GROUNDWATER

Groundwater is one of Florida's most valuable natural resources. Usable quantities of potable groundwater can be obtained throughout the state, with the exception of a few places, most of which are near the coasts. About 93 percent of Florida's population depends on groundwater for drinking water. Florida ranked fifth in the nation in the use of fresh groundwater in 1995. Because of its abundance and availability, groundwater is the principal source of freshwater for public supply and domestic (rural) and industrial uses. Of the total freshwater used in Florida in 1995, 60 percent was groundwater.

All of Florida is in the Coastal Plain physiographic province, a region of low relief underlain by unconsolidated to poorly consolidated sediments and hardened carbonate rocks. Florida is covered nearly everywhere by sands that overlie a thick sequence of limestone and dolomite. Together, the surficial sands and the limestone and dolomite form an enormous groundwater reservoir that provides more available groundwater than any other state (McGuinness 1963).

Hydrologists have estimated that the total quantity of fresh groundwater in Florida is more than a quadrillion gallons—about one-fifth as much as in all of the five Great Lakes, 100 times that in Lake Mead on the Colorado River, and 30,000 times the daily flow to the sea of Florida's 13 major coastal rivers (Conover 1973).

Nearly all of Florida's groundwater originates from precipitation. Annual precipitation (1951–95) averages over 50 inches per year. Part of this precipitation percolates to the water table and recharges the groundwater reservoir. Annual recharge to groundwater ranges from near zero in some perennially wet, lowland areas to greater than 20 inches per year or more in well-drained upland areas. In much of the state, most of this recharge moves through the surficial sands and discharges downward to deeper aquifers (groundwater reservoirs) or laterally to nearby lakes and streams.

Florida is underlain virtually everywhere by aquifers capable of yielding at least small quantities of potable water to wells. Aquifers are defined on the basis of rock types, geologic confinement, and groundwater flow. An aquifer system consists of two or more hydraulically connected aquifers. A change in the condition of one aquifer affects the other aquifers in the system. In Florida three aquifer systems are used for water supply: the surficial aquifer system, the intermediate aquifer system, and the Floridan aquifer system. Two aquifers within the surficial aquifer system—the sand and gravel and the Biscayne aquifers—are important sources of supply where they occur.

Aquifers in Florida are composed of sedimentary rock units of varying composition and depositional history. These units are divided into geologic formations based on rock composition and physical characteristics. Many units are related by the similarities of the sediments while others may be defined on the sediment heterogeneity. Aquifer systems are defined as a body of rock that is sufficiently permeable to conduct groundwater and to yield economically significant quantities of water to wells and springs. They are identified independently from lithostratigraphic units and may include more than one formation or be limited to only a portion of a formation.

The stratigraphic and hydrogeologic framework of Florida has significant variability from north to south and west to east in the peninsula and the panhandle. The stratigraphic units that comprise the aquifer systems in Florida occur primarily as subsurface units with very limited surface exposures. As a result of the generally low relief of the state, most of the stratigraphic descriptions are from well cuttings and cores used to study the subsurface sediments and rocks.

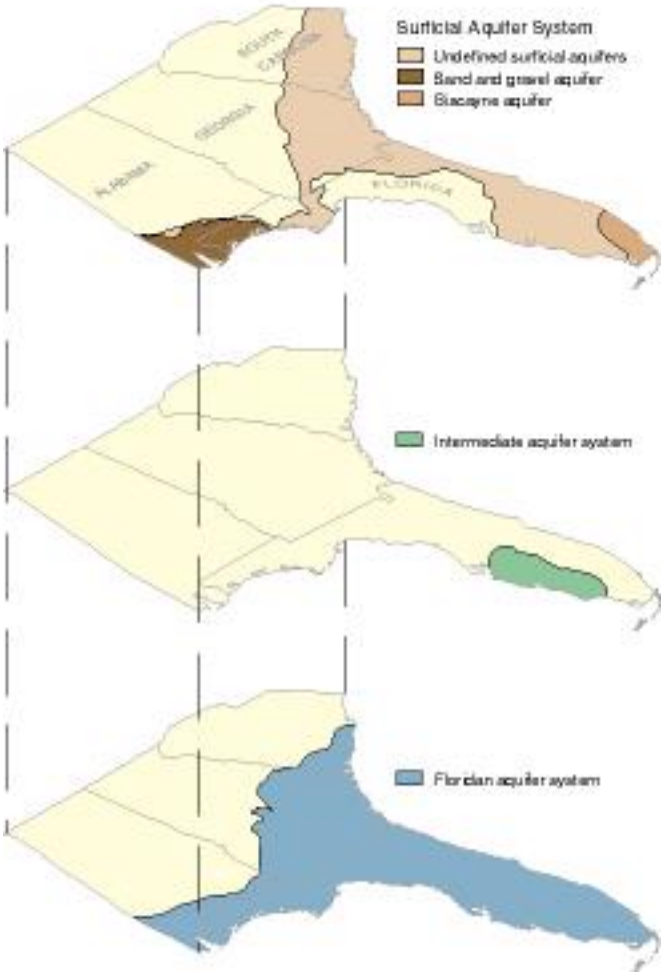
The following description of the stratigraphy of the various units associated with the aquifer systems is brief and generalized. More complete information concerning these groups and formations can be obtained by referring to Florida Geological Survey and U. S. Geological Survey publications relating to specific areas and/or specific aquifers.

The surficial aquifer system consists mostly of unconsolidated sand and includes the sand and gravel and the Biscayne aquifers and all the undefined aquifers present at the land surface. In Florida the surficial aquifer system is used by a few small municipalities as well as by large numbers of individual households. The sand and gravel and Biscayne aquifers are separately recognized parts of the surficial aquifer system that consist of distinct rock types. The sand and gravel aquifer is the major source of water in northwest Florida and the Biscayne aquifer is the major source of water in southeast Florida. Between the surficial aquifers and the Floridan aquifer system in some parts of the state is the intermediate aquifer system. The intermediate aquifer system is an important source of supply in Sarasota, Charlotte, and Glades counties.

The Floridan aquifer system underlies the entire state of Florida and portions of Alabama, Georgia, and South Carolina and has been called “Florida’s rain barrel” (Parker 1951).The Floridan provides water for many cities including Daytona Beach, Gainesville, Jacksonville, Lakeland, Ocala, Orlando, St. Petersburg, and Tallahassee as well as for hundreds of thousands of people in smaller communities and rural areas. The Floridan is also intensely pumped for industrial and agricultural supply. In several places where the Floridan contains saltwater, such as along the southeast coast, treated sewage and industrial wastes are injected into it. In the Orlando area large quantities of surface runoff are routinely diverted into the Floridan via drainage wells.

The different aquifers in the state have different capabilities of transmitting water. Transmissivity, expressed in feet squared per day, is a measure of the ease with which water moves through an aquifer. It is calculated by multiplying hydraulic conductivity (volume of water that moves in a unit of time under a unit gradient through a unit area) by the saturated thickness of the aquifer. Hydraulic conductivity is highest in aquifers with large conduits such as caves, sinkholes, and solution channels. However, a thick aquifer (hundreds of feet) will have a higher transmissivity than a thinner aquifer (tens of feet) that has the same hydraulic conductivity. In general, aquifers in Florida have high transmissivities. The highest transmissivities are found in the Floridan aquifer system (10,000 to greater than 1,000,000 feet squared per day) and Biscayne aquifer (100,000 to 1,000,000 feet squared per day), followed by the sand and gravel aquifer (10,000 feet squared per day), the surficial aquifer system (1,000 to 10,000 feet squared per day), and the intermediate aquifer system (200 to 13,000 feet squared per day).

Sequence of Aquifers



References

McGuinness, C.L. 1963. The Role of Groundwater in the National Water Situation. U.S. Geological Survey Water-Supply Paper 1800. Reston, Virginia.

Conover, C.S. 1973. Florida's Water Resources. Institute of Food and Agricultural Sciences, University of Florida. The Dare Report-1973, Pub 11. Gainesville.

Parker, G.G. 1951. "Geologic and Hydrologic Factors in the Perennial Yield of the Biscayne Aquifer." American Water Works Association Journal 43:810-843.

Study Questions

1. What is meant by the term "potable water?"
2. If 93% of Floridians depend on groundwater for drinking water, where do the other 7% get their drinking water?
3. What is dolomite? How was it formed?
4. What is a hydrologist?
5. Where does Florida get most of its groundwater?
6. What is meant by "recharging the groundwater?"
7. What is an aquifer?
8. What is the difference between an aquifer and an aquifer-system?
9. Florida has three aquifer-system. Name them in order from shallow to deep.
10. In order to understand the explanation in the reading of how an aquifer works, requires that you understand the terms that are used in the text. Define the following words or phrases.
    A. Sedimentary Rock
    B. Depositional History
    C. Sediment Heterogeneity
    D. Stratographic
    E. Lithostratographic
    F. Petrographic
    G. Unconsolidated Sediments
    H. Transmissivity
11. What aquifer-system has the highest transmissivity? Which one has the lowest?