UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

WATER-RESOURCES RECONNAISSANCE OF THE KWIGUK (EMMONAK) AREA, ALASKA

By
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Prepared in cooperation with the
Alaska Department of Natural Resources

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As part of an agreement between the Alaska Department of Natural Resources and the United States Geological Survey, Water Resources Division, a reconnaissance visit was made of the area in the vicinity of the village of Kwiguk (Emmonak), Alaska, during the period June 17-19, 1970, to evaluate the water resources and to suggest methods of developing additional sources of water.

The village of Kwiguk is on the northern part of the Yukon River delta in western Alaska, approximately 10 miles inland from the point at which the Yukon River (Kwikluak Pass) enters the Bering Sea. Kwiguk lies about two miles north of the Kwikluak Pass channel on a smaller channel known as Kwiguk Pass (fig. 1). The area for miles around the village is low in altitude, ranging from sea level to about 15 feet above sea level. It is underlain by deltaic deposits of fine sand and silty clay. The upper 10 to 15 feet of these materials were sampled at the village site and are about 13 percent fine sand and 87 percent silt and clay. These fine deposits apparently extend to depths of about 200 feet.

The major occupation of the 400 to 450 people of the village is fishing. The requirement for an adequate water supply to process the seasonal salmon catch was one of the principal reasons for this investigation. Because of inadequate village water-supply facilities, the fish barges had to be equipped to pump water from the Yukon River and to chlorinate it before use.

The village of Kwiguk (Emmonak) currently uses water from a Bureau of Indian Affairs well, from rain, from a nearby lake, and from the Yukon River.

The only well in the village was drilled in 1963 for the Bureau of Indian Affairs School complex. The well was originally drilled to a depth of 195 feet and a screen set at 194 feet. Water from this depth was salty, and the screen was pulled back and placed between 72.5 and 82.5 feet where water of acceptable quality was found. The yield of this well now averages about 3 gpm (gallons per minute). Because of this small yield, water is pumped into a storage tank for distribution throughout the Bureau of Indian Affairs buildings. The water is of the sodium bicarbonate type and has a high iron content. It is used only for washing, probably because of the objectionable color and taste. (Analysis 1 indicates the chemical quality of this water.)

Rain water is used as a drinking water supply by the Bureau of Indian Affairs personnel and by others in the village. The water is collected from roof drains and fed into storage tanks in the individual buildings. Sufficient rain apparently falls most of the year so that only moderate storage is required.

Water from a nearby lake (fig. 1) is pumped into a large retention tank for use by the Northern Commercial Company. No chlorination facilities are connected to this facility. (Analysis 2 indicates chemical quality of this water.)

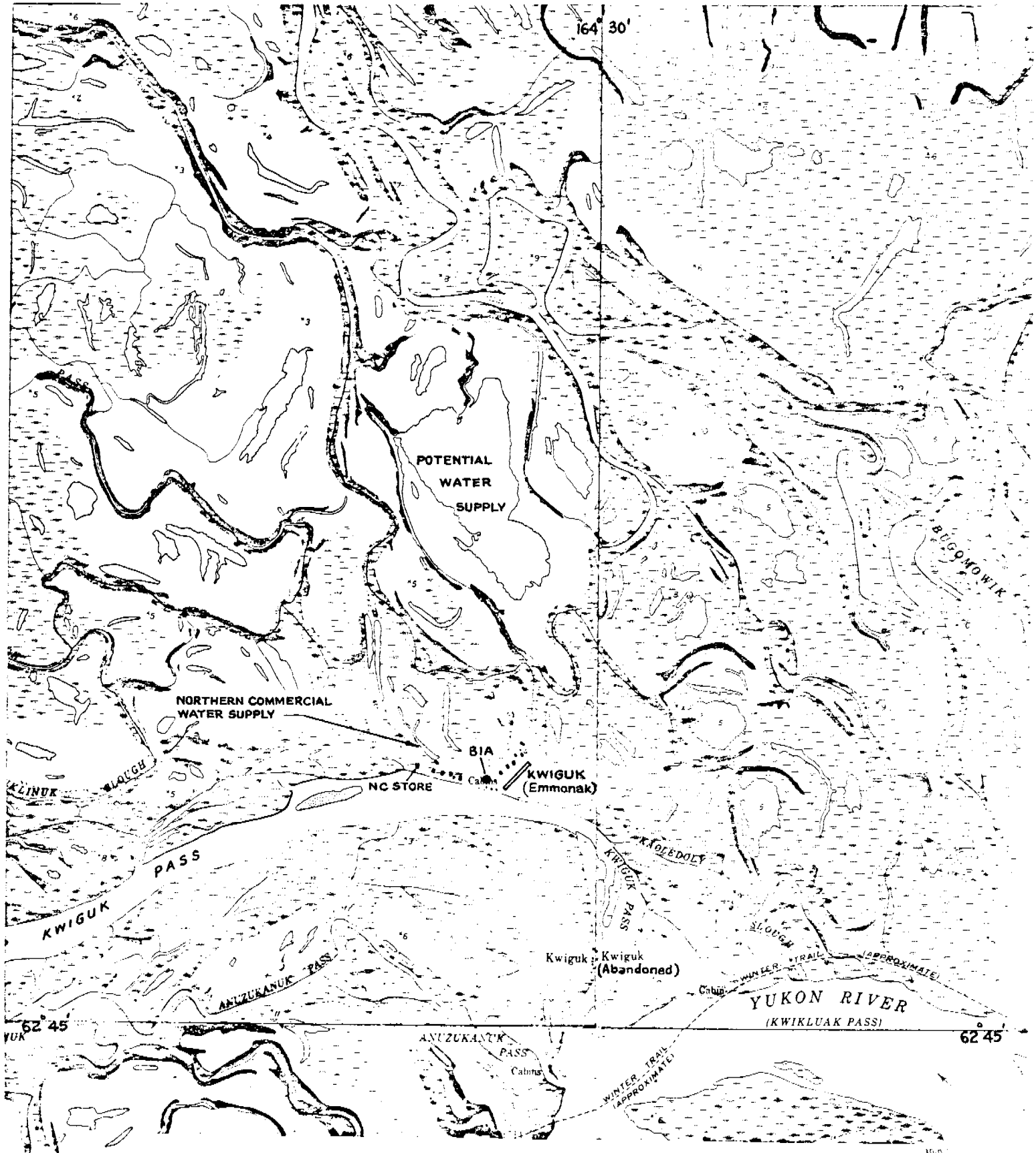
Water from the Yukon River is also utilized by the people of Kwiguk. It is generally bailed directly from the river and boiled before drinking. During summer months the water is highly sediment laden and must be left standing for extended periods to allow the sediment to settle. In addition to the sediment problem, there is also a possible contamination problem resulting from the disposal of sewage upstream on the Yukon River. (Analysis 3 indicates the Chemical quality of water in the Yukon River at this location.)

To develop an adequate (25 to 50 gpm) supply of water for the village of Kwiguk, three alternative plans may be considered:

1. Drill a deep well. The single well drilled in the village obtained saline water at a depth of 195 feet. However, a deeper well might obtain fresh water from more permeable materials. No deep wells have been drilled in the northern part of the Yukon River delta, but several wells at Bethel, about 125 miles south of Kwiguk on the Kuskokwim delta, obtain fresh water at depths of 400 to 450 feet below permafrost. Apparently no permafrost exists on the northern part of the Yukon delta. A new well should be centrally located in the village and a heated tank should be constructed for storage. In addition to providing a possible supply of water for the village, drilling of the exploratory well would also have considerable transfer value. Several other communities such as Alakanuk and Emangak are located within a radius of about 30 miles of the proposed exploratory well. The information gained from this drilling would provide information that could be used by these and other nearby villages to plan the most favorable means for expanding or developing their water supplies.

2. Utilize water from an unnamed lake about 1.5 miles north of the village of Kwiguk. The lake is nearly inaccessible and is believed to be uncontaminated. Construction of a pipeline and storage facilities would be required. The water from this lake was not sampled during the reconnaissance, but the quality is probably very similar to the lake water used by the Northern Commercial Company.

3. Pump water from the Yukon River. Because sand or gravel deposits do not occur within the flood plain of the Yukon River near the village, the construction of an infiltration gallery would probably not be effective. Larger quantities of water than presently obtained could be pumped directly from the Yukon River into large storage tanks where adequate settling could be accomplished.



Attachment 1.--Map of the area near the village of Kwiguk showing BIA facilities, the presently used lake, and the potential water-supply lake.

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ANALYSIS 1

WATER ANALYSIS

Location BIA School - Kwiguk County
Source
Point of coll.
Owner Treatment

Use Gage height (ft) Discharge (cfs) Temp (°F)
Appear. when coll. Turbid
Collected 6-17-70 By Al Feulner
Remarks

	mg/l	ap/l		mg/l	ap/l
Silica (SiO_2)	42		Bicarbonate (HCO_3)	575	9.42
Aluminum (Al)			Carbonate (CO_3)	00	0.00
Iron (Fe) (total)	1.1				
Manganese (Mn)	0.18		Sulfate (SO_4)	0.4	0.01
			Chloride (Cl)	111	3.13
			Fluoride (F)	0.4	0.02
Calcium (Ca)	32	1.60			
Magnesium (Mg)	37	3.04	Nitrate (NO_3)	9.2	0.15
Sodium (Na)	180	7.83	Phosphate (PO_4)	14	0.25
Potassium (K)	24	0.61			
Total		13.08	Total		12.98

	mg/l		
		Specific conductance (micromhos at 25° C)	1190
Dissolved solids: Calculated	733	pH	7.1
Residue on evaporation at 180°C		Color	100
Hardness as $CaCO_3$	197		
Noncarbonate	0		
Alkalinity as CaCo3	472		

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ANALYSIS 2

WATER ANALYSIS

Location Northern Commercial Co. - Kwiguk County
Source Lake Water
Point of coll.
Owner Treatment

Use Gage height (ft) Discharge (cfs) Temp (Max 12°C.
Appear. when coll. clear
Collected 6-18-70 By Al Feulner
Remarks Sampling depth - 6"

	mg/l	ap/l		mg/l	ap/l
Silica (SiO_2)	0.2		Bicarbonate (HCO_3)	32	0.52
Aluminum (Al)			Carbonate (CO_3)	00	0.00
Iron (Fe) (total)	0.39				
Manganese (Mn)	0.01		Sulfate (SO_4)	0.0	0.00
			Chloride (Cl)	3.2	0.09
			Fluoride (F)	0.2	0.01
Calcium (Ca)	6.4	0.32			
Magnesium (Mg)	2.2	0.18	Nitrate (NO_3)	0.6	0.01
Sodium (Na)	2.0	0.09	Phosphate (PO4)	0.0	0.00
Potassium (K)	3.8	0.10			
Total		0.69	Total		0.63

	mg/l		
		Specific conductance (micromhos at 25° C)	70
Dissolved solids:	35	pH	7.1
Calculated			
Residue on evaporation at 180° C		Color	30
Hardness as $CaCO_3$	25		
Noncarbonate	0		
Alkalinity as CaCo3	26		

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ANALYSIS 3

WATER ANALYSIS

Location Yukon River – Kwiguk County
Source Opposite BIA School
Point of coll.
Owner Treatment
Use Gage height (ft) Discharge (cfs) Temp (~~F~~) 12°C.
Appear. when coll. silty, cloudy
Collected 6-18-70 By Al Feulner
Remarks

	mg/l	ap/l		mg/l	ap/l
Silica (SiO_2)	4.5		Bicarbonate (HCO_3)	80	1.31
Aluminum (Al)			Carbonate (CO_3)	00	0.00
Iron (Fe) (total)	0.41				
Manganese (Mn)	0.00		Sulfate (SO_4)	13	0.27
			Chloride (Cl)	0.7	0.02
			Fluoride (F)	0.2	0.01
Calcium (Ca)	23	1.15			
Magnesium (Mg)	4.6	0.38	Nitrate (NO_3)	1.2	0.02
Sodium (Na)	2.2	0.10	Phosphate (PO4)	.06	
Potassium (K)	1.5	0.04			
Total		1.07	Total		1.63

	mg/l		
		Specific conductance (micromhos at 25° C)	163
Dissolved solids:			
Calculated	90	pH	7.4
Residue on evaporation at 180° C			
		Color	75
Hardness as $CaCO_3$	77		
Noncarbonate	11		
Alkalinity as CaCo3	66		

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