WATER FACT SHEET

U.S. GEOLOGICAL SURVEY, DEPARTMENT OF THE INTERIOR

REGIONAL STUDY OF THE CASTLE HAYNE AQUIFER OF EASTERN NORTH CAROLINA

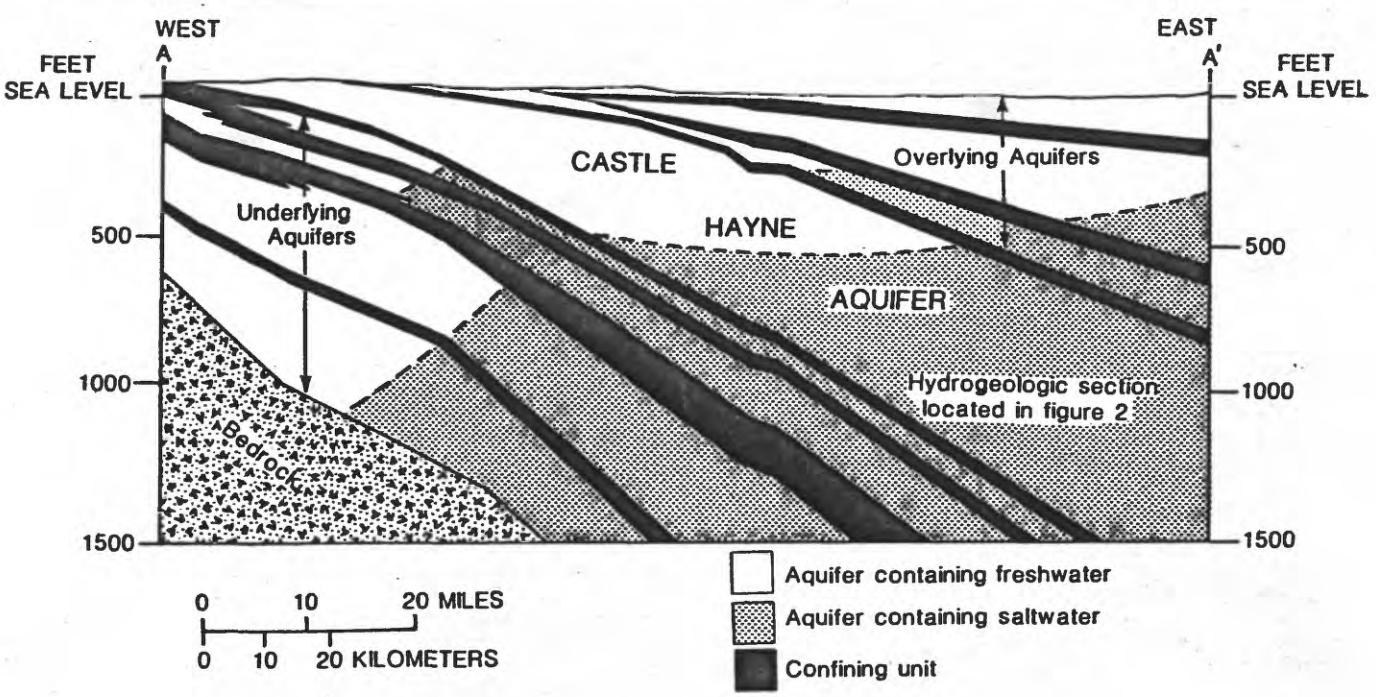

Figure 1. Hydrogeologic section through the eastern part of North Carolina.

WHAT IS THE CASTLE HAYNE AQUIFER?

The Castle Hayne aquifer is an eastward sloping and thickening wedge of limestone and sandstone (fig. 1), which is located in a 12,500 square-mile area in the eastern part of North Carolina (fig. 2). The Castle Hayne aquifer is the major source of freshwater for much of coastal North Carolina, and, in many parts of eastern North Carolina where the aquifers underlying the Castle Hayne contain saltwater (fig. 1), it is the only source of freshwater. The Castle Hayne also is the most productive aquifer in the State; more water is pumped from it than any other single aquifer, and maximum yields of individual wells are greater than yields from wells tapping other aquifers. Over 100 million gallons of water per day are withdrawn for municipal, industrial (including mining and quarrying), and irrigation uses. Well yields commonly range from 200 to 500 gallons per minute, although yields have been known to exceed 2,000 gallons per minute.

The freshwater and saltwater parts of the aquifers in eastern North Carolina are shown in figure 1. Saltwater is defined as containing more than 250 milligrams of chloride per liter of water, the limit used as a drinking water standard by the U.S. Environmental Protection Agency. The Castle Hayne aquifer is filled with water that contains less than 250 milligrams of chloride per liter in the freshwater area and with water exceeding that concentration in the saltwater area. Throughout extensive areas, freshwater is found in the upper part of the aquifer and saltwater is found in the lower part.

REGIONAL AQUIFER STUDY

A regional study of the Castle Hayne aquifer will provide definitive information on the declines in water levels and of saltwater intrusion in the area. Ground-water withdrawals from the Castle Hayne aquifer are regulated by the State of North Carolina in part of the region. A better understanding of the hydrology and the ground-water resource potential of the aquifer is necessary for effective management. The U.S. Geological Survey, the North Carolina Department of Natural Resources and Community Development, and several counties and municipalities are considering a cooperative study in order to better understand the aquifer. This paper summarizes some of the water problems that have been identified in the

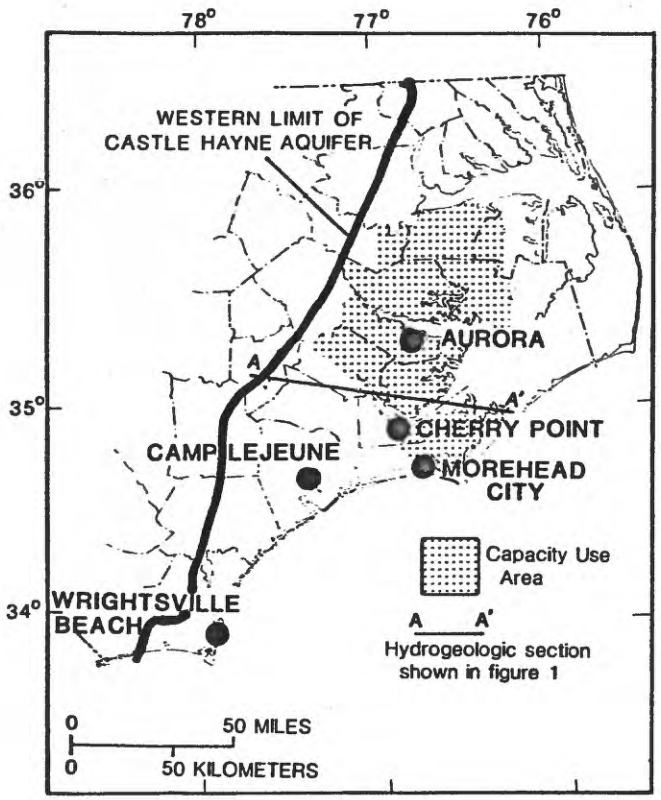

Figure 2. Areal extent of the Castle Hayne aquifer.

Castle Hayne aquifer and outlines how an aquifer study can provide useful information for better management of this and other major ground-water resources.

Water-Level Declines

Some areas in eastern North Carolina have experienced a lowering of water levels owing to ground-water withdrawals in the Castle Hayne aquifer. For example, withdrawals of as much as 65 million gallons a day from the aquifer have caused water levels to decline at least 125 feet at a mine near Aurora. Water levels in a well near Morehead City in Carteret County (fig. 2) have gradually declined about 2.5 feet from 1976 to 1986 as a result of withdrawals by several water-supply systems in that area. Water levels, which are lowest in July and August and show recovery beginning in early September, are affected primarily by ground-water withdrawals from the Castle Hayne aquifer during the summer tourist season.

Saltwater Intrusion

Saltwater intrusion is a major concern to water-system managers in coastal areas, and saltwater has intruded into the Castle Hayne aquifer in some areas of the North Carolina Coastal Plain: at a mine near Aurora; in some water-supply wells at the U.S. Marine Corps' Camp Lejeune (fig. 2); and in the public water supply during the summer tourist season in the Town of Wrightsville Beach on the southern coast (fig. 2). Saltwater can be drawn toward pumping wells from at least one of the following sources: (1) from underlying aquifers that contain saltwater in a process called upconing, (2) from nearby estuaries, and (3) from the Castle Hayne aquifer itself, owing to the lateral movement of saltwater from within the aquifer.

Saltwater intrusion into well fields is of primary concern where freshwater occupies the upper part of the Castle Hayne aquifer and saltwater is in the lower part. An increase in chloride concentration owing to the upconing of the saltwater in the lower part of the aquifer can occur in deep wells that penetrate to only a short distance above the saltwater. An increase in incidents of saltwater intrusion can be expected as development continues and more ground water is withdrawn.

Regulation of Ground-Water Resources

About 2,500 square miles of the study area was designated in 1968 by the State of North Carolina as the State's first and only (1987) capacity-use area in response to concerns about the effects of ground-water withdrawals from the Castle Hayne aquifer in a mining area near Aurora. A capacity-use area is defined as an area where the use of water resources exceeds, or threatens to exceed, the renewal or replenishment of the resource to the extent that regulation is, or will be, needed. All or parts of eight counties are included in this capacity-use area (fig. 2) where permits are required to withdraw more than 100,000 gallons per day of ground or surface water, and for construction of any wells other than those for individual domestic water supplies.

PRODUCTS OF THE AQUIFER STUDY

Products that result from the regional study of the Castle Hayne aquifer will be useful in understanding and managing the ground-water resource. A series of hydrogeologic maps that show the altitude of the top of the aquifer, location of saltwater in the aquifer, aquifer thickness, aquifer transmissivity, and confining-unit thickness will be useful to water-systems managers, well drillers, irrigators, and property owners in planning and constructing water wells and test holes. The history of ground-water pumpage can be compared with historical water-levels in the aquifer. These hydrogeologic, pumpage, and water-level data can be used to develop estimates of aquifer and confining-unit hydraulic coefficients and to develop a ground-water flow model for the Castle Hayne aquifer. The model will increase the understanding of the ground-water flow system and also can be used to assess various ground-water development scenarios for the entire Castle Hayne aquifer.

SELECTED REFERENCES

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