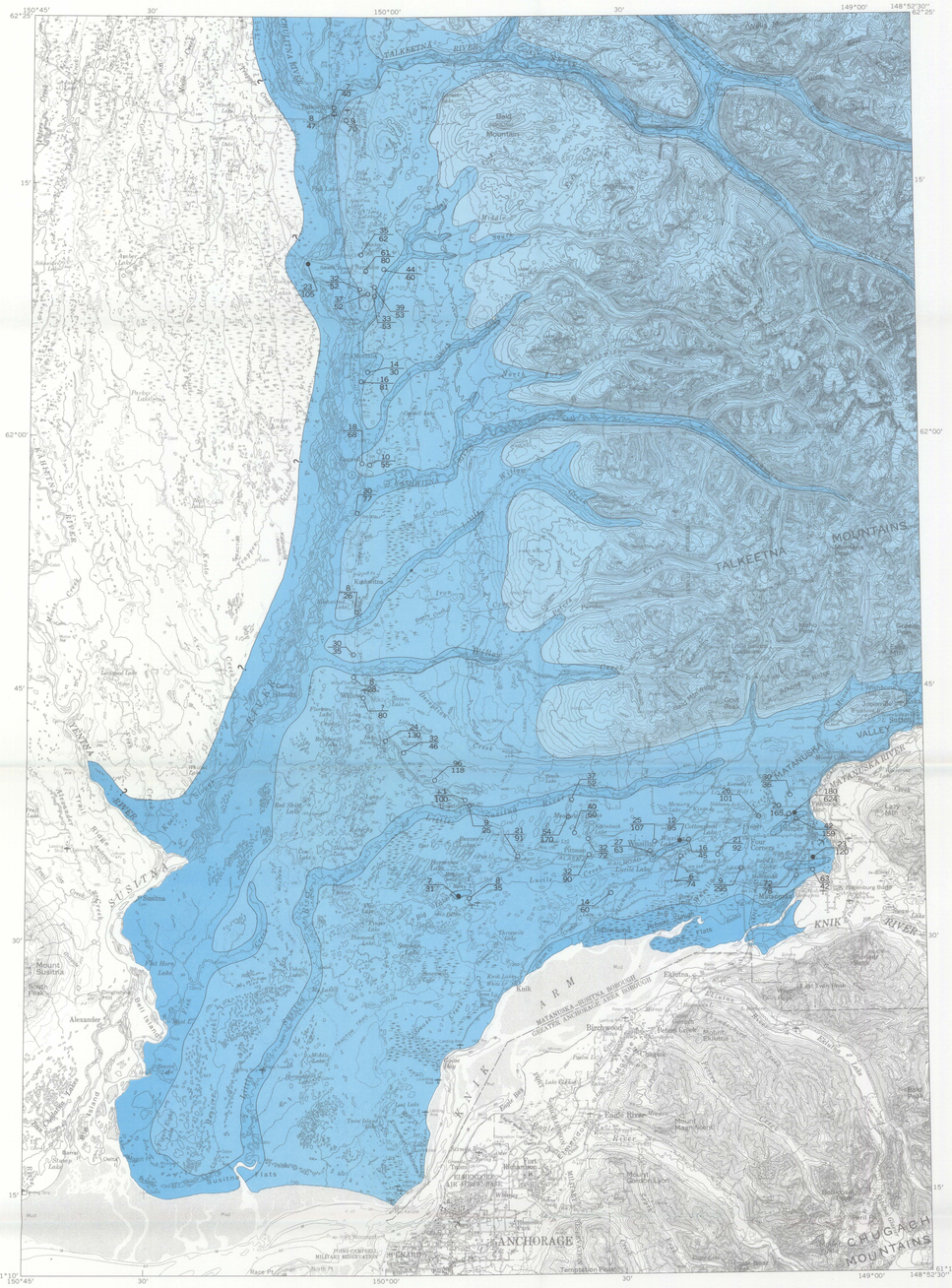
DEPARTMENT OF THE INTERIOR
UNITED STATES GEOLOGICAL SURVEY

PREPARED IN COOPERATION WITH
ALASKA POWER ADMINISTRATION

HYDROLOGIC INVESTIGATIONS
ATLAS HA-364



Base from U.S. Geological Survey, Talkeetna Mountains, 1954; Talkeetna, 1958; Tyonek, 1958 and Anchorage, 1962

SCALE 1:250 000

5 0 5 10 15 MILES
5 0 5 10 15 KILOMETERS

CONTOUR INTERVAL 200 FEET
DOTTED LINES REPRESENT 100-FOOT CONTOURS
DATUM IS MEAN SEA LEVEL
DEPTH CURVES AND SOUNDINGS IN FEET—DATUM IS MEAN LOWER LOW WATER
SHORELINE SHOWN REPRESENTS THE APPROXIMATE LINE OF MEAN HIGH WATER
1971 MAGNETIC DECLINATION AT SOUTH EDGE OF SHEET VARIES FROM 25° TO 26° EAST

AVAILABILITY OF GROUND WATER

EXPLANATION

ESTIMATED POTENTIAL YIELD, IN GALLONS PER MINUTE

Unit 1—Less than 10

Unit 2—10–50

Unit 3—50–1000

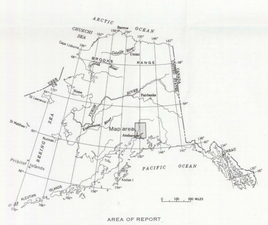
Unit boundary

Wells yielding more than 100 gallons per minute

7
o 40

Selected wells on which water level and well depth were recorded

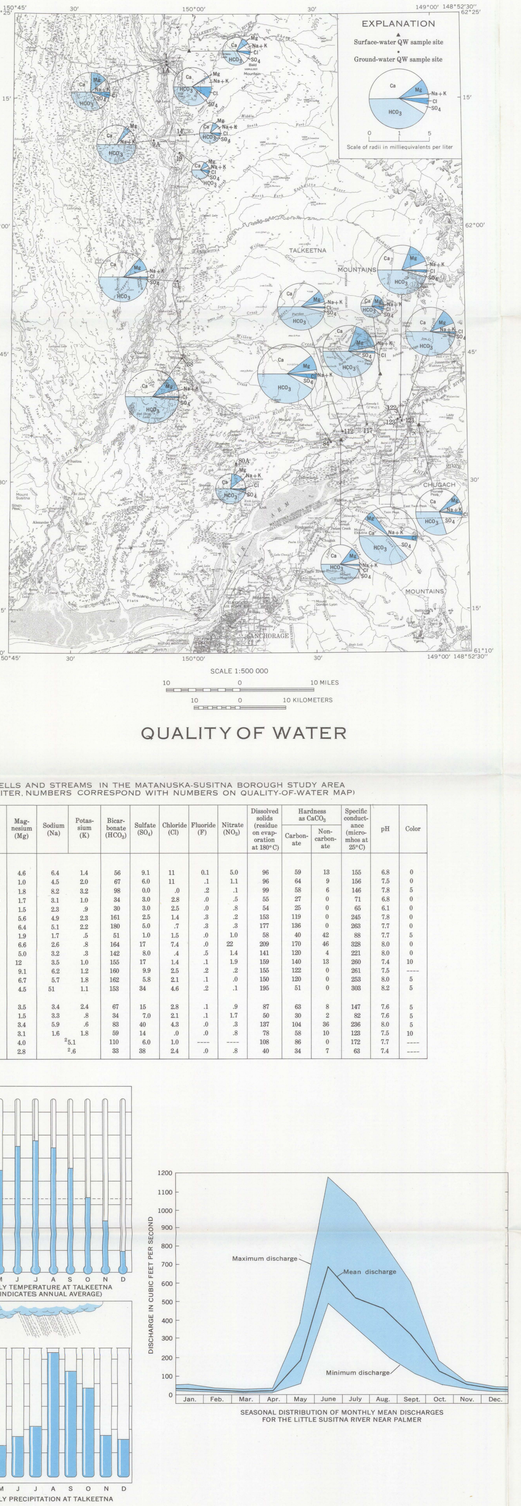
Upper number, depth to water in feet below land surface
Lower number, depth of well in feet below land surface



AREA OF REPORT

AVERAGE MEASURED DISCHARGE OF STREAMS

Name	Discharge in cubic feet per second	Discharge in acre-feet per year	Discharge in million gals per day
Matanuska River near Palmer	3,990	2,889,000	2,579
Cottonwood Creek near Wasilla	16	11,600	10
Little Susitna River near Palmer	209	151,300	135
Talkeetna River near Talkeetna	4,265	3,159,955	2,821
Susitna River at Gold Creek	10,130	7,334,000	6,547
Chulitna River near Talkeetna	9,079	6,573,000	5,868



SCALE 1:500 000

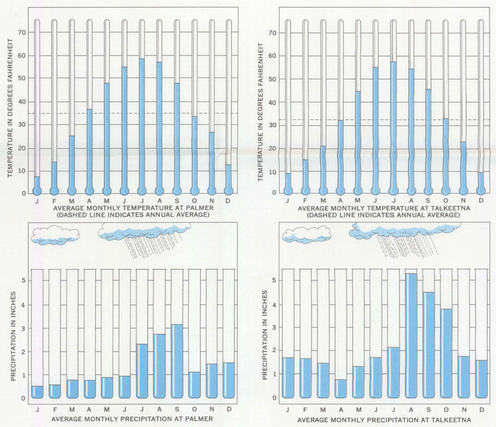
10 0 10 MILES
10 0 10 KILOMETERS

QUALITY OF WATER

TABLE OF CHEMICAL ANALYSES FROM WELLS AND STREAMS IN THE MATANUSKA-SUSITNA BOROUGH STUDY AREA
(CHEMICAL RESULTS IN MILLIGRAMS PER LITER. NUMBERS CORRESPOND WITH NUMBERS ON QUALITY-OF-WATER MAP)

Owner or name by which well is known	Date sampled	Silica (SiO_2)	Iron (Fe)	Manganese (Mn)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Dissolved solids (residue on evaporation at 180°C)	Hardness as $CaCO_3$: Carbonate	Hardness as $CaCO_3$: Noncarbonate	Specific conductance (micromhos at 25°C)	pH	Color
GROUND WATER																			
1 Alice Powell	9-20-66	14	.71	-----	16	4.6	6.4	1.4	56	9.1	11	0.1	5.0	96	59	13	155	6.8	0
1A U.S. Geological Survey	9-15-67	13	.10	-----	24	1.0	4.5	2.0	67	6.0	11	.1	1.1	96	64	9	156	7.5	0
9A State of Alaska	9-17-67	16	1.23	-----	20	1.8	8.2	3.2	98	0.0	.0	.2	.1	99	58	6	146	7.8	5
14 Joe Heck	7-27-67	18	.13	-----	8.0	1.7	3.1	1.0	34	3.0	2.8	.0	.5	55	27	0	71	6.8	0
19 H. Kennerson	7-27-67	20	.69	-----	7.6	1.5	2.3	.9	30	3.0	2.5	.0	.3	54	25	0	65	6.1	0
31 Arnold Echola	7-28-67	17	1.01	-----	38	5.6	4.9	2.3	161	2.5	1.4	.3	.2	153	119	0	245	7.8	0
39 Willow Elem. School	7-28-67	23	7.00	-----	44	6.4	5.1	2.2	180	5.0	.7	.3	.2	177	136	0	262	7.7	0
89A Big Lake School	11-15-63	12	.02	0.02	13	1.9	1.7	.5	51	1.0	1.5	.0	1.0	58	40	42	88	7.7	5
84 Dennis Crawford	8-03-67	15	.12	-----	57	6.6	2.6	.3	164	17	7.4	.0	22	209	170	46	328	8.0	0
112 Toyon Country Club	8-05-67	12	.03	-----	40	5.0	3.2	.3	142	8.0	.4	.5	1.4	141	120	4	221	8.0	0
117 Barry's Finger Lake Res.	8-01-66	10	.00	-----	36	12	3.5	1.0	155	17	1.4	.1	1.9	159	140	13	260	7.4	10
121 City of Palmer Well 1	11-01-52	13	.06	-----	34	9.1	6.2	1.2	160	9.9	2.5	.2	.2	155	122	0	261	7.5	-----
122 City of Palmer Well 2	7-22-66	11	.02	-----	37	6.7	5.7	1.8	162	5.8	2.1	.1	.0	150	120	0	253	8.0	5
123 City of Palmer Well 3	5-23-67	12	.00	-----	13	4.5	51	1.1	153	34	4.6	.2	.1	195	51	0	303	8.2	5
SURFACE WATER																			
Susitna River at Gold C	[1]8-22-67	7.1	.06	-----	19	3.5	3.4	2.4	67	15	2.8	.1	.9	87	63	8	147	7.6	5
Talkeetna R nr Talkeetna	8-23-67	6.7	.08	-----	9.7	1.5	3.3	.8	34	7.0	2.1	.1	1.7	50	30	2	82	7.6	5
Matanuska R nr Palmer	10-17-66	5.8	.00	-----	36	3.4	5.9	.6	93	40	4.3	.0	.3	137	104	36	236	8.0	5
Chulitna R nr Talkeetna	[1]8-22-67	5.4	4.26	-----	18	3.1	1.6	1.8	59	14	.9	.0	.3	78	58	10	123	7.5	10
Cottonwood C nr Wasilla	10-19-48	9.2	-----	-----	28	4.0		[2]5.1	110	6.0	1.0	-----	-----	108	86	0	172	7.7	-----
Little Susitna R nr Palmer	8-03-50	4.5	.02	-----	89	2.8		[2]7.6	33	38	2.4	.0	.3	40	34	7	63	7.4	-----

[1]Not shown on quality-of-water map; north of report area
[2]Sodium plus potassium



INTRODUCTION

This study, in cooperation with the Alaska Power Administration, was made with the specific purpose of collecting appropriate basic data and describing the present water resources of the area, and appraising the water-resources potential of the area for future use. The area covered by this report is shown on adjacent maps. However, attention was given primarily to the lowland part of the Matanuska-Susitna Borough.

The climate of the region is a mixture of maritime and continental types. In the southern part of the study area, southerly and southwesterly winds bring in warm moist air from the Gulf of Alaska and Cook Inlet. Precipitation there is only about half of that which falls in the northern part of the study area, due to the proximity of the mountains to the north. Average yearly precipitation is about 16 inches at Palmer and about 29 inches at Talkeetna. Temperatures are rather uniform throughout the lowland, except for a minor moderating effect of the ocean along the southern and southwestern extremities of the region. Average January temperatures range from about −3° F to +19° F, and average July temperatures range from about 50° F to 70° F. Accompanying illustrations present precipitation and temperature data from U.S. Weather Bureau records.

Palmer is the only incorporated community in the study area; other communities are Wasilla, Houston, Willow, Montana, Sunshine, and Talkeetna. The Palmer-Wasilla area, called the Matanuska Valley agricultural area, was established as an agricultural colony in 1935 and has experienced slow growth. Most of the activities are centered around dairy products and truck crops. In dry periods of the year, irrigation is used in a small part of the Matanuska Valley agricultural area. On a year-to-year average, however, the total acreage irrigated is about 40 acres, and irrigation wells supply most of this water.

Total population of the study area probably did not exceed 7,000 permanent residents in 1967. The area west and north of Wasilla has recently shown a population expansion coincident with the opening of a part of the Anchorage-to-Fairbanks highway through this region.

In addition a large number of visitors occupy cabins during the spring, summer, and early fall near the larger lakes served by the road network. The number of such temporary residents ranges from about 5,000 to nearly 20,000 people per week during the summer. This number is likely to increase as new roads are constructed to more lakes and streams.

Palmer is the only community in the study area with a municipal water-supply system and sewage disposal system. Throughout the rest of the study area water is obtained from individual wells, and wastes are disposed of through septic tanks or directly to the ground.

Population expansion and improved transportation, causing periodic large nonresident population, have created a need for additional water and have focused attention on the need for information regarding the location, development, and management of water resources in the area. Special needs in water development and management include plans for municipal water-supply and sewage facilities at communities not served presently.

Acknowledgments.—Appreciation is expressed to the many individuals and departments of both Federal and State governments from whom data relating to the ground-water potential and problems of the area were obtained. The author also wishes to express appreciation to local residents who provided data and permitted sampling and measurement of their private wells. The work of Trainer (1960) provided valuable information with respect to the eastern part of the study area.

AVAILABILITY OF SURFACE WATER

Two major streams bound the study area (the Susitna River to the west and the Matanuska River to the southeast) and many smaller streams flow from the Talkeetna Mountains to the Susitna River or Cook Inlet. The Susitna River, the largest stream in the area, combines the flow of the Chulitna, Susitna, and Talkeetna Rivers upstream from Talkeetna. All the major streams head in glaciers and contain silt or glacial flour.

Stream-gaging stations operated on the Matanuska and Little Susitna Rivers near Palmer, the Talkeetna River near Talkeetna, and the former station on Cottonwood Creek near Wasilla, are shown on the quality-of-water map. Gaging stations are also located north of the study area on the Chulitna River near Talkeetna and on the Susitna River at Gold Creek. These two stations are not shown on the quality-of-water map although the discharges measured at these stations are presented on the table "Average measured discharge of streams."

Peak-flow periods in all streams (except Cottonwood Creek) are in June, July, and August; low-flow periods in all streams are in February and March. The illustration showing the monthly mean discharge of the Little Susitna River near Palmer is typical for most streams in the area.

Average cumulative discharge of all measured streams in the study area is about 28,000 cfs (cubic feet per second). A table showing the discharge of streams in cubic feet per second, acre-feet per year, and millions of gallons per day indicates the availability of surface water.

Many lakes exist in the study area, but only a few are shown on the maps. The largest is Big Lake, which has about 7 square miles of surface area. Some of the other lakes in the area, which have been developed for recreational use, are Wasilla Lake (east of Wasilla), Lucile Lake (west of Wasilla), and Nancy Lake (south of Willow).

Most of the lakes are drained by small streams. Cottonwood Creek drains Wasilla Lake, Lucile Creek drains Lucile Lake, and Fish Creek drains Big Lake. All of these small streams have a well sustained base flow. The former gage on Cottonwood Creek showed a monthly range of 11 to 34 cfs and averaged 16 cfs in 5 years of record.

AVAILABILITY OF GROUND WATER

The study area has been divided into three units. The delineation of these units is based on geologic and hydrologic data and on analogy with similar areas for which more definitive data are available.

Unit 1

Unit 1, the upland east and north of the road system and railroad, is generally underlain by bedrock, composed chiefly of granitic rocks of Mesozoic(?) age and subordinate lavas and tuffs. Nearly all this area is more than 900 feet above sea level and only relatively thin soil, or glacial or alluvial deposits overlie the bedrock. Few data are available on ground water in this unit because there are no communities, few residences, and no known wells. Yields of less than 10 gpm (gallons per minute) can generally be expected from wells completed within the area, on the basis of analogy with yields from bedrock in similar areas. Somewhat larger yields might be developed from alluvial deposits along streams that dissect the upland or from fracture zones in the bedrock.

Unit 2

Unit 2 includes most of the area between Unit 1 and the Susitna River, Cook Inlet, and Knik Arm. It is the most heavily populated part of the study area and is underlain mainly by glacial deposits although outwash and alluvial deposits occur near streams.

Yields of wells generally range from 10 to 50 gpm. Nearly all wells obtain water from interbedded sand and gravel lenses in the glacial deposits. The depth of successful wells ranges in general from about 30 to 295 feet near Palmer. From the Wasilla area westward the depth of successful wells ranges from 25 to 170 feet. Most of the successful wells in Unit 2 have been completed at depths of between 50 and 150 feet below ground surface. The depth to water below land surface generally ranges from about 1 to 100 feet.

Wells drilled in Unit 2 should yield between 10 and 50 gpm if drilled to a depth of 75 to 150 feet. The amount yielded will depend upon the thickness, transmissibility, and extent of saturated water-bearing materials at the well site.

Unit 3

Unit 3 comprises several discontinuous, elongated strips of land that include the flood plains and lowland areas adjacent to streams and rivers. These are underlain by glacial and alluvial deposits of sand and gravel. Five wells in these areas reportedly yield more than 100 gpm. The five wells are indicated on the Water-Availability map. These wells are: 1) Palmer city well 3 north of Palmer, which is 624 feet deep and yields 325 gpm; 2) an irrigation well south of Palmer, which is 120 feet deep and yields 200 gpm; 3) a well at the Toyon Country Club east of Wasilla, which is 95 feet deep and yields 300 gpm; 4) a well at the Big Lake Summer Camp, which is 31 feet deep and yields 300 gpm; and 5) a well at a former road construction camp southwest of Sunshine, which is 105 feet deep and yields 250 gpm.

QUALITY OF WATER

Generally, surface water is of good quality and, except for isolated instances, contains less than 0.3 mg/l (milligrams per liter) of iron (the suggested maximum of the U.S. Public Health Service, 1962). All the surface waters have a hardness of less than 150 mg/l and are of the calcium magnesium bicarbonate type. The Matanuska River near Palmer contains more sulfate than the other streams. This is probably due to drainage from the coal mines northeast of Palmer. The table and the figure of chemical-quality data show the relationships of the various chemical constituents to one another.

Ground water in the study area has a greater chemical-quality variation than the surface water. It generally is harder than surface water, except in areas adjacent to streams where the water quality of both is similar. Much of the ground water obtained from shallow wells drilled in the alluvium contains objectionable concentrations of iron, most of which could be easily removed by aeration and filtration of the water prior to storage or use. Ground water ranges from about 50 to more than 200 mg/l in hardness and is of the calcium bicarbonate type. Water from city well 3 at Palmer (shown as well 123 in both the quality-of-water map and the table of chemical analyses) is of the sodium bicarbonate type and contains a higher concentration of sulfate than does water from most other wells in the area. This well is probably drilled in a former channel of the Matanuska River. The water level in the well appears to fluctuate with river level and the higher sulfate content is evidently related to the higher sulfate level of water in the river.

Because of previously noted excessive concentrations of boron in ground water in the Palmer area, an attempt was made to determine the distribution of this element in the waters of the study area. The highest known concentration of boron, 2.6 mg/l, was found in the city of Palmer well 3. Measurable concentrations of boron were also found in both surface and ground waters along the Matanuska River, as far west as Wasilla and as far south as Anchorage.

High boron content in waters is detrimental and often toxic to many types of plants (Hem, 1959, p. 245–246). Because there is little irrigation in the Matanuska Valley area and because the types of plants commonly grown in Alaska are not sensitive to boron, its occurrence is of little current importance. Future irrigation wells, however, should be tested for boron prior to use.

On recent spot sampling, several wells of different depths near Palmer and Wasilla, none of which are shown on adjacent maps, have yielded water which has a high nitrate content. One well northwest of Palmer yielded water with 270 mg/l nitrate. A suggested maximum of about 45 mg/l nitrate is set by the U.S. Public Health Service (1962). Water from wells in the area should be checked periodically for nitrate content because of its possible effects on health and upon livestock and milk production. The high nitrate concentrations are not accompanied by any detectable coliform bacteria, and the nitrate is possibly geologic in origin.

POTENTIAL WATER DEVELOPMENT

The foregoing sections indicate areas in which ground and surface water are available for development. However, the water potential of the area is largely undeveloped.

Large supplies of surface water are available for domestic, municipal, and industrial use throughout the study area in the form of lakes and streams. The largest stream is the Susitna River below Talkeetna. The composite of the flows of the three streams which join immediately above Talkeetna averages more than 24,000 cubic feet per second or nearly 15,000 million gallons per day. The average flow of the Matanuska River near Palmer is 3,990 cubic feet per second or about 2,500 million gallons per day.

Although large volumes of water are available from lakes and streams throughout the year, most of the water from streams is laden with glacial silt or flour. This water would require considerable treatment prior to use for nearly any purpose other than irrigation. The quantities of water presently required for domestic, municipal, and industrial use in the study area can be obtained in more suitable quality from wells or galleries. It appears that future water requirements could also be obtained from ground-water sources. In the event, though, that large volumes of water are required in the future for industrial purposes, the larger streams and lakes could be developed.

Considering use of ground water, Unit 3, which is adjacent to the principal rivers, offers the greatest possibility for ground-water development. Withdrawal of water in this unit is low and can be greatly increased if needed. Near major streams, well yields in excess of 1,000 gpm should be obtainable. Away from the streams, but where former drainage channels or buried valleys exist, up to 500 gpm should be available. Unit 3 is generally sparsely populated but contains the communities of Talkeetna and Montana, Sunshine, Willow, Houston, Wasilla, and Palmer are all near Unit 3, and could import water for their systems.

Test drilling will be required to develop the maximum yield of water from Unit 3. The valley fill adjacent to the principal streams consists of saturated material composed of coarse well-sorted sand and gravel. However, the yield of wells is limited by the thickness and extent of the aquifer. To find the point where the saturated material is thickest, a series of regularly spaced test holes should be drilled across the valley, rather than along the trend of the valley or at random. Such a test-drilling program will usually find the deepest points of the former channel.

Unit 2 has less potential for development than Unit 3. No widespread aquifer system is known to exist in the glacial deposits underlying the area. However, water in amounts of from 10 to 50 gpm is available to drilled wells nearly everywhere in the area.

Unit 1 is underlain by thin glacial deposits, outwash, or alluvium overlying consolidated rock and is believed to have little potential for ground-water development. Wells of small yield (less than 10 gpm) probably can be developed in the limited surface deposits or from fractured zones in the underlying bedrock.

Additional growth and increased industry in the Palmer area could lead to a demand for more water than can be produced by present facilities. Either additional wells north of town, or drilled wells in the abandoned channel south of town, or a gallery adjacent to the Matanuska River east of town could probably be developed to supply the increasing water needs.

Wasilla, the second largest community in the area, is located between Wasilla Lake and Lucile Lake, which are rapidly becoming popular recreational areas. Near the community center, sufficient ground water is available at shallow depth to supply the needs of Wasilla. But precautions should be taken to control contamination of the ground-water aquifers. A municipal water and sewer system at Wasilla would alleviate contamination problems in the lakes and in the shallow ground-water aquifers.

Big Lake, a community scattered along the northeast shore of a lake having the same name, is a fast growing recreational area. Existing wells near Big Lake have relatively large yields, suggesting that additional water supplies could be developed. Big Lake also has a potential contamination problem due to increased settlement, lack of community sewage facilities, and the use of numerous septic tanks which discharge into the shallow aquifers which drain into the lake.

Houston, a small community near a railroad stop, has small potential for population increase. Adequate water for future demand probably could be obtained from Unit 3 deposits, which are adjacent to the community.

Willow is a community with a potential growth based upon increasing recreational facilities near Nancy Lake. Future water supplies probably could be obtained from the Unit 3 deposits directly north of the community.

Montana is a community in Unit 3. The growth potential of the Montana area is not as great as either Willow or Wasilla. Adequate ground-water supplies for future growth probably are obtainable nearly everywhere in the community limits.

Sunshine is a small community near a railroad stop. Sufficient water for future needs could probably be developed within the community or from gravel near the Susitna River west of the community center.

Talkeetna is located on the lowland near the confluence of the Talkeetna, Susitna, and Chulitna Rivers. The area is underlain by gravel to a depth of about 60 feet and by blue clay below this depth to more than 100 feet. Large supplies of water are available from the gravel, but contamination may occur if means are not employed to keep contaminants from entering this gravel.

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WATER-RESOURCES RECONNAISSANCE OF A PART OF THE MATANUSKA-SUSITNA BOROUGH, ALASKA

By
Alvin J. Feulner

1971

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