Overview of Environmental and Hydrogeologic Conditions at Deadhorse, Alaska

U.S. GEOLOGICAL SURVEY

Open-File Report 95-437

Prepared in cooperation with the

FEDERAL AVIATION ADMINISTRATION

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By Michael G. Alcorn 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

Multiply	By	To obtain
centimeter (cm)	0.3937	inch
millimeter (mm)	0.03937	inch
millimeter per year (mm/yr)	0.03937	inch per year
meter (m)	3.281	foot
kilometer (km)	0.6214	mile
square kilometer (km^2)	0.3861	square mile
kilometer per hour (km/hr)	0.6214	mile per hour
cubic meter per second (m^3/s)	35.31	cubic foot per second

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

$$°F = 1.8\,(°C) + 32$$

VERTICAL DATUM

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

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ABSTRACT

The Federal Aviation Administration is making preliminary environmental assessments at most of its present or former facilities in Alaska. The Federal Aviation Administration facilities in Deadhorse are north of the Brooks Range on the Arctic Coastal Plain of Alaska. Deadhorse has an arctic climate: summers are short and cool, winters are long and cold, and annual precipitation is low. Wet tundra characterizes the vegetation. The area is underlain by unconsolidated alluvial sediments and sedimentary rocks. Surface water consists of numerous shallow lakes, a major river, and wetlands. Usable ground water is not available because of thick, continuous permafrost.

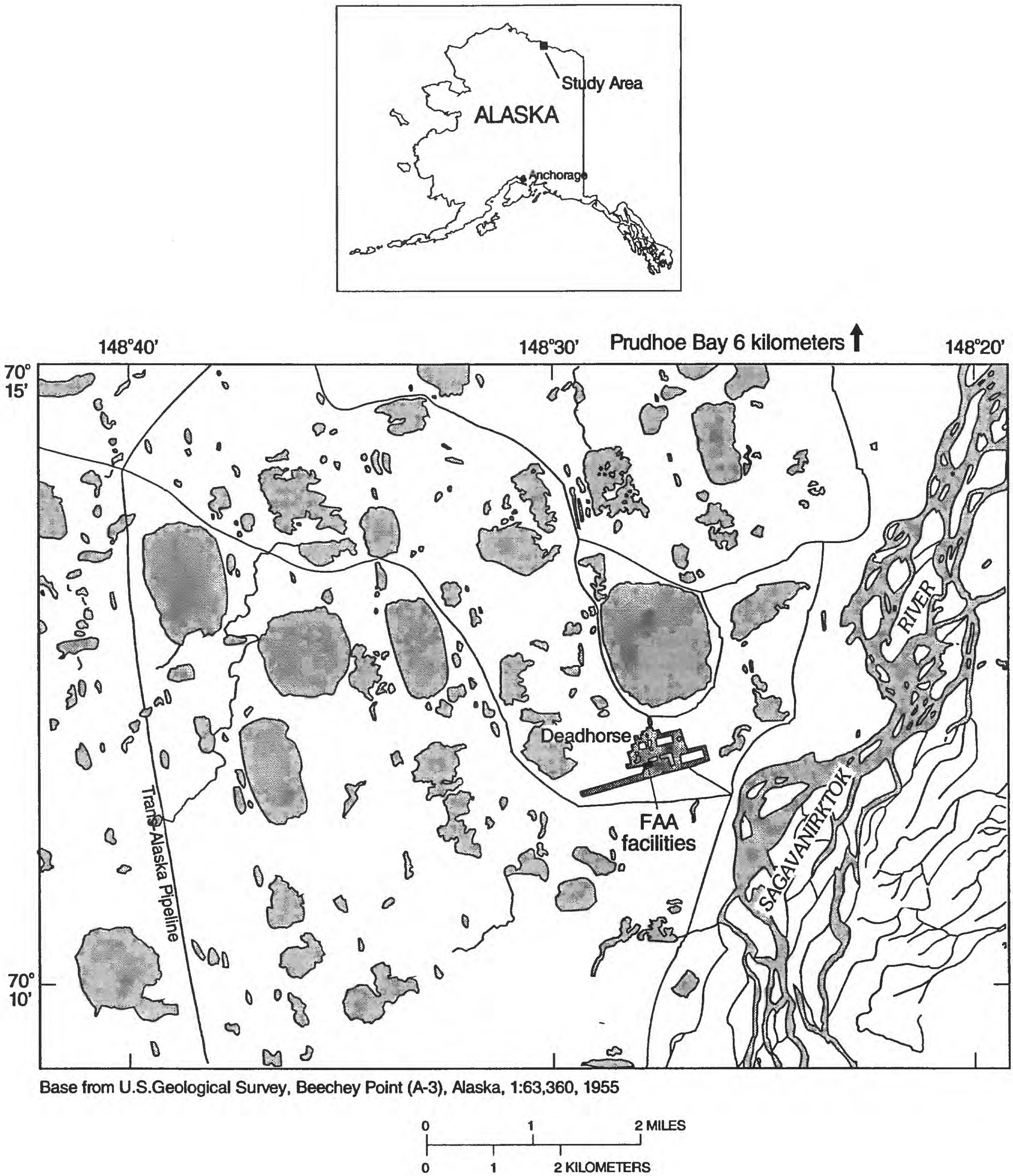
INTRODUCTION

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

BACKGROUND

Location

Deadhorse is adjacent to the western bank of the Sagavanirktok River on Alaska's Arctic Coastal Plain, about 1,000 km north of Anchorage, Alaska, 12 km south of Prudhoe Bay (fig. 1), and 427 km north of the Arctic Circle. The Deadhorse FAA facilities are at approximate lat 70° 12' N., long 148° 27' W. and at an elevation of about 17 m.



Base from U.S.Geological Survey, Beechey Point (A-3), Alaska, 1:63,360, 1955

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

History and Facilities

The FAA began operations at Deadhorse in 1970 when they took over operation of the Deadhorse Airport navigational aids from the State of Alaska (Ecology and Environment, Inc., 1992). Deadhorse was developed to service the oil exploration and production operations in the Prudhoe Bay area. Deadhorse has a permanent population of 26 and a transient population of 4,000 to 5,000 (Alaska Department of Community and Regional Affairs, 1994). Deadhorse consists of the FAA facilities for airport operations, housing units managed by the oil industry, several motels, contractor storage yards, and maintenance buildings. FAA facilities include the airport lighting system, beacons, navigational systems, air traffic control tower and radar, and a vehicle maintenance building. Detailed descriptions of Deadhorse facilities are found in an environmental compliance investigation report by Ecology and Environment, Inc. (1992).

Climate

Deadhorse has an arctic climate characterized by long cold winters, short cool summers, low annual rainfall, and persistent wind (Selkregg, 1975). Climatic data for Deadhorse are measured and recorded several kilometers away at Prudhoe Bay by the National Weather Service and Alaska Airlines. Climatic records have been kept since the early 1970's but are incomplete.

Average monthly temperatures range from about 7°C in July to -31°C in February and are above freezing only during the months of May through August (National Weather Service, written commun., 1995). Weather observation data recorded by Alaska Airlines at Prudhoe Bay from 1987 to 1994 show that mean annual snowfall is about 942 mm, and the mean annual precipitation is about 114 mm (Alaska Airlines, written commun., 1995). The highest recorded wind speed was 176 km/hr on February 25, 1989.

Sublimation, evaporation, and transpiration are significant climatological factors affecting the hydrologic budget of the Arctic Coastal Plain (McCarthy, 1994), including the Deadhorse area. Mean annual recorded precipitation of about 114 mm qualifies the Deadhorse area as a desert (Skinner and Porter, 1987). Estimates of annual evaporation, transpiration, and sublimation range from 60 mm per thaw season to 210 mm/yr (Brown and others, 1980; Dingman and others, 1980; Stewart and Rouse, 1976; Weller and Holmgren, 1974).

Because Deadhorse is located more than 400 km north of the Arctic Circle, daylight hours differ significantly from those of the 48 contiguous States. On November 24, the sun sets and stays below the horizon for 55 days until it rises again on January 18 (National Weather Service, written commun., 1995). On May 20, the sun rises and stays above the horizon for 64 days until it sets on July 22. These long periods of daylight increase mean summer temperatures, which increases the thaw rate of the permafrost active layer and increases evaporation and transpiration. Lack of solar radiation during the winter reduces mean winter temperatures, which reduces evaporation and transpiration and allows sublimation to become a significant factor.

Vegetation

The vegetation near Deadhorse is characterized as wet tundra (Selkregg, 1975; Viereck and Little, 1972). Sedges make up about 75 percent of the vegetation community. Many species of moss grow beneath the sedges along with low shrubs and a few species of lichens. Secondary species include cottongrass, lousewort, and buttercup in wetter sites, and heather and purple mountain saxifrage in the raised, drier areas on polygonal frost-heaved ridges. The distribution of different vegetation types is related to the microrelief of the polygonal ground patterns that occur throughout the area. These patterns can even be seen on shallow lake bottoms (Rieger and others, 1979).

GEOLOGY

Physiography

Deadhorse is on the northern edge of the Arctic Coastal Plain, which extends from the foothills of the Brooks Range to the south, to the Arctic Ocean to the north (Wahrhaftig, 1965). The area is characterized by low relief, numerous lakes and ponds, beaded drainage, patterned ground, thaw gullies and depressions, pingos, and frost boils (Rawlinson, 1983). Most of the lakes are distinctly elongated and oriented to the north-northwest (Rawlinson, 1983). Beaded drainage is characteristic and is caused when surface water flows from one lake or pond to the next on its route to the sea. Areas with beaded drainage typically have saturated soils because of low relief and the presence of continuous permafrost, which restricts vertical drainage. Patterned ground is the name given to areas that have striped or polygonal surface features caused by successive freezing and thawing (Hopkins and others, 1955). Pingos are isolated, steep-sided, circular to oval hills found in permafrost regions. They range from 3 to 30 m in height and are composed of a core of ice typically overlain by less than 1 m of silt, sand, and peat (Hopkins and others, 1955).

Surficial and Bedrock Geology

The geology of the Arctic Coastal Plain is well characterized due in part to the extensive exploration for petroleum in the region over the past several decades. Unconsolidated sediments of Quaternary age overlie sandstones, siltstones, conglomerates, and shales of Tertiary and Cretaceous age (Moore and others, 1994; Tailleur and Weimer, 1987; Rawlinson, 1983; U.S. Geological Survey, 1983). This sequence overlies dipping strata of shales, oil-bearing sandstones, limestones, and weakly metamorphosed sedimentary basement rocks of Paleozoic age. A simplified geologic cross section representing the subsurface geology under Deadhorse is shown in figure 2. The unconsolidated sediments consist of interbedded fluvial and glaciofluvial gravels, sands, and silts that range in thickness from 10 to 60 m (Ecology and Environment, Inc.,1992; Rawlinson, 1986; Detterman and others, 1975). Further geologic information may be found in reports by Dinter and others (1990), Gryc (1988), and Black (1964).

Permafrost

Deadhorse is in an area of thick, continuous permafrost (Ferrians, 1965). Permafrost is rock or soil that has remained continuously below $0^{o}C$ for 2 or more years (Williams, 1970). In the Deadhorse area, permafrost extends to depths of 660 m (Rawlinson, 1983). Unfrozen ground occurs only below river channels and lakes deeper than 2 m and beneath heated buildings and other artificial structures (Rawlinson, 1983). These zones are referred to as thaw bulbs or thermal taliks and may extend to considerable depths (Brewer, 1958). The temperature of permafrost at Deadhorse is colder than the permafrost of most places on the Arctic Coastal Plain and ranges from -9°C at 50 m below ground surface (bgs) to 0°C at 600 m bgs (Rawlinson, 1983). The layer above the permafrost that thaws each summer and refreezes each winter is referred to as the "active layer" (Williams, 1970). The thickness of the active layer is typically about 0.5 m, rarely exceeds 1.0 m, and varies depending on soil texture and vegetation type (Rawlinson, 1983). Vegetation acts as insulation, reducing seasonal thawing (Dingman and others, 1980; Brown and others, 1968). Most buildings and other structures in the Deadhorse area are built on man-made gravel pads that are about 1.5 to 2.5 m thick. The active layer on the pads may exceed 1 m, but the thaw will not reach the underlying soil because the pads are designed to insulate the soil and keep it frozen year round. Liquid hazardous waste spilled on the gravel pads can be expected to infiltrate through the gravel and accumulate on the frost table.

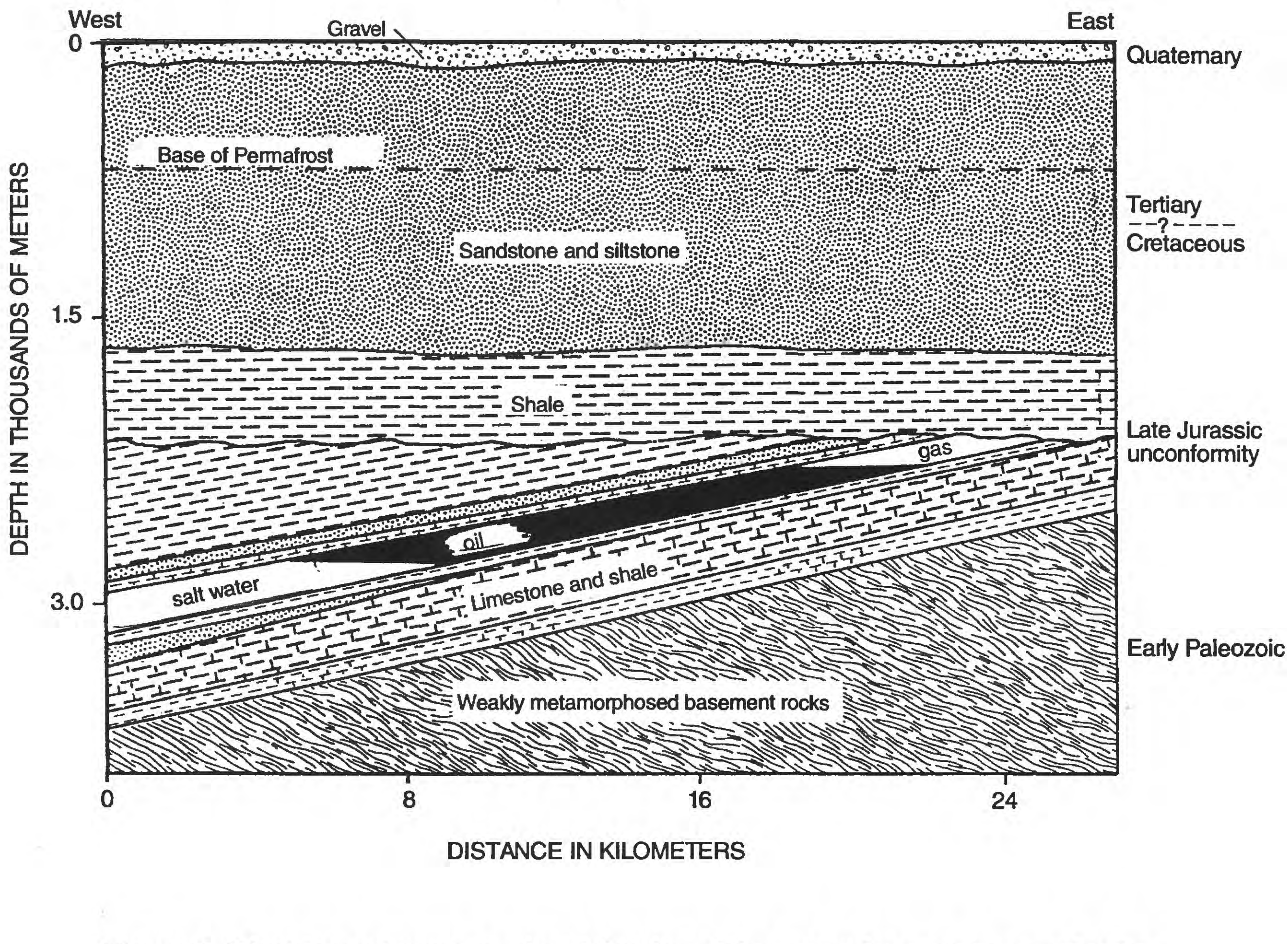


Figure 2. West-to-east cross-sectional drawing of the subsurface geology at Prudhoe Bay. Modified from Sohio Alaska Petroleum Company, 1982.

Soils

Soils in the Deadhorse area are classified as loamy, nearly level to rolling pergelic cryaquolls and histic pergelic cryaquepts (Rieger and others, 1979). These soils are found over thick permafrost and exhibit strongly patterned frost features. They are poorly drained and consist of loamy, nonacid, and calcareous sediment. They may be saturated for several months during the summer and frozen the rest of the year. The soils immediately east of Deadhorse, near the Sagavanirktok River, are classified as very gravelly, nearly level pergelic cryaquepts. These soils are found on low terraces and braided flood plains and consist of gravelly stream deposits underlain by permafrost (Rieger and others, 1979).

The soil order classifications are mollisol and inceptisol. These orders are generally characterized by thick accumulations of organic matter at the surface, persistent cold temperatures, shallow permafrost, and very high moisture contents. The mollisol is a well-developed soil, while the inceptisol is a more immature soil (Rieger and others, 1979). The high organic content of these soils is largely the result of the persistent cold temperatures, which restrict biodegradation and promote the accumulation of organic material from vegetation (McCarthy, 1994). Because organic material has a lower thermal conductivity than mineral soils, it insulates the underlying permafrost. As a result, permafrost is typically within 0.5 m of the surface in such soils, provided the surface has not been disturbed. The soils throughout the area generally have a very fine-grained texture and are characterized by high porosity and low permeability. However, the more gravelly soils that occur near the river have a higher permeability than those to the west.

Physical churning of the soils above the permafrost results from cyclic freezing and thawing (McCarthy, 1994). Because of this churning, distinct soil layers are often absent and organic material from plants at the surface is commonly distributed downward. Cyclic freezing of the soils also causes contraction cracks to form. Such cracks may fill with water, freeze, and crack again. As this cycle repeats, the fissures grow (McCarthy, 1994). Extensive networks of interconnected cracks, referred to as patterned ground or ice-wedge polygons, are common in the Deadhorse area. A more detailed discussion of the formation of ice-wedge polygons is provided by Carter and others (1987).

HYDROLOGY

Surface Water

Surface water is abundant in the Deadhorse area. Numerous shallow lakes, a major river, and extensive seasonal wetlands surround Deadhorse (fig. 1). Prudhoe Bay is 12 km north and extends to the Beaufort Sea and the Arctic Ocean. The Sagavanirktok River flows in a braided channel in a north-northeast direction to the Beaufort Sea. The west channel of the Sagavanirktok flows within 500 m of the Deadhorse Airport. The Sagavanirktok River is the second largest river on the North Slope, having a total drainage area of about 14,900 km^2 and a length of about 267 km (Hodel, 1986). Although discharge data for the Sagavanirktok River west channel near Deadhorse are limited, the maximum peak discharge of this channel is estimated to be 236 m^3/s (Hodel, 1986). U.S. Geological Survey stream-gaging records are not regularly kept for this channel. The next closest gaging station (USGS station No. 15908000) is on the main channel of the Sagavanirktok River, about 100 km to the south. From 1982 to 1988, average discharge was about 36 m^3/s, with a maximum discharge of about 650 m^3/s (U.S. Geological Survey, 1989). Ninety-six percent of the total discharge occurred between May and September, with no recorded discharge in March and April.

Ground Water

Permafrost controls ground-water movement on the Arctic Coastal Plain. During the brief summer thaw period, the upper 0.5 m of the subsurface is thawed and ground water may be able to flow, but during the rest of the year, the near-surface ground water is frozen, unable to move. Because permafrost is often virtually impermeable, it acts as a confining layer, restricting downward movement of water. The presence of this shallow confining layer similarly impedes downward infiltration of petroleum products and similar hazardous wastes. Such wastes may remain at the surface or within the shallow subsurface. The permafrost isolates the near-surface flow system, including surface water and ground water within the active layer, from deeper intrapermafrost and subpermafrost aquifers. The subpermafrost aquifers are below the permafrost and have a salinity of several thousand parts per million (Hopkins and others, 1955). Beneath the ocean and deep lakes, thermal taliks (thaw bulbs) may penetrate the entire thickness of the permafrost (Williams, 1970).

Deep rock layers that lack interstitial water can be highly permeable, exhibiting virtually the same permeability and porosity as host rock in its unfrozen state. Briny ground water can flow through, or at least reside in, such an environment (James Cowan, U.S. Geological Survey, written commun.,1995).

Environmental Susceptibility

The tundra environment in the Deadhorse area is much more susceptible to damage by human activity than are soils in more temperate environments (McCarthy, 1994). For example, disturbances resulting from vehicle traffic or construction activities can cause long-term changes to the tundra. Such changes are often the result of damage to vegetation, compaction of the surface organic mat and underlying soils, or a combination of these factors. Vegetation and the surface organic mat help to insulate underlying permafrost. If this insulating layer is damaged or destroyed, the thermal regime in the soil will be altered and the depth of seasonal thaw may increase substantially. Thawing of ice-rich permafrost may lead to considerable subsidence of the local land surface. In the flat terrain of the Deadhorse area, even small changes in land-surface elevation can have large effects on drainage patterns. The formation of new lakes where surface disturbances have occurred is common. Once a lake has formed, the thermal regime of the underlying permafrost is further disturbed by heat from the water. Thawing of permafrost beneath the lake may occur, resulting in further subsidence of the lakebed and gradual expansion of the lake. This process is similar to the natural cycle of lake formation, expansion, and drainage—referred to as the thaw-lake cycle—which occurs commonly on the Arctic Coastal Plain (Edwards and Brigham-Grette, 1990; Kidd, 1988; Harry and French, 1983; Billings and Peterson, 1980).

Lakes in the Deadhorse area are susceptible to freeze concentration (McCarthy, 1994). As the lake freezes, impurities in the water tend to be excluded from the ice and are concentrated in the remaining unfrozen water. Because of this phenomenon, water quality in lakes and lagoons generally decreases throughout the winter and spring as the ice cover grows and the volume of unfrozen water decreases. In lakes and lagoons that remain partially unfrozen year round, water quality is generally poorest just prior to the thaw season, when the volume of unfrozen water is smallest. Water-quality problems in the Arctic are further exacerbated by the limited availability of water. Annual runoff on the Arctic Coastal Plain averages about 110 mm (Dingman and others, 1980), and a large part of this limited runoff occurs during the brief snowmelt period, typically no more than 2 weeks in duration. A considerable portion of this snowmelt runoff occurs while lakes and lagoons are still covered with ice. As a result, a portion of the annual inflow to surface-water bodies commonly flows over the ice cover and leaves through the outlet of the lake without mixing with the water beneath the ice. Dilution of the water remaining beneath the ice with fresh snowmelt water is reduced (McCarthy, 1994).

The arctic environment also has a limited capacity to attenuate contaminants in soil and active-layer water (McCarthy, 1994). Low soil temperatures restrict the activity of microorganisms and reduce rates of biodegradation. The presence of near-surface permafrost also decreases the ability of the environment to attenuate contamination by restricting the downward flow of water, thereby reducing the dilution of contaminants. The environment in the Deadhorse area is clearly sensitive to both physical disturbances and chemical contamination resulting from human activity (McCarthy, 1994).

Floods and Hydrologic Hazards

The buildings and runway at the Deadhorse FAA facilities have been built up above the surrounding tundra on gravel pads and effectively avoid most flood hazards. According to the U.S. Army Corps of Engineers, the entire area is within the 100-year flood plain of the Sagavanirktok River, but the flood hazard to the FAA facilities is rated low because of the construction practices (U.S. Army Corps of Engineers, 1993; Harlan Legare, U.S. Army Corps of Engineers, oral commun., 1995).

Additionally, the Deadhorse FAA facilities may be affected by the westward migration of the Sagavanirktok River. Deposition and erosion of channel sediment is a continuous process that affects the position of the braided channel. U.S. Geological Survey maps made in 1955 and updated in 1975 indicate westward movement of the river channel.

Drinking-Water Sources

The presence of deep, continuous permafrost in the Deadhorse area limits the use of ground water as a source for drinking water. Potable ground water is not known to exist in the deeper underlying sedimentary rocks below the permafrost (Williams, 1970; Hopkins and others, 1955). Ground water sufficient for development has been obtained from thaw bulbs below rivers. Withdrawal of ground water in taliks, however, has dewatered the overlying water body (Nelson and Munter, 1990). Williams (1970) and Hopkins and others (1955) have also indicated the possibility of obtaining ground water from lakes deeper than 2 m.

Drinking water is currently supplied to the Deadhorse facilities by hauling surface water from the Sagavanirktok River to the facilities (Ecology and Environment, Inc., 1992; FAA Flight Service Center personnel, oral commun., 1995). Water-quality data for the west channel of the Sagavanirktok River is in the appendix. Potential spills of hazardous waste at the Deadhorse Airport pose little danger to the present drinking-water source. Alternative drinking-water sources are limited but may be found in other surface-water sources such as from rivers or lakes that have a depth greater than 2 m, from the desalinization of seawater, or in thaw bulbs beneath the Sagavanirktok River or large lakes.

SUMMARY

The Deadhorse FAA facilities are located on the Arctic Coastal Plain, 12 km south of Prudhoe Bay, Alaska. Continuous, thick permafrost underlies the entire area. The relatively flat land surface remains mostly saturated during the summer. Ground water exists only in the upper 0.5 m for a few months each summer and is frozen the rest of the year. The Sagavanirktok River flows within 500 m of the Deadhorse FAA facilities and is its source of drinking water. Alternative drinking-water sources may be available from other large surface-water bodies or in thaw bulbs beneath them. The river poses a low flood hazard to the FAA facilities.

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APPENDIX

Surface water-quality data near Deadhorse, Alaska

701216148241000 - SAGAVANIRKTOK R W CHANNEL NR DEADHORSE AK

WATER-QUALITY DATA, WATER YEAR OCTOBER 1975 TO SEPTEMBER 1976

DATE	CARBON, ORGANIC TOTAL (MG/L AS C) (00680)	SODIUM, DIS-SOLVED (MG/L AS NA) (00930)	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)	SILICA, DIS-SOLVED (MG/L AS SIO2) (00955)	NITRO-GEN, TOTAL (MG/L AS NO3) (71887)
NOV								
11...	5.5	2.1	0	0.20	3.2	30	3.7	2.8

701216148241000 - SAGAVANIRKTOK R W CHANNEL NR DEADHORSE AK

WATER-QUALITY DATA, WATER YEAR OCTOBER 1975 TO SEPTEMBER 1976

DATE	TIME	LAT-I-TUDE	LONG-I-TUDE	MEDIUM CODE	SAMPLE TYPE	RECORD NUMBER	TEMPER-ATURE WATER (DEG C) (00010)	TUR-BID-ITY (JCU) (00070)
NOV								
11...	1700	70 12 16 N	148 24 10 W	9	9	97600826	0.0	0

701216148241000 - SAGAVANIRKTOK R W CHANNEL NR DEADHORSE AK

WATER-QUALITY DATA, WATER YEAR OCTOBER 1975 TO SEPTEMBER 1976

DATE	ALKA-LINITY WAT WH TOT FET FIELD MG/L AS CACO3 (00410)	BICAR-BONATE WATER WH FET FIELD MG/L AS HCO3 (00440)	NITRO-GEN, TOTAL (MG/L AS N) (00600)	NITRO-GEN, ORGANIC TOTAL (MG/L AS N) (00605)	NITRO-GEN, NITRATE TOTAL (MG/L AS N) (00620)	NITRO-GEN,AM-MONIA + ORGANIC TOTAL (MG/L AS N) (00625)	NITRO-GEN, NO2+NO3 TOTAL (MG/L AS N) (00630)	PHOS-PHORUS TOTAL (MG/L AS P) (00665)
NOV								
11...	211	260	0.64	0.40	0.240	0.40	0.240	<0.010

701310148270000 - LK COLLEEN NR PRUDHOE BAY AK

WATER-QUALITY DATA, WATER YEAR OCTOBER 1976 TO SEPTEMBER 1977

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)	IRON, DIS-SOLVED (UG/L AS FE) (01046)	MANGA-NESE, DIS-SOLVED (UG/L AS MN) (01056)	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)
FEB											
17...	15	5.9	380	12	0.10	2.5	680	360	1680	1880	2.28

1

701310148270000 - LK COLLEEN NR PRUDHOE BAY AK

WATER-QUALITY DATA, WATER YEAR OCTOBER 1976 TO SEPTEMBER 1977

DATE	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 TOTAL (MG/L AS N) (00620)	NITRO- GEN, NO2+NO3 DIS- SOLVED (MG/L AS N) (00631)	PHOS- PHATE, ORTHO, DIS- SOLVED (MG/L AS PO4) (00660)	PHOS- PHORUS ORTHO, DIS- SOLVED (MG/L AS P) (00671)	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)
FEB												
17...	1520	0	0.220	0.220	0.12	0.040	1600	360	530	68	130	1

1

701310148270000 - LK COLLEEN NR PRUDHOE BAY AK

WATER-QUALITY DATA, WATER YEAR OCTOBER 1976 TO SEPTEMBER 1977

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)	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)
FEB											
17...	1100	70 13 10 N	148 27 00 W	9	9	97701047	-0.5	22	7.2	153	1250

701310148270000 - LK COLLEEN NR PRUDHOE BAY AK

WATER-QUALITY DATA, WATER YEAR OCTOBER 1975 TO SEPTEMBER 1976

DATE	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)	IRON, DIS-SOLVED (UG/L AS FE) (01046)	MANGA-NESE, DIS-SOLVED (UG/L AS MN) (01056)	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)
FEB										
05...	4.8	380	3.8	0.30	1.3	80	40	1530	1280	2.08

1

701310148270000 - LK COLLEEN NR PRUDHOE BAY AK

WATER-QUALITY DATA, WATER YEAR OCTOBER 1975 TO SEPTEMBER 1976

DATE	NITRO- GEN, NO2+NO3 DIS- SOLVED (MG/L AS N) (00631)	PHOS- PHATE, ORTHO, DIS- SOLVED (MG/L AS PO4) (00660)	PHOS- PHORUS ORTHO, DIS- SOLVED (MG/L AS P) (00671)	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)
FEB										
05...	0.610	0.0	<0.010	1000	310	340	38	86	1	16

701310148270000 - LK COLLEEN NR PRUDHOE BAY AK

WATER-QUALITY DATA, WATER YEAR OCTOBER 1975 TO SEPTEMBER 1976

DATE	LAT-I-TUDE	LONG-I-TUDE	MEDIUM CODE	SAMPLE TYPE	RECORD NUMBER	TEMPER-ATURE WATER (DEG C) (00010)	COLOR (PLAT-INUM-COBALT UNITS) (00080)	ALKA-LINITY WAT WH TOT FET FIELD MG/L AS CACO3 (00410)	BICAR-BONATE WATER WH FET FIELD MG/L AS HCO3 (00440)	NITRO-GEN, NITRATE TOTAL (MG/L AS N) (00620)
FEB										
05...	70 13 10 N	148 27 00 W	9	9	97600828	0.0	35	699	850	0.610