UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

Jamaica, N. Y.

Ground-water conditions in the vicinity of Portsmouth, New Hampshire

By H. L. Brashears, Jr.

February 9, 1942

In October 1941 the Federal Works Agency requested the U. S. Geological Survey to make a brief investigation of the ground-water conditions in the vicinity of Portsmouth, New Hampshire. It was estimated that an additional supply of water of about 3,000,000 gallons per day was needed as a result of increased defense activities of the Federal Government in the Portsmouth area.

The field work on which this report is based was done during the period November 5 to 7, 1941. A brief study of the ground-water conditions was made in the towns of Newington, Portsmouth, Greenland, Rye, and North Hampton. The field work consisted mainly of surface traverses and the examination of gravel pits and road cuts. Samples taken from a few wells being drilled at the time of the field study were examined. In addition, records of wells and pumpage data on ground-water were collected from well drillers and operators.

Acknowledgment is made to W. S. Coulter, senior engineer, Federal Works Agency, and H. E. Lamm, of the C. W. Lamm Co., Inc., of New York City, for their assistance and suggestions.

The Portsmouth region is a coastal lowland that has been extensively glaciated. The area is hilly and is characterized by many bogs and steep-sided hills, the local relief being about 100 feet. The deposits consist of Pleistocene glacial drift and Pleistocene and Recent marine clay overlying a

floor of consolidated Paleozoic rocks. The bedrock floor is well dissected and the elevation of its surface locally ranges from somewhat below sea level to about 100 feet above sea level. At many places bedrock crops out at the surface, but in general it is covered with Pleistocene beds that range from a few feet up to about 100 feet in thickness.

Although ground water occurs in both the bedrock and the glacial drift, the yield of wells in bedrock is small, and large quantities of ground water are available only in the glacial drift.

The glacial drift is generally not continuous but occurs as disconnected bodies, locally ranging from about 1 to 2 miles in width and from about 1 to 10 miles in length. The glacial drift examined during the field study has been described and mapped by Katz and Keith. 1/ The glacial drift is composed of

1/ Katz, F. J., and Keith, Arthur, The Kennebunk moraine, Maine, New Hampshire, and Massachusetts: U. S. Geol. Survey Prof. Paper 108-B, pl. 4, p. 12, 1917.

terminal-moraine and associated outwash deposits. The outwash deposits consist mainly of well to poorly stratified sand, gravel, and boulders and are highly permeable. The morainic deposits likewise are sandy and gravelly, layers of clay occurring at only a few places. At most places the land surface of the glacial drift is sandy, the soil cover being thin or absent. At places the edges of the bodies of drift are overlapped by postglacial marine clay. 2/

2/ Katz, F. J., and Keith, Arthur, op. cit., pl. 9, p. 18.

The principal ground-water development in the Kensington-Portsmouth area is that of the City of Portsmouth. The city pumps water from several well fields, none of which are more than a mile apart. The areal extent of the moraine exposed in the Kensington-Portsmouth area is about 11 square miles.

The average daily pumpage in 1939 was reported to be 1.33 million gallons per day, but at times the pumpage during short periods has been more than 2,000,000 gallons per day. There are a considerable number of domestic wells in this area, but the combined yield of these probably is not large. It is reported that no noticeable decline of ground-water level has occurred in the vicinity of the city wells. The yield of some of the city wells has decreased, but this is reported to be due to improper construction and development and not to overdevelopment of the water-bearing beds. It is believed that an additional development of about 2,000,000 gallons per day could be made in the moraine of the Newington-Portsmouth area. (See pl. 4 of Prof. Paper 100-B.) However, care should be exercised in making a development of such size, because interference with the existing Portsmouth well fields might occur if new wells are improperly located or if excessive amounts of ground water are withdrawn.

The pumpage from the well field of the Hampton Water Company is the only large ground-water development in the moraine exposed in Rye, North Hampton, and Hampton. (See pl. 4 of Prof. Paper 100-B). This development, consisting of three wells is located in the southern part of the moraine. The average daily pumpage is 1 million gallons. The only pumpage in the northern part of this morainal body is from domestic wells and the total pumpage from these is probably small. The area of the northern part of this morainal deposit is about 7 square miles. It is believed that perhaps 3 million gallons a day could be developed in the northern part of this moraine if the wells were properly located and constructed.

So far as is known, the ground-water developments in the morainal deposits in the Greenland area consist only of wells used for domestic purposes. Bracket Spring, at the foot of the north end of this moraine, furnishes about 75 gallons per minute continuously for a State-owned fish hatchery. The area of this drift deposit is about 3 square miles. It is probable that an additional development of about 1 million gallons a day can be made in this moraine, although care should be taken to avoid interference with the flow of Bracket Spring.

In most parts of the three morainal areas mentioned above, with one exception, the surface of the bedrock lies above sea level. At the point where the B. and M. R. R. crosses the moraine between Newington and Portsmouth bedrock is reported to be about 50 feet below sea level. Therefore, because the glacial water-bearing beds in these three areas are almost entirely above sea level, there is little likelihood that salt-water encroachment will take place.

Because of the irregular character and variable thickness of the glacial water-bearing beds, test holes should be drilled to provide a basis for determining the proper type of permanent wells. In places the water-bearing beds above the bedrock are thin. Developments in these areas should be designed so as to produce a minimum amount of drawdown. A relatively large number of small-capacity wells installed over a considerable area would be more desirable than a few wells of large capacity. However, in areas where the water-bearing material is not highly permeable it may be desirable to construct large-diameter gravel-walled wells.