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# PRINCIPAL AQUIFERS IN FLORIDA

*By*

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## INTRODUCTION

Ground water, one of Florida's most valuable resources, is also one of its most abundant. The State is fortunate to have several prolific ground-water reservoirs that yield tremendous quantities of water to wells and to some of the world's largest springs. These ground-water reservoirs, or aquifers, are of two types--artesian and nonartesian. An artesian aquifer is one that contains water under sufficient pressure to rise above the top of the containing formation. A nonartesian aquifer is one that contains water which is not confined, and the upper water surface (water table) is free to rise and fall.

The principal source of ground water in Florida is the artesian Floridan aquifer which supplies most of the water users in the State. Nonartesian sources include the Biscayne aquifer of southeastern Florida, the sand-and-gravel aquifer of extreme western Florida, and a shallow aquifer which lies at depths of less than 100 feet over much of the State.

The accompanying map shows the approximate areas where these aquifers are the main source of supply; however, the boundaries do not represent the areal extents of the aquifers. For example, the Floridan aquifer extends beyond the southern boundary shown on the map, but it is not of great economic significance there because the water is highly mineralized.

Aquifers other than the four described occur in the State, but they are, for the most part, of minor significance. One of these is an artesian aquifer which is formed by permeable zones that occur locally within the confining beds above the Floridan aquifer.

## FLORIDAN AQUIFER

The thick limestones of the Floridan aquifer underlie all of the State and supply ground water to all but southernmost and westernmost Florida. Along much of the Atlantic and Gulf Coastal areas, the aquifer contains highly mineralized water.

The Floridan aquifer includes the Lake City, Avon Park, and Ocala Limestones, all of Eocene age; the Suwannee Limestone of Oligocene age; and the Tampa Limestone and permeable parts of the Hawthorn Formation of Miocene age. In some areas the aquifer is exposed at the surface, but over much of the State it lies beneath several hundred feet of sediments.

The thick semipermeable beds which overlie the aquifer, except in its outcrop areas, restrict the upward movement of the water and cause the aquifer to have artesian pressure. The altitude to which water will rise in artesian wells generally ranges from a few feet above mean sea level, in areas near the coast, to more than 130 feet above mean sea level in Polk County. In southern Florida, along coastal areas, and in low stream valleys, the artesian pressure is sufficient to cause wells to flow. However, in some heavy use areas such as eastern Duval County and southern Bay County, the water level has been lowered below sea level.

Water in the Floridan aquifer is replenished by rainfall in central and northern Florida and in southern Alabama and Georgia where the aquifer crops out or where it is covered by permeable materials. Some replenishment in central Florida occurs where the confining material is breached by sink holes.

The quality of the water in the Floridan aquifer has been contaminated by the encroachment of highly mineralized water.

Wells developed in the Floridan aquifer vary in size, depth, and yield. Domestic wells are usually at least 2 inches in diameter, and the large municipal and industrial wells may be 30 inches or more in diameter. The depth of wells ranges from about 50 feet to more than 1,000 feet depending on the local geologic and hydrologic conditions and the yield required.

The yield of wells developed in the Floridan aquifer ranges from a few gallons per minute for small-diameter wells to several thousand gallons per minute for some of the large-diameter industrial wells. The amount of water that can be produced from the aquifer is controlled by the diameter of the well, the capacity of the pump, and the hydrologic properties of the aquifer.

## BISCAYNE AQUIFER

The nonartesian Biscayne aquifer underlies an area of about 3,000 square miles in Dade, Broward and southern Palm Beach counties. The wedge-shaped aquifer is 100 to 400 feet thick in coastal Dade and Broward counties but thins to a few feet near the western boundary of the counties.

The Biscayne aquifer is composed of rocks ranging in age from late Miocene through Pleistocene. The rocks, from oldest to youngest, are the Tamiami Formation of Miocene age, the Caloosahatchee Marl of Pliocene age, and the Fort Thompson Formation, Key Largo Limestone, Anastasia Formation, Miami Oolite, and Pamlico Sand of Pleistocene age.

The aquifer is an interconnected hydrologic unit of permeable materials whose boundaries are set by differences in the hydrologic properties. The permeable limestone of the aquifer is shielded against upward intrusion of saline water from the Floridan aquifer by relatively impermeable beds of clay and marl. However, there is no shield against lateral encroachment of sea water, the major problem in the area served by the Biscayne aquifer. Encroachment has resulted from overdrainage by canals. However, proper control of drainage canals and proper water management have greatly reduced the threat of sea-water encroachment.

Water in the Biscayne aquifer is derived chiefly from local rainfall and during dry periods from canals connected to conservation areas.

The ground water from uncontaminated parts of the aquifer is fairly uniform in quality. The hardness generally ranges from 200 to 300 ppm (parts per million) and the chlorides from about 15 to 30 ppm. Nearly all the water is colored either with organic material or iron, or both; the color is usually greatest in the upper part of the aquifer. Excessive amounts of iron are encountered in some parts of the aquifer.

The Biscayne aquifer is highly productive everywhere along the coastal ridge and for a considerable distance to the west; however, its productivity varies considerably from place to place. Wells developed in the aquifer are as large as 36 inches in diameter. A typical well is 6 inches in diameter, 50 to 75 feet deep, and finished with 3 to 10 feet of open hole in highly permeable limestone. In the northern part of the area, wells may be as deep as 200 feet. Yield from 6-inch wells ranges from 1,000 to 1,500 gpm (gallons per minute) with less than 4 feet of drawdown.

## SAND-AND-GRAVEL AQUIFER

The nonartesian sand-and-gravel aquifer, the major source of ground water in extreme western Florida, is a wedge-shaped deposit extending northward into Alabama. It generally thickens to the west and southwest from its thin outcrop along the Walton-Washington County line. In southeastern Escambia County, the aquifer is about 300 feet thick and in the southwestern part of the county, at the Choctawhatchee River, it is about 700 feet thick.

The sand-and-gravel aquifer is composed of sediments ranging in age from Miocene to Pleistocene. The sediments are chiefly very fine to very coarse quartz sand which in places is mixed with granules and small pebbles of quartz and chert. Lenses and stringers of gravel and clay occur throughout the aquifer.

Water in the sand-and-gravel aquifer is derived chiefly from local rainfall and is of excellent chemical quality. The total dissolved solids content of the water generally ranges from 15 to 40 ppm, the hardness from 4 to 30 ppm, the chlorides from 2 to 30 ppm, the iron less than 0.25 ppm, and the fluoride less than 0.2 ppm. The water is usually slightly acidic.

Wells in the sand-and-gravel aquifer furnish most of the ground water used in Escambia and Santa Rosa counties and a substantial part of the smaller supplies in Okaloosa County. Wells may be as large as 30 inches in diameter, the depth varies from 30 to 500 feet, and the yield ranges from 50 to 2,000 gpm.

## SHALLOW AQUIFER

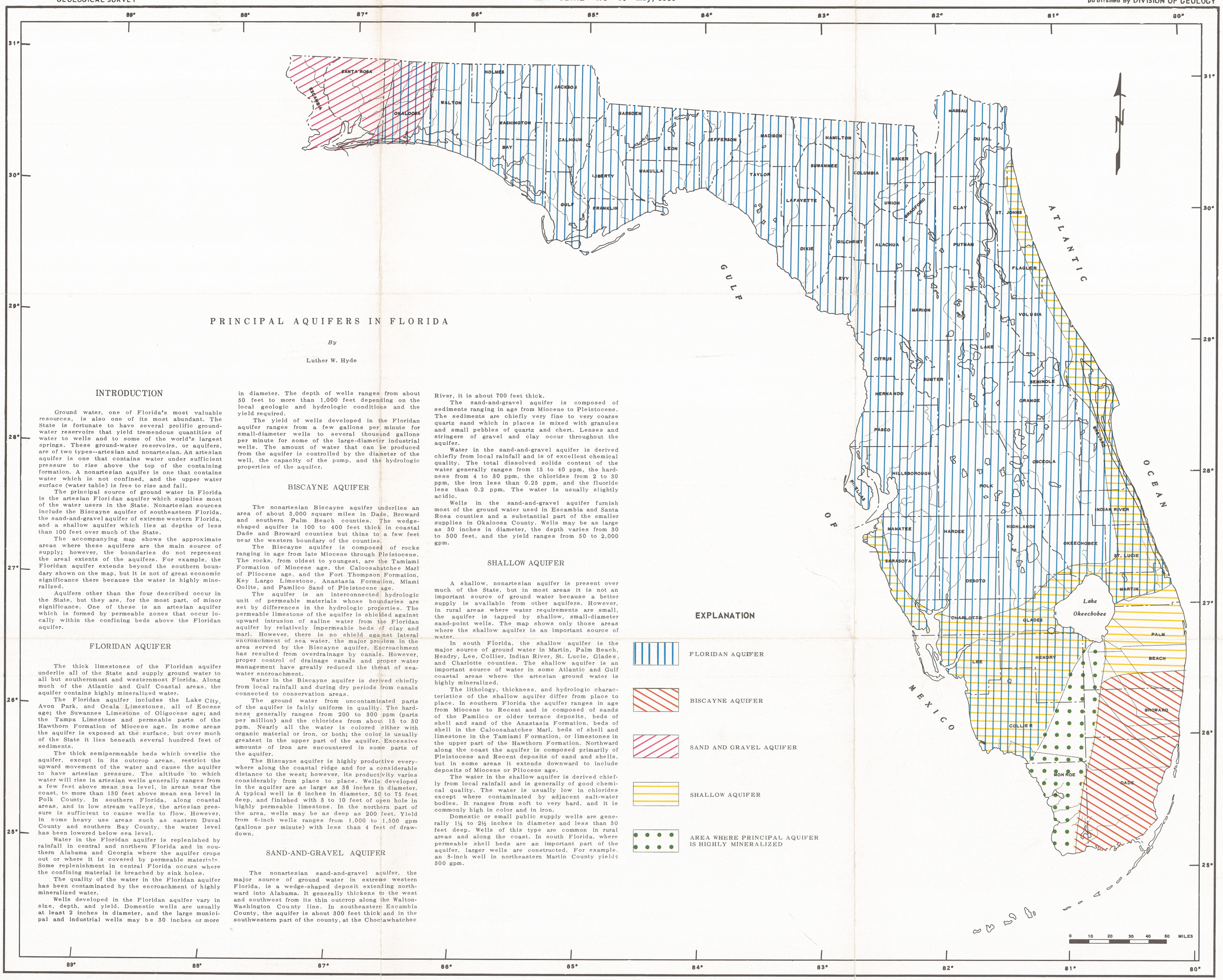
A shallow, nonartesian aquifer is present over much of the State, but in most areas it is not an important source of ground water because a better supply is available from other aquifers. However, in rural areas where water requirements are small, the aquifer is tapped by shallow, small-diameter sand-point wells. The map shows only those areas where the shallow aquifer is an important source of water.

In south Florida, the shallow aquifer is the major source of ground water in Martin, Palm Beach, Hendry, Lee, Collier, Indian River, St. Lucie, Glades, and Charlotte counties. The shallow aquifer is an important source of water in some Atlantic and Gulf coastal areas where the artesian ground water is highly mineralized.

The lithology, thickness, and hydrologic characteristics of the shallow aquifer differ from place to place. In southern Florida the aquifer ranges in age from Miocene to Recent and is composed of sands of the Pamlico or older terrace deposits, beds of shell and sand of the Anastasia Formation, beds of shell in the Caloosahatchee Marl, beds of shell and limestone in the Tamiami Formation, or limestones in the upper part of the Hawthorn Formation. Northward along the coast the aquifer is composed primarily of Pleistocene and Recent deposits of sand and shells, but in some areas it extends downward to include deposits of Miocene or Pliocene age.

The water in the shallow aquifer is derived chiefly from local rainfall and is generally of good chemical quality. The water is usually low in chlorides except where contaminated by adjacent salt-water bodies. It ranges from soft to very hard, and it is commonly high in color and in iron.

Domestic or small public supply wells are generally 1¼ to 2½ inches in diameter and less than 50 feet deep. Wells of this type are common in rural areas and along the coast. In south Florida, where permeable shell beds are an important part of the aquifer, larger wells are constructed. For example, an 8-inch well in northeastern Martin County yields 500 gpm.




## EXPLANATION

- FLORIDAN AQUIFER
- BISCAYNE AQUIFER
- SAND AND GRAVEL AQUIFER
- SHALLOW AQUIFER
- AREA WHERE PRINCIPAL AQUIFER IS HIGHLY MINERALIZED