

GEOLOGICAL SURVEY RESEARCH 1967

Chapter C

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Scientific notes and summaries of investigations in geology, hydrology, and related fields



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GEOLOGICAL SURVEY RESEARCH 1967

This collection of 44 short papers is the second published chapter of "Geological Survey Research 1967." The papers report on scientific and economic results of current work by members of the Geologic and Water Resources Divisions of the U.S. Geological Survey.

Chapter A, to be published later in the year, will present a summary of significant results of work done during fiscal year 1967, together with lists of investigations in progress, reports published, cooperating agencies, and Geological Survey offices.

"Geological Survey Research 1967" is the eighth volume of the annual series Geological Survey Research. The seven volumes already published are listed below, with their series designations.

Geological Survey Research 1960—Prof. Paper 400
Geological Survey Research 1961—Prof. Paper 424
Geological Survey Research 1962—Prof. Paper 450
Geological Survey Research 1963—Prof. Paper 475
Geological Survey Research 1964—Prof. Paper 501
Geological Survey Research 1965—Prof. Paper 525
Geological Survey Research 1966—Prof. Paper 550

USE OF AN INFILTRATION GALLERY TO OBTAIN FRESH WATER AT OCEAN CAPE, ALASKA

By ALVIN J. FEULNER, HENRY H. HEYWARD, and CLIFFORD G. ANGELO, Anchorage, Alaska

Work done in cooperation with the

*U.S. Air Force, Alaskan Air Command, through the Radio Corporation
of America White Alice Communications Project, Alaska, 1966*

Abstract.—Sufficient water for a military facility at Ocean Cape has been obtained during the past 3½ years from a horizontal infiltration gallery that taps a layer of fresh water resting on saline water. The gallery, which is 5 feet above mean sea level and 250 feet inland from the shoreline, supplants a well at the same general location. When first installed, the well yielded water of satisfactory quality, but within 2 years the chloride content of the water increased to more than 500 ppm.

Ocean Cape is the westernmost point of land on the Phipps Peninsula, which juts out from the south coast of Alaska between the Gulf of Alaska and Yakutat Bay. The village of Yakutat, at the head of Monti Bay (an arm of Yakutat Bay), is about 5 miles east of Ocean Cape. The location of the Phipps Peninsula area in Alaska is shown on the index map in figure 1, and the relations of the land and water surfaces on the peninsula are shown on the larger scale map in figure 1 and on an aerial photograph (fig. 2).

To supply water for a military facility at Ocean Cape, a 10-inch-diameter well was drilled in 1960 to a depth of 76 feet. The materials penetrated in drilling were gravel, sand, and silt, and the static water level was about 24 feet below the land surface. The well is about 250 feet east of the Gulf of Alaska and only a few hundred feet west of the Ankau Saltchucks, which are bodies of saline water that connect with Monti Bay. The land surface at the well is about 30 feet above sea level; the general elevation of the land surface in the vicinity of the well ranges from about 25 to 50 feet above sea level. The location of the well

and storage tank is shown in the aerial view of the Ocean Cape facility (fig. 3).

Pumping tests indicated that yields of from 50 to 70 gallons per minute could be obtained with a drawdown of about 30 feet. Following test pumping and development work, it was suggested that the well be pumped at rates of no more than 20 gpm, at which rate the drawdown would be about 15 feet, to avoid problems of saltwater intrusion to the well. Despite its nearness to open bodies of salt water, the well produced water ranging in chloride content from 95 to 116 parts per million in several tests conducted in 1960. However, when pumped in 1962 at a rate of approximately 25 gpm, the chloride content had increased to 515 ppm, which is double the limit recommended by the U.S. Public Health Service (1962, p. 7) for drinking water supplies. Because the bottom of the well is about 46 feet below sea level and the water level is drawn down to about 10 feet below sea level when the well is pumped at 25 gpm, it appeared that higher concentrations of saline water could be expected if pumping continued. As pumping at a lower rate did not seem practical, another source of water was needed.

Several nearby streams and lakes were sampled for chemical quality. Of these, only two lakes contained water that would be suitable. A small lake near the road and about 1.3 miles from the facility (shown as lake 1 on fig. 1) had a chloride content of 88 ppm, and a very small lake about 300 feet north of the site (figs. 1 and 3) had a chloride content of 10 ppm. Development of a supply from the farther lake was considered not feasible because a pipeline would be too costly;

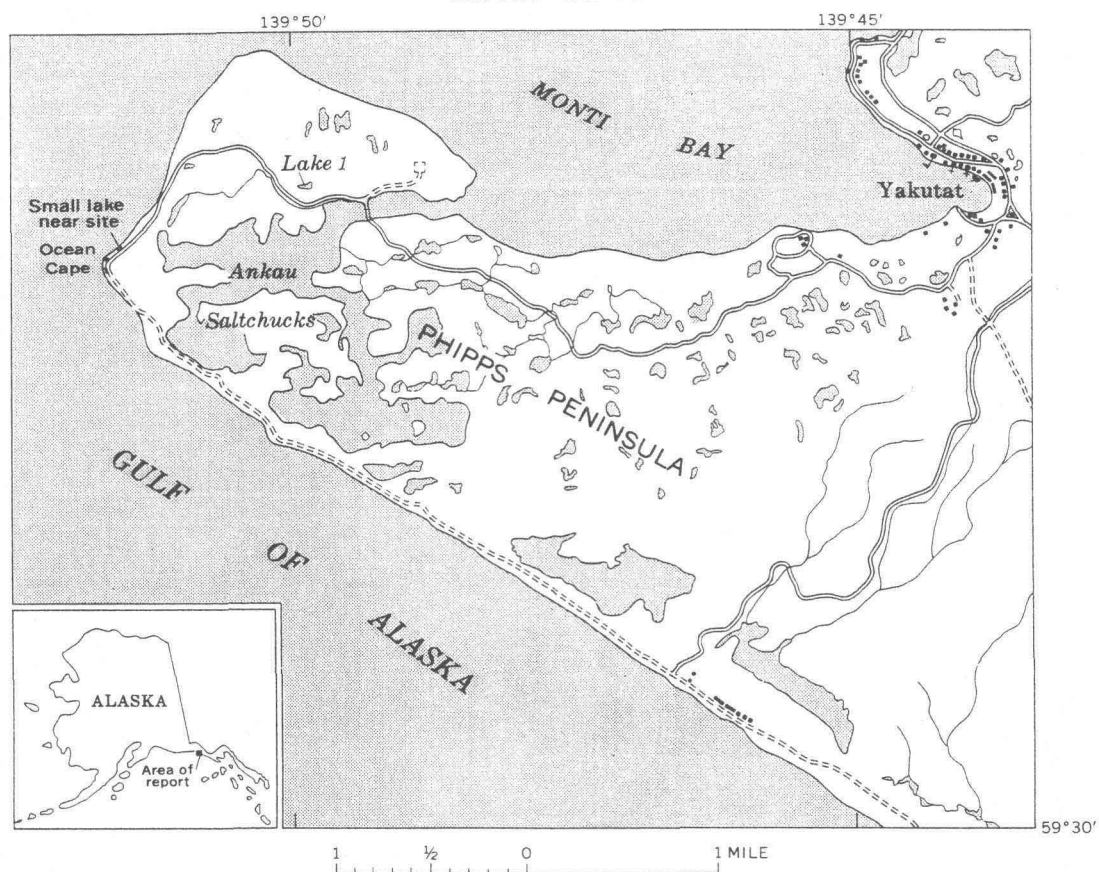


FIGURE 1.—Map of the Ocean Cape area on Phipps Peninsula, southern Alaska.

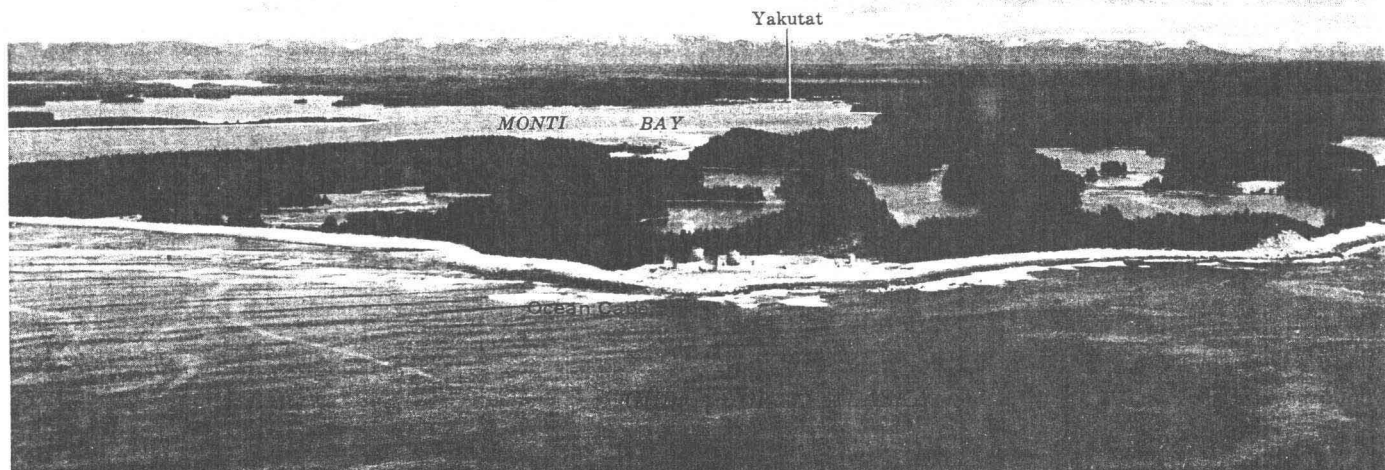


FIGURE 2.—Location of Ocean Cape with respect to the Gulf of Alaska, Monti Bay, and Yakutat. Photograph courtesy of Radio Corporation of America.

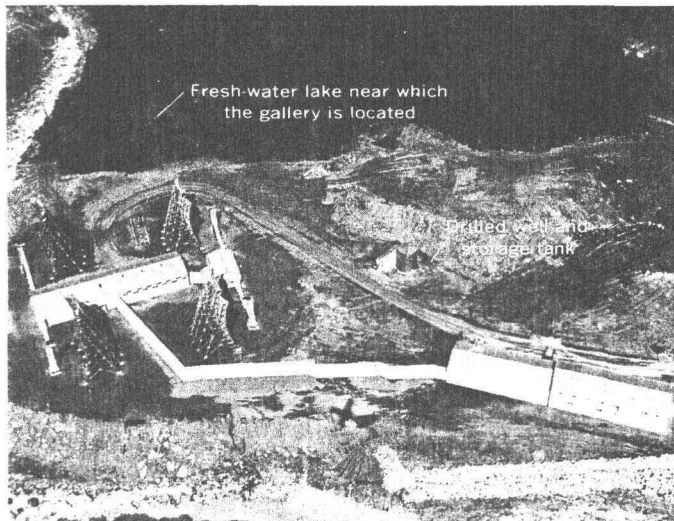


FIGURE 3.—View of drilled well, storage tanks, and lake where gallery is located at the Ocean Cape facility. Photograph courtesy of Radio Corporation of America.

development of a supply from the nearer lake was not considered because the water contained too much organic material.

As development of another supply from ground water seemed the only practical alternative, it was decided that a horizontal infiltration gallery tapping only the uppermost water-bearing sediments would be less likely to yield saline water than would a vertical well that necessarily would extend below sea level. The gallery, constructed in 1962, consists of an 80-foot-long corrugated perforated intake pipe and a vertical access pipe connecting the intake pipe with the land surface. The diameters of the intake and access pipes are 4 and 3 feet, respectively. The ditch in which the intake pipe was laid was excavated to 4.3 feet above mean sea level and then backfilled with about 1 foot of graded gravel. After the intake pipe had been laid, more graded gravel was added until the pipe was covered to a depth of about 2 feet. A 1-foot layer of sand, a similar thickness of gravel, and a 2-foot layer of sand completed the filling of the ditch. The details of the installation are illustrated in figure 4.

Observations of the depth to water in a well between the gallery site and the nearby lake indicated that the water table fluctuated seasonally between levels of about 9 and 13 feet above mean sea level (fig. 4). Thus,

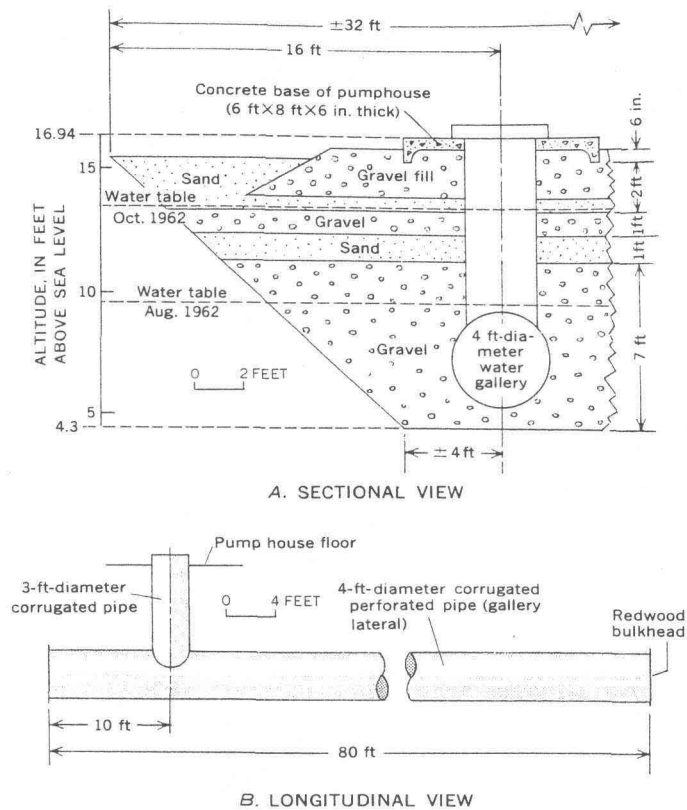


FIGURE 4.—Sectional and longitudinal views of gallery installation.

the intake pipe would be below the water table and high enough above the contact of fresh and saline water to permit withdrawal of fresh water without causing a progressive encroachment of the saline water.

The gallery was placed in operation in late 1962 and the water sampled for chemical quality periodically from 1962 through 1966. During the 3½ years following the installation, the chloride content of the water fluctuated seasonally within the range of 22 to 34 ppm. Sufficient water to maintain the facility was supplied constantly during this entire period.

It appears from this history of development at Ocean Cape that other coastal areas having similar geologic and hydrologic conditions could make use of horizontal galleries for water-supply development.

REFERENCE

- U.S. Public Health Service, 1962, Public Health Service drinking water standards: Public Health Service pub. 956.