *	237 = 5.48 *	238 = *	239 = S *						
235 # / / *	237 = . *	238 = *	239 = *						
235 # / / *	237 = . *	238 = *	239 = *						
235 # / / *	237 = . *	238 = *	239 = *						
235 # / / *	237 = . *	238 = *	239 = *						
235 # / / *	237 = . *	238 = *	239 = *						
235 # / / *	237 = . *	238 = *	239 = *						
235 # / / *	237 = . *	238 = *	239 = *						
235 # / / *	237 = . *	238 = *	239 = *						
235 # / / *	237 = . *	238 = *	239 = *						
235 # / / *	237 = . *	238 = *	239 = *						
235 # / / *	237 = . *	238 = *	239 = *						
235 # / / *	237 = . *	238 = *	239 = *						

Keypunched 6/7 KLR

GPO : 1976 OL—214—152

Method of Measurement	239 =	A	C	E	G	H	L	M	R	S	T	V	Z
		airline,	calibrated, airline	estimated,	pressure, gage	calibrated, pressure gage	geophysical, logs	manometer,	reported,	steel, tape	electric, tape	calibrated electric tape	other

Site Status	238 =	D	E	F	G	H	Ø	P	R	S	T	V	X	Z
		dry,	flowed recently	flowing,	nearby, flowing	nearby, recently flowing	obstruction,	pumping,	recently, pumped	nearby, pumping	nearby, recently pumped	foreign, substances	surface-water, effect	other

20

FORM 9-145 UNITED STATES DEPARTMENT OF THE INTERIOR-GEOLOGICAL SURVEY-WATER RESOURCES DIVISION-GROUND WATER BRANCH

AREA ~~COUNTY~~ Homer

WATER LEVELS IN OBSERVATION WELLS

STATE Alaska YEAR 1962

Hom 39. Harry Gregoire. NE¼NE¼ sec. 19, T. 6 S., R. 13 W, Bartlett St. Drilled unused artesian well in sand to Tertiary age, diam 6 in, depth 66 ft, cased to 60. Lsd 225 ft above msl. MP top of casing, 2.00 ft above lsd. Recorder installed September 12, 1962.

Highest water level 6.13 June 13, 1962; lowest 10.55, September 15, 1962; Records available 1962

(Daily highest water level below lsd. from recorder graph)

Day	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1										10.03	7.88	
2										10.05	7.68	
3										10.07	7.04	
4										10.16	6.86	
5										10.18	6.94	h8.93
6										10.14	7.13	9.16
7										10.14	7.29	9.36
8										10.40	7.56	9.38
9										10.44	7.64	9.30
10										10.48	7.81	9.41
11										10.47	7.87	9.62
12									h10.29	10.42	7.87	9.50
13									10.39	10.30	7.89	h9.50
14									10.46	e10.21	7.83	9.60
15									10.55	e10.23	7.90	9.63
16									10.54	--	7.89	9.67
17									10.54	h9.81	7.46	9.77
18									10.53	9.32	7.31	9.74
19									10.54	8.58	7.30	9.80
20									10.51	8.28	7.46	9.93
21									10.40	8.25	7.54	10.04
22									9.94	7.80	7.71	9.90
23									9.48	7.63	7.82	7.20
24									9.37	7.98	7.87	6.50
25									9.36	8.13	8.14	6.29
26									9.39	8.13	8.36	6.29
27									9.44	7.92	--	6.58
28									9.55	7.85	--	7.04
29									9.66	7.80	--	7.28
30									9.91	7.85	--	7.62
31										7.97		7.87

GPO 855703 e Estimated h Tape Measurement

12

FORM 9-145 UNITED STATES DEPARTMENT OF THE INTERIOR-GEOLOGICAL SURVEY-WATER RESOURCES DIVISION-GROUND WATER BRANCH

AREA ~~COUNTY~~ Homer

STATE Alaska YEAR ~~1963~~ 1963

WATER LEVELS IN OBSERVATION WELLS

Hom 39. Harry Gregoire. NE¼NE¼ sec. 19, T. 6 S., R. 13 W., Bartlett St. Drilled unused artesian well in sand to Tertiary age, diam 6 in, depth 66 ft, cased to 60. Lsd 225 ft above msl. MP top of casing, 2.00 ft above lsd. Recorder removed May 29, 1963. No measurements during 1964. Measurements discontinued June 21, 1964.

Highest water level 2.68 January 19 19 63; lowest 10.55 September 15, 19 62; Records available 1962-63

(Daily highest water level below lsd. from recorder graph)

Day	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1	8.08	6.20	5.89	6.89				Discontinued				
2	8.33	6.42	5.90	6.93								
3	8.78	6.48	4.83	6.97								
4	8.92	6.63	5.11	6.99								
5	9.23	6.94	4.99	7.00								
6	9.33	7.14	4.99	6.98								
7	9.51	7.34	5.14	6.98								
8	9.82	7.55	5.28	6.89								
9	9.94	7.84	5.51	6.88								
10	9.96	8.17	5.62	6.94								
11	9.17	8.19	5.85	6.92								
12	7.06	8.40	5.92	6.83								
13	e6.31	--	6.30	6.86								
14	--	--	6.34	6.95								
15	4.94	--	6.37	6.98								
16	6.16	--	6.33	7.03								
17	5.50	--	6.28	7.04								
18	2.72	--	6.40	7.18								
19	2.68	--	6.56	7.16								
20	2.84	--	6.72	7.10								
21	3.08	--	6.68	7.00								
22	3.34	--	6.70	6.40								
23	3.53	--	6.90	6.33								
24	3.87	--	6.78	h6.02								
25	4.64	--	6.32	5.67								
26	5.36	--	6.28	5.40								
27	5.64	4.50	6.36	5.35			h5.48					
28	5.91	5.63	6.46	5.22								
29	6.01	--	6.58	5.15	h4.84							
30	6.09		h6.79	5.30								
31	6.14		6.92									

GPO 855703 e Estimated h Tape Measurement

Section: 11

S 151, 32, 47.

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
WATER RESOURCES DIVISION AK-10764

WELL SCHEDULE

Date 8/9, 19 62 Field No. 39

Record by BER Office No.

Source of data well owner - P.O.

1: *Location:* State Alaska ~~County~~ SC

Map Seldovia (C-5) tbl 4.

NE ¼ NE ¼ sec. 19 T 6 S N R 13 E W

2. *Owner:* Harry Gregoire Address 988 Hope

Tenant vacant Address Bush St

Driller Thorp Address Kenai

3: *Topography* Slope

4. *Elevation* 225 ft. above below SL

5. *Type:* Dug, drilled, driven, bored, jetted Nov 1957

6. *Depth:* Rept. 66 ft. Meas. ft.

7. *Casing:* Diam. 6 in., to in., Type

Depth 60 ft., Finish OE

8. *Chief Aquifer* From ft. to ft.

Others

9. *Water level* 13.54 ft. rept. meas. 4-11 1962 above below TOC

which is 2.00 ft. above ~~below~~ surface

10. *Pump:* Type Capacity G. M.

Power: Kind Horsepower

11. *Yield:* Flow G. M., Pump 320 G.M., Meas., Rept. Est.

Drawdown ft. after hours pumping G. M.

12. *Use:* Dom., Stock, PS., RR., Ind., Irr., Obs. Removed 4/11/62

Adequacy, permanence pump 76

13. *Quality* Temp °F.

Taste, odor, color Sample Yes No

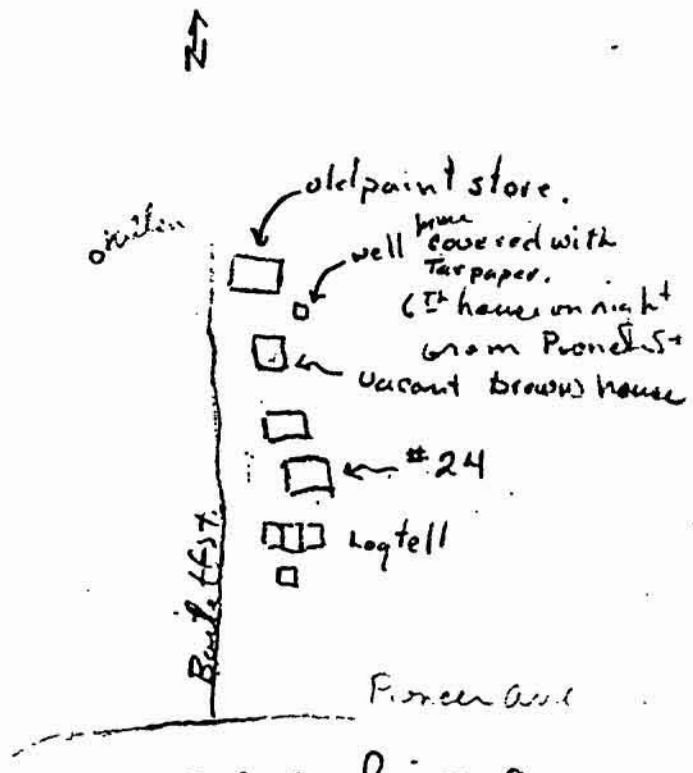
Unfit for

14. *Remarks:* (Log, Analyses, etc.) may be dug well in gravel?

Installed WL recdr Fall 1962

U. S. GOVERNMENT PRINTING OFFICE 16—62891-1

0 - Muskeg & cl
9 - Muskeg & cl
13 - SS & C
- BC
16 - S (some water)
19
32 - BC
34 - S (some water)
39 - SS & C
50 - C
51 - SS
62 - FS (water)
66 - clay



0.23 mi N of Pioneer Ave
150' E of Bartlett St

4/11/62
25-9.18 Top of NW corner rock hole 2 cc/p
which is about 3' above OC open
use for obs well - measure difference (3.28) when
water in pit drawn away
Evidently affected by Keller pumping.

WRD Exp. (GW)
April 1966

U. S. DEPT. OF THE INTERI

MASTER CARD

Record by G. ANDERSON/RH

State

Latitude: 57 19

24

9-195
(July 1949)

Unused

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
WATER RESOURCES DIVISION

TD - 66'

WATER LEVEL MEASUREMENTS (Office) FIELD No. # 39

OWNER Harry Gregoire OFFICE No.

LOCATION in p.h. on Bartlett St. PROJECT Homer

MEASURING POINT Top of casing 2.00' ab lsd

ELEVATION OF ~~MEASURING POINT~~ lsd - 225'

DATE	HOUR	DEPTH TO WATER MP	~~DEPT. OF WATER SURFACE~~ DWLSD	MEAS. BY	REMARKS (Nearby wells pumping, etc.)
1963					
4-24	Changed recorder - new battery Rmv + depth				
5-29	11:	4.84'	4.84'	Rw	Changed recorder
7-27	1830	7.48'	5.48'	Rw mm	9-1-52
1964					
4-5	1320	—		R	Recorder
5-18	1235	—		Rmv	still frozen @ ~5'
6-21	1855	No MPOS		Rmv	Evidently pulled in 2.5'
		Line			

59258-1 U.S. GOVERNMENT PRINTING OFFICE

~~Vacant E of Killey~~ Unused

9-195
(July 1949)

TD-66'
+ dap

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
WATER RESOURCES DIVISION

WATER LEVEL MEASUREMENTS (Office) FIELD No. 39

OWNER Harry Gregoire OFFICE No.

LOCATION ~~in~~ p.h. on Bartlett ST PROJECT Homer

MEASURING POINT Top of casing 2.00' ab lsd

ELEVATION OF ~~MEASURING POINT~~ lsd = 225'

DATE	HOUR	DEPTH TO WATER MP	~~ELEV. OF WATER SURFACE~~ OWLSD	MEAS. BY	REMARKS (Nearby wells pumping, etc.)
1962		start			
4-11	2°°P	13.54'	11.54'	Rmv	25-9.18 from rec which is 3:28 ab
5-1	1050	8.31'	6.31'	Rmv	15-6.69 TOC
5-21	1625	8.76'	6.76'	Rmv	16-7.24
6-13	0910	8.13'	6.13'	Rmv	10-1.87
7-21	1415	9.22'	7.22'	Rmv	10-0.78
9-12	1110	12.29'	10.29'	Rmv	13-0.71
	Installed recorder - see charts				
10-17	18	operating OK - changed charts			
10-25		do			
12-5		changed chart			
12-13		new battery			
1963					
1-15		do			Shortened cable, wire at frozen in ice outside of casing, cable off pulley
3/27	0800	7.8			9-1.18
				M	10-7.28 Reset Standard
3-27	1330	operating OK		R	winter
5-29	1015	Removed recorder for Rest			

50258-1 U.S. GOVERNMENT PRINTING OFFICE