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Information Circular No. 76

**HYDROLOGIC ASPECTS OF FRESHENING  
UPPER OLD TAMPA BAY, FLORIDA**

By  
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*Prepared by the*  
UNITED STATES GEOLOGICAL SURVEY  
*in cooperation with*  
SOUTHWEST FLORIDA WATER MANAGEMENT DISTRICT  
*and the*  
BUREAU OF GEOLOGY  
FLORIDA DEPARTMENT OF NATURAL RESOURCES

TALLAHASSEE  
1972

**Completed manuscript received  
February 1, 1972  
Printed for the Florida Department of Natural Resources  
Division of Interior Resources  
Bureau of Geology  
by Rose Printing Company  
Tallahassee, Florida**

**Tallahassee  
1972**

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# HYDROLOGIC ASPECTS OF FRESHENING UPPER OLD TAMPA BAY, FLORIDA

By J. A. Mann

## ABSTRACT

Upper Old Tampa Bay, a 17-square mile area of Old Tampa Bay, Florida, has been proposed for conversion to a fresh-water lake. The amount of runoff to the proposed lake and its chemical quality are both adequate to freshen and sustain a fresh-water lake in this part of the bay. During 1950-66 runoff to the proposed lake, including discharge from Lake Tarpon, would have averaged 134 mgd (million gallons per day) and would have displaced the volume of the proposed lake at normal pool stage (2.5 feet above mean sea level) about 1.7 times per year. Without discharge from Lake Tarpon, the volume of the proposed lake would have been displaced 1.2 times. If the lake level was initially at a normal pool stage during a critically dry year, such as 1956, the proposed lake would have declined 0.25 to 0.5 foot below the minimum design level, (1.5 feet above mean sea level).

At points above tidewater, average mineral content of streamflow contributing to the lake is less than 100 mg/l (milligrams per liter), and average chloride content is less than 20 mg/l. The average chloride concentration of the bay proper, based on water samples collected in June, October, and November of 1967, ranged from 14,000 to 16,000 mg/l.

Lake freshening would take place through a combined process of displacement and dilution of the saline water in the lake at time of closure. Freshening of the proposed lake to a chloride concentration of 250 mg/l would require about 4 years. Annual fresh-water losses through operation of locks would amount to the volume of water lost by a 0.1-foot decline in lake level, a relatively insignificant amount.

The study area is underlain by a shallow water-table aquifer. The fine-grained beds at the base of this aquifer act as a confining layer for the underlying artesian aquifer (the Floridan aquifer), which consists of limestone beds of the Tampa Formation and older formations. At places the confining layer has been breached, allowing an imperfect hydraulic interconnection between the two aquifers.

Saline water occurs in both the shallow aquifer and the upper part of the Floridan aquifer near the bay. Except for the Oldsmar area, present hydrologic conditions preclude major fresh-water spring discharge from the Floridan aquifer through the bottom of the bay.

Damming Upper Old Tampa Bay and maintaining the proposed lake at a normal pool stage of 2.5 feet above mean sea level would cause a rise in

fresh-water levels in both the water-table aquifer and the upper part of the Floridan aquifer (Tampa and Suwannee Limestones), thereby eventually flushing saline water from both aquifers. Because of the imperfect connection between the proposed lake and the Floridan aquifer, leakage from the lake to the aquifer would initially average less than 1 mgd upon closure of the dam and would gradually decrease as the head difference diminishes.

Displacement of saline water from the Floridan aquifer and depression of the fresh-water salt-water interface to a stable hydrostatic position might take 10 to 20 years. The long-term rise in water levels in the upper part of the Floridan aquifer would be 2 to 3 feet within 1 mile of the lake and less than 1 foot 3 to 4 miles inland. This rise in water levels would not be sufficient to depress the fresh-water salt-water interface to the base of the permeable zone in the upper part of the Floridan aquifer near the bay.

## INTRODUCTION

The proposed conversion of part of Old Tampa Bay (fig. 1) to a fresh-water lake has been considered for many years. The water-control works proposed in the engineering studies consisted of (1) a continuous landfill adjacent to the north side of Courtney Campbell Causeway; (2) gated spillways to permit discharge and regulation; and (3) two locks for boat navigation. The larger of the two locks was for tugs and barges; the smaller for pleasure boats. Small-boat passage was also provided for by proposed use of either mechanical boat hoists, marine railways, or davits. The lake level was to be regulated between 1.5 and 2.5 feet above msl (mean sea level) with a maximum permissible level of 3.0 feet above msl.

The Lake Tarpon Water Control Project, utilizing an outfall canal from Lake Tarpon to Old Tampa Bay and a cofferdam around a sinkhole in Lake Tarpon, was not originally considered as part of the conversion project. Because the Lake Tarpon project is a reality, the combined effects of the two projects are considered in this report in evaluating the hydrologic aspects of freshening.

At the present time the project is inactive. This report summarizes for the record the hydrologic effects of the proposed project and was prepared by the U.S. Geological Survey in cooperation with the Southwest Florida Water Management District and the Bureau of Geology, Florida Department of Natural Resources.

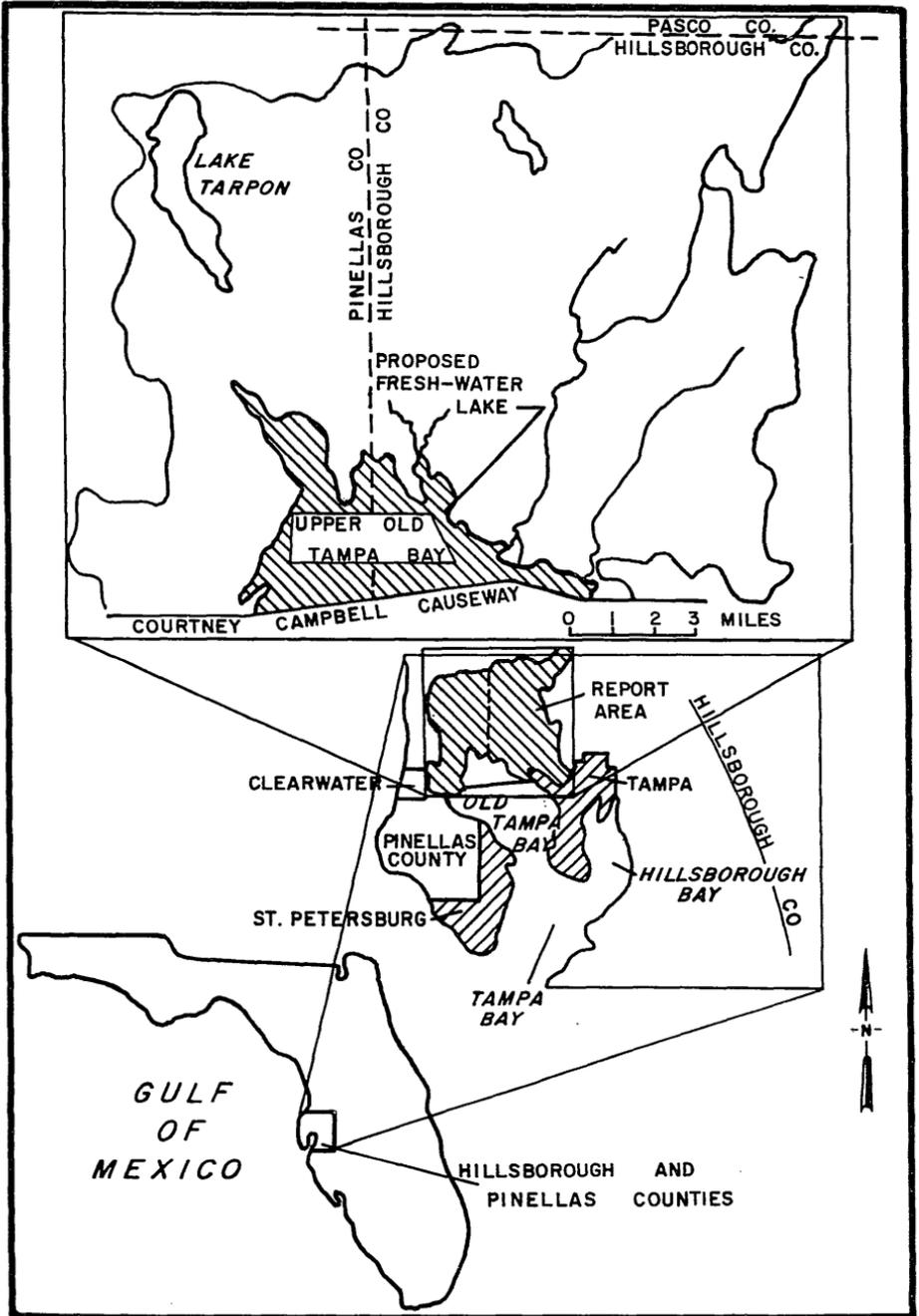


Figure 1.—Map showing location of the upper Old Tampa Bay area, Florida.

## PURPOSE AND SCOPE

The purpose of the study was to evaluate (1) the hydrology of upper Old Tampa Bay under the conditions existing in 1966-69; (2) the hydrologic feasibility of freshening the bay; and (3) the possible hydrologic effects that freshening of the bay might have on the aquifer system, particularly with respect to changes in both the level and chemical quality of water in the aquifers. This report summarizes the findings of the study. Its aim is to provide an evaluation of the surface- and ground-water resources of the area as related to the proposed freshening; to describe the aspects of hydrology and geology that relate to freshening of upper Old Tampa Bay; to evaluate possible hydrologic changes in the bay and contiguous area caused by the freshening; and to define the effect of freshening on the aquifer system.

## METHODS OF INVESTIGATION

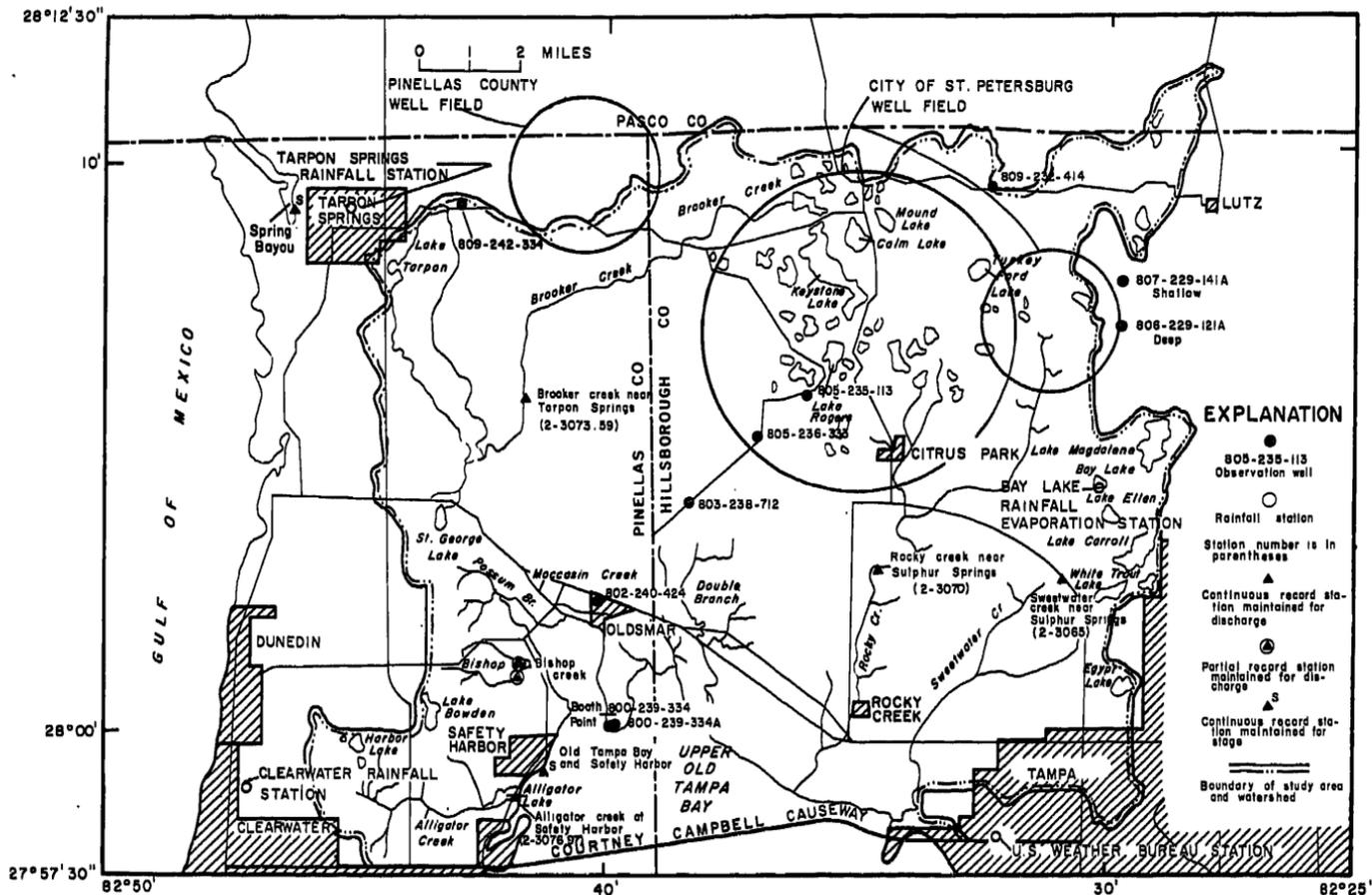
Streamflow data were available from four long-term gaging stations (fig. 2) and two partial-record stations at inflow points to the bay. These data and the derived estimates of flow for ungaged areas were used to establish the amount and seasonal distribution of surface inflow.

Tidal fluctuations in the bay were recorded continuously at two locations. These data were used in conjunction with fluctuations of water levels in observation wells to qualify judgments concerning the degree of interconnection between the aquifer systems and the bay.

Observation wells tapping both the shallow and deep aquifers were used to monitor the water-level fluctuations and to provide information on the hydraulic properties of the aquifers. Physical characteristics of the aquifers were determined from a study of well cuttings, geophysical logs, and other information obtained during well construction. Test wells were drilled in some locations where additional data were needed. Paired shallow and deep test wells were completed at sites adjacent to the bay to monitor the effects of tides on water levels in the aquifers and to aid in evaluating the degree of interconnection between the bay and the aquifers and causes of changes in water quality in the aquifers.

A hollow-stem auger was used to drill test holes in the bay bottom and the contiguous area. The results of this test drilling were used in conjunction with other data to determine the areal extent of clay beds, the physical characteristics of the sediments overlying the Floridan aquifer, and the degree of interconnection between the bay and the Floridan aquifer.

Aquifer tests and laboratory analyses of samples of nonindurated sediments in adjacent areas, collected as part of other investigations, provided



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Figure 2.— Map showing location of selected observation wells, municipal well fields, rainfall stations, streamflow gaging stations, and tidal recording stations in the upper Old Tampa Bay area, Florida.

useful data in evaluating the hydraulic characteristics of the aquifer and related confining beds in the bay area.

Samples were collected from streams, wells, and the bay for chemical analysis. Traverses were made periodically in the bay under differing hydrologic conditions. During these traverses, water samples were collected in order to detect possible variations in salinity and areas of possible inflow from submarine springs.

### ACKNOWLEDGMENTS

Excellent cooperation was received from city and county officials, industry, and local residents during this investigation. Special acknowledgments are given the Florida Department of Transportation, and Hillsborough and Pinellas Counties, for permission to drill and maintain test wells on public lands, and to the Florida Bureau of Geology and the Southwest Florida Water Management District for information provided the author. Appreciation is also expressed to J. S. Rosenshein and Gilbert H. Hughes of the Geological Survey for their extensive revision, and technical and editorial review of the manuscript. Work on the investigation was performed under the direction of C. S. Conover, district chief for Florida, and under the immediate supervision of J. W. Stewart and J. S. Rosenshein.

### PREVIOUS INVESTIGATIONS

A report by Matson and Sanford (1913) contains the earliest known published information on the hydrology and geology of this part of Old Tampa Bay. Sellards and Gunter (1913) discussed artesian flow.

Reports by Collins and Howard (1928) and Black and Brown (1951) included some information on the quality of water. Stringfield (1933, p. 13-17) presented a generalized description of the hydrology and geology of Pinellas and northwestern Hillsborough Counties.

The geologic features of the Tampa Bay area are described by Cooke (1945). A report by Ferguson and others (1947, p. 137) describes one of the larger springs in upper Old Tampa Bay. Heath and Smith (1954) described the hydrology and geology of the study area in Pinellas County. Reynolds, Smith, and Hills, Architects and Engineers, prepared a feasibility report in 1959 for the Hillsborough-Pinellas County committee studying the proposed freshening project. A report by Menke, Meredith, and Wetterhall (1961) describes the

hydrology of the Tampa Bay area in Hillsborough County. A report to the Hillsborough-Pinellas County committee by Reynolds, Smith, and Hills, in 1963, considered the engineering feasibility of the freshening project. A 1965 report by Black, Crow, and Eidsness, Consulting Engineers to the Board of County Commissioners, Pinellas County, reviewed the proposed freshening project.

## DESCRIPTION OF THE SURROUNDING AREA

Tampa Bay is in about the middle of the west side of the Florida peninsula (fig. 1) and is open to the Gulf. It is surrounded on three sides by the Tampa-St. Petersburg metropolitan area. The bay is one of the largest along Florida's many miles of coastline. Tampa Bay is divided into an eastern and western embayment by the interbay peninsula on which part of the city of Tampa is located. The eastern part is known as Hillsborough Bay and the western part as Old Tampa Bay. The northern part of Old Tampa Bay, north of Courtney Campbell Causeway, is known locally as upper Old Tampa Bay. This northern part has been proposed for conversion to a fresh-water lake.

## TOPOGRAPHY AND DRAINAGE

The Tampa Bay area is in the Coastal Lowlands topographic region of Florida as defined by Cooke (1945, p. 8). Altitudes range from sea level to about 100 feet along the western drainage divide just northwest of Safety Harbor (fig. 3). A hilly area extends northward from Safety Harbor to Lake Tarpon. Interspersed among these hills are numerous sinkholes, the most well known of which is on the northwest shore of Lake Tarpon and has a subterranean connection with Spring Bayou at Tarpon Springs (Heath and Smith, 1954). The high mineral content of Lake Tarpon (fig. 21, p. 44, Cherry, Stewart, and Mann, 1970) is caused chiefly by movement of saline water into the lake from Spring Bayou through this subterranean connection.

The area is dotted with lakes and ponds of various sizes. Lake Tarpon is the largest with a water surface of about 4 sq mi (square miles). The larger lakes are clustered in three distinct groups: (1) those trending northward along the hills west and northwest of Safety Harbor including Lake Tarpon; (2) those in the central part including Keystone Lake and Lake Rogers; (3) and those trending northward along the low sandy ridge of the eastern drainage divide, including Lakes Magdalene and Carroll.

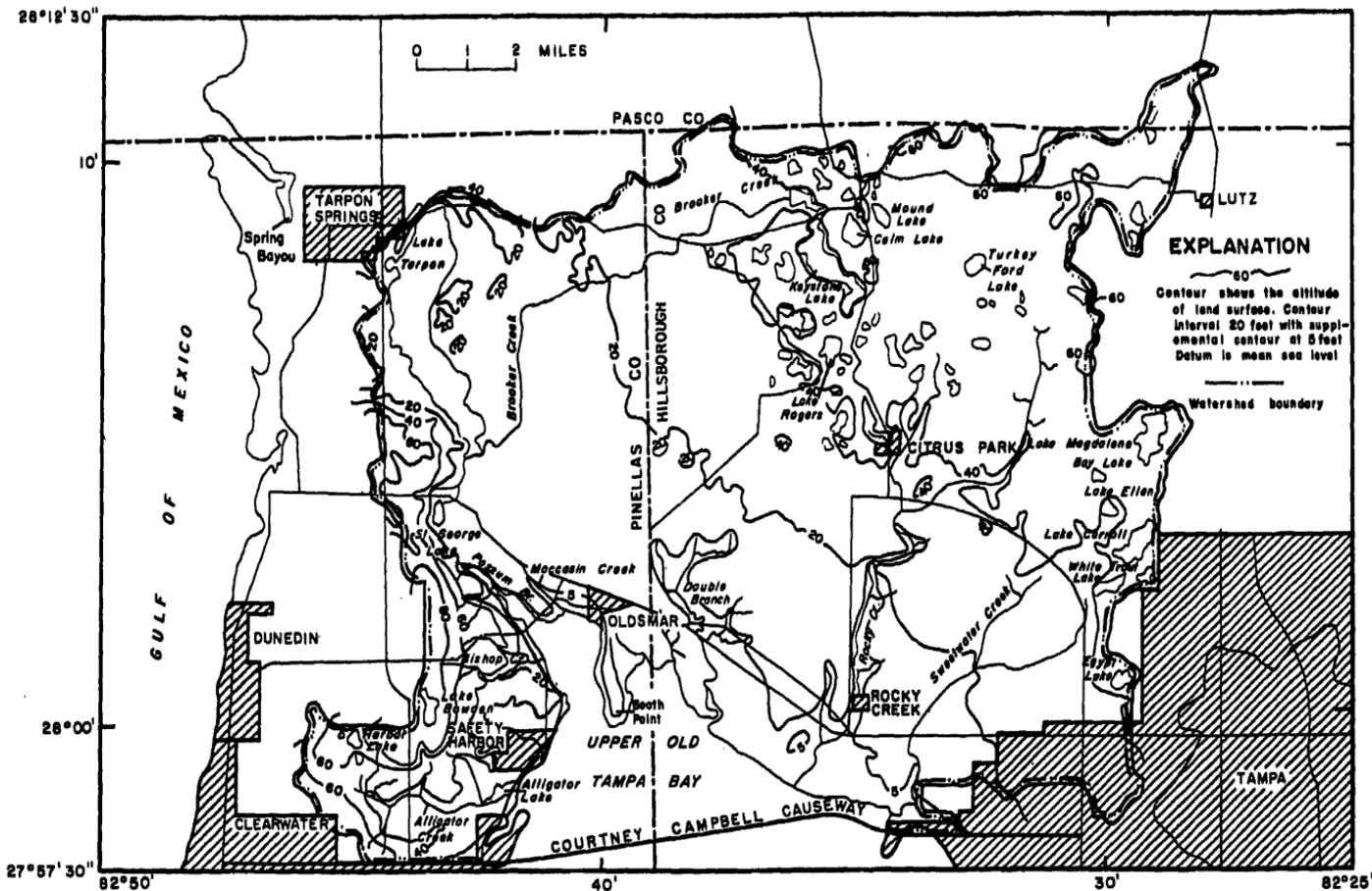


Figure 3.—Map showing topography of the upper Old Tampa Bay area, Florida.

Drainage areas of streams range from 10 to 45 sq mi. Most of the land is relatively flat-lying, and channel slopes are mild. Channels are poorly developed, and stream courses are well defined only for short reaches. The larger streams, except Alligator and Brooker Creeks, are open to the bay, and their flow is affected by tidal fluctuation near their mouths.

## CULTURE AND DEVELOPMENT

The study area is sparsely populated except adjacent to the bay and around the larger lakes, where property is in demand for residential development. The many lakes and the bay provide fishing, boating, skiing, and swimming. Most of the land outside the residential areas is used for cattle ranching, dairying and citrus farming.

Many current (1970) developments involving water resources in the bay area will cause some alteration in the runoff pattern and possibly affect the hydrologic regimen of the bay. The Soil Conservation Service, in conjunction with local conservation districts, has two watershed projects (fig. 4) in planning stages or under construction: the Upper Tampa Bay Watershed Project and the Brooker Creek Watershed Project. Together, the project areas include most of the 190-sq-mi drainage area of the bay. The Rocky Creek bypass channel (channel G), which will carry floodwater around the community of Rocky Creek, has been completed.

The outfall canal for Lake Tarpon has also been completed as a part of the Four River Basins Project of the Corps of Engineers. This canal and structures, along with a gated cofferdam around a sinkhole in Lake Tarpon, is designed to control the level of the lake. If the gated cofferdam is effective over a long period of time, the movement of salt water from Spring Bayou through the subterranean connection into Lake Tarpon will be stopped as well as the unregulated discharge of Lake Tarpon into the sinkhole. Under these conditions, Lake Tarpon will gradually freshen, thus augmenting the available supply of water for freshening the proposed bay lake by diversion of Lake Tarpon by way of the outfall canal into upper Old Tampa Bay.

Land development is also changing the runoff pattern. New residential subdivisions, with homes fronting on canals, are continually being built around the bay. The extensive dredging and filling associated with the building is not only changing the runoff pattern but in some places is increasing the natural discharge from the shallow water table and the deeper limestone aquifers where both are breached by canals. This increased discharge also results in lower water levels in the aquifers adjacent to the canals.

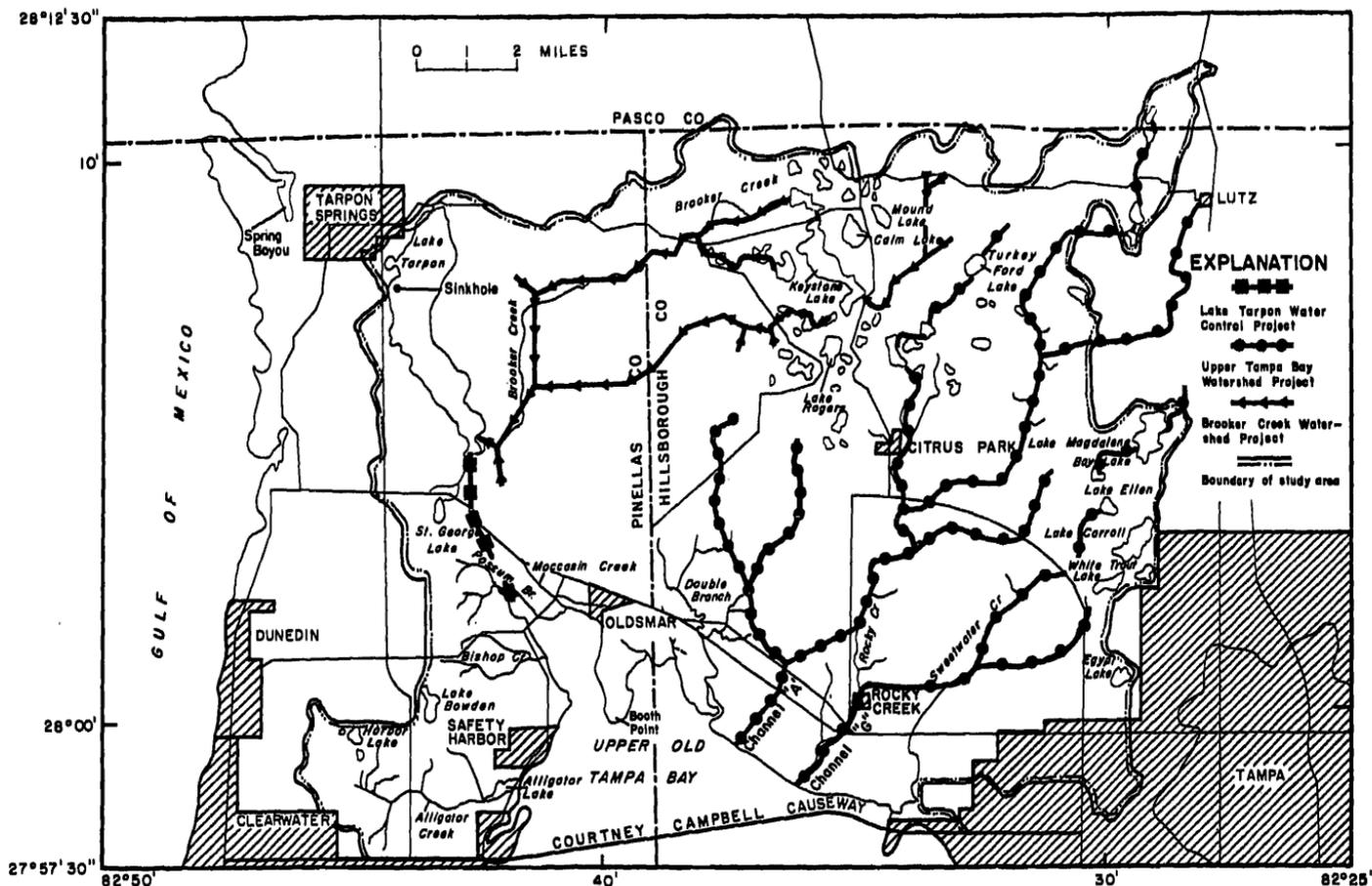


Figure 4.— Map showing Lake Tarpon Water Control Project, Upper Tampa Bay Watershed Project, and Brooker Creek Watershed Project.

## CLIMATE

The climate of this part of Florida is subtropical, and the prevailing westerly winds moving across the Gulf have a cooling effect on the land areas in the summer and a warming effect in winter.

The average annual rainfall is about 52 inches with 60 percent occurring from June through September (fig. 5). Usually the driest month is November and the wettest is July. Thundershowers during the spring and summer months cause intense rainfall on small areas for short periods. Areally extensive heavy rainfalls are associated with (1) low-pressure cells that either move slowly or that stall over the area and (2) tropical storms that generally occur in the early fall.

The average annual evaporation from open-water bodies is nearly equal to the average annual rainfall. Based on pan evaporation data at Bay Lake near Sulphur Springs and a pan coefficient of 0.8, the average annual evaporation from open-water bodies in the Tampa Bay area is estimated to be 50 inches. This evaporation varies seasonally from about 2 inches in January to about 6 inches in May (fig. 5). In a given year, the evaporation may be greater or less than the annual precipitation.

The average daily maximum temperature ranges from 70°F to 90°F and the minimum temperature from 50°F to 72°F.

## GEOLOGY

The report area is covered by surficial deposits of sand, silt, and clay. Underlying these deposits is a thick sequence of marine limestones. In much of the upper Old Tampa Bay area, clay of the Hawthorn Formation, which contains thin discontinuous beds of sandy limestone, underlies the surficial deposits and overlies the limestone of the Tampa and older formations. The lithologic characteristics of the rock units in the upper 1,000 feet are summarized in table 1. The aquifer unit to which each formation is referred is also indicated in this table.

The Tampa Formation is the first continuous limestone unit of the Floridan aquifer underlying the area. Its contact with both the Hawthorn Formation and the undifferentiated sand, silt, and clay is unconformable.

In adjacent wells, the top of the Tampa Formation can differ as much as 30 feet, and, therefore, is not easily mapped. However, a generalized configuration of this surface is shown in figure 6 and is taken in part from unpublished interpretive maps furnished by R. N. Cherry and J. W. Stewart of the Geological Survey.

The Tampa Formation lies unconformably on the Suwannee Limestone

**Table 1. Geologic formations in the Upper Old Tampa Bay area, Florida**

System	Series	Formation <sup>1</sup>	Approximate thickness (ft)	Lithology	Aquifer	
Quaternary	Holocene	Undifferentiated <sup>2</sup>	0-90	Sand and shell; alternating with clay, blue-gray, and clay, gray-green, sandy, calcareous, phosphatic; interbedded with layers of limestone, gray, white, and tan, sandy, phosphatic.	Shallow	
	Pleistocene					
Tertiary	Miocene	Hawthorn Formation	100-150	Limestone, white to gray, sandy; locally crystalline; contains dolomitic and silicified layers.	Floridan	
		Tampa Formation				
	Oligocene	Suwannee Limestone	250-300	Limestone, cream to tan, thin-bedded fine-grained, dense, hard.		
		Eocene	Ocala Group	Crystal River Formation		0-300
	Williston Formation			30-50		Coquina, cream-colored, or limestone, cream to tan, detrital;—loosely cemented calcareous matrix; locally silicified.
Inglis Formation	50-150			Limestone, cream to tan, granular, porous, medium-hard, massive; dolomite, locally tan to brown, near base.		
Avon Park Limestone	300-500	Limestone, white to tan, soft, chalky, granular; dolomite, tan to brown, hard, crystalline				
Lake City Limestone	200-600	Limestone, tan to cream, soft, granular, pasty; locally interbedded with layers of dolomite and bentonitic clay; some gypsum.				

<sup>1</sup>Nomenclature conforms to that of the Bureau of Geology, Florida Department of Natural Resources

<sup>2</sup>Designated surficial deposits in this report

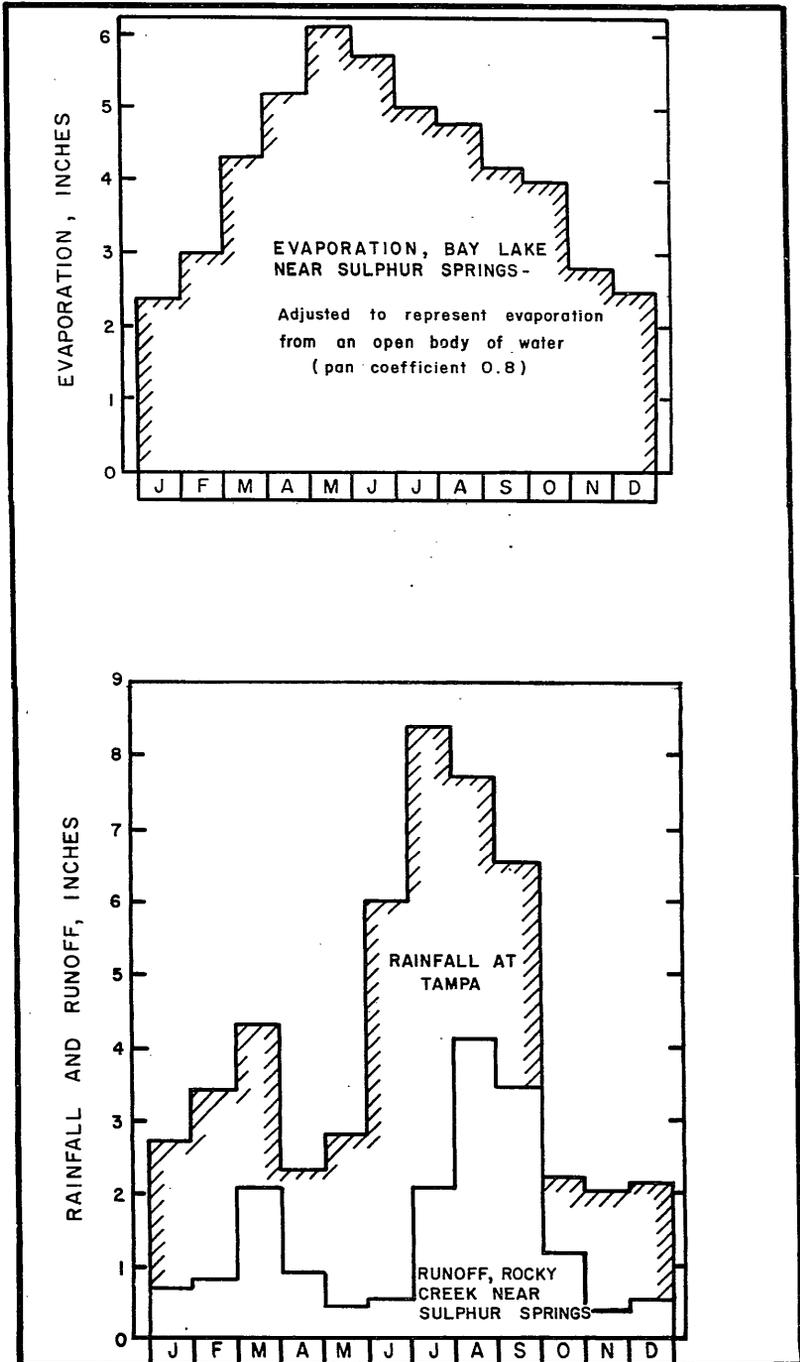


Figure 5.—Mean monthly rainfall evaporation, and runoff, 1953-66.

Table 1. Geologic formations in the Upper Old Tampa Bay area, Florida

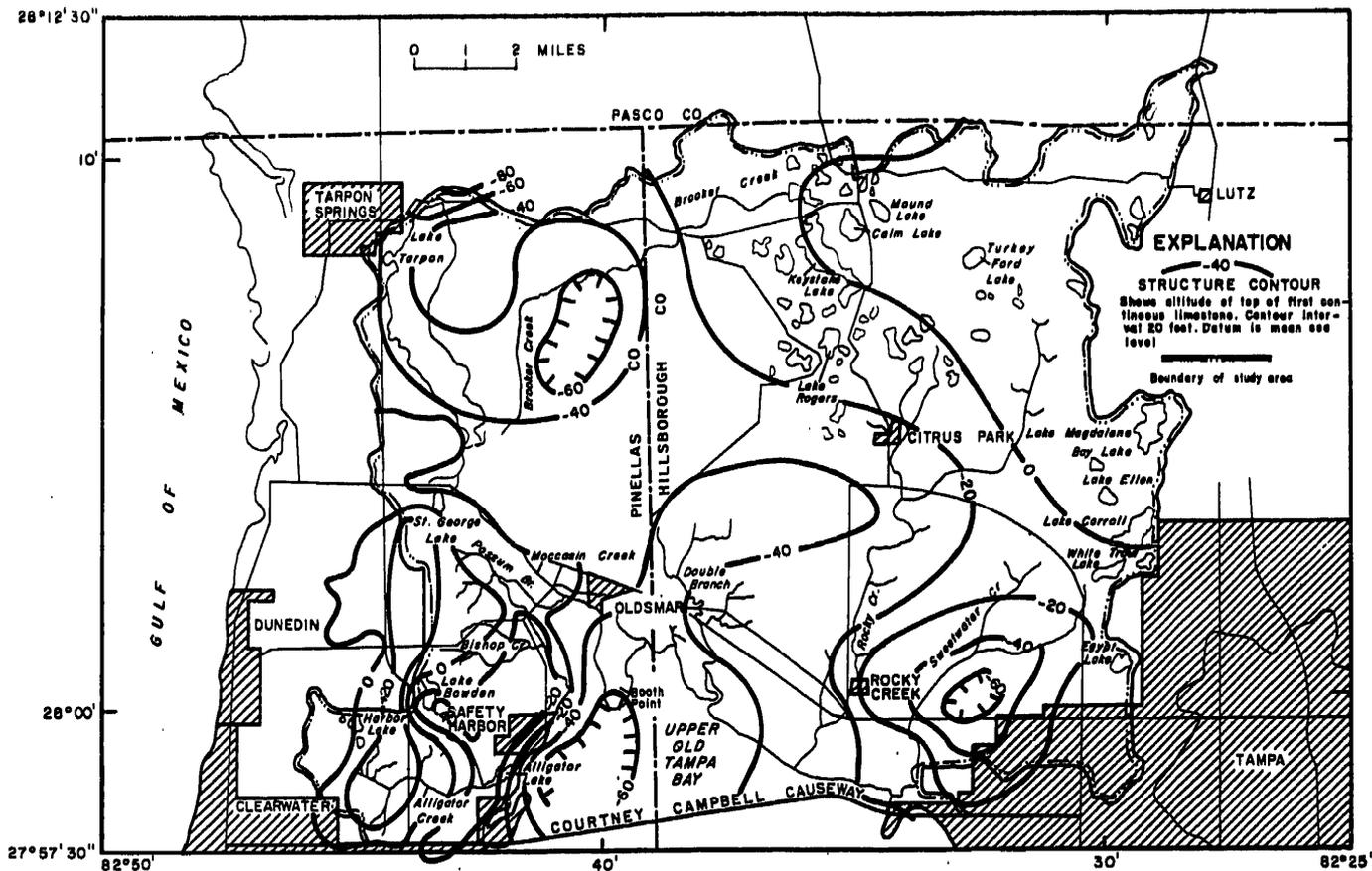


Figure 6.—Map of the upper Old Tampa Bay area showing generalized contours on the top of the first continuous limestone (Tampa Formation) of the Floridan aquifer.

(Cooke, 1945, p. 145). The Suwannee Limestone is a hard generally fossiliferous limestone, whereas the Tampa Formation is a hard sandy limestone. The Suwannee Limestone is highly permeable and a good source of water. Most wells of large yield in the area tap both the Tampa Formation and Suwannee Limestone. Although the rock units below these formations generally contain highly permeable zones—the Avon Park Limestone in particular—the water in these deeper zones is highly mineralized. Therefore, these zones are not tapped for potable water supplies.

## HYDROLOGY

The hydrologic phase of the study of upper Old Tampa Bay is concerned chiefly with two principal aspects: (1) the rate and degree of freshening, which is a function of rainfall on the bay, evaporation from the bay, inflow to the bay, and discharge from the bay; and (2) the effects of freshening upon the fresh-water aquifer system, which are dependent on the degree of hydraulic interconnection between the bay and the aquifers.

### RUNOFF TO THE PROPOSED LAKE

The most important factor relative to the rate of freshening is adequacy of inflow. Inflow to the proposed lake is derived chiefly from runoff from a drainage area of 190 sq mi. The major streams contributing inflow are Sweetwater Creek, Rocky Creek, Double Branch, Alligator Creek, and Brooker Creek by way of the outfall canal from Lake Tarpon (fig. 4). Rocky Creek is the only perennial stream within the drainage area of the proposed lake. Sweetwater, Brooker, and Alligator creeks ceased to flow for 3 to 4 months each year during the extreme drought of 1955-56.

Analyses of inflow to the upper bay were made, both including and excluding runoff from the Lake Tarpon-Brooker Creek watershed. If the cofferdam does not effectively close Lake Tarpon's underground connection with Spring Bayou, a salt-water body, a control structure could be placed in the Lake Tarpon outfall canal. This structure should prevent saline water in Lake Tarpon from discharging into the proposed fresh-water lake. Therefore, runoff from the Lake Tarpon-Brooker Creek watershed would not be available to the proposed lake. However, if closure is effective and Lake Tarpon becomes permanently fresh, this watershed would be a source of runoff for the proposed lake.

A 17-year period, calendar years 1950-66, inclusive, was chosen for computing average runoff to the lake. This period included the most severe drought of record, 1955-56, and the wettest 2 years of record, 1959-60. Average annual rainfall during the 17-year period was 53 inches, 1 inch more than the long-term average annual rainfall in the area. Thus runoff during the chosen period was probably not greatly different from average runoff for a longer period.

Runoff from the entire contributing area of 190 sq mi for the 17-year period was estimated by averaging runoff at gages on Sweetwater, Rocky, Alligator, and Brooker creeks and applying the average runoff per square mile to the entire area. The average runoff from the gaged area of 80.4 sq mi for the 17-year period was 56 mgd (million gallons per day) and the average runoff from the 190 sq mi, 130 mgd. During this same period, the average annual rainfall (R) on the proposed lake and Lake Tarpon exceeded the estimated average rate of evaporation (E) from both lake surfaces by 4 mgd ( $R - E = 4$  mgd), thereby making a total of 134 mgd available on the average for freshening the proposed lake.

Figure 7 provides a graphical comparison of the cumulative total rainfall and evaporation for an open body of water in the bay area and the cumulative total inflow into the proposed lake for the 17-year period 1950-66. The inflow shown includes runoff from Lake Tarpon and Brooker Creek.

#### INFLOW DURING AVERAGE AND ABOVE-AVERAGE CONDITIONS

**Inflow, including runoff from Lake Tarpon and Brooker Creek:**—At the normal operating level of 2.5 feet above msl, the volume of the proposed lake would be about 87,000 acre-feet and the average depth 8.5 feet. Therefore, an average inflow of 134 mgd (150,000 acre-feet per year) would be sufficient to displace the volume of water in the lake 1.7 times each year.

The maximum annual runoff for the 17-year period was in 1959. The runoff was estimated to average 476 mgd. With the gain from the rainfall minus evaporation ( $R - E$ ) for 1959, average inflow would be 513 mgd (570,000 acre-feet per year). This rate of inflow would be sufficient to displace the volume of water in the proposed lake 6.5 times.

**Inflow excluding runoff from Lake Tarpon and Brooker Creek:**—Inflow from the Lake Tarpon-Brooker Creek watershed averaged 40 mgd during the 17-year period and 114 mgd during the maximum year (1959). With this runoff excluded, inflow (runoff plus rainfall minus evaporation) would be as follows:

Maximum year (1959)	362 mgd
Average year	94 mgd

An average annual inflow of 94 mgd (105,000 acre-feet per year) would be

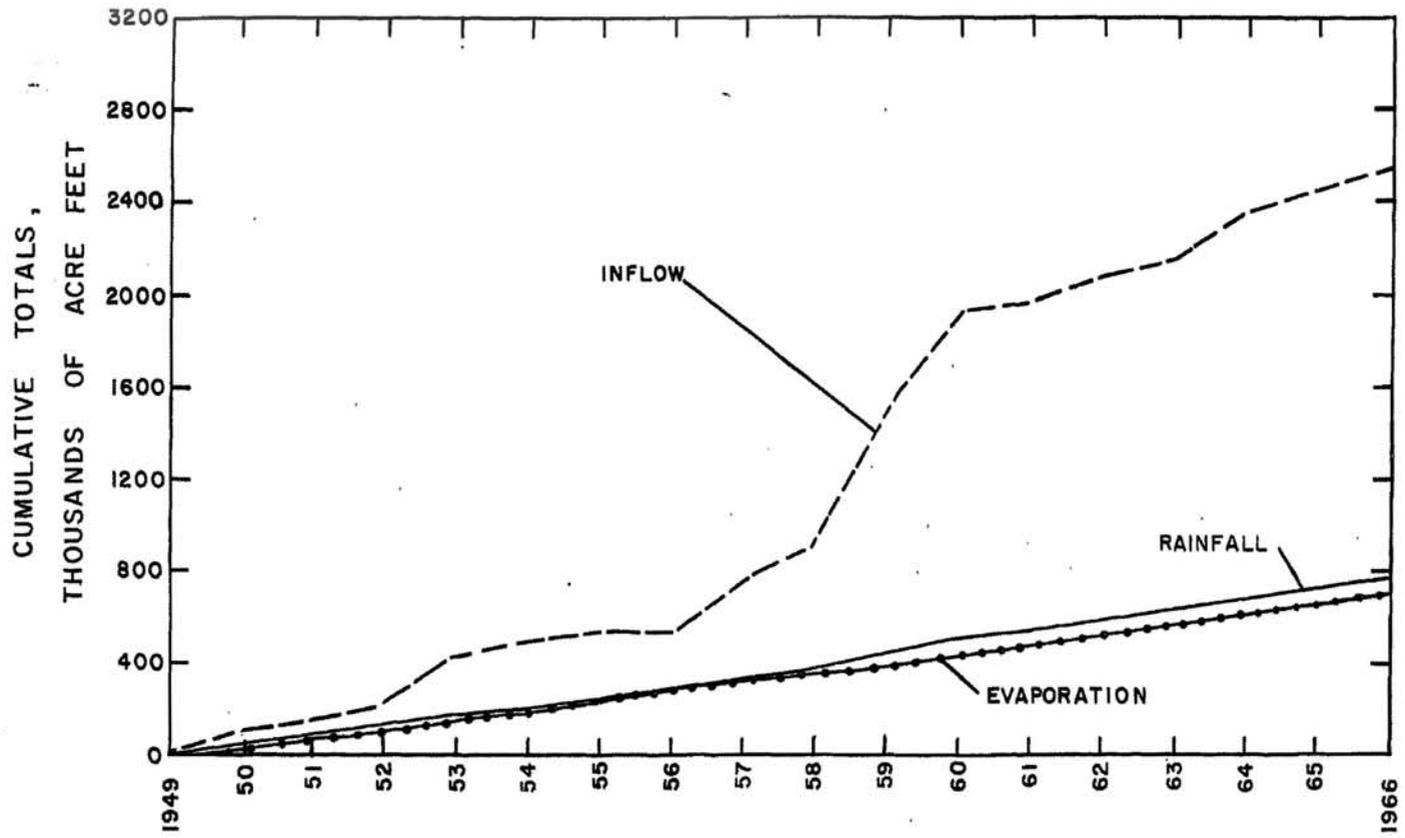


Figure 7.—Cumulative total rainfall on, evaporation from, and inflow to proposed fresh-water lake including Lake Tarpon-Brooker Creek watershed.

sufficient to displace the volume of water in the lake 1.2 times per year—4.5 times during a maximum year.

#### INFLOW DURING A CRITICALLY DRY YEAR

The most critical year for inflow in the 17-year period was 1956, when runoff averaged only 14 mgd. In order to determine the minimum lake level likely to be reached during such a critical year, monthly inflow (runoff + rainfall - evaporation) for 1956 was mathematically routed through the proposed lake. The lake was assumed to be initially at the normal operating level (2.5 feet above msl). All inflow in excess of that required to hold the pool at this level was assumed to be discharged.

With the inflow from Lake Tarpon-Brooker Creek watershed included in the total inflow, the minimum level reached during the critical drought year was 0.5 foot below the minimum design level (1.5 feet above msl). With inflow from this watershed excluded from the total inflow, the minimum lake level reached was 0.25 foot below the minimum design level. This difference in minimum lake levels is caused by several factors. Inflow to Lake Tarpon from Brooker Creek ceased during March through July 1956, while the proposed lake received appreciable inflow from Rocky Creek, which did not go dry. During these months, Lake Tarpon and the proposed lake would have tended to stabilize at about the same level. As a result, water supplied by Rocky Creek would be distributed over the area of both lakes rather than the area of the proposed lake alone causing a lower minimum level to be reached when the total inflow included that from the Lake Tarpon-Brooker Creek watershed.

If a control structure were to be installed in the outfall canal that connects the proposed lake to Lake Tarpon, water from Rocky Creek could be constricted during droughts to the area of the proposed lake. With such a provision, inflow from Lake Tarpon-Brooker Creek watershed could be used beneficially to freshen the proposed lake without adverse effects during unusual droughts.

The preceding analysis of minimum water-level elevations in the proposed lake does not take into account losses by operation of the locks. Some fresh-water losses occur as a result of lock operations. However, when these losses are placed in hydrologic perspective, they are minor. Plans for existing and anticipated navigation requirements call for two locks (Reynolds, Smith, and Hills, December 1963). The larger lock, 350 feet long, 56 feet wide, and 15 feet deep, would pass tugs and oil barges supplying the power plant at Booth Point. To conserve fresh water, a smaller lock would be provided for pleasure craft. This lock would have a chamber 65 feet long, 15 feet wide, and 8 feet deep.

The capacity of the larger lock is 294,000 cu ft (cubic feet). One-tenth of

a foot of water from the lake surface (47,500,000 cu ft) would supply water for 160 lockages. Oil barges make about 25 trips per year. Assuming that fresh water would be discharged on downstream lockages only, 135 lockages through the large lock could be utilized for pleasure craft. The smaller lock has a capacity of 7,800 cu ft; and 135 lockages through the large lock would be equivalent to 5,100 lockages through the small lock. The small lock could accommodate several pleasure craft at each lockage. With the boat lifts and marine railway to permit passage of small pleasure craft without loss of fresh water, this number of lockages should more than satisfy navigation needs for the bay area. If Lake Tarpon is connected to the upper bay, additional surface area would be available, and 200 lockages through the large locks would use only 0.1 foot of water.

### CHEMICAL CHARACTERISTICS OF SURFACE WATER

The chemical quality of streamflow discharging into the proposed lake is generally good excluding consideration of the nutrient and biochemical content which were not determined during this investigation. The mineral content of samples collected above tidewater average less than 100 mg/l (milligrams per liter) and the chloride content about 20 mg/l. Both the mineral and chloride contents vary seasonally according to flow conditions because the streamflow is more highly mineralized during periods of low flow, when discharge is derived chiefly from the ground-water reservoir, than during periods of high flow, when the discharge is derived chiefly from runoff. These seasonal relations between discharge and water quality are illustrated on figure 8. The data shown on figure 8 are for samples collected at a site above tidal influence, and the chemical quality is representative of runoff from the entire area contributing to the proposed lake.

The variation in specific conductance in figure 8 reflects the variation in mineral content, and the actual mineral content (in milligrams per liter) is equivalent numerically to about 55 percent of the specific conductance (in micromhos).

The results of the salinity traverses across upper Old Tampa Bay (fig. 9) indicate that in a large part of the bay the chloride concentration did not differ from the average chloride concentration of the bay (average of all samples) by more than 10 percent. Neither did the maximum and minimum chloride concentrations at any specified sampling point differ from each other by more than 10 percent. The differences in the concentration of chloride at each sampling point for those samples collected from both the top and the bottom of the bay were generally in the range of normal error in laboratory work,

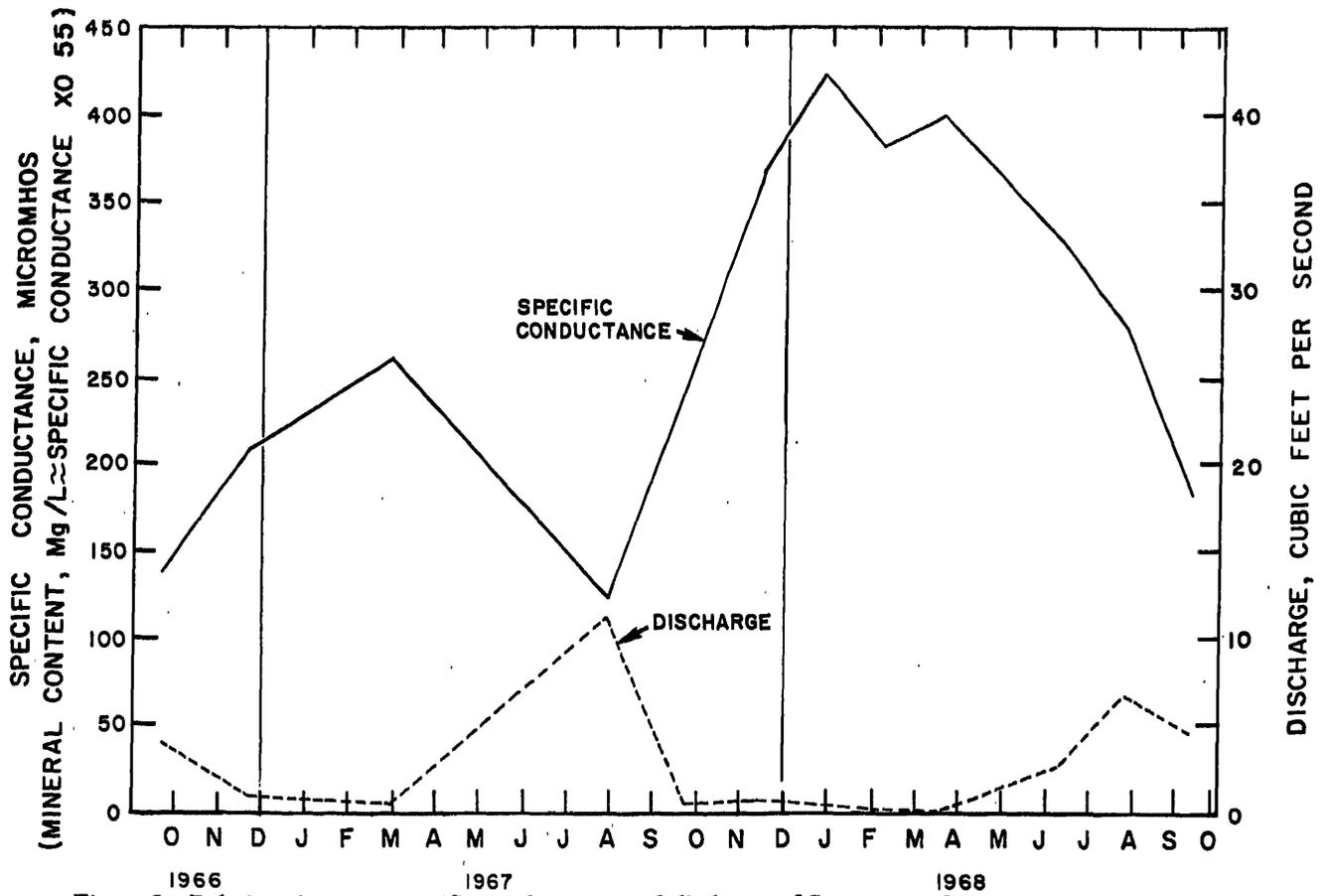


Figure 8.—Relations between specific conductance and discharge of Sweetwater Creek near Sulphur Springs.

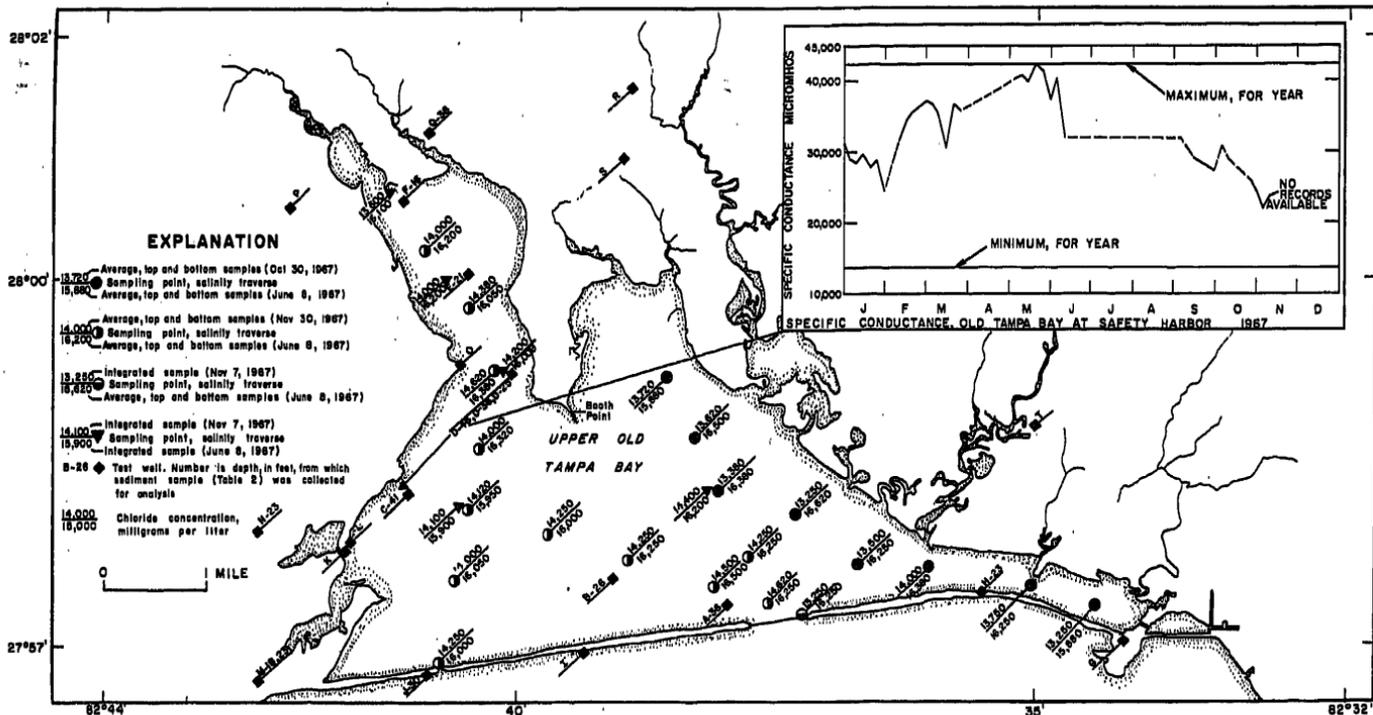


Figure 9.—Chloride concentrations at sites sampled in upper Old Tampa Bay and location of auger holes.

regardless of whether the samples were collected from either the shallow part (less than 6 feet deep) or the deep part (6 to 12 feet) of the bay. This lack of significant vertical differences in chloride concentration indicates that current movement and wind action is generally sufficient to keep the water in the bay well mixed except in the vicinity of the mouths of the larger creeks during short periods of high streamflow.

Samples of water were collected on July 12, 1965, from Mullet Creek near Safety Harbor at both high and low tide. At that place the stream is affected by tidal fluctuation. The range in concentration of chloride in milligrams per liter is as follows:

7,000 (high-tide – top).  
13,000 (high-tide – bottom).  
5,800 (low-tide – top).  
9,200 (low-tide – bottom).

The fresh-water discharge of Mullet Creek at the time of sampling in the stream was about 10 cfs (cubic feet per second), estimated by comparison with discharge of Alligator Creek near Safety Harbor. The difference in chloride concentrations in top and bottom samples indicated that near points of relatively large fresh-water inflow density separation does occur during the wet season.

Chloride concentrations in the bay at Safety Harbor, where monitoring was continuously carried out, ranged from 9,500 to 16,500 mg/l during October 1966-September 1968. The maximum concentration occurred at the time of minimum fresh-water inflow, and the minimum concentration occurred at the time of maximum fresh-water inflow.

#### RATE OF FRESHENING

Factors that determine the rate of freshening in the proposed lake are: (1) the rate and mineral concentration of inflow to the lake; (2) the degree of mixing; (3) the original volume and mineral concentration of the water in the proposed lake at the time of its separation from Tampa Bay; and (4) the rate and mineral concentration of discharge from the lake. To simplify the analyses presented below the following assumptions were made: (1) lake level would be at normal operating level (2.5 feet above msl) when closed; (2) at the time of closure the average chloride concentration of water in the lake would be 14,000 mg/l; (3) the chloride concentration of the inflow water would be zero; (4) the lake would be completely mixed at all times; and (5) inflow of saline water from boat locks would not significantly affect the rate of freshening. The average inflow has been established as sufficient to flush the proposed lake 1.7 times per year with inflow, including that from Lake Tarpon-Brooker Creek watershed.

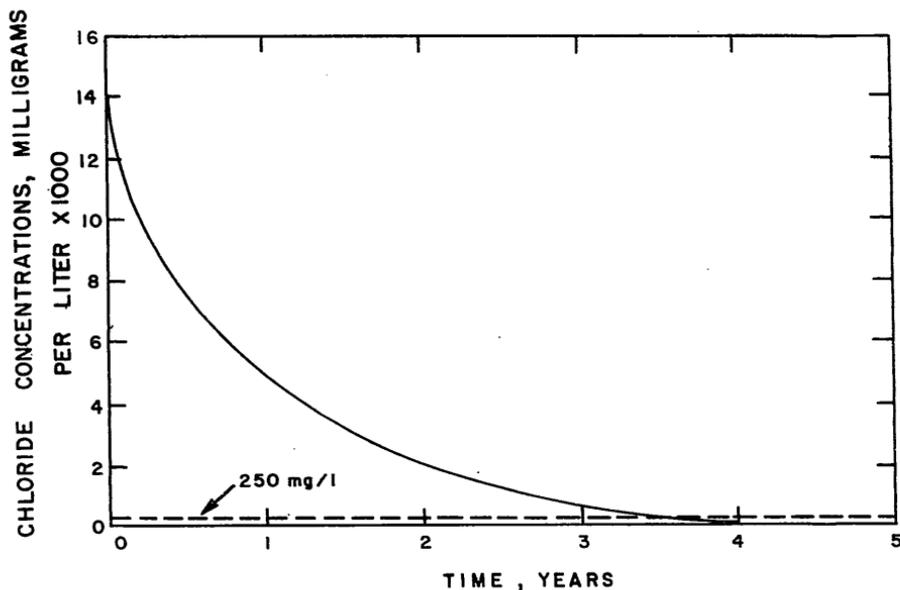


Figure 10.—Calculated rate of freshening of proposed lake by dilution.  
(Includes inflow from Lake Tarpon-Brooker Creek watershed.)

Chloride concentration in the lake at the end of 1 year would be about 5,000 mg/l, and the dilution (freshening) would follow the relation shown in figure 10. Chloride concentrations would be less than 250 mg/l in 3.5 to 4 years. If mixing is not complete the denser salt or brackish water will tend to collect near the bottom of the lake. To facilitate passing this water, spillways in the engineering works have been designed for undergate discharge. Displacement of saline water in this way would decrease the time required for freshening.

Documented information on rate of freshening of existing man-made saline lakes in Florida has been published in two reports. Musgrove, Foster, and Toler (1965, p. 45 and fig. 27, p. 46) showed that the chloride concentration of Deer Point Lake in northwestern Florida decreased from 3,700 mg/l to less than 250 mg/l in about 4 months after flow over the spillway began. This reduction occurred after the initial volume of the lake had been replaced about four times by fresh-water inflow. Cherry, Stewart, and Mann (1970, p. 38) showed that the chloride concentration in Seminole Lake in Pinellas County decreased from 2,300 mg/l in 1950 to less than 250 mg/l in 1957. Within 2 years after completion of the dam that created the lake, the chloride concentration was lowered to less than 250 mg/l for extended periods. This concentration has remained continuously less than 250 mg/l since 1957. Although the hydrologic setting, volumes of inflow, and initial chloride concentrations of these lakes differ from those of the proposed lake, the foregoing information indicates that

the calculated rate of freshening of the proposed lake is reasonable. The information, particularly with respect to Deer Point Lake, indicates that freshening of the proposed lake would occur chiefly by dilution after initial displacement of some saline water by undergate flow.

The time required for freshening would be considerably shorter if the suggested level of salinity for maintaining feeding areas for key water fowl were generally acceptable. The Florida Game and Fresh Water Fish Commission has suggested that a chloride concentration of 1,000 mg/l be maintained in a large part of the proposed lake to sustain growth of widgeon grass. The Commission indicates that this level of salinity could be tolerated by fresh-water fish. Adoption of this suggestion would necessitate the mixing of saline water from the bay with the fresh-water inflow.

## GROUND WATER

### SHALLOW AQUIFER

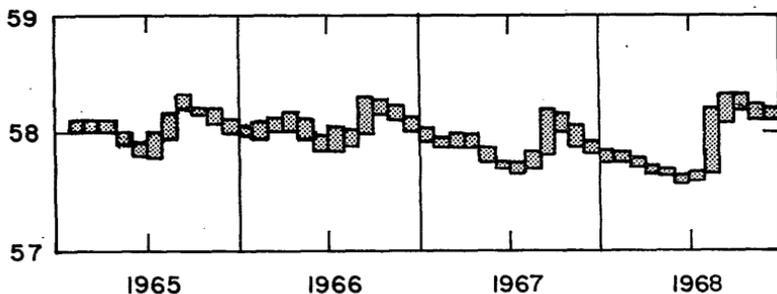
A water-table aquifer overlies the Floridan aquifer in most of the area and includes the surficial sands and the upper part of the Hawthorn Formation except where it has been removed by erosion. The thickness of the material forming the shallow aquifer in the bay area can be estimated by comparing elevations on the map (fig. 6) showing the top of the first consistent limestone and the topographic map (fig. 3). This thickness ranges from 20 to 40 feet southwest of Oldsmar to as much as 100 feet northwest of Oldsmar.

The depth to the water table averages less than 5 feet below land surface throughout most of the area. This depth increases in several areas (fig. 2) where large quantities of ground water are withdrawn from the underlying Floridan aquifer for municipal supply. Near these well fields the water table lies as much as 15 feet below the land surface.

The water table in the shallow aquifer slopes generally toward the bay, and its elevation is highest along the ridge area west of Safety Harbor and in the northeastern part of the study area. The natural seasonal fluctuation of the water table generally ranges from 1 to 2 feet except during extremely wet or dry years. Figure 11 shows the monthly range in water levels during 1965-68 in two wells, one tapping the shallow aquifer and the other the Floridan aquifer; both of which are at the same site near the northeastern edge of the study area. Although water levels in wells in the immediate vicinity of the bay are affected by tidal fluctuations, seasonal water-level fluctuations in these wells follow the same general pattern as observed in those inland.

WELL, 807-229-141A  
 DEPTH, 22 FEET  
 SCREENED, 18-21 FEET  
 AQUIFER, WATER TABLE

WATER LEVEL,  
 FEET ABOVE MEAN SEA LEVEL



WELL, 806-229-121A  
 DEPTH, 134 FEET  
 CASED, 44 FEET  
 AQUIFER, FLORIDAN

WATER LEVEL,  
 FEET ABOVE MEAN SEA LEVEL

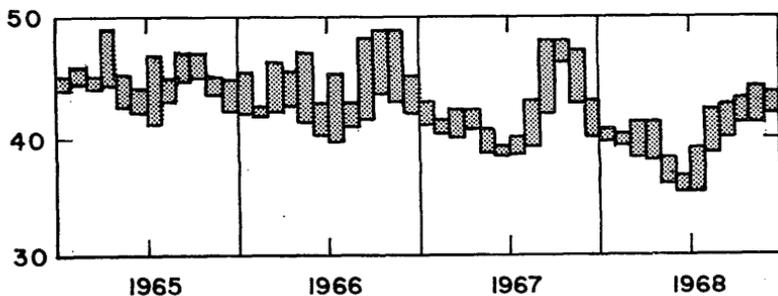


Figure 11.—Maximum and minimum monthly water levels in a shallow and a deep well near the northeast edge of the study area.

**Chemical character of water in the shallow aquifer.**—In most of the area water from the shallow aquifer is of suitable quality for domestic and municipal supplies although high iron content is a local problem. Because of its low permeability, no public water suppliers derive their water from this aquifer. In the area immediately adjacent to the bay, water from the shallow aquifer is generally high in chloride, about 7,000 mg/l, and in dissolved solids. The water in the aquifer is generally saline where (1) the land surface is subject to some tidal flooding and (2) the fresh-water head in the aquifer is generally less than 1 foot above mean sea level.

### FLORIDAN AQUIFER

The Floridan aquifer, the major aquifer underlying the bay and adjacent area, is not everywhere under artesian or confined conditions. The overlying clay of the Hawthorn Formation together with clay beds in the surficial deposits form a relatively impermeable but leaky confining layer. In much of the area adjacent to the bay, this clay is absent either as result of nondeposition or removal by erosion or having been breached by sinkholes. In these areas the Floridan aquifer is under water-table conditions. These conditions may change from chiefly water table to chiefly artesian in areas a few miles apart, depending on the presence or absence of the confining layer.

The potentiometric surface of the Floridan aquifer slopes generally toward the bay in Hillsborough and Pinellas Counties, as shown in figure 12. The altitude of this surface is less than the altitude of the water table in the shallow aquifer in the northeastern part of the drainage area. In some areas adjacent to the bay, the potentiometric surface is above land surface, and wells that tap the Floridan aquifer flow.

The trough in the potentiometric surface in the vicinity of Oldsmar is caused by natural discharge of water by seepage from the Floridan aquifer to the bay. The location of the zero-potential contour is inferred. This contour delineates the boundary of the area of natural fresh-water discharge from the aquifer. Bayward from the zero-potential contour, the aquifer contains saline water.

The position of the zero contour on the potentiometric surface is not a fixed one. The contour moves bayward during wet periods and landward during dry periods. Fluctuation of the position of zero contour is indicated by fluctuation of water levels (fig. 13) in a deep observation well (800-239-334) on Booth Point that taps the Floridan aquifer. In September 1967, the average water level in the deep well was 1.5 feet above msl. In September 1968, its average water level was about mean sea level. Thus, at this well the head in the Floridan aquifer fluctuated from 0.5 foot below msl to 2.5 feet above msl during

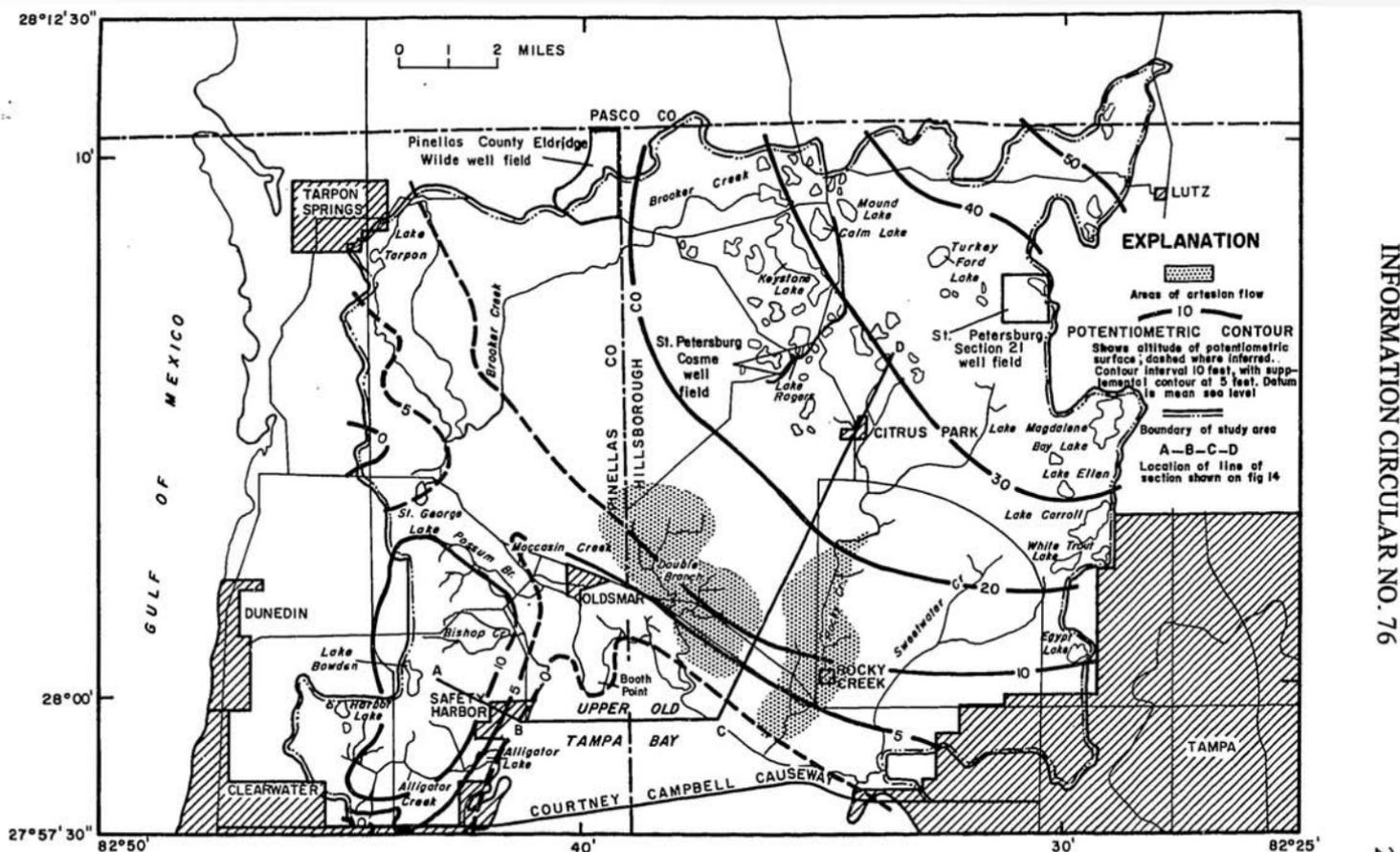


Figure 12.— Map of the upper Old Tampa Bay area showing generalized configuration of the potentiometric surface of the Floridan aquifer and the area of artesian flow, August-November, 1967.

the investigation, indicating that the position of the zero-potential contour was at times inland from the well.

**FLUCTUATIONS OF THE POTENTIOMETRIC SURFACE**

Water levels in the Floridan aquifer fluctuate seasonally less than 5 feet in coastal areas and 10 feet in inland areas. This general range in fluctuation may be

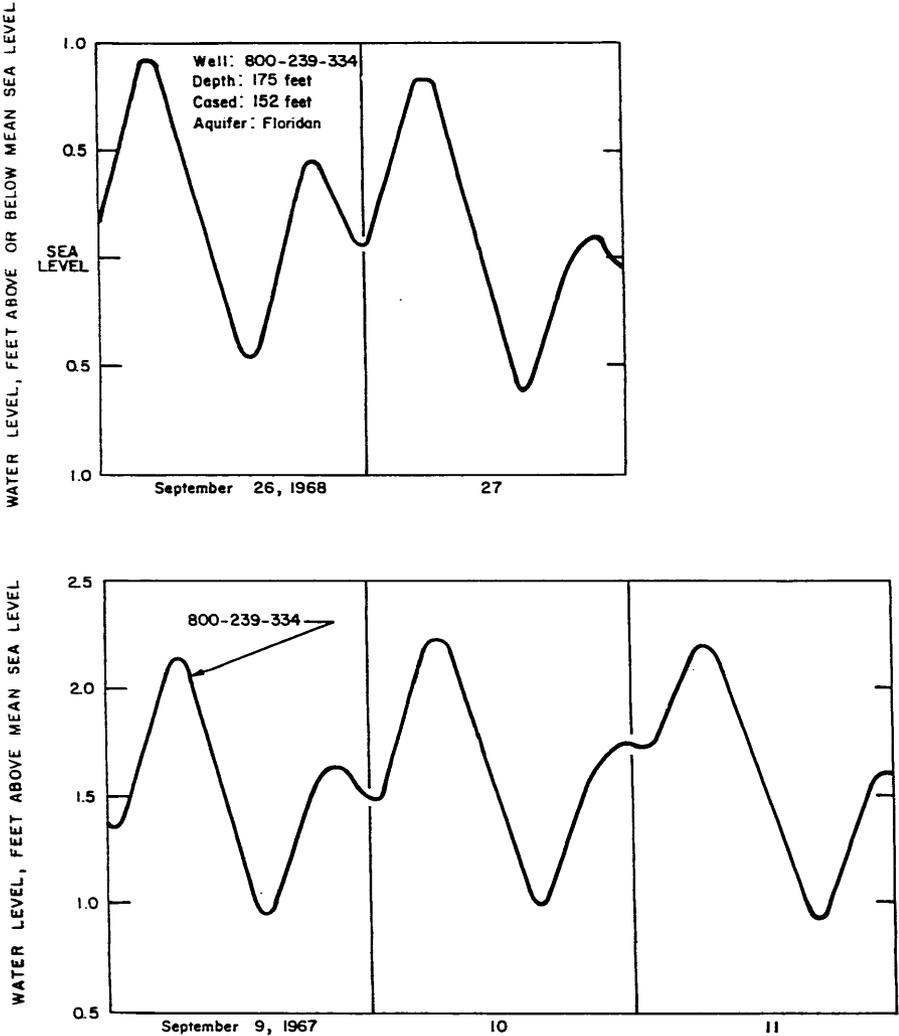


Figure 13.—Water-level fluctuations in a deep observation well on Booth Point that taps the upper part of the Floridan aquifer.

exceeded during extreme wet or dry years or in areas of large ground-water withdrawal. The fluctuation of water levels in 1965-68 in an observation well that taps the Floridan aquifer is shown in figure 11. This well is south of Lutz and lies just outside the northeast edge of the area (fig. 2).

#### CHEMICAL CHARACTER OF THE WATER

Water of good quality is obtained from the upper part of the Floridan aquifer (Tampa and Suwannee Limestones) by municipal well fields in northwest Hillsborough and northeast Pinellas Counties. Downgradient from the well fields, water containing a high chloride concentration occurs at relatively shallow depths in the upper part of the aquifer (Cherry, 1966 and Shattles, 1965). Both the altitude of the potentiometric surface and the thickness of the fresh-water section in the aquifer decrease bayward. This saline water at shallow depths in the upper part of the aquifer has resulted in wells being abandoned in the Oldsmar area and in the west-central part of Tampa owing to lowering of fresh-water levels by pumping, thereby permitting upward movement of saline water in the aquifer into the wells. The chloride concentration in the upper part of the aquifer (Tampa and Suwannee Limestones) exceeds 1,000 mg/l adjacent to the bay, and the concentration probably increases markedly bayward of the zero-contour on the potentiometric surface, as indicated by data collected from the observation well (800-239-332) at Booth Point. Water samples collected from the well contained chloride concentrations of 18,000 mg/l when the zero contour was inland from the well and 7,000 mg/l when the contour was bayward from the well.

#### RECHARGE AND DISCHARGE

The Floridan aquifer is recharged by percolation of rainfall through the overlying sediments and from ground-water inflow from adjacent areas (Stewart, 1968, p. 206-209). The aquifer is discharged along stream channels where the channel bottom intersects the aquifer, in the area of artesian flow around the northern and northeastern parts of the bay (fig. 12), and in areas where canals have cut into the aquifer.

Pumping tests in the area just west of Safety Harbor and in the well fields in northwestern Hillsborough County indicate that the Floridan aquifer underlying the study area has a transmissivity of about 400,000 gpd per ft (gallons per day per foot). The gradient of the potentiometric surface averages about 4 feet per mile immediately inland from the bay. Based on these figures, about 32 mgd moves through the Floridan aquifer toward the bay. Much of this 32 mgd is discharged to streams that flow into the bay. Part of the ground-water inflow to the bay occurs as seeps along the northwestern and western parts of the bay. This amount will probably remain about the same even if the proposed lake becomes a reality.

## HYDRAULIC INTERCONNECTION

Important aspects of the investigation involved the evaluation of the effects of bay freshening upon: (1) the aquifer system beneath and adjacent to the bay; (2) the part of the aquifer that contains salty water; and (3) the part of the aquifer that contains fresh water.

Water levels in wells near tidal waters respond to changes in tide in different ways, depending on whether the wells tap unconfined or confined aquifers. In confined aquifers having an outcrop exposed to tidal bodies of water, tidal waters may move into and out of the aquifers, depending on the onshore head in the aquifers. Tidal fluctuations can also be transmitted to a confined aquifer through its confining layer, as a pressure-loading response to incoming or outgoing tides. As the tidal fluctuations increase, water-level fluctuations in wells increase, whether the fluctuations are caused by tidal loading or horizontal movement of water in an aquifer in response to the introduction of tidal water. Therefore, the observed water-level response in wells in itself is not evidence of either direct or a high degree of interconnection between the Floridan aquifer and upper Old Tampa Bay.

The occurrence and wide distribution of natural fresh-water springs in the bay would indicate a high degree of connection between the bay and the Floridan aquifer. Prior to lowering of the head in the Floridan aquifer, springs reportedly flowed around the bay, at places such as Phillippi Springs, at Safety Harbor. However, this spring ceased to flow before 1959 (Wetterhall, 1965, p. 13). The famous Espiritu Santo mineral springs in Safety Harbor are reported to have been points of natural discharge from the aquifer.

The springs did not flow in 1946 (Ferguson and others, 1947, p. 137). Reportedly, spring zones were breached during the construction of several of the subdivision canals in the area. However, salinity traverses did not indicate fresh-water inflow to these canals. Spring zones were reportedly breached also in the construction of the Lake Tarpon outfall canal. The bottom of the canal is about at the elevation (15 feet below msl) of the top of the limestone of the Floridan aquifer, and, during construction, the top of the limestone was breached in places. Water is retained in this canal between earthen plugs that prevent salt-water movement from Upper Tampa Bay to Lake Tarpon and the reverse. In 1968 the water between the plugs was considerably fresher (chloride content, 160 mg/l) than water in Lake Tarpon (chloride content, 6,000 mg/l) or water in the Bay (chloride content, 15,000 mg/l). The large fresh-water overflow from a culvert placed in the top of the plug on the bayward side indicates that the upper part of the Floridan aquifer immediately below the confining layer is highly permeable.

Clay beds in the Hawthorn Formation and in the surficial deposits act as a confining layer for the Floridan aquifer. These clay beds extend beneath the bay

**Table 2.—Results of sieve analysis of split-spoon samples collected from test wells augured in bay bottom and along Courtney-Campbell Causeway**

Well: See figure 10 for location. Interval sampled: Either in feet below water surface or land surface.

Well	Interval sampled	Grain size (millimeters)				Percent		Remarks
		10 percentile	25 percentile	Median	75 percentile	Sand	Silt and clay	
A	36-37.5			0.010	0.175	43.8	56.2	Well in bay.
B	26-27.5	0.102	0.125	.205	.235	94.0	5.8	Do.
C	41-42.5	.072	.112	.155	.215	91.4	8.6	Do.
D	25-26.5			.049	.165	45.8	54.2	Do.
	36-37.5				.011	15.8	81.9	Do.
	46-47.5			.010	.122	32.6	67.4	Do.
E	21-22.5			.003	.155	34.6	64.2	Do.
F	16-17.5				.040	16.6	76.5	Do.
J	30-31.5			.082	.135	55.3	44.5	Well on causeway.
								Well on shore.
M	18-19.5		.004	.122	.205	65.4	34.6	Do.
	23-24.5		.092	.155	.205	76.4	21.6	Do.
N	23-24.5			.078	.102	57.4	42.6	Do.
Q	38-39.5		.122	.195	.235	84.0	16.0	Do.

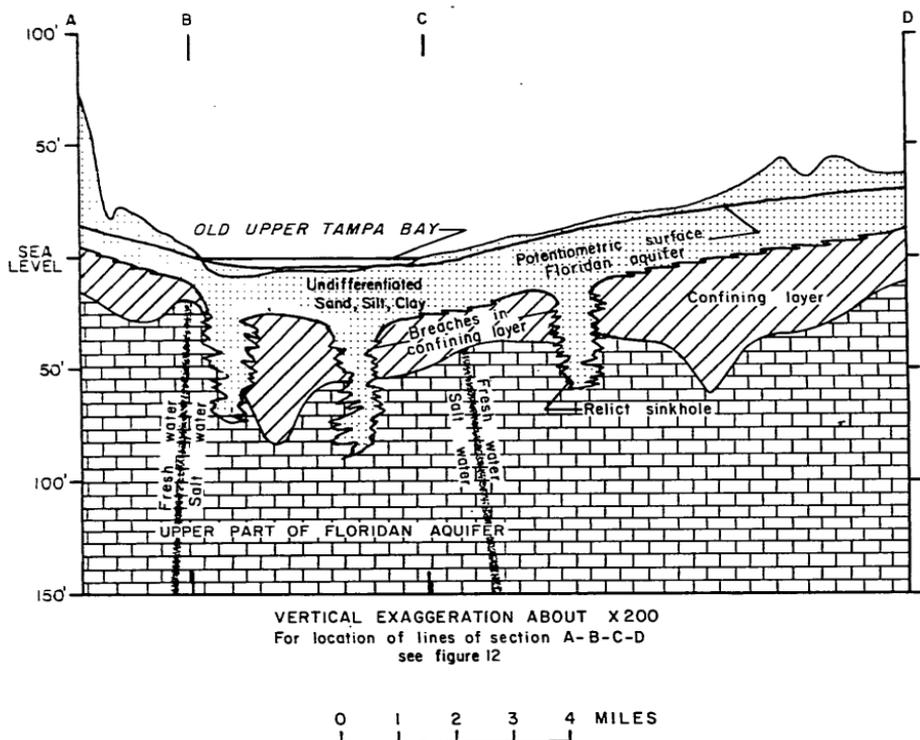


Figure 14.—Generalized section showing geohydrology of upper Old Tampa Bay area.

and generally overlie the Floridan aquifer and underlie the silty or clayey fine to medium sand that forms the bay bottom in many areas. Breaches in this confining layer must occur offshore (fig. 14) in a manner similar to that in which they occur onshore in the area adjacent to upper Old Tampa Bay, as indicated by samples obtained from two test wells (B and C) drilled in the bay (table 2 and fig. 9). In these two test wells, no clay beds were penetrated, and sand extended from the bay bottom either to the top of the Tampa limestone (well B) or to the bottom of the well (well C). Onshore breaches in the confining layer have been reported by Heath and Smith (1954, p. 29) and Stewart (1968, p. 43). These breaches allow direct interconnection between the shallow and deep aquifers and probably represent areas underlain by relict sinkholes that have been filled with permeable material. Aerial photographs of the upper Old Tampa Bay area show that filled-in sinkholes do occur immediately adjacent to the bay; particularly in the marshy area between Rocky and Double Branch Creeks. Some of these sinkholes would probably be submerged by the proposed lake during high water periods.

The high degree of interconnection between the shallow aquifer and the Floridan aquifer in the well field 6 to 8 miles northeast of the bay further indicates that, at least locally, a good interconnection between the bay and the Floridan aquifer can occur. The effectiveness of the confining layer in retarding downward movement of water in the well fields is probably not greatly different from that beneath the bay. However, the permeability of the bay sediments themselves may markedly reduce the degree of interconnection; particularly where the bay sediments are relatively impermeable and overlie areas where breaches in the confining layer are filled with permeable sand. Laboratory determinations of coefficient of permeabilities made on repacked core samples of sediments underlying the bay indicate that the permeabilities range from less than 0.001 gpd per square foot to more than 2 gpd per square foot. Although all the samples were collected at depths greater than 10 feet below the bottom of the bay, the range in permeabilities are representative of similar materials in the upper part of the test wells. Based on these permeabilities, the initial rate of recharge through the bay bottom to the Floridan aquifer at normal pool stage (2.5 feet msl) of the proposed lake would range from 0.002 mgd to 4 mgd per square mile of lake bottom and average less than 1.0 mgd. Based on the initial average rate of leakage alone (1.0 mgd), at least 10 years would be required to depress the fresh-water salt-water interface in the upper part of the Floridan aquifer beneath the proposed lake to the hydrostatic position at which it should stabilize, according to the Ghyben-Herzberg principle (100-120 feet below mean sea level). However, these rates of leakage will decrease as the difference in head between the Floridan aquifer and the proposed lake decreases. As a result, depression of the interface to a stable hydrostatic position may take more than 20 years.

Historical information on springs associated with suboutcroppings of limestone along the shoreline of part of the bay indicates that the bay and the upper part of the Floridan aquifer are locally interconnected. These points of local interconnection will have an undetermined effect on the rate of inflow of water during freshening into the part of the aquifer beneath the bay as well as that in the area immediately adjacent to the bay and may reduce somewhat the time required for the hydrostatic position of the fresh-water salt-water interface to stabilize in the aquifer.

### EFFECTS OF FRESHENING ON THE AQUIFER SYSTEM

**The water-table aquifer.**—Construction of the dam across the south end of the embayment would have relatively rapid effects on the water levels in water-table wells in the surrounding area provided closure occurs during the rainy season. Prior to closure of the dam, the gradient of the water table will be

toward the lake. Upon closure, the lake and the water-table aquifer will respond in a manner similar to that reported by Musgrove, Foster, and Toler (1965, p. 45) for Deer Point Lake in northwestern Florida. The level of the proposed lake will rise in response to fresh-water inflow; the gradient from the aquifer to the lake will be temporarily reversed; and water will move for an undetermined time from the lake to the water-table aquifer. Saline water from the lake will invade the aquifer, and chloride concentrations in the aquifer will increase for at least several hundred feet inland. Saline water will remain in the aquifer until such time that fresh-water levels in the water-table aquifer rise above the normal pool stage of the lake. At this time, the water table will again slope toward the lake, and water in the shallow aquifer will again discharge to the lake. In time, the saline water will be flushed from the aquifer. The net result on the water table in the immediate vicinity of the lake will be a rise equal to the rise in lake level.

**The Floridan aquifer.**—Upon closure of the dam, the level of the proposed lake will rise in response to fresh-water inflow, and water will gradually move from the lake into the Floridan aquifer. Initially this water will be highly saline. After 2 to 3 years of fresh-water inflow, the water in the proposed lake will become progressively fresher (fig. 10) than that in the Floridan aquifer beneath the bay.

Because of the imperfect interconnection between the lake and the aquifer, leakage to the aquifer will be greatest in those local areas where the lake is underlain by breaches in the confining layer that are not covered by finer grained bay sediments and where bedrock crops out in the proposed lake. The effect of this leakage should first result in a gradual freshening of the water in the upper part of the aquifer beneath the bay and immediately adjacent to the bay. The gradual adjustment of the fresh-water salt-water interface in the aquifer to the hydrostatic position at which it should stabilize (100-120 feet below msl) may require more than 20 years.

Fresh water will move inland as the fresh-water head in the aquifer at the shoreline gradually stabilizes at about 2.5 feet above mean sea level. The effects of this movement will not greatly alter the existing balance between recharge and discharge in the aquifer or the current gradient toward the bay until a fresh-water head above msl is established along the bayward edge of the zero-potential contour. At the time this occurs, the head in the aquifer will slowly rise, resulting in a temporary imbalance in rates of discharge from and recharge to the aquifer as water goes into storage. The fresh-water head in the aquifer will continue to increase until the water level in the aquifer stabilizes at a new gradient to the proposed lake, and a new local balance is established between recharge and discharge. These readjustments will probably not markedly alter the amount of discharge (p. 29) from the aquifer in the vicinity of the proposed lake.

The greatest long-term change in water level in the aquifer will be within 1

mile of the proposed lake (fig. 15). Where the zero potentiometric contour presently occurs, the water level in the Floridan aquifer will rise 2 to 3 feet above mean sea level, depending upon the inland position of the zero contour. Inland from the edge of the bay, most of the water-level rise will occur within 3 to 4 miles of the shoreline. Farther inland the rise in water level in the aquifer will be less than 1 foot.

The increase in the fresh-water head above mean sea level will cause the fresh-water salt-water interface in the areas where the potentiometric surface is currently at mean sea level to be depressed 100 to 120 feet below sea level. One to two miles inland, the current position of the fresh-water salt-water interface will generally be depressed less than 70 feet. Three to four miles inland the change in the position of fresh-water salt-water interface will be less than 50 feet.

The displacement of the fresh-water salt-water interface will increase the fresh-water supply that is available for development only in the immediate vicinity of the bay, where wells requiring relatively small quantities of water containing a low chloride concentration can tap the upper 60 to 80 feet of the Floridan aquifer. However, careful control of pumping levels will be required in these areas to prevent upward movement (upconing) of saline water into the wells as a result of decline in fresh-water head owing to local pumping. Displacement of the interface will have minor effects with respect to controlling upconing of saline water as a result of pumping further inland because the interface will not be depressed to the base of the permeable zone in the upper part of the Floridan aquifer near the bay.

## SUMMARY AND CONCLUSIONS

Adequate inflow of water of good quality is available to freshen the proposed lake in a reasonable period (about 4 years). During an average year, the inflow would be sufficient to displace the volume of the proposed lake 1.2 to 1.7 times, depending upon whether discharge from Lake Tarpon contributes to lake inflow. During a critically dry year, such as 1956, inflow would not be adequate to maintain lake levels at minimum design level, and the level of the proposed lake would decline 0.25 to 0.50 feet below this desired low level. Loss of water through boat lockages would not be sufficient to affect these lake levels significantly during either average or critically dry periods.

An imperfect interconnection exists between upper Old Tampa Bay (proposed lake) and the upper part of the Floridan aquifer. Leakage of fresh water from the proposed lake to the Floridan aquifer will occur chiefly where the confining layer is breached and where bedrock crops out in the proposed

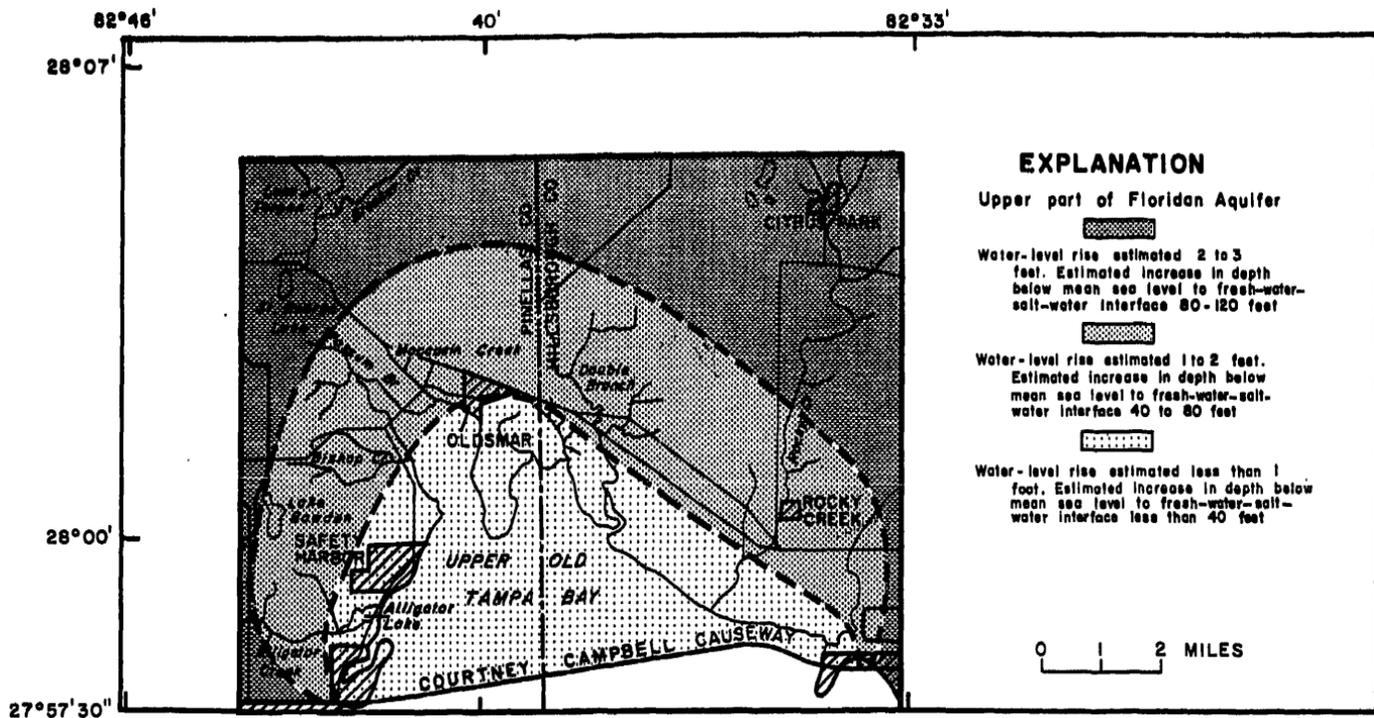


Figure 15.—Estimated long-term rise in fresh-water levels in the upper part of the Floridan aquifer as a result of conversion of upper Old Tampa Bay into a fresh-water lake.

lake. Upon closure of the dam this leakage should average initially less than 1 mgd per square mile of lake bottom and gradually decrease as the head difference decreases with time. As a result, the gradual adjustment of the fresh-water salt-water interface in the upper part of the Floridan aquifer to the hydrostatic position at which it should stabilize beneath the lake (100-120 feet below msl) may require more than 20 years.

The proposed lake will result in a rise in water levels in the shallow aquifer in the immediate vicinity of the lake. The rise will be equal to the rise in lake level. A comparable long-term rise will also occur in water levels in the upper part of the Floridan aquifer. Within 1 mile of the proposed lake, water levels in the Floridan aquifer should rise 2 to 3 feet above mean sea level. Three to four miles inland the rise in the water level in the aquifer should be less than 1 foot. The long-term rise in water levels in the Floridan aquifer will not be sufficient to depress the fresh-water salt-water interface to the base of the permeable zone in the upper part of the Floridan aquifer near the bay. Therefore, the displacement of the interface will have minor effects with respect to controlling upward movement of saline water as a result of pumping farther inland.

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