Streamflow

The two major streams draining the area are the Seldovia River and Barbara Creek. The drainage areas of these streams are 24.6 mi^2 and 20.7 mi^2, respectively. Fish Creek has a drainage area of 3.83 mi^2. An unnamed tributary of Seldovia Slough has a drainage area of 0.93 mi^2 above the city's reservoir in section 32, T.8 S., R.15 W. Gaging stations have been continuously operated on Barbara Creek since June 1972 and the Seldovia River since August 1978. Miscellaneous measurements have been made on Fish Creek and the reservoir creek. Data on mean annual runoff, mean annual discharge, and annual minimum discharge for Barbara Creek are presented in table 1.

The annual minimum discharge of Barbara Creek for the period of record averaged 16 ft^3/s, or 10.3 million gal/d. The Seldovia River has a drainage basin 20 percent larger than Barbara Creek and, presumably, a larger minimum flow. (Concurrent low-flow measurements on March 15, 1978, showed the discharges of Seldovia River and Barbara Creek to be 57.2 ft^3/s and 19.4 ft^3/s, respectively.) Both streams flow within 5 mi of Seldovia and could provide water to the community. However, both are salmon-spawning streams, and diversion could cause a conflict between municipal water needs and preservation of fish habitat.

Water Use

The City of Seldovia obtains much of its water from a small reservoir on the unnamed tributary to Seldovia Slough. During the winter, flow from the reservoir is inadequate for municipal needs, and the water supply is supplemented by water impounded behind a diversion dam on Fish Creek. During prolonged periods of subfreezing temperatures, both sources have been inadequate to supply the city's needs during peak-usage hours.

Municipally supplied water used for commercial and residential purposes is estimated to be 231,600 gal/d, and industrial use prior to 1978 was about 209,700 gal/d (Tryck, Nyman, and Hayes, written commun., 1978). However, since 1978, modification in the plant design of the largest industrial user, a seafood cannery, has reduced industrial consumption to less than 100,000 gal/d. Maximum water use by the cannery is during crab season, August 1 - September 15 and December 1 - May 31 (Betty Hamlin, Pacific Pearl Seafoods, oral commun., 1978).

HYDROGEOLOGY

The distribution of surficial and bedrock materials is shown in figure 2. Surficial materials are glacial drift, alluvium, alluvial fan deposits, beach and intertidal deposits, and peat. Bedrock consists of indurated sediments and crystalline (igneous and metamorphic) rocks.

Sedimentary Bedrock

East of Seldovia Point and within about one-half mile of the coast, bedrock consists of indurated sandstone, siltstone, and conglomerate. This bedrock has both primary (intergranular) and secondary (fracture) porosity. Although no wells are known to have been drilled in sedimentary bedrock near Seldovia, numerous wells have been drilled in similar materials near Homer. Those wells provide water supplies adequate for domestic use, but yields of more than 15 gal/min are uncommon. A yield of 1-15 gal/min is generally considered adequate for a domestic supply.

Igneous and Metamorphic Bedrock

Most the Seldovia area is underlain by igneous and metamorphic bedrock. These rocks consist of complexly juxtaposed schist, volcanic rocks, and metamorphosed sediments (Forbes and Lanphere, 1973). They have little or no primary porosity, but some secondary porosity and permeability may occur in fractures. There have been too few wells drilled in crystalline bedrock near Seldovia to assess its potential for producing water to wells. However, many domestic wells are completed in crystalline bedrock in the same coastal mountain belt near Anchorage, 130 mi to the northeast, and Kodiak, 120 mi to the southwest. Such bedrock wells are commonly 100-500 ft deep and yield less than 5 gal/min.

Glacial Drift Deposits

Glacial drift consists primarily of a veneer of till that covers bedrock and fills depressions in the bedrock. Drift is generally poorly sorted and has low permeability. Locally, however, it may contain stratified fluvial material that will yield small quantities of water to wells. The drift is absent on many bedrock knolls and bluffs, but it exceeds 20 ft in thickness in some road cuts and borrow pits along the Seldovia-Jakolof Bay Road. In areas in which the drift is thin and poorly sorted, ground-water availability depends on the permeability of the underlying bedrock.

Alluvium

Alluvial materials deposited by the Seldovia River, Barbara Creek, and Fish Creek are thin and of small areal extent. Although the alluvium is quite permeable, its storage volume is small. Withdrawal of ground water from the alluvium will rapidly induce infiltration from the streams, thereby reducing streamflow.

A well drilled in the alluvium of Fish Creek (well 11450, fig. 3) penetrated 48 ft of unconsolidated material and was completed in a confined aquifer of sand and gravel. A water sample from this well was of calcium bicarbonate ion composition and contained 92 milligrams per liter (mg/L) of dissolved solids (table 2). The silty clay in the interval between 20 and 36 ft below land surface yielded no water to the well. If such clay deposits are common in the lower reaches of tributaries to Cook Inlet near Seldovia, the permeable materials in alluvial aquifers may be too thin to provide more than a domestic supply.

Alluvial Fan Deposits

Alluvial fan deposits at the mouths of small, steep streams consist of moderately to poorly sorted silt, sand, and gravel. A cutbank in a borrow pit in an alluvial fan east of the airport exposed poorly sorted, bedded materials ranging in clast size from silt to boulders. Two wells were drilled in the alluvial fan east of the north end of the Seldovia airport. The first (well 11401, fig. 3) penetrated 40 ft of unconsolidated materials and produced about 5 gal/min of water. Most of the water came from a sandy gravel unit between 26 and 28 ft. Other materials penetrated were insufficiently permeable to yield significant quantities of water. The second well (11402) drilled 100 ft away on the same fan penetrated 14 ft of organic silt overlying bedrock and was dry.

Wells in allvial fan deposits may yield enough water for a domestic supply; however, the probability of developing a municipal well in such materials appears low. The seasonal persistence of ground water in the alluvial fans is also unknown. Steep gradients and thin aquifers are conditions that make seasonal depletion by natural drainage a possibility in some small alluvial fans.

Beach and Intertidal Deposits

Clasts in beach and intertidal deposits range in size from silt and clay in tidal lagoons to cobbles and boulders where wave action is great. Regardless of the grain size of the materials, the potential for obtaining fresh ground water from such deposits is poor. Ground water in these deposits is either saline or would rapidly become saline during pumping.

Peat

Peat bogs consist of silty organic material filling topographic lows. They are saturated nearly to land surface with highly colored water that smells of swamp gas. The peat may be underlain by any of the materials previously discussed. The maximum thickness of peat in eight test borings was 28 ft (Cutler Engineering, written commun., 1978).

WATER-RELATED PROBLEMS

On-Site Sewage Disposal

State of Alaska regulations require that on-site sewage-disposal systems that discharge effluent to the land consist of an approved treatment facility and either a soil-absorption system or an evaporation pond. The most common acceptable on-site sewerage consists of a septic tank and soil-absorption system (either a leach field or a seepage pit). In the septic tank, the sewage undergoes settling and some decomposition. The septic tank effluent then flows into the soil-absorption system where it infiltrates into the earth materials. If the materials are insufficiently permeable to allow the effluent to infiltrate, nearly raw sewage may flow to the surface and pollute the land and nearby surface water. Most bedrock is sufficiently impermeable for this to occur, and Alaska statutes prohibit the construction of a soil-absorption system in bedrock (State of Alaska, 1973).

Effluent discharged to permeable unsaturated materials undergoes filtration, physical absorption, chemical adsorption, and aerobic decomposition. If the effluent is discharged to saturated materials, the treatment is much less effective in removing pollutants because aerobic decomposition and physical absorption are greatly reduced. In order to reduce the probability of pollution by inadequately treated sewage, State of Alaska statutes prohibit construction of a soil-absorption system that discharges effluent within 4 ft of the water table "as measured during the season of the year with maximum water table elevation" (State of Alaska, 1973).

A sewage-disposal system is commonly constructed so that its shallowest parts are below the effects of seasonal frost. This generally causes the effluent to be discharged at a depth greater than about 6 ft. Where the depth to ground water is less than 10 ft or the depth to bedrock less than 6 ft, it is likely that soil-absorption systems will not comply with Alaska waste-disposal regulations. Such systems are more likely to cause contamination of the land surface, ground water, and surface water than are systems which meet State standards.

Most of Fish Creek basin is underlain by bedrock at a depth of less than 6 ft. Exceptions are bedrock depressions, where glacial drift or alluvium and an overlying layer of peat are commonly more than 10 ft thick. However, such peat bogs are generally saturated nearly to land surface. Because either the water table or bedrock is within 6 ft of land surface throughout most of the basin, Fish Creek is highly susceptible to pollution by on-site sewage disposal systems.

Shallow bedrock or shallow ground water occurs in most of the area mapped as glacial drift overlying bedrock. An exception is the area below an altitude of 500 ft along the coast of Kachemak Bay northeast of Seldovia. Numerous exposures of unconsolidated materials along road cuts, incised streams, and bluffs indicate that the depth to bedrock and depth to the water table are commonly greater than 10 ft in this area.

Seepage and Slope Stability

Along the coast of Kachemak Bay east of Seldovia Point, there are many large land-slump features. The date at which slumping occurred is unknown, but it predated aerial photos taken in 1951. Nothing is known of the hydrologic or tectonic factors (for example, wave action, heavy rains, and earthquakes) which may have contributed to the slumping. However, land along the sea bluff may be unstable under certain conditions.

Hillside springs or seeps occur where thin colluvial or glacial aquifers on top of bedrock pinch out or become less permeable downslope from more permeable zones. Where these conditions exist, ground water flowing along the top of the bedrock emerges as springflow (fig. 4). Excavation into such aquifers, such as for homes or roads, may result in winter icings, continuous seepage during the summer, and unstable cutbanks.

CONCLUSIONS

Well yields in the Seldovia area may be adequate for domestic supplies, but larger water requirements would have to be met by surface water sources. Where the bedrock surface or water table is near the land surface, effluent from sewage disposal systems may pollute nearby soils or surface water. Seepage on slopes and unstable land along the coast will make construction of roads and structures difficult.

Table 1.--Selected discharge data for Barbara Creek near Seldovia (drainage area = 20.7 mi^2).

Year	Mean annual discharge (ft^3/s)	Annual minimum discharge (ft^3/s)	Annual runoff [(gal/d)/acre]
1973	74.1	16	3,615
1974	69.2	18	3,373
1975	99.9	16	4,877
1976	96.6	17	4,715
1977	152.0	36	7,411
1978	86.9	18	4,242

Table 2.--Chemical analysis of sample from well 11450 in Fish Creek basin.

Dissolved constituent or property	Concentration (~indicates a semiquantitative analysis)	Range of probable values for semiquantitative analyses*
Aluminum	~ 50 µg/L†	(30-70)
Antimony	~ 30 µg/L	(10-50)
Barium	~ 10 µg/L	(7-30)
Beryllium	~< 1 µg/L	(<1)
Bicarbonate	75 mg/L	
Bismuth	~< 1 mg/L	(<1)
Boron	~ 100 µg/L	(70-300)
Cadmium	~ 3 µg/L	(1-5)
Calcium	~ 10 mg/L	(7-30)
Carbonate	0 mg/L	
Chloride	8.5 mg/L	
Chromium	~< 50 µg/L	(<50)
Cobalt	~ 7 µg/L	(5-10)
Copper	~< 10 µg/L	(<10)
Fluoride	0.1 mg/L	
Gallium	~< 30 µg/L	(<30)
Germanium	~ 50 µg/L	(30-70)
Iron	~ 300 µg/L	(100-500)
Lead	~< 30 µg/L	(<30)
Lithium	~< 10 µg/L	(<10)
Magnesium	~ 5 mg/L	(3-7)
Manganese	~ 100 µg/L	(70-300)
Molybdenum	~ 10 µg/L	(7-30)
Nickel	~< 50 µg/L	(<50)
$NO_2 + NO_3$ as N	0.04 mg/L	
pH	6.5	
Potassium	~< 1 mg/L	(<1)
Residue on evaporation	92 mg/L	
Silica	15 mg/L	
Silver	~< 10 µg/L	(<10)
Sodium	~ 7 mg/L	(5-10)
Specific conductance	150 µmho/cm	
Strontium	~ 70 µg/L	(50-100)
Sulfate	7.7 mg/L	
Tin	~< 5 µg/L	(<5)
Vanadium	~< 10 µg/L	(<10)
Water temperature	3.0°C	
Zirconium	~< 5 µg/L	(<5)

*Cations were analyzed semiquantitatively. Range of probable values represents approximately one standard deviation. If no range is indicated, sample was analyzed quantitatively.

†µg/L = microgram per liter

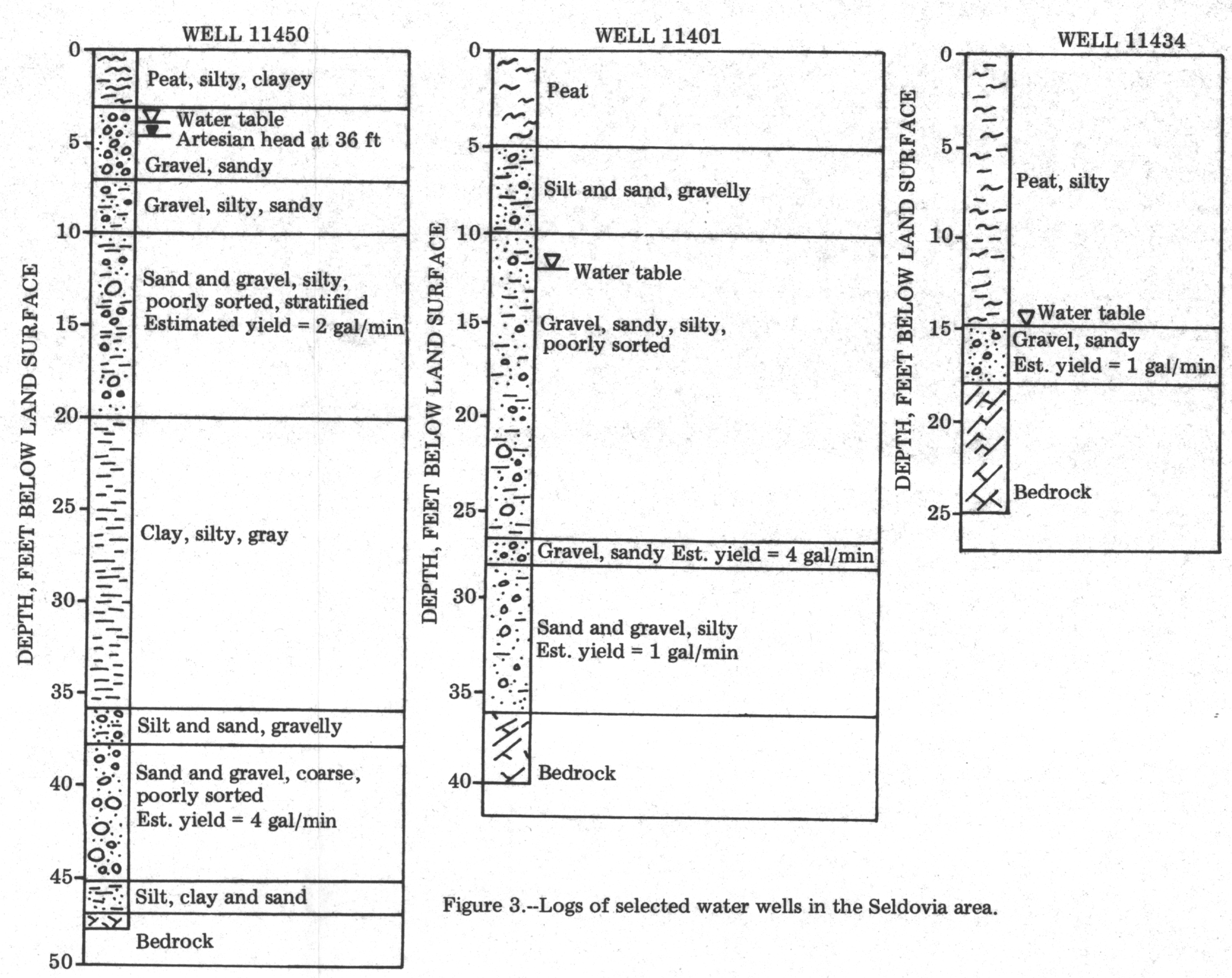

Figure 3.--Logs of selected water wells in the Seldovia area.

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CONVERSION TABLE

Multiply	By	To obtain
gallon (gal)	3.785	liter (L)
gallons per minute (gal/min)	0.06309	liters per second (L/s)
foot (ft)	0.3048	meter (m)
cubic feet per second (ft^3/s)	0.02832	cubic meters per second (m^3/s)
mile (mi)	1.609	kilometer (km)
square mile (mi^2)	2.589	square kilometer (km^2)

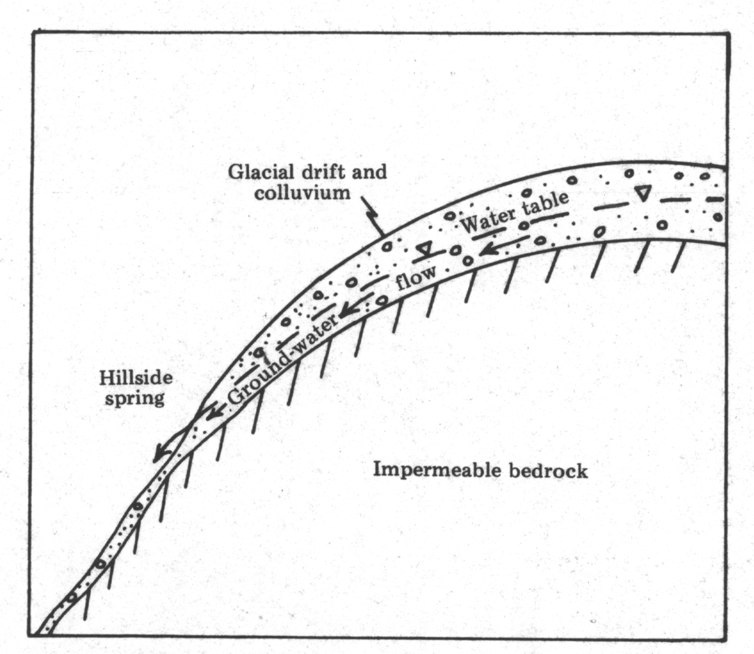

Figure 5.--Diagram showing conditions that cause hillside springs. Thickness of unconsolidated material is generally less than 10 feet.

HYDROGEOLOGY OF THE SELDOVIA AREA, ALASKA

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