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SALT INTRUSION CAN BE CONTROLLED

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Salt-water intrusion is the chief threat to the fresh-water supplies of Dade County. Intensive investigations of the geology and hydrology of Dade County by the U. S. Geological Survey in cooperation with the county show that uncontrolled drainage canals have been the primary cause of salt-water intrusion in the Biscayne aquifer, the highly permeable limestone reservoir rock that yields all of our drinking water. Intrusion occurs by two processes:

(1) Uncontrolled canals drain fresh ground water stored in the aquifer, waste it to the ocean, and cause water levels to decline excessively; this permits salty ground water at depth to move inland;

(2) Uncontrolled canals carry salt water several miles inland from Biscayne Bay, and during dry periods the salt water infiltrates outward from the canals and contaminates adjacent parts of the aquifer.

The maps in figure 1 show the areas progressively affected by salt-water intrusion. The major advance of salt water took place before 1946 when there were no control dams in the major canals to prevent the waste of fresh water from the aquifer. The situation was critical along the Miami Canal during the dry season of 1946. Several supply wells in the Miami well field were contaminated by salt water from the canal. Because the pattern of salt-water intrusion closely followed the individual canal channels, there was no doubt that the contamination was a direct result of canal construction and drainage.

Late in 1946 control dams were erected in all major canals connected to Biscayne Bay. As a result, the salt water retreated seaward along most of the canal systems (compare 1946 and 1950 maps) and the Miami well field was maintained secure. The improvement in the fresh-water picture demonstrated that salt intrusion could be controlled by

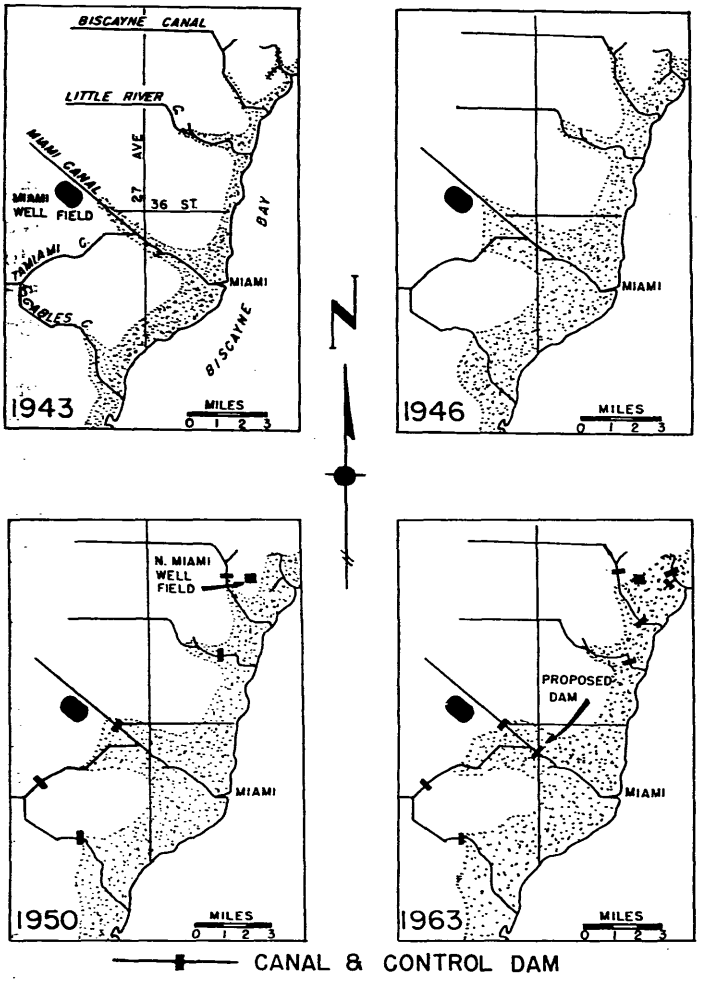


Figure 1. Maps of eastern Dade County showing areas progressively affected by salt-water intrusion.

relatively simple methods -- chiefly through water conservation and maintenance of water levels at proper elevations.

A comparison of the 1950 map with the 1963 map shows a continued inland intrusion of salt water along the Tamiami Canal toward Miami's municipal well field, and east of the Biscayne Canal near North Miami's municipal well field. These later movements were due to the fact that the control dams in those two canals were located too far inland to give continuous protection to the

well fields. In 1960 the control dam in the Biscayne Canal was moved from its original location, opposite the North Miami well field to a site two miles downstream. However, the move was too late and the field was contaminated by a massive slug of salt water. Recent samplings of water in that area indicate a slow freshening as a result of relocating the barrier. A boat lock and control dam have been proposed in the Miami Canal at 27th Avenue. This would furnish effective control for both the Miami and Tamiami Canals and give good protection to Miami's well field.

A perennial problem in the urban and agricultural expansion in Dade County is that of flood prevention during rainy seasons. Flood control has been and is being provided by a network of levees and drainage canals. However, the area must not be drained excessively; to do so would endanger the water supplies during prolonged drought. Many troublesome areas result where property of low elevations is developed without placement of sufficient fill to proper flood-control elevations. These areas must be protected against flooding. One such area is in North Miami Beach along the Oleta River.

Provision for adequate drainage in the North Miami Beach area necessitates deepening and widening the downstream reach of the Oleta River channel. The existing unimproved drainage condition approximates condition A in figure 2. The diagram, figure 2, shows the relative changes in the position of the salt front in an aquifer within an area where a drainage system is being developed. Improvement of the Oleta River channel without a control dam would result in effective surficial drainage of the surrounding area, but also in a general lowering of ground-water levels, and an inland movement of salt water along the stream channel and in the Biscayne aquifer beneath and adjacent to the river. This condition would be comparable to position B in figure 2.

Prevention of excessive drainage and of coincident salt intrusion necessitates that a control dam be provided. Proper operation of the control

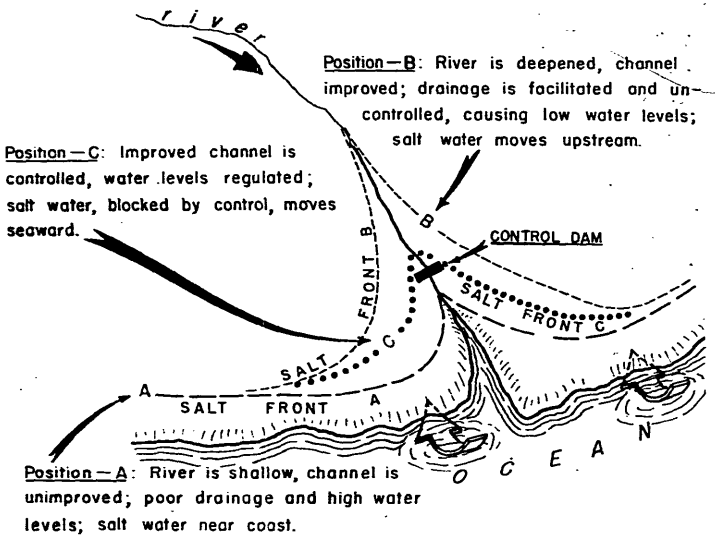


Figure 2. Sketch showing relative change in salt-front pattern in an aquifer where a drainage system is being developed.

dam would insure not only protection against flooding but also protection to the water resources. This condition is shown by position C, figure 2, where the salt front has stabilized between its original position, before improvement, and its probable position if no control dam were installed. Position C represents a medium condition that provides the maximum possible combined protection from both flooding and salt-water intrusion.

The map of North Miami Beach and vicinity, figure 3, shows the location of the Oleta River with respect to the Snake Creek Canal. The Snake Creek Canal is a primary canal of the regional water-control system. It extends westward for several miles and serves as the main drainage for all of northern Dade County. During the dry seasons the control dam, near the coast, (shown in figure 3) is closed in order to maintain the upstream water level at as high an elevation as possible.

Improvement of drainage along the Oleta River could reduce the ability of the control in the Snake Creek Canal to maintain high water levels. If the Oleta River should be improved but not controlled, eastward outseepage will occur from the Snake

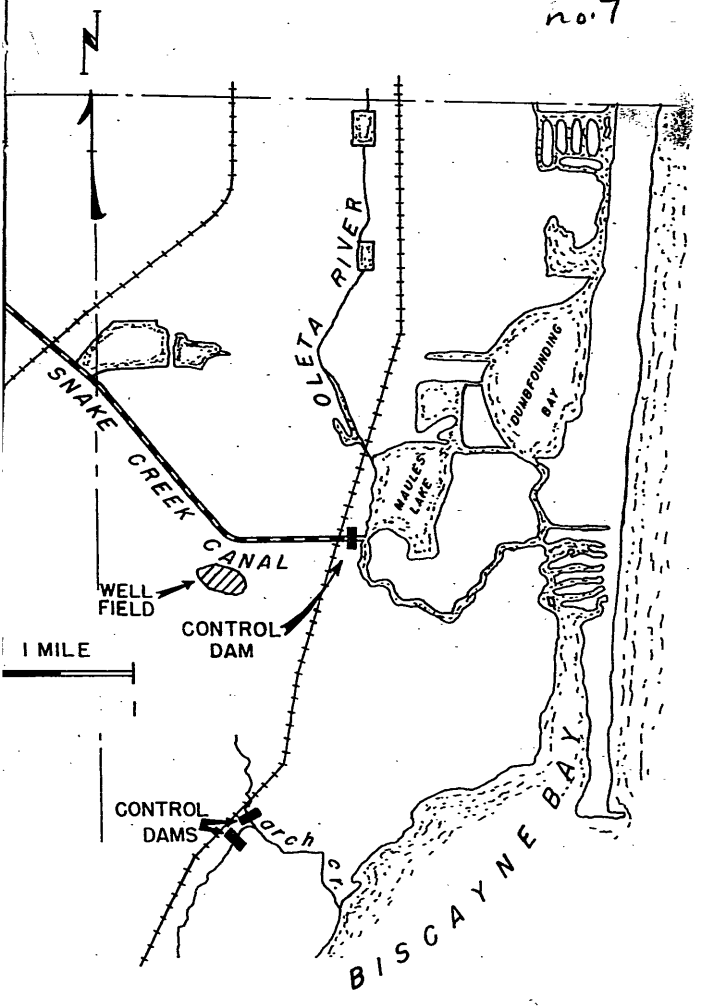


Figure 3. Map of North Miami Beach showing location of Oleta River with respect to Snake Creek Canal.

Creek Canal system to the Oleta River under a high gradient. However, if the Oleta River should be improved and controlled, the outseepage from Snake Creek Canal would occur under a lower gradient, thereby decreasing the waste of fresh water. The control of salt intrusion in north Dade County depends entirely upon maintaining a high water level in the Snake Creek Canal system. If water losses from the Snake Creek Canal should become great enough to lower water levels excessively, the salt front would begin to move inland and would

pose a threat to the municipal well field for Nort Miami Beach (figure 3).

Dade County is one of the fastest growin areas in the country. If growth is to continue constant consideration must be given to the prc tection of the water resources of the area. Thi means in part that the amount of water wasted b canal discharge each year must be decreased an salt-water intrusion controlled. In 1963 Dade Coun ty's water needs were about 200 million gallons day. It has been predicted that in 25 years Dad County will be using nearly 1 billion gallons day. That quantity will not be available unles wastage to the ocean is controlled and the wate resources are carefully conserved and properly managed.

Several reports have been prepared whic describe in more detail the problem of salt intru sion in Dade County. They are available to in terested persons at the office of the County Engi neer, the Florida Geological Survey, and of th U. S. Geological Survey as well as at most loca libraries. Information contained in the reports in clude:

(1) Explanation of principles governing salt water intrusion.

(2) Description of the mechanics of salt-wate intrusion.

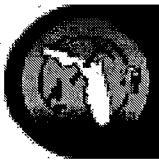
(3) Results of research on salt-water intru sion.

(4) Methods of combating salt-water intrusion.

(5) Description of areas affected by salt-wate intrusion.

(6) Local problems of salt-water intrusion.

(7) Evaluation of water resources of Dade County.



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