

ENCROACHING SALT WATER
IN NORTHEAST PALM BEACH COUNTY, FLORIDA

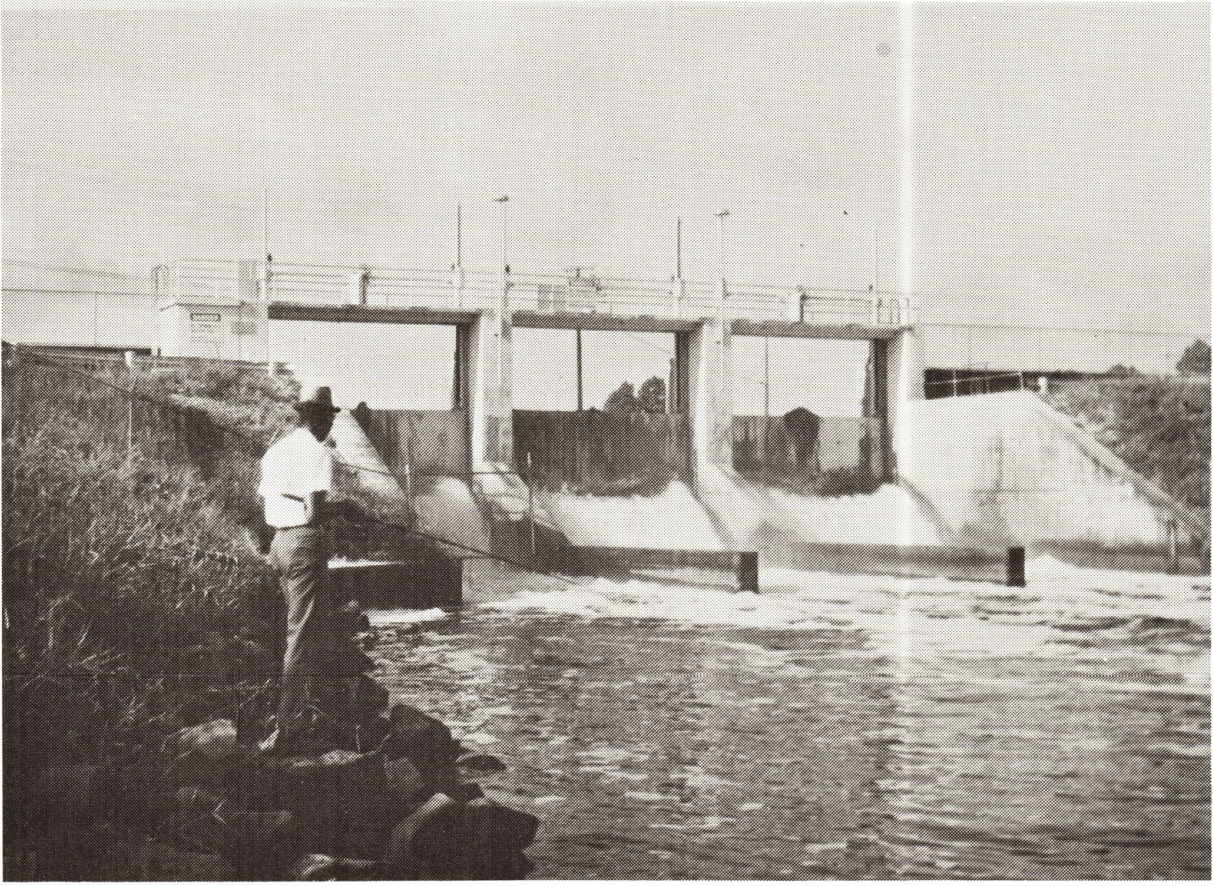
By
Harry G. Rodis

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Tallahassee, Florida
1973



In the upper reaches of the Loxahatchee River, dying cypress trees, and barnacles growing on logs, indicate a change from a fresh-water to a salt-water environment. Red mangrove trees (at right) thrive in a salt-water environment and are replacing the fresh-water vegetation.



Salinity-control structure on Canal 18 keeps upstream canal levels high near Jupiter well field, which retards the inland movement of salt water. Barnacles clinging to rocks on the downstream side of the structure indicate presence of salt water.



Drainage of inland areas for agriculture and urban development causes rainfall to run off quickly through canal systems to the sea. Water is, thus, diverted from the shallow aquifer and the Loxahatchee. The agricultural area shown above is near the Loxahatchee headwaters; most of the rain falling on this area drains into Canal 18 rather than the Loxahatchee.



Wells in Tequesta Well Field "1" shown above are 60 to 70 feet deep and yield approximately 500 gallons per minute. Other wells nearby range in depth from 30 to 180 feet and may yield from 5 to 750 gallons per minute. The water is generally of good chemical quality, low in hardness, and low in chloride except where contaminated by adjacent salty-water bodies. Below 180 feet, water becomes scarce and generally is very salty.

THE PROBLEM

Sea water is encroaching inland in northeast Palm Beach County and adjacent parts of Martin County. It threatens the fresh-water resources of growing coastal communities and a river. This atlas describes the causes and possible solutions to the problem.

Before the advent of settlers, this area had coastal springs, which seeped from saturated rocks and sand (shallow aquifer) into the sea, and streams carried fresh water seaward to Jupiter Inlet. The Everglades and lakes stored much of the rain that fell, and flow into the Loxahatchee River estuary was nearly constant during the wet season. Some of the water from the Everglades, lakes, and local rainfall percolated downward to replenish the shallow aquifer. In the early 1900's, man began to drain the Everglades to make additional land available for farms and homes and began to connect lakes and streams to the sea. The flow of fresh water to the estuary and into the shallow aquifer, thus, gradually diminished, thereby changing the balance between the fresh- and salt-water environments and causing salt water to move inland. Today, salt-water tides reach the upper Loxahatchee River (northwest fork), destroying fresh-water flora and fauna. Salt water, no longer held back by high-water levels, is encroaching as a wedge into the shallow aquifer and is threatening to contaminate fresh-water wells.

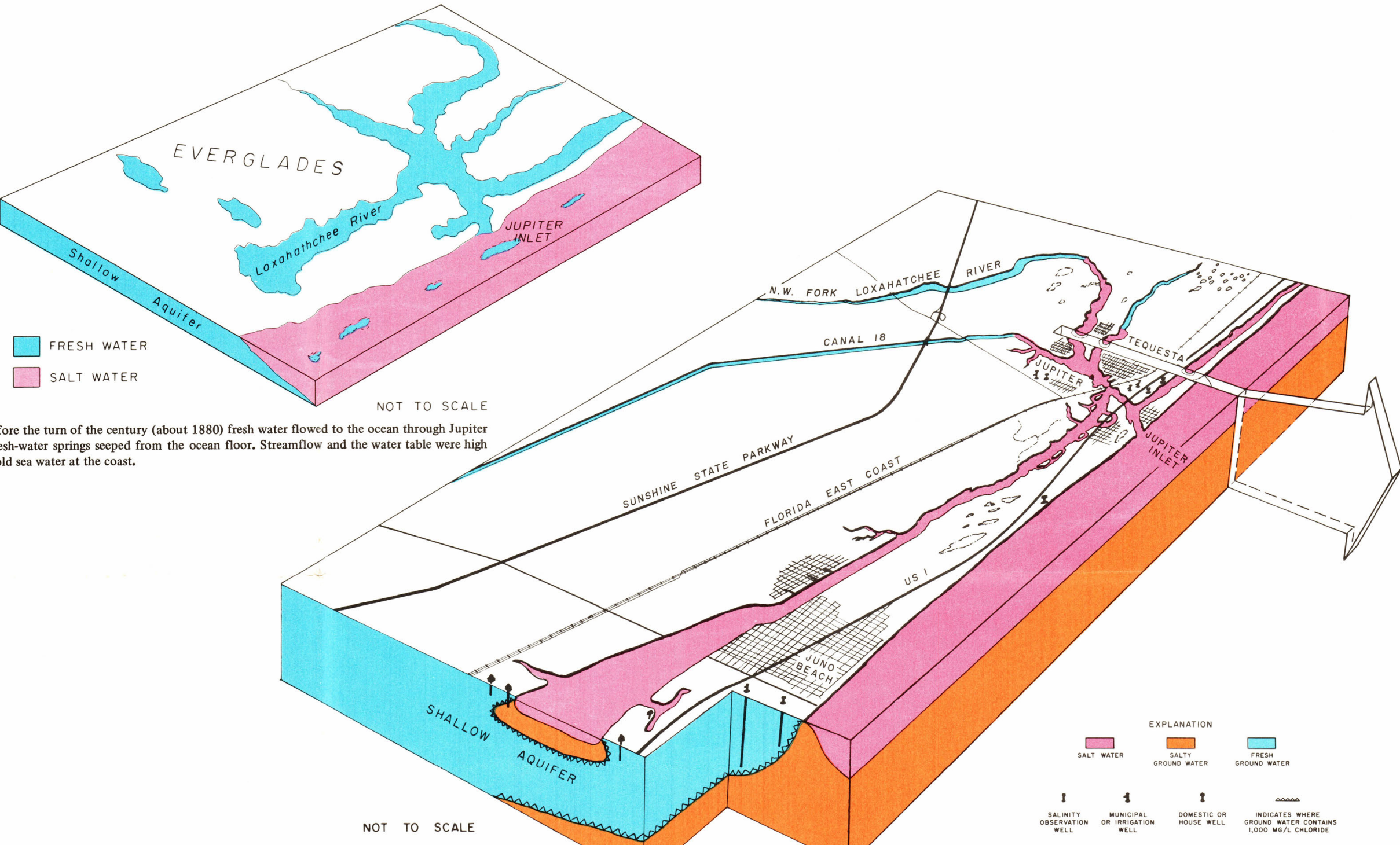
Although the general position of the salt-water wedge in the shallow aquifer has not changed markedly in the past several years, parts of the salt front near heavily pumped municipal and irrigation wells have advanced inland about half-a-mile. During a drought in 1970-71, pumping was discontinued in several wells in the Tequesta and Juno Beach well fields because of increasing salt content in the water. More than 5 million gallons per day of fresh water is withdrawn from municipal and golf-course wells near the salt-water front. Much of this water is ultimately discharged to the sea through treatment plants, is evaporated, or is transpired. Water levels have declined sharply. The result is a net loss of fresh water in the aquifer, much of which is replaced by salt water. In other words, with a sufficient water-level decline, salt water moves inland.

The upper reach of the Loxahatchee River is one of the last remaining natural rivers in south Florida. The river requires a sustained flow of fresh water to nourish plant and animal communities and to prevent salt water from moving farther upstream. Except for occasional floods, the flow of fresh water has diminished at an accelerated rate, as rainfall runs off quickly through an expanding system of drainage canals. During the 1970-71 drought, the flow of the river was about 200 gallons per minute. A sustained flow many times greater than this is necessary to maintain the fresh-water environment of the river, even in part.

OUTLOOK

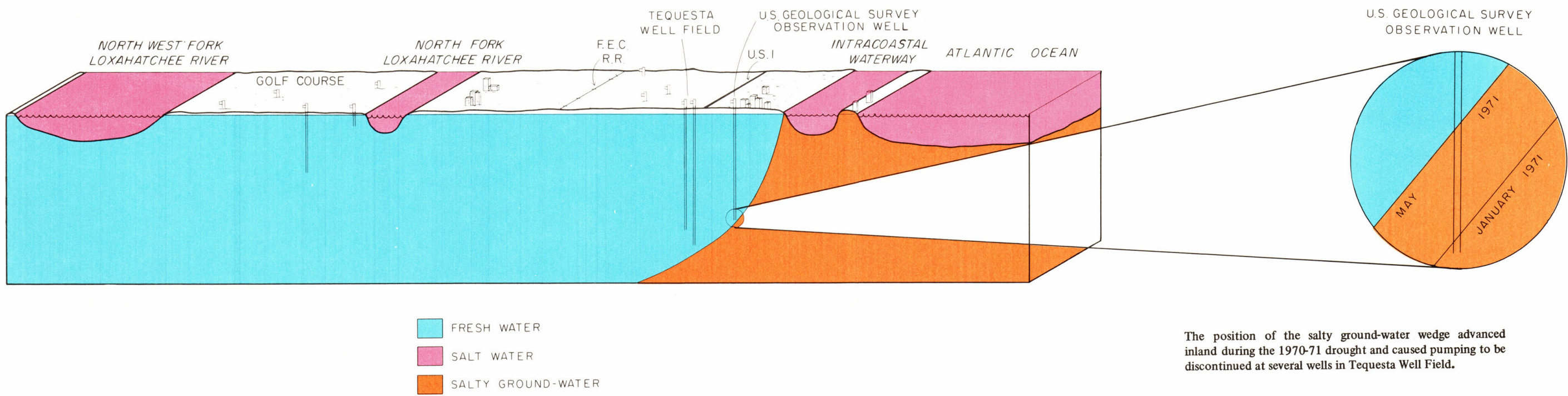
By the year 2000, fresh-water needs for coastal communities may increase 8 to 10 fold. The present source of fresh water in the shallow aquifer near the coast will not be ample to meet the demand. Water in deeper aquifers is generally too highly mineralized for most uses. Potential fresh-water resources are available, however, from the shallow aquifer in areas west of the present well fields. Municipalities possibly could explore the potentials in these areas. Use of the present water source can be prolonged by wider spacing of wells, reduced pumping rates, improved design for municipal wells, and reuse of water. For example, treated sewage and storm runoff could be used to irrigate golf courses or to maintain a head of fresh water at the fresh-salt water interface.

Much of the remaining fresh-water environment of the Loxahatchee River can be maintained by a sufficient flow of fresh water. This could be provided by diverting enough fresh water from inland canals and water-storage areas to the river to retard the advance of salt water. Preventing upstream movement of salt-water tides by constructing a salinity barrier, dam, or lock downstream also would aid in maintaining the fresh-water environment.



Before the turn of the century (about 1880) fresh water flowed to the ocean through Jupiter Inlet, and fresh-water springs seeped from the ocean floor. Streamflow and the water table were high enough to hold sea water at the coast.

Today (1972) sea water encroaches the coast. Wedges of salty ground water threaten municipal wells and other wells in Juno Beach, Tequesta and Jupiter, while salt-water tides invade the Loxahatchee River. Declining ground-water levels and diminishing streamflow permit sea water to move inland beneath fresh ground water as well as into the Loxahatchee. The shallow aquifer shown above is about 200 feet thick and underlies the eastern part of Palm Beach and Martin Counties.



A wedge of salty ground water threatens Tequesta Well Field, and smaller wedges extending from the lower reaches of the Loxahatchee River and the Intracoastal Waterway have contaminated numerous shallow domestic wells. U. S. Geological Survey observation wells, one of which is shown above, determine movement of the salt-water wedge near municipal well fields. Heavy pumping at the well field pulls water levels down below sea level.

