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UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

[Report - Open file series]

HYDROLOGIC DATA FROM A DEEP TEST WELL, CITY OF SARASOTA, FLORIDA

OPEN-FILE REPORT 79-1275

Prepared in cooperation with the

CITY OF SARASOTA

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By H. Sutcliffe, Jr.

Open-File Report 79-1275

Prepared in cooperation with the
CITY of SARASOTA, FLORIDA

Tallahassee, Florida
1979

UNITED STATES DEPARTMENT OF THE INTERIOR

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CONTENTS

	Page
Conversion factors	iv
Abstract	1
Introduction	2
Acknowledgments	2
Location of test well	3
Well construction	3
Well logs	3
Water-quality analyses	3
Aquifer tests	6
References	6

ILLUSTRATIONS

		Page
Figure 1.	Map showing location of deep test well	4
2.	Graph of lithologic log of deep test well	5

TABLES

		Page
Table 1.	Geologist's log of Sarasota deep test well	7
2.	Summary of logs available for Sarasota deep test well	19
3.	X-ray diffraction analyses of well cuttings from selected depths, Sarasota deep test well	20
4.	Field analyses of water samples collected from selected depths, Sarasota deep test well	21
5.	Analyses of water samples collected from selected depths, Sarasota deep test well	23

CONVERSION FACTORS

For use of those readers who may prefer to use SI (metric) units rather than inch-pound units, the conversion factors for the terms used in this report are listed below:

Multiply inch-pound unit	By	To obtain SI (metric) unit
inch (in)	25.4	millimeter (mm)
foot (ft)	0.3048	meter (m)
gallon per minute (gal/min)	0.6308	liter per second (L/s)
million gallons per day (Mgal/d)	0.04381	cubic meter per second (m^3/s)

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ABSTRACT

The city of Sarasota drilled a test well to a depth of 3,513 feet at the city's wastewater-treatment facility in downtown Sarasota. The test well was drilled to determine the feasibility of disposing of liquid waste from the city's secondary treatment plant. Drilling of the test well began in July 1973 and was completed in November 1974. A conventional circulation mud-rotary drilling method was used to a depth of 1,146 feet below land surface and a reverse circulation air-lift method was used to a depth of 3,513 feet. The greatest chloride concentration of water withdrawn from the test well was 31,000 milligrams per liter. The test well, uncased and open to dolomitic limestone between 2,006 and 3,513 feet, yielded 392 gallons per minute with a drawdown of approximately 100 feet.

INTRODUCTION

For years, the city of Sarasota has discharged domestic liquid waste into the Gulf of Mexico after secondary waste treatment and sand filtration. Faced with legal constraints imposed by the State of Florida and Sarasota County on disposal of waste into the Gulf, the city began investigation of alternate waste-disposal methods in 1968.

Various methods of wastewater disposition were outlined for the city by its engineering consultants. These methods included: (1) tertiary treatment of the waste and use of the present outfall; (2) construction of a deep-water outfall in the center of Sarasota Bay; (3) construction of an outfall extending into the Gulf of Mexico offshore from the keys; (4) land spreading; and (5) deep-well injection. A report (Black, Crow, and Eidsness, Inc., 1968) indicated that deep-well injection was the most cost-effective method of those cited. This method of disposal was bypassed at the time because of the adverse attitude of some water agencies toward deep-well injection into the "Boulder Zone," a zone of high transmissivity which underlies much of southern Florida. Tertiary treatment was subsequently recommended by the consulting engineer firm.

During the period that alternative solutions were being considered, responsibility for representing Federal interests for deep-well injection programs was transferred to the Environmental Protection Agency. Deep-well injection was subsequently accepted as a proper means of disposing of liquid wastes, provided the waste and the receiving aquifer meet certain established criteria. Pursuant to this change in attitude, the city reactivated the disposal-well feasibility study in 1971 and awarded a contract in May 1973 to drill a test well.

Drilling of the test well began in July 1973 to determine whether a suitable zone that would accept as much as 4 Mgal/d of wastewater from a well could be found within 3,500 feet of land surface. Such a zone should be bounded above and below by confining beds to prevent vertical migration of the injected effluent, and should contain water with dissolved solids concentration high enough (greater than 35,000 mg/L) to preclude its use for desalination. If such a zone were located, enough wells to dispose of as much as 25 Mgal/d of liquid waste would be needed.

The U.S. Geological Survey collected field information during construction and testing of the well; additional information was obtained from the driller and the city. This report presents a summary of this information.

ACKNOWLEDGMENTS

The author wishes to acknowledge the following individuals for their assistance and interest during test drilling and well construction: Max Sturm, Utilities Director, and Ken Thompson, City Manager, city of

Sarasota; Charles R. Sproul and Bill Clark of Black, Crow and Eidsness, Inc., consulting engineers; and Arlen Cason of Alsay-Pippin Corporation, drilling contractors.

LOCATION OF TEST WELL

The test well is in the city's wastewater treatment plant yard on 12th Street in downtown Sarasota (fig. 1). This site was chosen because it is near the existing liquid-waste outfall line and because freshwater was available from standby production wells for injection testing.

WELL CONSTRUCTION

The test well was drilled using both conventional circulation mud-rotary drilling and reverse circulation air-lift drilling techniques. The rig was equipped with 4-1/2-inch drill pipe and five drill collars. Conventional mud-circulation drilling was used to a depth of 1,146 feet below land surface where loss of circulation prevented continued use of this method. Reverse circulation air-lift drilling method was used from 1,146 feet to the total depth of 3,513 feet. A graphic log of the test well was prepared by Black, Crow and Eidsness, Inc. (1975) and is reproduced here as figure 2.

WELL LOGS

The geologist's log (table 1) describes the lithology of the cuttings on the basis of microscopic examination. Geophysical logs were run for several different intervals of the test well in 1973-75. A summary of the geophysical and other logs available from the city of Sarasota are listed in table 2. Some of the drill cuttings were analyzed with x-ray diffraction and the results are given in table 3.

WATER ANALYSES

The first water sample for analysis was collected from a depth of 1,146 feet after the 24-inch casing was set and cemented at 1,108 feet. The first cavity was encountered at this depth and the drilling method was changed to the reverse circulation air method, making it possible to collect representative water samples. This first water sample had the following concentrations: chloride, 1,250 mg/L; dissolved solids, 4,522 mg/L; and sulfate, 1,575 mg/L. The sample was not considered representative of the zone because a substantial amount of drilling mud was still being circulated.

Figure 1.--Location of deep test well.

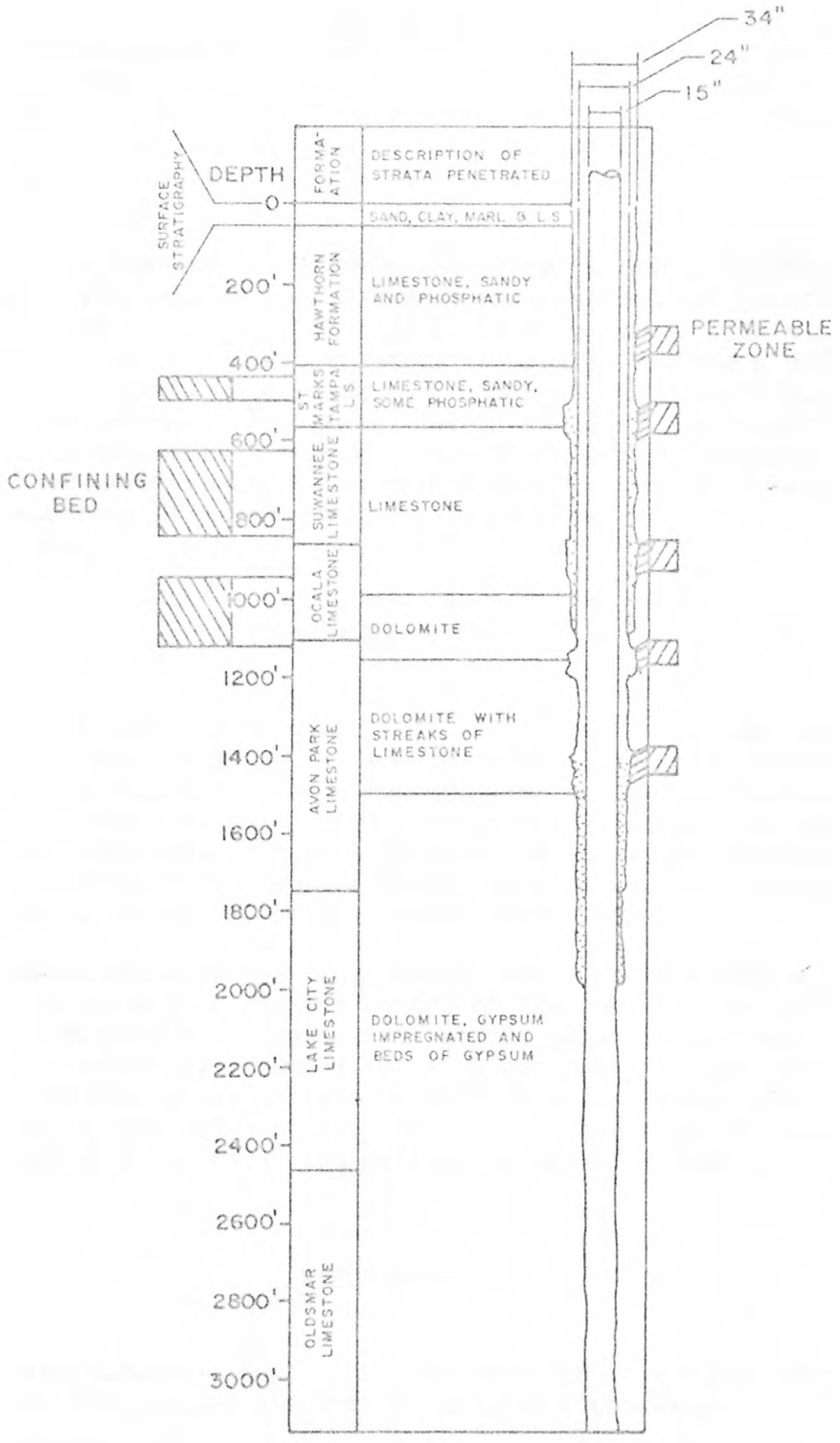

Figure 2.--Lithologic log of deep test well.

Water samples were collected directly from the return line of the air-lift drilling rig and represent a mixture of water from the permeable zones at or above the level of the drill bit. Field chemical analyses of water from successively deeper sections of the limestone between 1,160 and 3,090 feet below land surface are listed in table 4. Table 5 lists standard laboratory analyses of water samples from depths between 1,214 and 3,513 feet below land surface. Chloride concentration of water withdrawn from the well increased with depth to a maximum of 31,000 mg/L at 3,513 feet.

Two samples were analyzed for trace elements (table 5). One sample collected from the zone above 1,232 feet was analyzed for uranium isotopes by the Department of Geology, Florida State University. The sample contained 0.30 ug/L (micrograms per liter) of uranium and had a U234/U238 activity ratio of 1.40. According to M. I. Kaufman of the U.S. Geological Survey (written commun., December 4, 1974), these values suggest that the water is not contemporary seawater. Were it originally seawater, the water must have been exposed to an environment favorable for altering the relative abundances of isotopes initially present.

AQUIFER TESTS

During drilling, two aquifer tests were made for uncased sections of the test well. The first was for the interval between the bottom of the 24-inch casing at 1,108 feet and the temporary bottom of the hole at 1,649 feet. The test well was pumped for 2 hours and 25 minutes at a rate of 1,000 gal/min with a drawdown of 1.59 feet. A vertical flow-meter test indicated that 60 to 70 percent of water entering the well came from a cavity between 1,144 and 1,146 feet below land surface.

A step-drawdown test was made in the uncased section below the 16-inch casing at 2,006 feet and the bottom of the test well at 3,513 feet. According to the consultant engineers' report (Black, Crow and Eidsness, Inc., 1975), the well was "pumped for 80 minutes at 150 gpm, 90 minutes at 250 gpm, 100 minutes at 325 gpm, and 134 minutes at 392 gpm. Maximum drawdown observed was 100.35 feet. Analysis of the test data gave a transmissivity of 9,000 to 10,000 gallons per day per foot."

REFERENCES

Black, Crow and Eidsness, Inc., 1968, Engineering report for the city of Sarasota, Florida, on disposal of treated wastewater.

_____ 1975, Wastewater treatment and disposal alternatives, city of Sarasota.

Table 1.--Geologist's log of Sarasota deep test well

[Altitude of top of 24-inch flange, 24.6 feet.]

Depth (ft)		Lithology
0- 10	Sand	- fine to very coarse grain, and pebbles of quartz and phosphate; marl
10- 20	Marl	- sandy, yellow; phosphate
20- 30	Limestone	- hard, cherty, sandy, vugular, sucrosic; phosphate
30- 40	Clay	- slightly marly, slightly waxy, gray-green
40- 50	Marl	- soft, slightly sucrosic, yellow-gray; some clay
50- 60	Limestone	- marly, cream-gray; phosphate
60- 70		- same, some hard, cherty, cream
70- 80		- same, some fossiliferous; vugular
80- 90		- chalky, marly, cream; phosphate
90-100		- hard, cherty, dolomitic, cream-gray; phosphate
100-110		- chalky, marly, sandy (some coarse-grained); more phosphate
110-140		- cherty, fossiliferous, some sandy, cream; some coarse-grained sand and pebbles of phosphate and chert
140-170		- hard, dense, cherty, some fossiliferous, some vugular; phosphate
170-180		- sucrosic, dolomitic, hard, cherty
180-190		- sandy, cherty, fossiliferous, vugular
190-200		- same, dolomitic in part; phosphate
200-210		- sandy, granular, cream-white; phosphate
210-220		- same, some chert
220-230		- some chalky, sandy; some dense, dolomitic, cherty; phosphate
230-250		- same, some fossiliferous, vugular
250-270		- dense, cherty, more fossiliferous, cream-white; phosphate
270-290		- dense, cherty, fossiliferous, cream-white, some sucrosic, dolomitic; phosphate

Table 1.--Geologist's log of Sarasota deep test well - continued

Depth (ft)	Lithology	
290-310	Limestone	- same; some coarse-grained quartz and phosphate
310-320		- some dense, cherty, some marly, slightly sandy; phosphate
320-330		- slightly dolomitic; more coarse-grained quartz and phosphate
330-340		- some marly, sandy, some clayey; phosphate
340-360		- hard, dense, cherty, fossiliferous, sandy, some dolomitic; phosphate
360-380		- same, but much sand (coarse-grained); phosphate
380-400		- same, but less sand, more chert
400-410		- same; some clay
410-430		- same, but mostly quartz; chert; phosphate (all coarse-grained)
430-470		- very sandy in part, fossiliferous, cream; phosphate
470-500		- same; some calcite, yellow, crystalline
500-510		- very sandy (coarse-grained), cherty, fossiliferous, phosphate (re-sampled 500-700, sample quality much better)
510-520		- less sandy, more dense, cherty
520-530		- chalky, fossiliferous, cream-white
530-540		- very sandy, granular, chalky, fossiliferous, cream; specked with phosphate
540-550		- same; and trace of clay
550-560		- as above, and some fragmental, vugular
560-570		- same, and some large fossils; chert
570-580		- fossiliferous, dense to crystalline, cream
570-620		- same, slightly nodular, cream-brown, some vugular
620-640		- same, some granular, more nodular, more fossiliferous
640-660		- same; with considerable calcite
660-680		- nodular, fossiliferous, some crystalline, cream-white

Table 1.--Geologist's log of Sarasota deep test well - continued

Depth (ft)		Lithology
680- 750	Limestone	- same, some large fossils
750- 760		- same, more fossiliferous
760- 780		- same, some flat, platy; some calcite
780- 790		- same, some large fossils
790- 810		- same; much calcite
810- 820		- same, more fossiliferous
820- 830		- same, some flat, platy
830- 840		- same, trace of Lepidocyclina
840- 860		- same, some chalky
860- 870		- same, trace of Camerina
870- 890		- same, slightly clayey, cream, some Camerina and Lepidocyclina
890- 930		- chalky, granular, slightly fossiliferous, cream
930- 980		- same, more Lepidocyclina and Camerina
980- 990		- same, trace of dolomite
990-1,000	Dolomite	- sucrosic, yellow-brown; some limestone, fossiliferous
1,000-1,040		- same, some vugular
1,040-1,080		- same as above, but samples poor, much cavings; more limestone
1,080-1,090		- same, some black spots and streaks (lignite?)
1,090-1,100		- sucrosic, some vugular, yellow-brown; some limestone
1,100-1,110		- same; more limestone, chalky, cream, fossiliferous, trace of Dictyconus
1,110-1,150		- same, more limey; samples very poor
1,150-1,160	Limestone	- crystalline, sucrosic, slightly dolomitic, cream to gray-brown
1,160-1,170		- chalky, slightly nodular, some fossiliferous; calcite, cream
1,170-1,190		- pitted vugular, good porosity, very fossiliferous ("sand-dollars," filled with Dictyconus)

Table 1.--Geologist's log of Sarasota deep test well - continued

Depth (ft)		Lithology
1,190-1,205	Limestone	- same, and some crystalline, slightly dolomitic
1,205-1,210	Dolomite	- coarsely crystalline, vugular, yellow-brown
1,210-1,220		- same; some limestone, fossiliferous
1,220-1,225		- same, light to dark brown
1,225-1,230		- same; some limestone, crystalline, brown
1,230-1,235	Limestone	- finely crystalline, cream to dark brown; some dolomite
1,235-1,240	Dolomite	- crystalline, dark brown to black
1,240-1,270		- same, some carbonaceous; some limestone, crystalline, cream to black
1,270-1,275	Limestone	- coarsely crystalline, brown to black; some dolomite
1,275-1,280	Dolomite	- fine to coarsely crystalline, gray-brown; some limestone
1,280-1,285	Limestone	- fossiliferous, fine to coarsely crystalline and fragmental, cream-brown
1,285-1,290		- same; some dolomite, black, cherty
1,290-1,300	Dolomite	- coarsely crystalline, vugular, brown, apparently very porous
1,300-1,305		- same, some limestone, carbonaceous streaks
1,305-1,350		- some crystalline, some dense, cherty, gray to brown to black
1,350-1,400		- same, some carbonaceous spots and streaks, very vugular in part
1,400-1,410		- granular, sucrosic, pitted, buff-brown
1,410-1,420		- some soft, some hard, cherty
1,420-1,430		- fine to coarsely crystalline, vugular, dark brown
1,430-1,435		- same; some finely crystalline quartz
1,435-1,440		- same; some limestone, partly dolomitic, fossiliferous, cream
1,440-1,500		- fine to coarsely crystalline, vugular, light to dark brown; some hard, dense, cherty, gray-brown

Table 1.--Geologist's log of Sarasota deep test well - continued

Depth (ft)		Lithology
1,500-1,510	Dolomite	- same, some limey, some black, with carbonaceous streaks
1,510-1,515	Limestone	- granular, dolomitic, some carbonaceous, cream-brown
1,515-1,520	Dolomite	- fine to coarsely crystalline, vugular, brown
1,520-1,540		- same; may be a trace of impregnated gypsum
1,540-1,560		- crystalline, flaky, vugular, cherty, cream-brown mottled
1,560-1,575		- same; more vugular in part, and yellow-brown; may be a trace of impregnated gypsum
1,575-1,585		- same; some soft, granular, micro-oolitic(?), limey
1,585-1,590		- same, some hard, cherty, gray-brown, less vugular; may be a trace of impregnated gypsum
1,590-1,615		- crystalline, cream-brown mottled, some hard, dense, tan, some soft, carbonaceous
1,615-1,620		- hard, dense, cherty, gray-tan, trace of impregnated gypsum
1,620-1,640		- crystalline, some vugular, cream-brown mottled
1,640-1,645		- same, trace of carbonaceous material
1,645-1,650		- crystalline, some vugular, cream-brown mottled
1,650-1,660		- same, some gray-black, some carbonaceous, more limey
1,660-1,670		- dense, lithographic, cream-brown
1,670-1,700		- dense to crystalline, some vugular, cream-brown
1,700-1,710		- same, honeycomb porosity, some carbonaceous
1,710-1,720		- dense, lithographic, cherty, cream-brown
1,720-1,740		- dense to crystalline, honeycombed, slightly carbonaceous; trace of impregnated gypsum
1,740-1,745		- dense, lithographic, slightly cherty, slightly limey, cream
1,745-1,750		- dense to crystalline, some honeycombed, some carbonaceous

Table 1.--Geologist's log of Sarasota deep test well - continued

Depth (ft)		Lithology
1,750-1,755	Dolomite	- same; impregnated gypsum, considerable free gypsum
1,755-1,760		- same; less gypsum
1,760-1,770		- crystalline, cream-brown; much gypsum (free and impregnated)
1,770-1,780	Gypsum	- some gypsum-impregnated dolomite, some carbonaceous dolomite
1,780-1,790	Dolomite	- crystalline, slightly granular, vugular, light brown, some carbonaceous; trace of gypsum
1,790-1,795		- dense to finely crystalline, slightly limey, fairly soft, cream-brown; trace gypsum
1,795-1,800		- crystalline, cream-gray, some carbonaceous; some impregnated gypsum
1,800-1,805		- hard, dense to finely crystalline, some vugular; much gypsum
1,805-1,815	Gypsum	- some gypsum-impregnated dolomite
1,815-1,820		- same
1,820-1,840	Dolomite	- limey, granular, some crystalline, cherty, cream-buff-brown; impregnated gypsum; some selenite
1,840-1,850	Limestone	- chalky, some dolomitic and cherty, some fossiliferous and carbonaceous, cream; gypsum and selenite
1,850-1,860	Gypsum	- some limey, gypsum-impregnated dolomite
1,860-1,865	Limestone	- dolomitic, chalky to dense, some cherty, some vugular, cream
1,865-1,875	Gypsum	- some gypsum-impregnated dolomite and some selenite
1,875-1,895	Dolomite	- slightly limey, crystalline, vugular, cream-brown; impregnated gypsum; some limestone, chalky, dolomitic, cream
1,895-1,900	Gypsum	- some gypsum-impregnated dolomite; some selenite
1,900-1,910	Dolomite	- crystalline, some dense, some honeycombed, some hard, cherty, cream-brown; some selenite
1,910-1,920		- limey, chalky, clayey, slightly fossiliferous, buff; some gypsum

Table 1.--Geologist's log of Sarasota deep test well - continued

Depth (ft)		Lithology
1,920-1,925	Dolomite	- hard, crystalline, honeycombed, dark brown; some selenite
1,925-1,930		- limey, clayey to granular, soft, buff, some hard, dense
1,930-1,940		- dense, hard, cherty, some vugular, buff; some gypsum and selenite
1,940-1,945		- same, some soft, limey, cream, carbonaceous; some gypsum
1,945-1,950	Gypsum	- some anhydrite; some shale, brown-black, waxy; some gypsum-impregnated dolomite
1,950-1,960	Dolomite	- crystalline, vugular to honeycombed, some carbonaceous, some limey, cream-brown; gypsum and selenite
1,960-1,965		- dense to finely crystalline, some fossiliferous, vugular and honeycombed; some selenite
1,965-1,970		- same; some shale and gypsum
1,970-1,975		- crystalline, vugular, some limey, some fossiliferous, gray to tan; gypsum and selenite
1,975-1,980		- crystalline, vugular to honeycombed, hard, cherty, brown; more selenite
1,980-1,995		- dense to finely crystalline, some limey, granular, some vugular, buff; gypsum and selenite
1,995-2,000		- crystalline, vugular to honeycombed, cherty, dark brown; gypsum
2,000-2,010		- limey, granular, slightly pitted, slightly fossiliferous, buff to light brown; selenite
2,010-2,025		- crystalline to granular, vugular to honeycombed, some limey; dark brown; selenite; shale, hard, black, waxy
2,025-2,035	Limestone	- coarsely granular to fragmental, vugular, partly dolomitic(?), cream-brown mottled, fossiliferous (Dictyconus, et.al.)
2,035-2,050	Dolomite	- crystalline, granular, carbonaceous, cream-brown; selenite, anhydrite, and gypsum
2,050-2,060	Limestone	- crystalline, fragmental, fossiliferous, cream, some carbonaceous; shale, black, waxy; gypsum
2,060-2,070		- crystalline, fragmental, fossiliferous, cream, some cherty; gypsum

Table 1.--Geologist's log of Sarasota deep test well - continued

Depth (ft)		Lithology
2,070-2,080	Limestone	- same, many Dictyconus; much calcite, yellow, crystalline
2,080-2,090		- same; some shale
2,090-2,130		- crystalline, fragmental, very fossiliferous (Dictyconus, et.al.); calcite, yellow, crystalline
2,130-2,230		- crystalline, fragmental, very fossiliferous (coquinoid in part), cream-buff; calcite, yellow; gypsum, anhydrite, and selenite
2,230-2,245	Dolomite	- crystalline, granular, some vugular, dark brown; gypsum
2,245-2,250		- granular, slightly honeycombed, yellow-brown
2,250-2,260		- fine to coarsely crystalline, some vugular, yellow-brown; selenite
2,260-2,265		- same, slightly limey in part; more gypsum
2,265-2,285		- granular and crystalline, some carbonaceous, cream to gray-brown; gypsum
2,285-2,288		- coarsely crystalline, honeycombed, yellow-brown; selenite and gypsum
2,288-2,291		- finely crystalline to dense, cherty, yellow-brown; gypsum
2,291-2,305	Limestone	- fragmental, fossiliferous, cream-brown mottled; some dolomite
2,305-2,310		- coarsely crystalline, yellow-brown, some dolomite
2,310-2,315	Dolomite	- fine to coarsely crystalline, some vugular, yellow-brown; gypsum
2,315-2,320	Limestone	- fragmental, fossiliferous, some carbonaceous, cream-brown; some dolomite; gypsum
2,320-2,330		- same; dolomite, cream to gray to brown; gypsum
2,330-2,345		- very coarse, fragmental, chalky matrix, coquinoid, cream-white
2,345-2,350	Dolomite	- crystalline, sucrosic, yellow-brown; trace of gypsum
2,350-2,395	Limestone	- fragmental, clastic, recemented dolomite grains and rubble, very fossiliferous, cream-white, calcite

Table 1.--Geologist's log of Sarasota deep test well - continued

Depth (ft)		Lithology
2,395-2,405	Dolomite	- very coarsely crystalline, vugular, yellow-brown with black spots; some selenite
2,405-2,440		- fine- to medium-crystalline, granular; gypsum and selenite
2,440-2,465		- granular, sucrosic, slightly limey; gypsum
2,465-2,475	Limestone	- chalky, granular, slightly marly, slightly nodular, slightly fossiliferous, cream-white
2,475-2,490		- same, some fragmental with dolomite grains; trace of gypsum
2,490-2,500	Dolomite	- granular, sucrosic, some vugular, yellow-brown; some gypsum
2,500-2,510		- finely crystalline, sucrosic, cream-brown; limestone; gypsum
2,510-2,525	Limestone	- soft, chalky, nodular, fossiliferous, cream-white; gypsum
2,525-2,530		- same; trace of dolomite, hard, cherty, brown
2,530-2,532	Dolomite	- finely crystalline, sucrosic, cream-brown; gypsum
2,532-2,560	Limestone	- chalky, granular, nodular, fossiliferous, cream-white
2,560-2,585		- same, but slightly more fossiliferous and cream-buff, some pin-point porosity
2,585-2,590		- same, coarser, more fragmental; trace of dolomite
2,590-2,600		- same, more fossiliferous; trace of gypsum and selenite
2,600-2,610		- very fossiliferous, fragmental, slightly vugular, (Dictyconus, et.al.); selenite
2,610-2,630		- less fossiliferous, coquinoid in part, nodular to oolitic, good porosity
2,630-2,680		- less fossiliferous, some hard, dense, tight; calcite, yellow, crystalline
2,680-2,685		- quite fossiliferous (Dictyconus, et.al.), nodular, vugular, some carbonaceous
2,685-2,690		- dense to finely crystalline, less fossiliferous, cream-white

Table 1.--Geologist's log of Sarasota deep test well - continued

Depth (ft)		Lithology
2,690-2,705	Limestone	- very fossiliferous to coquinoid, clastic, nodular, cream; selenite
2,705-2,720		- chalky, clayey, less fossiliferous; dolomite grains
2,720-2,730	Dolomite	- coarsely crystalline, clastic, lime cement, gray-brown, some chert; trace of selenite
2,730-2,740		- finely crystalline, sucrosic, slightly limey, cream-brown; trace of chert and gypsum
2,740-2,745		- same; and limestone
2,745-2,755	Limestone	- fragmental, clastic, very fossiliferous in part, pin-point porosity, cream; calcite; trace of gypsum
2,755-2,770		- chalky to clastic, fossiliferous, cream to buff, some cyrstalline, brown-black
2,770-2,780	Dolomite	- medium to coarsely crystalline, granular and flaky, gray-brown
2,780-2,790	Limestone	- clastic, re-cemented rubble; some dolomite grains, fossiliferous, some porosity
2,790-2,800		- some dense, some coarsely crystalline, some oolitic or coquinoid
2,800-2,820		- fragmental, loosely cemented, good porosity, oolitic or fossiliferous, coquinoid in part, cream-buff
2,820-2,830		- same; trace of selenite
2,830-2,850		- clastic, granular, fossiliferous, some coquinoid, some oolitic, cream-buff
2,850-2,855		- crystalline, granular, dolomitic in part, vugular to honeycombed, buff-brown; trace of selenite
2,855-2,860		- chalky, finely granular, cream
2,860-2,865		- same, some nodular, slightly fossiliferous; trace of selenite
2,865-2,875		- granular or micro-oolitic, fossiliferous, cream
2,875-2,885		- coarser grain, some vugular, slightly dolomitic, buff

Table 1.--Geologist's log of Sarasota deep test well - continued

Depth (ft)		Lithology
2,885-2,900	Dolomite	- finely crystalline to dense and cherty, flaky in part, gray to cream-brown; some selenite and gypsum
2,900-2,905		- hard, dense, cherty, slightly vugular, gray-brown; selenite
2,905-2,910		- fine- to medium-crystalline, brown; gypsum and selenite
2,910-2,915		- dense to finely crystalline
2,915-2,925		- fine to coarsely crystalline
2,925-2,930	Limestone	- dolomitic, coarsely crystalline, yellow-brown, tight
2,930-2,940	Dolomite	- some coarsely crystalline and very porous, brown, some limey and cherty, some black, sooty, asphaltic(?)
2,940-2,945	Limestone	- some granular and crystalline, some chalky, clayey, some dolomitic, cream to black
2,945-2,965	Dolomite	- finely crystalline to dense, cherty, some flaky, some limey, gray-brown to black
2,965-2,975		- same; some gypsum; some limestone, cream
2,975-2,980	Limestone	- chalky, granular, fossiliferous, cream; some chert
2,980-2,995		- granular, nodular, fossiliferous, some vugular, cream-brown
2,995-3,000		- coquinoid, nodular to oolitic, much intergranular porosity, cream
3,000-3,005	Dolomite	- crystalline, some coarse, brown-black; selenite; some limestone
3,005-3,015		- some light brown, finely crystalline to dense; selenite and gypsum
3,015-3,020		- as above, some limey, cream
3,020-3,025		- same, some coarsely crystalline
3,025-3,030		- medium to coarsely crystalline, dark brown; selenite
3,030-3,060		- some dense, cherty, some coarsely crystalline, cream-brown; selenite; trace of limestone, fossiliferous, cream (cavings?)

Table 1.--Geologist's log of Sarasota deep test well - continued

Depth (ft)		Lithology
3,060-3,080	Dolomite	- crystalline to dense, some cherty, cream to brown; selenite and gypsum
3,080-3,085		- same; much more gypsum
3,085-3,090		- same; less gypsum
3,090-3,160		- same; slightly more gypsum
3,160-3,180	Limestone	- tan to light gray, shaley, slightly cherty
3,180-3,190	Dolomite	- gray to brown, dense, cherty; trace of gypsum
3,190-3,200		- same, slightly limey; more gypsum
3,200-3,220		- same; slightly less gypsum
3,220-3,230		- same, cherty
3,230-3,250		- same, slightly limey, vugular; gypsum
3,250-3,260		- same; less gypsum
3,260-3,280	Limestone	- chalky, cream-white, clayey; trace of gypsum
3,280-3,290	Dolomite	- limey, vugular, cream-brown
3,290-3,310	Limestone	- clayey to chalky, cream, gypsiferous
3,310-3,320	Dolomite	- limey, vugular, cream
3,320-3,330	Limestone	- dolomitic, chalky to clayey, cream; gypsum
3,330-3,350	Dolomite	- limey, clayey; trace gypsum
3,350-3,360		- dense, cherty, gray; small amount of coal
3,360-3,385		- same, crystalline, cherty; more gypsum
3,385-3,410		- same, granular and more crystalline, cream to white
3,410-3,455	Gypsum	- slightly dolomitic
3,455-3,480	Limestone	- dolomitic, cherty, cream, highly gypsiferous
3,480-3,490	Gypsum	- trace limestone
3,490-3,495	Limestone	- slightly nodular, cream; some gypsum; some dolomite
3,495-3,505	Gypsum	- trace limestone
3,505-3,513	Limestone	- nodular, oolitic, fossiliferous, vugular, slightly dolomitic, cream

Table 2.--Summary of logs available for Sarasota deep test well

[Logs are available from the city of Sarasota, Florida.]

Date of run	Operator	Type of log	Depth interval (ft)
September 19, 1973	U.S. Geological Survey	Caliper, temperature, spontaneous potential (SP), single-point resistance, gamma ray	0-1,125
February 7-8, 1974	U.S. Geological Survey	Caliper, SP, single-point resistance	1,000-3,080
		Temperature	0-3,010
		Flowmeter (down)	2,400-3,075
		Flowmeter (up)	3,070-1,102
March 20, 1974	Schlumber	Gamma ray	0-2,260
		Caliper, sonic, induction, 16-inch short normal, resistivity, SP	1,000-2,260
July 24, 1975	Florida Bureau of Geology	Gamma ray, caliper	0-3,480
July 24, 1975	U.S. Geological Survey	SP, 16-inch short normal and 64-inch long normal, resistivity	2,008-3,500
July 30, 1973-November 1, 1974	Pippin Corporation	Abstracted daily drilling report	0-3,513
August 1, 1973-February 4, 1974	Pippin Corporation	Driller's log	0-3,088

Table 3.--X-ray diffraction analyses of well cuttings from selected depths, Sarasota deep test well

[Analysis, in percent based on peak height, performed by U.S. Geological Survey Hydrologic Laboratory, Lakewood, Colorado.]

Depth of sample (ft)	Quartz	Calcite	Dolomite	Aragonite	Siderite	Total clay minerals	Total percent
40*	13	0	22	4	0	29	68
90	5	0	68	0	0	14	87
430	17	12	33	0	8	5	75
600	3	92	4	0	0	0	99
850	3	76	8	0	1	0	88
1,100	2	14	84**	0	0	0	100
1,350	0	1	99**	0	0	0	100

* See figure 2 for stratigraphic unit sampled.

** Reported value reduced so that total equals 100 percent.

Table 4.--Field analyses of water samples collected from selected depths, Sarasota deep test well

Date of sample	Time	Depth of sample (ft)	Specific conductance (umhos/cm at 25°C)	Temperature (°C)	Chloride (mg/L)	Specific gravity (g/cm^3)
11/09/73	1630	1,160	4,800			
11/12/73	1530	1,175	5,700			
11/13/73	1000	1,190	5,400			
11/14/73	1300	1,206	5,400			1.003
11/16/73	1600	1,214	10,000			1.006
11/23/73	1000	1,230	30,000		11,000	1.016
11/29/73	1730	1,270	42,000		17,300	1.024
12/03/73	1310	1,305	43,000		17,300	1.024
12/04/73	1300	1,335	43,000		17,300	1.023
12/05/73	1730	1,365			17,300	1.024
12/06/73	1015	1,395			17,200	1.023
12/06/73	1300	1,425	43,000		17,200	1.024
12/06/73	1610	1,455	43,000		17,200	1.026
12/06/73	1830	1,495	43,000		17,200	1.026
12/07/73	1135	1,530			17,200	1.025
12/18/73	1230	1,555		31	17,500	1.026
12/19/73	1000	1,585		31	17,300	1.024
12/19/73	1300	1,615	43,000	33	17,300	1.024
12/20/73	1235	1,645	42,000	33	17,400	1.024
1/02/74	[a]1520	1,645	11,200	31.5	3,400	1.006
1/07/74	1740	1,680	45,000		17,300	1.023
1/08/74	1135	1,710	45,500		17,300	1.025
1/08/74	1510	1,740			17,300	1.024
1/09/74	1020	1,770			17,000	1.025
1/09/74	1550	1,800	43,800		17,300	1.025
1/10/74	1245	1,835			17,200	1.024
1/10/74	1630	1,865			17,300	1.024
1/11/74	1120	1,895	42,000	33	17,200	1.024
1/11/74	1620	1,925	43,000	32	17,200	1.024
1/14/74	1040	1,960	43,000	33	17,200	1.026
1/14/74	1420	1,990	42,000	33	17,100	1.024
1/14/74	1830	2,020	43,000	32	17,200	1.025
1/15/74	1350	2,050	42,000	33	16,900	1.024
1/16/74	1815	2,080	42,000	32	17,000	1.024
1/17/74	0945	2,110	42,000	32	16,900	1.024

[a]Pumped sample.

Table 4.--Field analyses of water samples collected from selected depths, Sarasota deep test well - continued

Date of sample	Time	Depth of sample (ft)	Specific conductance (umhos/cm at 25°C)	Temperature (°C)	Chloride (mg/L)	Specific gravity (g/cm^3)
1/18/74	1635	2,145	43,000	32	17,600	1.024
1/18/74	2030	2,175	42,000	32	17,600	1.024
1/21/74	1135	2,205	43,000	32	17,400	1.025
1/21/74	1530	2,240	44,000	33	17,600	1.025
1/22/74	1030	2,270	43,000	32	17,300	1.024
1/22/74	1650	2,300	44,000	33	17,400	1.024
1/23/74	0935	2,330	43,000	32	17,500	1.024
1/23/74	1300	2,360	44,000	33	17,400	1.024
1/23/74	1645	2,395	43,000	32	17,400	1.024
1/24/74	1350	2,425	44,000	33	17,500	1.025
1/24/74	1715	2,455	44,000	32	17,500	1.025
1/25/74	1045	2,485	43,000	33	17,400	1.025
1/25/74	1730	2,520	43,000	32	17,600	1.025
1/28/74	1210	2,550	43,000	33	17,400	1.025
1/28/74	1515	2,585	44,000	33	17,300	1.025
1/28/74	1740	2,615	45,000	32	17,800	1.026
1/29/74	1030	2,645	46,000	33	18,200	1.026
1/29/74	1315	2,675	45,000	33	18,200	1.026
1/29/74	1615	2,705	46,000	33	18,200	1.026
1/30/74	1200	2,770	48,000	34	19,000	1.028
1/30/74	1515	2,800	47,000	33		1.026
1/30/74	1700	2,830	49,000	33	19,000	1.027
1/30/74	1915	2,865	49,000	33		1.028
1/31/74	1245	2,900	52,000	33		1.028
1/31/74	1800	2,930	52,000	34		1.029
2/01/74	1315	2,960	52,000	34	20,400	1.029
2/01/74	1530	2,990	50,000	35		1.028
2/01/74	1910	3,025	51,000	35		1.028
2/04/74	1315	3,055	54,000	35		1.030
2/04/74	1800	3,090	54,000	35		1.030

Table 5.--Analyses of water samples collected from selected depths, Sarasota deep test well

[Samples collected from air-lift circulation during drilling except as noted in remarks column. Concentrations are in milligrams per liter except as noted.]

Date of sample	Time	Depth of sample (feet)	Specific conductance (umhos/cm)		pH (units)	Temperature (°C)	Color (Pt-Co units)	Hardness		Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO_3)	Alkalinity as $CaCO_3$	Carbon dioxide (CO_2)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Silica (SiO_2)	Dissolved solids		Strontium (Sr) (ug/L)	Remarks
			Laboratory	Field				Ca + Mg as $CaCO_3$	Noncarbonate												Residue at 180°C	Calculated sum of constituents		
11/16/73	1600	1,214	14,500		7.7		7	3,200	3,100	720	330	1,700	38	142	116	4.5	1,500	3,600	1.5	23	8,900	8,020	34,000	
11/28/73	2300	1,232	9,340	9,000	7.5	31.0	4	5,900	5,600	1,200	670	1,100	30	151	124	7.6	1,600	2,500	0.3	23	6,840	7,200	20,000	Pumped
11/30/73	1730	1,270	42,000	42,000	7.6		0	7,300	7,100	1,300	970	10,000	300	188	154	7.6	2,900	19,000	1.8	16	34,200	34,600	45,000	
12/06/73	1830	1,495	43,000	43,000	7.6		0	7,200	7,000	1,300	940	9,600	310	190	156	7.6	3,100	19,000	1.9	15	34,500	34,600	44,000	
1/02/74	1520	1,645	11,200	11,200	7.8	31.5	0	3,100	3,000	690	330	1,900	40	150	123	3.8	1,600	3,700	1.5	23	8,720	8,390	31,000	Pumped
1/14/74	1830	2,020	43,000	43,000	7.5	32.0	0	6,200	6,000	920	930	12,000	330	173	142	8.8	3,300	20,000	1.9	14	36,200	37,600	42,000	
1/17/74	0945	2,110	42,000	42,000	7.6	32.0	2	7,800	7,700	1,300	1,100	10,000	320	187	153	7.5	3,100	19,000	2.0	15	35,500	35,000	43,000	
1/18/74	2030	2,175	42,000	42,000	7.7	32.0	0	7,200	7,100	1,300	950	11,000	320	132	108	4.2	3,100	20,000	1.9	15	35,700	36,800	44,000	
1/23/74	1645	2,395	43,000	43,000	7.7	32.0	3	4,400	4,300	140	980	11,000	330	150	123	4.8	3,400	18,000	1.9	15	37,800	34,000	43,000	
1/25/74	1045	2,485		4,300	7.6	33.0	3	6,800	6,700	1,200	920	11,000	330	159	130	6.4	3,300	19,000	1.9	15	35,900	35,900	43,000	
1/29/74	1315	2,675	45,000	45,000	7.7	33.0	2	8,100	7,900	1,400	1,100	10,000	350	153	126	4.9	3,300	19,000	2.5	15	37,600	35,300	42,000	
1/29/74	0840	2,684		51,000		37,0	20	9,500	9,300	1,800	1,200	17,000	550	223			4,600	29,000	4.3	14	54,900	54,300	37,000	Pumped
1/30/74	1200	2,770	48,000	48,000	7.5	34.0	3	8,700	8,600	1,500	1,200	11,000	380	166	136	8.4	3,600	20,000	2.6	14	37,800	44,000	44,000	
2/01/74	1315	2,960		52,000		34.0	2	7,900	7,800	1,500	1,000	13,000	420	137	112	8.7	4,100	22,000	4.0	14	42,200	42,100	42,000	
2/01/74	1530	2,990	50,000	50,000	7.2	35.0	2	7,900	7,800	1,500	1,000	13,000	420	163	134	16	3,300	23,000	4.2	14	34,400	42,400	43,000	
2/04/74	1315	3,090	54,000	54,000	7.1	35.0	2	8,200	8,000	1,600	1,000	13,000	440	167	137	21	3,400	23,000	4.0	13	42,900	42,600	44,000	
10/18/74	1500	3,261	69,400			38.5	3	8,700	8,500	1,800	1,000	16,000	590	150			4,400	28,000	1.1	14	53,600	51,900	33,000	
10/31/74	0900	3,415	72,100			35.0	4	11,000	11,000	2,000	1,400	17,000	540	132			4,400	30,000	1.1	14	55,100	55,500	33,000	
11/01/74	1900	3,513	72,800			39.0	7	9,700	9,600	1,900	1,200	17,000	480	139			4,600	31,000	1.1	12	55,600	56,300	30,000	
11/10/74	1400	3,513	83,000			38.5	200	9,200	9,000	2,000	1,000	17,000	540	203			4,700	30,000	1.2	15	54,700	55,400	35,000	Pumped

[Analyses are in micrograms per liter.]

Date of sample	Time	Depth of sample (feet)	Aluminum dissolved	Arsenic dissolved	Boron dissolved	Cadmium dissolved	Chromium dissolved	Chromium hexavalent	Cobalt dissolved	Copper dissolved	Iron dissolved	Lead dissolved	Lithium dissolved	Manganese dissolved	Mercury dissolved	Molybdenum dissolved	Nickel dissolved	Vanadium dissolved	Zinc dissolved
11/28/73	2300	1,232	170	3	100	2	0	0	0	7	180	13	0	70	0.1	4	3	1.2	0
11/10/74	1400	3,513	30	5	5,000	6	1	0	0	0	280	0	890	170	0.5	0	4	240	40