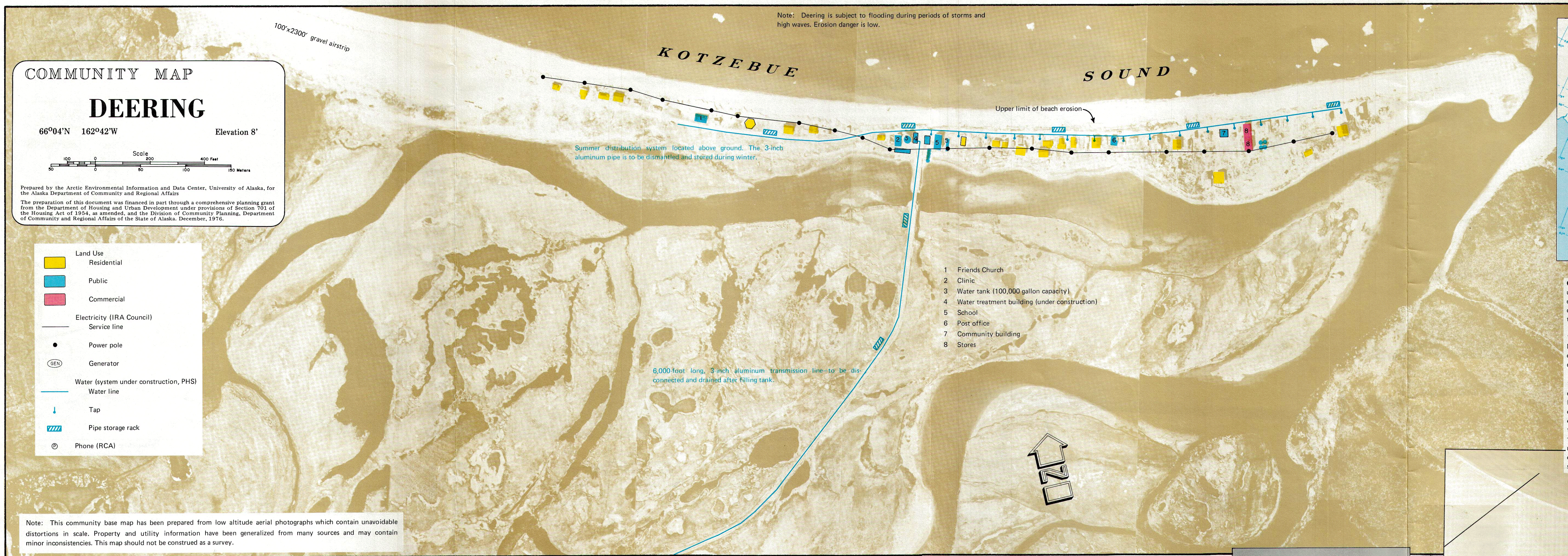
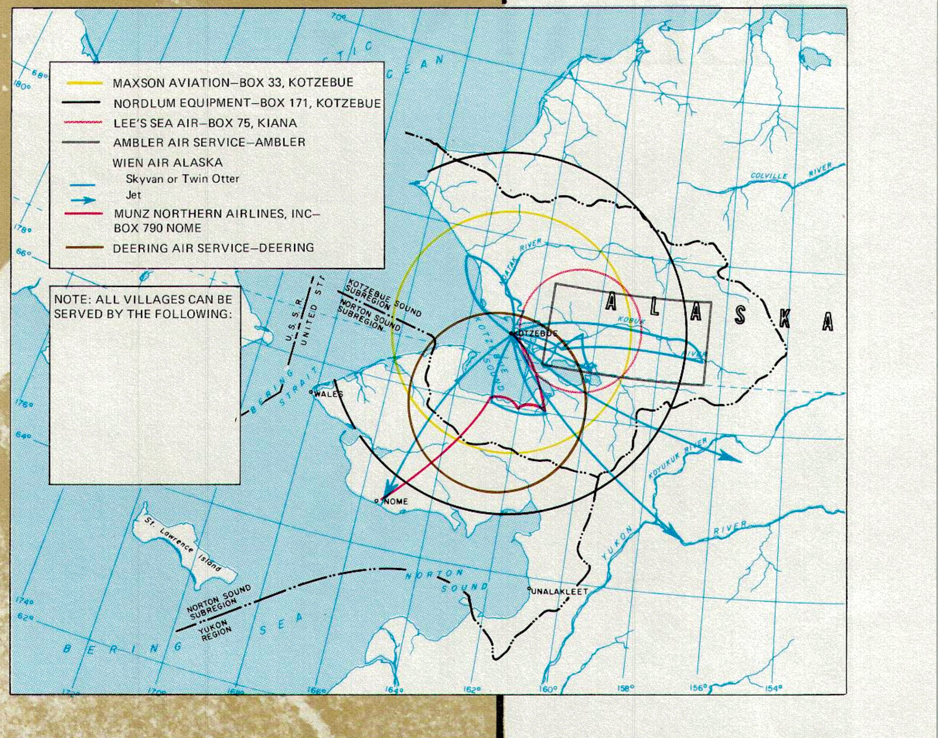
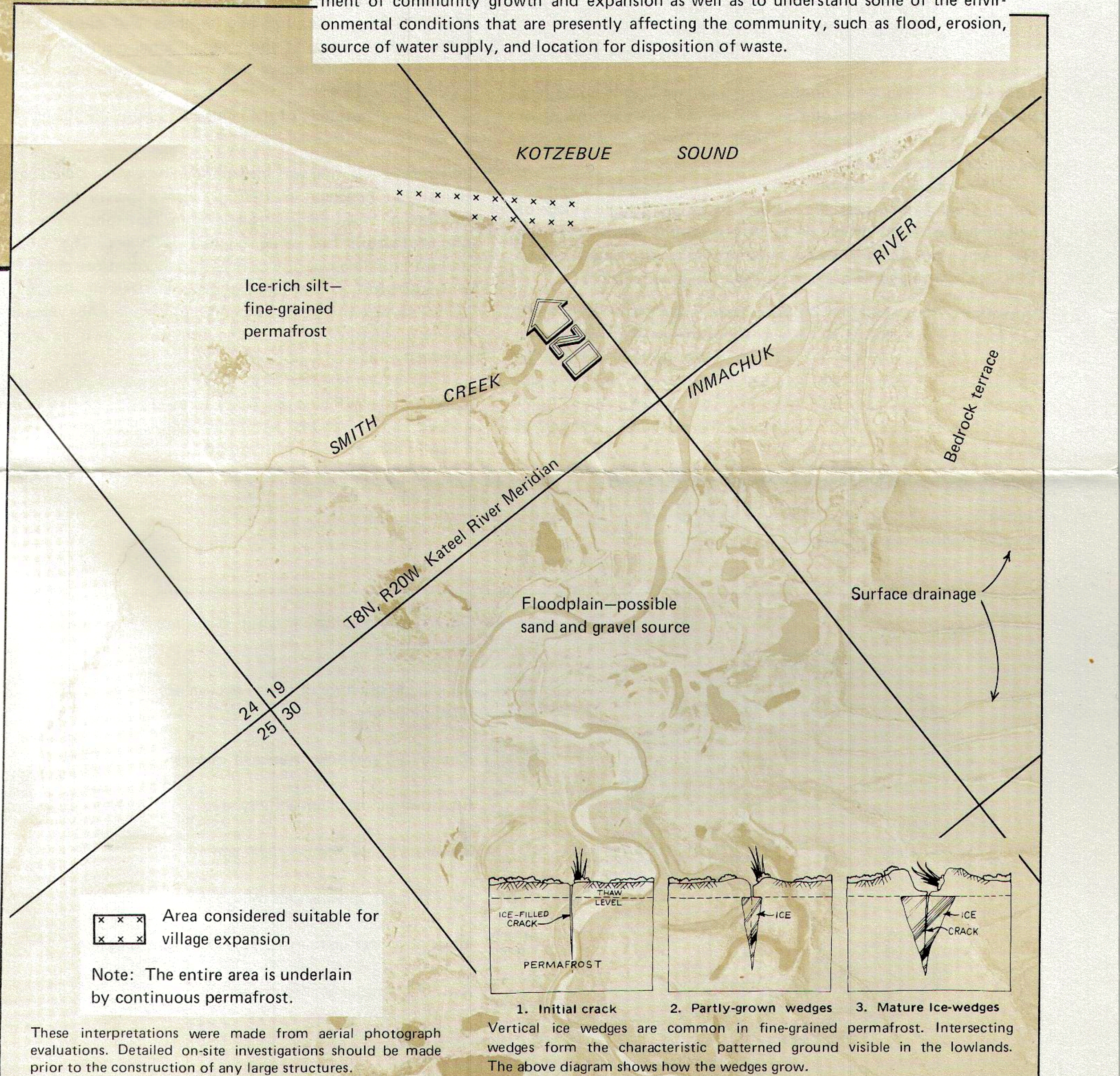




Community Base Map—Maps are needed to show land use, ownership, location of utilities, and to plan for future village improvements. These maps can be prepared by either surveying the land on the ground or through enlargement of aerial photos or by a combination of both. Air photos can be taken at various heights. The height determines the extent of the area covered by the photograph.

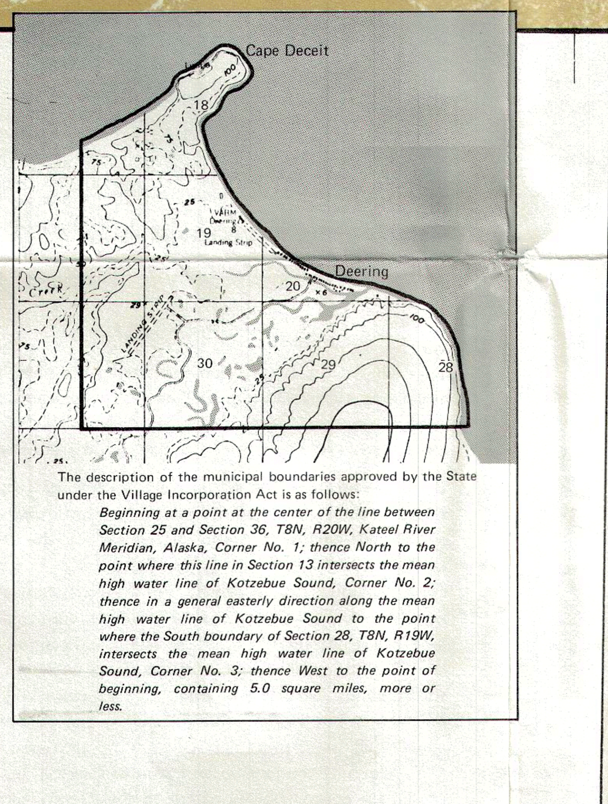
The Community Base Map was prepared from a photograph taken at a height of 1,800 feet and enlarged to a scale of 1:2,400 (1 in. = 200 ft.). This map was used to locate the present utilities, residential development, and various community services and can be used in the future to evaluate the area for village expansion and to locate new construction.

The photograph to the right was taken at a height of 8,400 feet or one inch equals 1,400 feet. From this height the village as well as the land around it can be clearly evaluated. This photograph shows that Deering is located on the coast and has no roads leading into the community. The Inmachuk River meanders along its wide floodplain, continually changing course as reflected by the remnants of stream channels presently occupied by lakes. The topography of the area is generally flat, except to the left of the floodplain, where a bedrock terrace is being carved by surface runoff. The terrain reflects the presence of permafrost. This kind of data is very important in the development of community growth and expansion as well as to understand some of the environmental conditions that are presently affecting the community, such as flood, erosion, source of water supply, and location for disposition of waste.



These interpretations were made from aerial photograph evaluations. Detailed on-site investigations should be made prior to the construction of any large structures.

Vertical ice wedges are common in fine-grained permafrost. Intersecting wedges form the characteristic patterned ground visible in the lowlands. The above diagram shows how the wedges grow.



The description of the municipal boundaries approved by the State under the Village Incorporation Act is as follows: Beginning at a point at the center of the line between Section 25 and Section 36, T8N, R20W, Kateel River Meridian, Alaska, Corner No. 1; thence North to the point where this line in Section 13 intersects the mean high water line of Kotzebue Sound, Corner No. 2; thence in a general easterly direction along the mean high water line of Kotzebue Sound to the point where the South boundary of Section 28, T8N, R19W, intersects the mean high water line of Kotzebue Sound, Corner No. 3; thence West to the point of beginning, containing 5.0 square miles, more or less.

Environmental Considerations for Community Development

Community development must consider all environmental factors that affect the engineering design and location of structures, including climate, topography, soils, permafrost, erosion, and flooding.

Climate

Climatic data on winds, precipitation, temperature, and snowfall (Figure 5) allow engineers to design buildings strong enough to withstand heavy winds and deep snow, select type and thickness of insulation to reduce heat loss, and estimate fuel requirements. Climatic data are also needed to determine the type of clothing needed to protect the human body against extreme temperatures.

Chill Factor—If the air temperature is below body temperature, a person loses heat to the atmosphere. When the wind blows, the rate of heat loss increases; therefore, air temperature and wind velocity are the two environmental factors which affect body heat loss. Wind chill data (Figure 6) were developed by combining wind and temperature measurements into numbers which express equivalent chill temperatures.

Figure 6
Wind Chill Temperatures

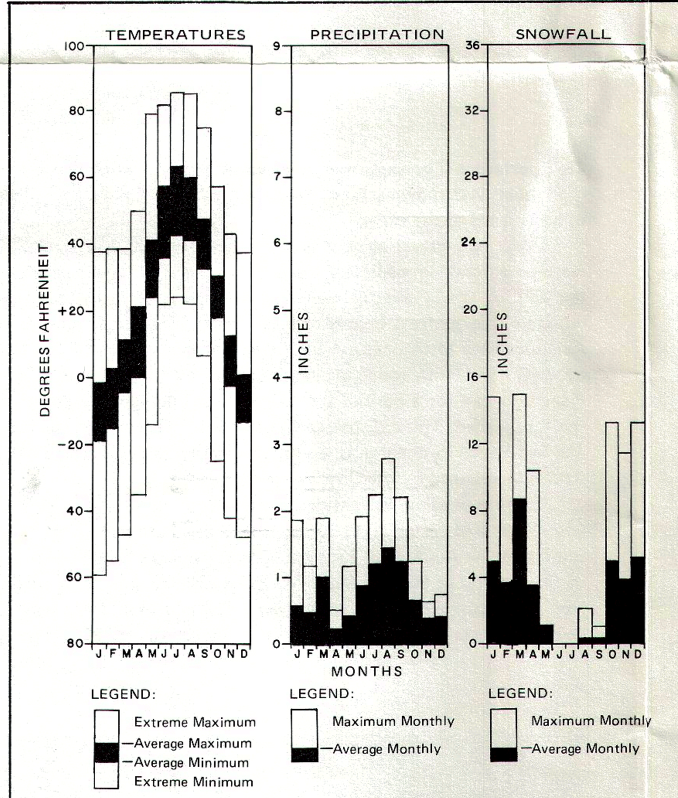
WIND SPEED (MILES PER HOUR)	COOLING POWER OF WIND EXPRESSED AS "EQUIVALENT CHILL TEMPERATURE"
CALM	[illegible]
5	[illegible]
10	[illegible]
15	[illegible]
20	[illegible]
25	[illegible]
30	[illegible]
35	[illegible]
40	[illegible]
WINDS ABOVE 40 HAVE LITTLE ADDITIONAL EFFECT	LITTLE DANGER / INCREASING DANGER / GREAT DANGER

DANGER OF FREEZING EXPOSED FLESH FOR PROPERLY CLOTHED PERSONS

Snow Load—Snow load data are used in the design of structures to determine the strength needed to withstand the weight of packed snow. The U.S. Army Cold Regions Research and Engineering Laboratory has estimated local ground snow loads in pounds per square foot (psf) for many areas of Alaska. The design load selected depends on the expected use, life span, and geographic location of the building. For example, a five-year life could be selected for a temporary facility. A structure that can withstand 56 pounds of snow per square foot is considered safe for five years in Deering. A building with a life expectancy of 25 years must be able to withstand a snow load of 77 psf; 86 psf for a 50-year structure; and buildings with an anticipated life of 100 years or more, such as hospitals and other long-lasting, permanent facilities, should be able to withstand 95 psf.

Wind Speed—Information on wind speed and direction is necessary to design and orient airports and other structures. It has been estimated that for a structure with an expected life of 10 years a structural design that could withstand extreme wind speeds of at least 83 miles per hour should be chosen; 91 miles per hour for a structure with an expected life of 25 years; 100 miles per hour for a 50-year life; and 110 miles per hour for a structure with a life expectancy of 100 years or more.

Location of buildings must also consider the direction of wind to minimize snowdrifts (Figure 7).



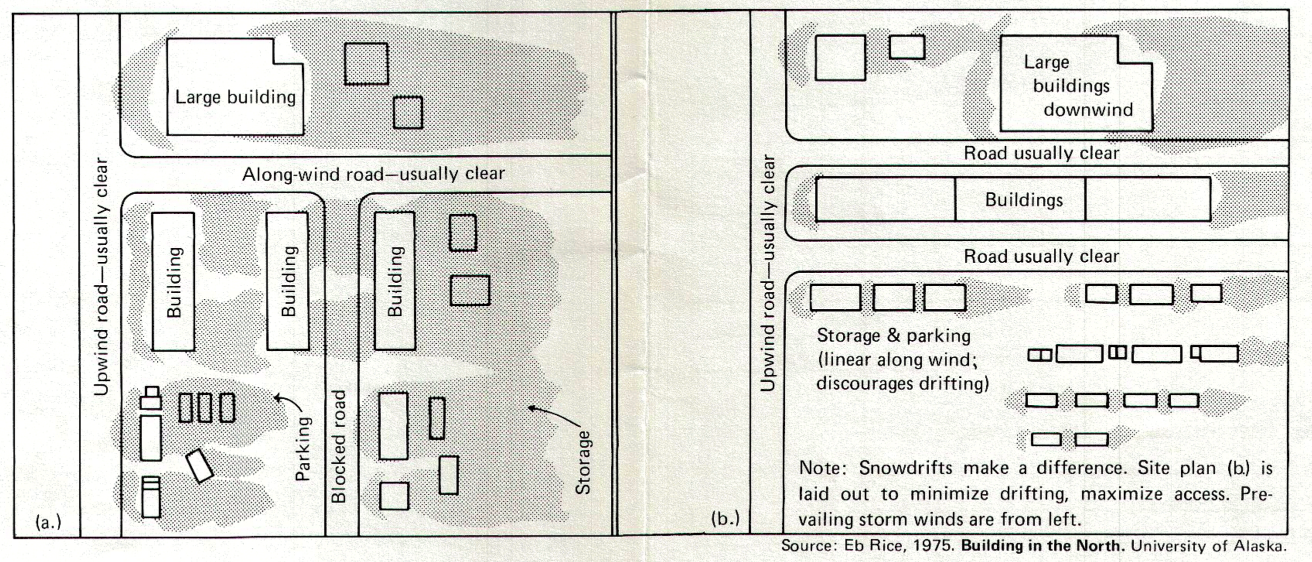
Note: Deering is located in the transitional climate zone which is characterized by long, cold winters and cool summers. Temperature extremes of 85°F in summer and -60°F in winter have been recorded. Precipitation is light and averages less than nine inches annually, including 36 inches of snow. There are an estimated 917 growing degree days at Deering, less than the 1,500 considered necessary for large-scale agriculture. Prevailing winds average 10 knots annually and are easterly in winter and westerly in summer. Additional information on climate is available at the Arctic Environmental Information and Data Center, University of Alaska.

MONTH	TEMPERATURE (°F): Means: Daily Maximum	Daily Minimum	Monthly	Extr.: Record Highest	Record Lowest	PRECIPITATION (IN INCHES): Mean	Greatest Daily	Greatest Monthly	Snow, Ice Pellets: Mean	Greatest Daily	Greatest Monthly	Greatest Depth on Ground	HEATING DEGREE DAYS
(a)	15	15		20	20	5-17	5-17	5-17	6	6	6	6	
J	-2.6	-19.7	-11.2	38	-60	0.55	0.75	1.71	4.8	7.0	14.9	34	2362
F	1.7	-15.8	-7.1	38	-56	0.44	0.19	1.17	3.6	2.5	8.5	40	2037
M	10.2	-6.7	-1.8	39	-48	1.00	0.81	1.87	8.6	4.0	15.0	44	2071
A	20.4	-0.1	10.2	50	-36	0.17	0.09	0.50	3.3	4.0	10.5	21	1644
M	40.3	23.3	31.8	80	-15	0.44	0.44	1.15	1.0	7.0	3.0	25	1029
J	57.5	35.6	46.6	82	22	0.73	0.80	1.93	0.0	0.0	0.0	0	552
J	63.4	42.4	52.9	85	24	1.20	0.80	2.44	0.0	0.0	0.0	0	375
A	59.3	40.7	50.0	85	22	1.46	0.75	2.78	0.2	2.0	2.0	0	465
S	47.8	32.8	40.3	75	6	1.23	0.54	2.23	0.2	1.0	1.0	0	741
O	30.6	17.8	24.2	57	-26	0.62	0.36	1.22	4.8	3.0	13.3	10	1265
N	13.0	-3.0	5.0	43	-43	0.36	0.18	0.60	3.8	2.0	11.5	11	1800
D	1.4	-13.9	-6.3	37	-49	0.37	0.23	0.70	5.6	2.0	13.4	19	2210
YR	28.6	11.1	19.9	85	-60	8.57	0.80	2.78	35.9	7.0	15.0	44	16551

Figure 5
Climatic Data Recorded at Candle and Considered Representative of Deering

Heating Degree Days—Annual fuel requirements for a heated building can be calculated from heating degree days information. Structural heating usually begins when the air temperature is near 65 degrees F, the index temperature. If a particular day has a mean temperature of 50 degrees F, 15 heating degree days accumulate (65 minus 50). For the entire year the heating load is the sum of the daily degree days. The degree days for each month of the year for Deering are shown in Figure 8. This information, combined with an inventory of types, sizes, and insulative qualities of buildings, can determine the amount of fuel required for a specific time period in the village.

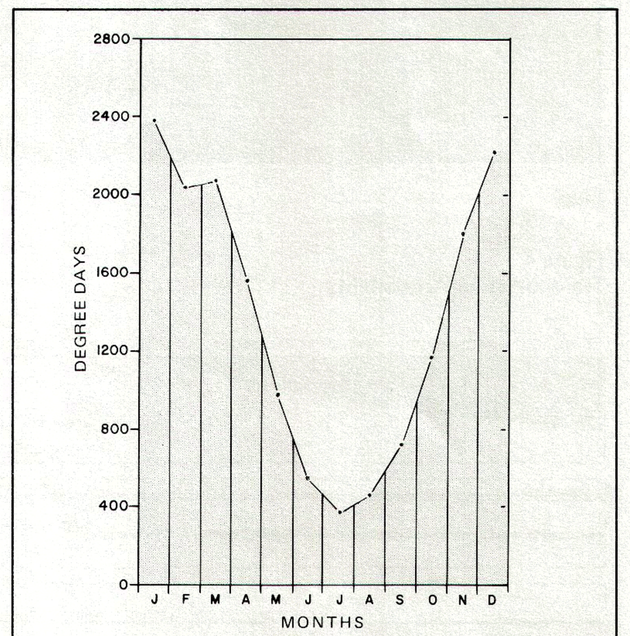
Figure 7
Snowdrifts and Wind Direction



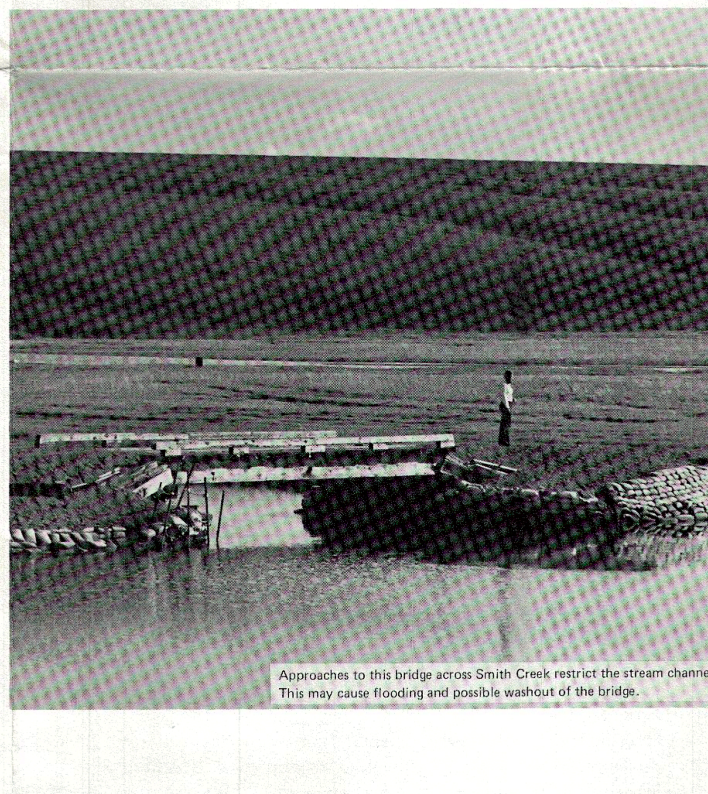
Note: Snowdrifts make a difference. Site plan (b) is laid out to minimize drifting, maximize access. Prevailing storm winds are from left.

Source: Eb Rice, 1975. **Building in the North.** University of Alaska.

Figure 8
Heating Degree Days—Deering



A rectangular 800-square-foot home insulated with fiberglass requires about 65 gallons of fuel oil for heating during January in Deering. This estimate is based on four-inch thick-fiberglass in the walls and floor, six inches in the ceiling, and a desired temperature of 70°F inside the home. Fuel consumption could be reduced by adding more insulation, minimizing window sizes, and by installing a subfloor to trap air between the floor and crawl space. Heaters should also be adjusted for efficient burning. Assistance in construction can be obtained from data developed by Dr. Eb Rice, University of Alaska, Fairbanks.



Approaches to this bridge across Smith Creek restrict the stream channel. This may cause flooding and possible washout of the bridge.

Topography and Soils

Site selection and foundation design of buildings are directly affected by the strength or bearing capacity of soils, presence or absence of permafrost, topography, drainage, erosion, and flooding. The village of Deering is located on a spit at Good Hope Bay on Kotzebue Sound. The beach is composed of sand in the first five feet underlain by gravel. This well-drained material thaws to a depth of about seven feet in summer. A tidal river, Smith Creek, flows parallel to the beach in an estuary inland from the village and discharges to the ocean east of the site. Treeless tundra occurs inland from the river.

Permafrost—Permafrost (permanently frozen ground) is continuous under most of the area. Although permafrost is not a problem on the spit where the material is well-drained, finer-grained frozen silts occur west of the village and inland from the Smith Creek estuary. These sediments contain large amounts of ice and become unstable and settle when thawed.

In the event of village expansion to the west, consideration should be given to the presence of frozen ground. The most common methods of protecting permafrost from melting are to place a thick gravel pad between the structure and frozen ground to limit heat transfer, or to raise buildings on pilings to allow air circulation under the structure. Utility pipes should be properly insulated or placed in utilidors so that a minimum of heat transfers from the pipes to the adjacent ground.

Erosion and Flooding—Storm surges and wind-driven waves can cause coastal flooding at Deering every 40 to 60 years according to the U.S. Army Corps of Engineers. Large waves threatened the village in 1963, but no homes were flooded. Flood resulting from a storm in 1973 caused extensive damage to homes, and the villagers were temporarily evacuated to the mining camp 22 miles upriver. In spite of flooding and storms, very little beach erosion has occurred. In order to maintain the stability of the coastline, gravel extraction should be restricted to the mainland side of the barrier beach.

The most important thing to remember when building in the Arctic is that successful design requires site investigation and the advice of competent engineers because of the special conditions in the North. Neglecting these considerations can lead to complete failure of structures.

Gravel-filled fuel drums have been placed to prevent the erosion resulting from wave action.

Sources of Information

Alaska, Dept. of Community and Regional Affairs. 1972. *Alaska Community Survey: Deering.*

Alaska, Dept. of Community and Regional Affairs and Alaska Municipal League. 1976. *Alaska Municipal Officials Directory 1976.* 53 p.

Alaska, Dept. of Environmental Conservation. 1976. Data on file related to Village Safe Water Program. Juneau. Unpublished.

Alaska, Div. of Aviation. Various dates. Data and maps on file related to studies made prior to and during construction of the Deering airstrip. Unpublished.

Alaska, State Housing Authority, Dept. of Planning and Technical Services. 1971. *Statewide Housing Study Volume II: Housing Resources, Housing Related Services, Housing Plan.* 115 p.

Carlson, A.R. 1970. Heat loss and condensation in northern residential construction. *Northern Engineer.* 2(2):14-17.

Erskine, R. 1969. Architecture and town planning in the north. *Northern Engineer.* 1(4):7-11.

Fryer, M.W. 1969. An engineering approach to architectural design for cold regions. *Northern Engineer.* 1(4):11-13.

Mauneluk Association, Inc. 1974. *The NANA Region; Its Resources and Development Potential.* 289 p.

Mirth, R.A. 1974. The sun can heat our homes—even in the north. *Northern Engineer.* 6(3):3-10.

Orth, D.J. 1967 (revised 1971). *Dictionary of Alaska Place Names.* U.S. Geological Survey, Professional Paper 567. 1084 p.

Rice, E. 1975. *Building in the North.* Geophysical Institute, University of Alaska. 66 p.

Selkregg, L.L. et al. 1976. *Alaska Regional Profiles: Northwest Region.* Arctic Environmental Information and Data Center, University of Alaska, Anchorage. Prepared for the Office of the Governor and the Joint Federal/State Land Use Planning Commission. 265 p.

Tobiasson, W. and R. Redfield. 1973. *Alaskan Snow Loads.* U.S. Army Cold Regions Research and Engineering Laboratory.

U.S. Army, Corps of Engineers. 1976. Flood plain management services, Alaskan communities flood hazard and pertinent data on file. Unpublished.

U.S. National Oceanic and Atmospheric Administration. 1971. *Wind Chill (Equivalent Temperatures).* Environmental Information Series.

U.S. Public Health Service. 1964. Project Summary: Sanitation Facilities Construction; The Village of Deering, Alaska. Project AN-65-450. Unpublished.