DEPARTMENT OF THE INTERIOR
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PREPARED IN COOPERATION WITH THE
SOUTHWEST FLORIDA WATER MANAGEMENT DISTRICT

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SALTWATER INTRUSION IN THE FLORIDAN AQUIFER, COASTAL CITRUS AND HERNANDO COUNTIES, FLORIDA, 1975

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INTRODUCTION

The coastal parts of Citrus and Hernando Counties—particularly Citrus County—are undergoing extensive urban development along U.S. Highway 19 (fig. 1). The Floridan aquifer, a thick sequence of limestone and dolomite, is the principal source of water supply for the coastal parts of these two counties. The construction of canals that penetrate the Floridan aquifer, deficient rainfall during 1964–75, and pumping of ground water, have caused saltwater to intrude the aquifer. The purpose of this report is to show the inland extent of that intrusion as of 1975. The report is based on field data collected in 1964, 1973, and 1975. Field data were collected and the report was prepared in cooperation with the Southwest Florida Water Management District. Tables 1 and 2 constitute a summary of data collected.

GEOHYDROLOGY

The Floridan aquifer consists of a thick sequence of limestone and dolomite of Eocene age that dips about 1 ft/mi southwestward in the study area. Along the coast and along the lower reaches of the Crystal, Homosassa, and Chassahowitzka Rivers the Floridan aquifer is unconfined. In the remainder of the coastal zone the aquifer is confined by overlying unconsolidated deposits. The top of the Floridan aquifer is near or below mean sea level in this coastal area. For a more detailed discussion of the geology of the area see Vernon (1951). In general, the Floridan aquifer is recharged by rainfall which is stored in surficial sands and lakes and which then infiltrates to the underlying Floridan aquifer. The major recharge areas are in the interior of the Florida Peninsula and the general pattern of ground-water flow is from the interior toward the coastline.

The potentiometric contours on the map indicate the direction in which water moves in the Floridan aquifer in this area; water moves from areas of high potential to areas of low potential and the general direction of flow is perpendicular to the contour lines. The pronounced inland curvature of the potentiometric contours on the upper half of the map are the result of large amounts of ground water discharging from the Floridan aquifer to springs in the Homosassa and Crystal Rivers. In addition, the Floridan aquifer not only discharges water to other large springs in the coastal zone, but also by upward leakage through the sea floor. This discharge from the Floridan varies in quantity with the season and with the locations of the areas of leakage along the coast.

SALTWATER INTRUSION

In November 1964, water samples were collected from 141 wells in the coastal parts of Citrus and Hernando Counties and were analyzed for chloride concentration. In December 1975, 42 of the 141 wells were resampled. During the 11-year period, the concentration of chloride increased in water from 22 wells, decreased in water from 7, and did not change in 13. In 1964, and again in 1973, water samples were collected from 32 surface-water sites for chloride analysis. Over the 9-year period, chloride concentration increased in 21 samples, decreased in 6, and remained the same in 5. The 1973 sampling included three sites not sampled in 1964. The three sites were resampled in 1975 with no resulting change in chloride concentration.

To determine the inland extent of saltwater intrusion shown on figure 1, analyses were made for the 42 wells mentioned above, and an additional 26 random samples from wells (68 in all). The boundary between freshwater and saltwater was arbitrarily drawn on the basis of a chloride concentration of 250 mg/L in ground water at a depth of 100 ft below sea level. For the area of the Cross-Florida Barge Canal and the lower Withlacoochee River, data available from previous studies (Bush, 1973, and Faulkner, 1973) were plotted on figure 1. However, all the wells except wells 71 and 78 were less than 100 ft deep and yielded water with low chloride concentrations. Therefore, the 250 mg/L isochlor was estimated and appears as a dashed line. (See also figure 2 which shows a geohydrologic section across the saltwater-freshwater interface.) Figure 1 shows that saltwater intrusion extends farther inland in Citrus County than in Hernando County. This intrusion is related to a direct recharge of saltwater to the Floridan aquifer along canals and rivers during periods of reduced freshwater runoff and of large ground-water withdrawals for the heavily urbanized coastal area of Citrus County.

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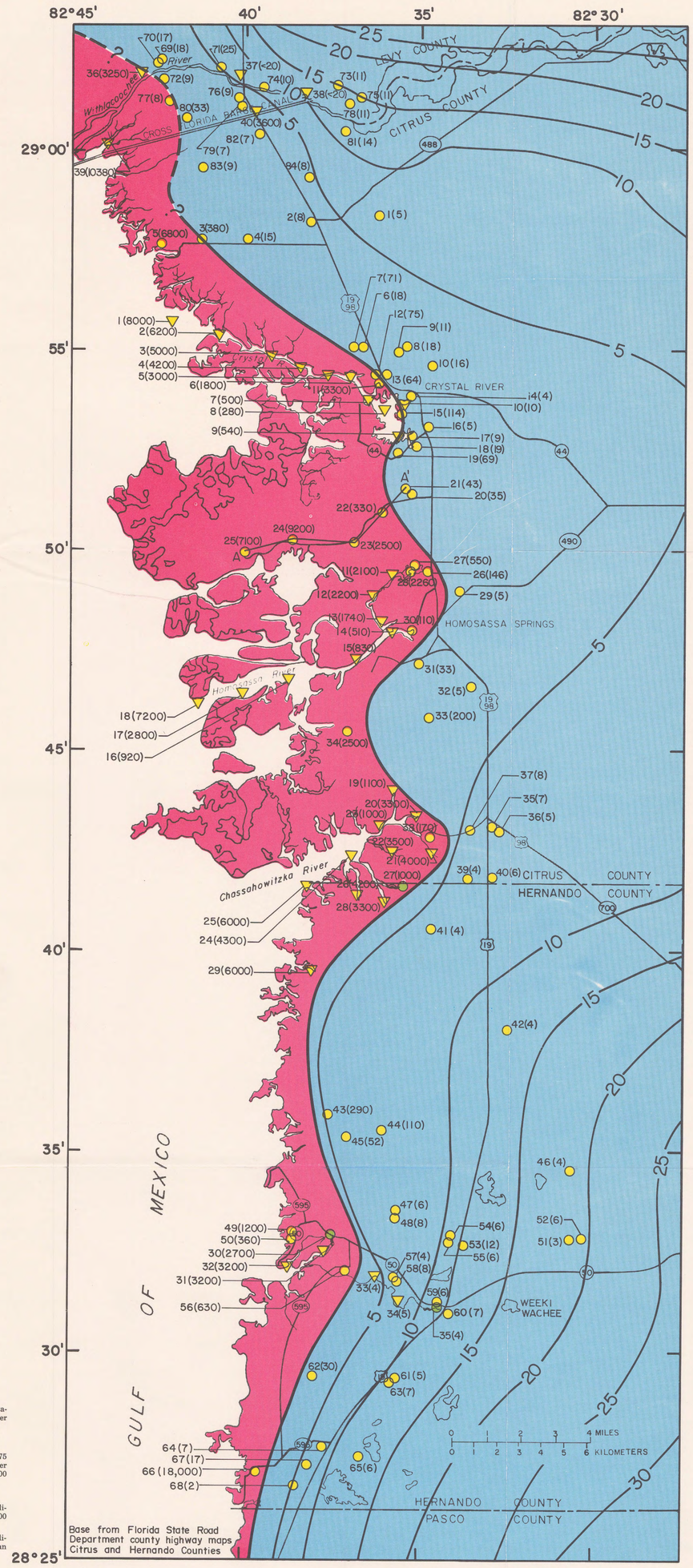

Figure 1. Potentiometric surface of Floridan aquifer 1975 and chloride concentration in wells, springs and rivers, 1971–75.

EXPLANATION

- 2(8) — WELL SAMPLE. Chloride concentration, in milligrams per liter. Site number
- 33(4) — SPRING SAMPLE. Chloride concentration, in milligrams per liter. Site number
- 7(500) — STREAM SAMPLE. Chloride concentration, in milligrams per liter. Site number
- -5- — POTENTIOMETRIC CONTOUR—Shows altitude at which water level would have stood in tightly cased wells, December 1975. Contour interval: 5 feet. Datum: MSL
- SALTWATER-FRESHWATER INTERFACE, DECEMBER 1975. Along this line, chloride concentrations of 250 milligrams per liter occur in the Floridan aquifer at an approximate depth of 100 feet below sea level. Dashed where estimated.
- A—A' — Line of geohydrologic section.
- Area in which chloride concentrations are greater than 250 milligrams per liter in the Floridan aquifer, at depths less than 100 feet below mean sea level.
- Area in which chloride concentrations are less than 250 milligrams per liter in the Floridan aquifer, at depths greater than 100 feet below mean sea level.

Table 1.—*Chloride concentration in water from selected wells, 1964–75.*

Site no.	Well depth (ft)	Casing depth (ft)	Chloride concentration in milligrams per liter (date of collection: month/year)				
1	64	30	5(6/66)				
2	60		8(11/64)	3(4/65)	7(5/66)	8(12/75)	
3	47	42	120(4/65)	185(11/71)	340(11/73)	480(9/74)	380(11/75)
4	88	67	17(4/65)	14(11/71)	15(11/73)	14(11/74)	15(11/75)
5	70	60	1,740(4/65)	4,720(11/71)	6,600(11/73)	6,600(11/74)	6,800(11/75)
6	22		7(11/64)	18(12/75)	-		
7	113	40	70(11/64)	52(4/65)	105(5/66)	71(12/75)	
8	54		18(11/64)	18(12/75)			
9	108		15(11/64)	11(12/75)			
10	496		16(11/64)	18(4/65)	20(5/66)	16(12/75)	
11	176	162	3,400(11/64)	2,050(4/65)	2,360(11/69)	3,220(11/71)	3,300(12/75)
12	53	3	110(11/64)	52(4/65)	71(9/69)	63(11/71)	75(12/75)
13	30	30	90(11/64)	64(12/75)			
14	152	100	3(11/64)	4(2/65)	4(12/75)		
15	59		79(11/64)	114(12/75)			
16	51	35	5(11/64)	5(12/75)			
17	123	112	4(11/64)	7(4/65)	9(5/66)	8(6/71)	9(11/75)
18	119	89	11(11/64)	19(12/75)			
19	129	96	31(11/64)	36(4/65)	47(5/66)	69(12/75)	
20	105	65	35(12/75)				
21	100	70	43(12/75)				
22	75	60	525(11/66)	540(11/68)	345(11/71)	420(11/73)	330(11/75)
23	41	39	2,150(11/66)	2,350(11/68)	1,985(11/71)	2,400(11/73)	2,500(11/75)
24	55	48	8,400(11/66)	8,560(11/68)	8,480(11/71)	9,600(11/73)	9,200(11/75)
25	37	34	6,900(11/66)	7,000(7/67)	6,280(11/69)	6,100(11/71)	7,100(11/75)
26	60		146(12/75)				
27	48		270(11/64)	550(12/75)			
28	94		244(11/64)	2,260(12/75)			
29	100		8(11/64)	6(4/65)	8(5/66)	5(12/75)	
30	50	44	68(11/64)	60(11/67)	82(11/69)	47(11/71)	110(11/75)
31	86	40	22(11/64)	33(11/64)	33(12/75)		
32	111	99	4(11/65)	4(4/65)	8(5/66)	5(12/75)	
33	99	81	160(9/65)	115(11/66)	118(11/71)	200(11/75)	
34	45	39	2,650(9/65)	2,500(11/67)	2,500(11/69)	2,200(11/71)	2,500(11/75)
35	176	166	9(11/66)	6(11/67)	7(11/70)	7(11/71)	7(11/75)
36	162		5(12/75)				
37	124		7(11/64)	6(4/65)	10(5/66)	8(12/75)	
38	92		68(11/64)	79(4/65)	96(5/66)	170(12/75)	
39	100		4(12/75)				
40	93		5(11/64)	5(4/65)	8(5/66)	6(12/75)	
41			4(12/75)				
42			4(12/75)				
43	110	110	150(9/65)	138(11/67)	152(9/68)	200(5/73)	290(5/75)
44	140	133	64(10/65)	57(11/67)	64(9/68)	51(5/73)	110(5/75)
45	125	123	57(10/65)	54(9/67)	70(9/68)	52(5/73)	52(5/75)
46	117	100	4(12/75)				
47	101		6(12/75)				
48			6(12/75)				
49			1,200(12/75)				
50	54	40	360(12/75)				
51	235	216	3(12/75)				
52	195	167	6(12/75)				
53	212	152	12(12/75)				
54	101	63	6(12/75)				
55	101	63	6(12/75)				
56	75	66	550(11/67)	467(11/69)	600(11/73)	630(11/73)	630(11/75)
57			4(12/75)				
58			8(12/75)				
59	321	49	6(12/75)				
60	315	62	7(12/75)				
61			5(12/75)				
62	180		30(12/75)				
63	170		7(12/75)				
64			7(12/75)				
65	373	210	6(12/75)				
66	195	176	13,600(10/65)	16,500(11/67)	18,000(11/73)	18,000(11/75)	
67	101	64	17(12/75)				
68	250	81	2(12/75)				
69	52	49	18(6/71)				
70	59	49	17(6/71)				
71	155		7(6/71)	25(9/75)			
72	61	30	9(7/71)				
73	64	47	11(2/66)				
74	60	28	10(12/70)				
75	67	62	10(9/74)	11(9/75)			
76	40		9(7/71)				
77	24	18	8(6/71)				
78	125	84	11(2/66)				
79	58	19	7(6/71)				
80	30	8	33(6/71)				
81	78	42	14(7/71)				
82	30	21	7(6/71)				
83	28	20	9(6/71)				
84	27		8(6/71)				

Table 2.—*Chloride concentration in water from streams and springs, 1964, 1971, 1973, and 1975.*

Surface-water site	Site no.	Chloride concentration in milligrams per liter (Date of collection: month/year)				
Crystal River	1	8,000 (3/64)	8,000 (6/73)			
Do.	2	3,000 (3/64)	6,200 (6/73)			
Do.	3	1,900 (3/64)	5,000 (6/73)			
Do.	4	1,150 (3/64)	4,200 (6/73)			
Do.	5	630 (3/64)	3,000 (6/73)			
Do.	6	415 (3/64)	1,800 (6/73)			
Do.	7	400 (3/64)	500 (6/73)			
Do.	8	320 (3/64)	280 (6/73)			
Do.	9	350 (3/64)	540 (6/73)			
Do.	10	10 (3/64)	10 (6/73)			
Halls River	11	2,200 (3/64)	2,100 (6/73)			
Do.	12	2,000 (3/64)	2,200 (6/73)			
Do.	13	2,050 (3/64)	1,740 (6/73)			
Homosassa River	14	565 (3/64)	510 (6/73)			
Do.	15	810 (3/64)	830 (6/73)			
Do.	16	1,400 (3/64)	920 (6/73)			
Do.	17	1,700 (3/64)	2,800 (6/73)			
Do.	18	3,400 (3/64)	7,200 (6/73)			
Potter Creek	19	460 (4/64)	1,100 (6/73)			
Salt Creek	20	2,400 (4/64)	3,300 (6/73)			
Baird Creek	21	3,800 (4/64)	4,000 (6/73)			
Johnson Creek	22	3,300 (4/64)	3,500 (6/73)			
Chassahowitzka River	23	770 (4/64)	1,000 (6/73)			
Do.	24	950 (4/64)	4,300 (6/73)			
Do.	25	1,600 (4/64)	6,000 (6/73)			
Ryle Creek	26	2,000 (4/64)	4,200 (6/73)			
Crawford Creek Spring	27	260 (4/64)	1,000 (6/73)			
Crawford Creek	28	2,160 (4/64)	3,300 (6/73)			
Blind Creek	29	9,200 (4/64)	6,000 (6/73)			
Mud River Spring	30	2,700 (5/73)	2,700 (12/75)			
Mud River	31	3,200 (5/73)	3,200 (12/75)			
Weeki Wachee River	33	5 (4/64)	4 (5/73)			
Do.	34	5 (4/64)	5 (5/73)			
Weeki Wachee Spring	35	3 (4/64)	4 (5/73)			
Withlacoochee River	36		3,250 (6/71)			
Do.	37		20 (6/71)			
Do.	38		20 (6/71)			
Cross-Florida Barge Canal	39		10,380 (6/71)			
Do.	40		3,600 (6/71)			

Location of the area of investigation.

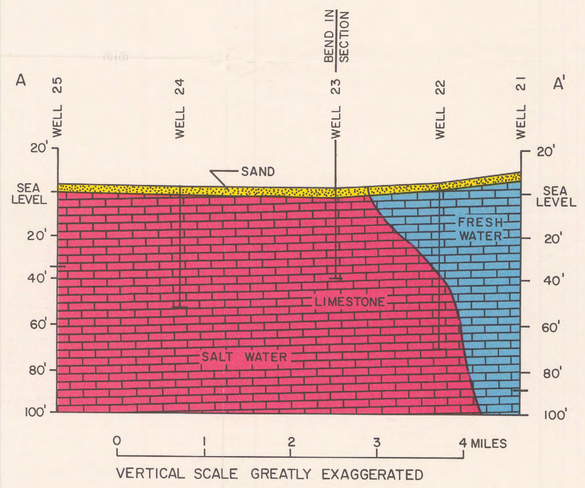

Figure 2. Geohydrologic section across the saltwater-freshwater interface.

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