CONSTRUCTION AND TESTING OF AN INJECTION WELL CORAL SPRINGS IMPROVEMENT DISTRICT BROWARD COUNTY, FLORIDA

MARCH 1986

PREPARED FOR:

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FOR GOVERNING BOARD CONSIDERATION
MAY 10, 1984

UNDERGROUND INJECTION CONTROL PROGRAM

STAFF REPORT

Construction of Deep Injection and Monitoring Well

Coral Springs Improvement District, Broward County, Florida

INTRODUCTION

Application has been made by Coral Springs Improvement District, through their consultants, Geraghty and Miller, Inc., for construction of a deep injection well and associated monitoring system. The injection well will be used for disposal of secondarily treated domestic wastewater to the Boulder Zone. Domestic sewage is presently treated at two "package" style plants with a total capacity of 2.0 million per day average daily flow. Current projections indicate a need for an expanded capability to treat 3.25 million gallons per day and to provide for further expansion to a total of 6.5 million gallons per day.

DESCRIPTION OF PROJECT

The injection well system will consist of one 12 inch Class 1 injection well approximately 3500 feet deep, with two monitor tubes installed in the annular space between the intermediate and surface casings. The injection well will be open to the highly transmissive, cavernous zone between approximately 3000 feet and 3500 feet. The monitor tubes will provide water level and water quality monitoring capability at approximately 1300 and 2200 feet through a 30 foot perforated gravel packed section of tubing. The injected fluid will be confined by approximately 800 feet of low permeability massive dense dolomite, dolomitic limestone and chalky limestone. The primary purpose of the monitoring tubes will be to detect any upward movement of the injected fluids into the Floridan aquifer, or loss of injected fluid from the well casings, should this occur.

The injection well will have a maximum design capacity of 3.5 million gallons per day, although the initial upgrade of the plant will be sized for a base line or average daily flow of 3.0 million gallons per day. Three effluent pumps are provided (two service and one standby pump) capable of handling peak flows of 2,600 gallons per minute. Higher flows will be equalized so that all flows up to base line will be directed to process treatment and all flows above base line will be split using weirs of proportional length such that 85 percent of the excess flows will be stored in an aerated holding tank and will be returned to the process stream when the plant inflow is less than average daily flow.

The pumping system, effluent force main and injection well will be protected from water hammer and surge by a vacuum release at the well head, surge control valves and a fast-opening pressure relief valve. This system will effectively dampen shock loads and will automatically reinstate the level of protection after the initial cause for relief has dissipated.

Emergency discharge of effluent, in case the injection well is out-of-service will be to existing shallow ponds. This is the system presently utilized for polishing, oxidation and percolation of the effluent.

WASTEWATER REUSE

Coral Ridge Properties was issued a water use permit in 1982 for 33.6 million gallons per month maximum to irrigate an eighteen hole golf course (136 acres).

The permit was subsequently transferred to Tournament Players Club. Proposed irrigation withdrawals were from on-site lakes. The applicant states that the course is specifically designed to minimize irrigation supply requirement by utilizing moisture-sensing devices to monitor soil water content, and by extensive utilization of native, drought-tolerant vegetation. Water application rates were developed with a frequency or cycle period of 15 minutes per day for greens, tees and fairways, and 30 minutes per day for roughs, only part of which were to be sprinkled.

The applicant has reviewed the existing opportunities for wastewater reuse and has concluded that the only candidate is the golf course. The maximum irrigation requirements for this course (1.1 mgd) would not utilize the projected up to 3.0 mgd of wastewater to be produced. In the absence of any other feasible supplementary method, a deep well would be required.

Based on the expected costs associated with abandoning or demolishing parts of the existing system already in place, and the capital costs and operating costs for replacement facilities necessary to transport, store, pump and distribute the effluent, as well as the low irrigation demand and consequently minimal benefit to the water resources of the area, it is concluded that requiring irrigation reuse as an alternative, or in conjunction with a deep well would not be practical.

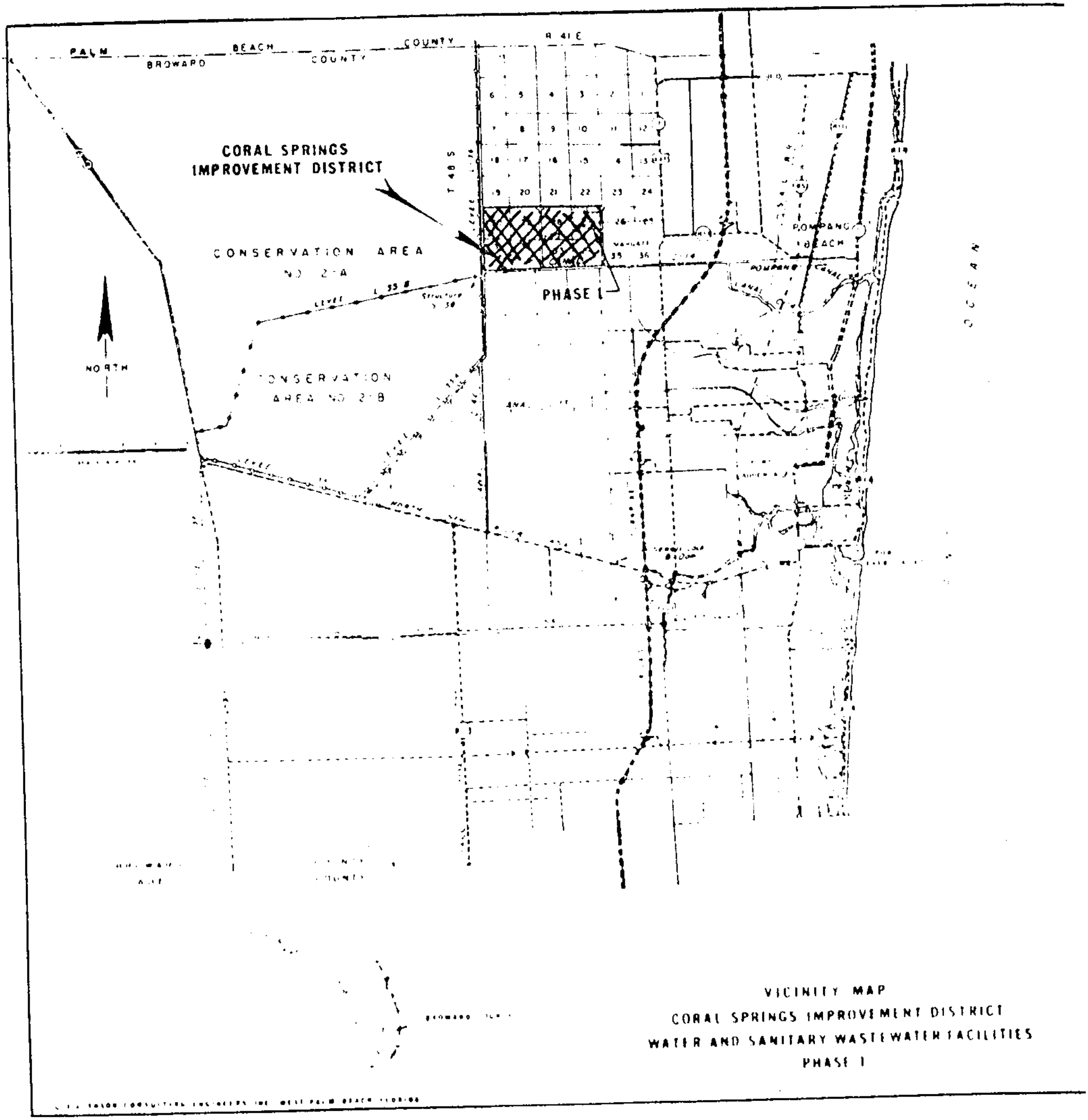
RECOMMENDATIONS

1) Staff is satisfied that the proposed deep well injection system provides the most viable, cost effective and environmentally safe method of wastewater disposal for Coral Springs Improvement District.

2) Staff is satisfied that the system meets the specifications set out in Chapter 17-28, FAC, for integrity, safety and protection of underground sources of drinking water. The system has been conceptually approved by the Technical Advisory Committee established under Chapter 17-28, FAC to review Class 1 injection well projects.

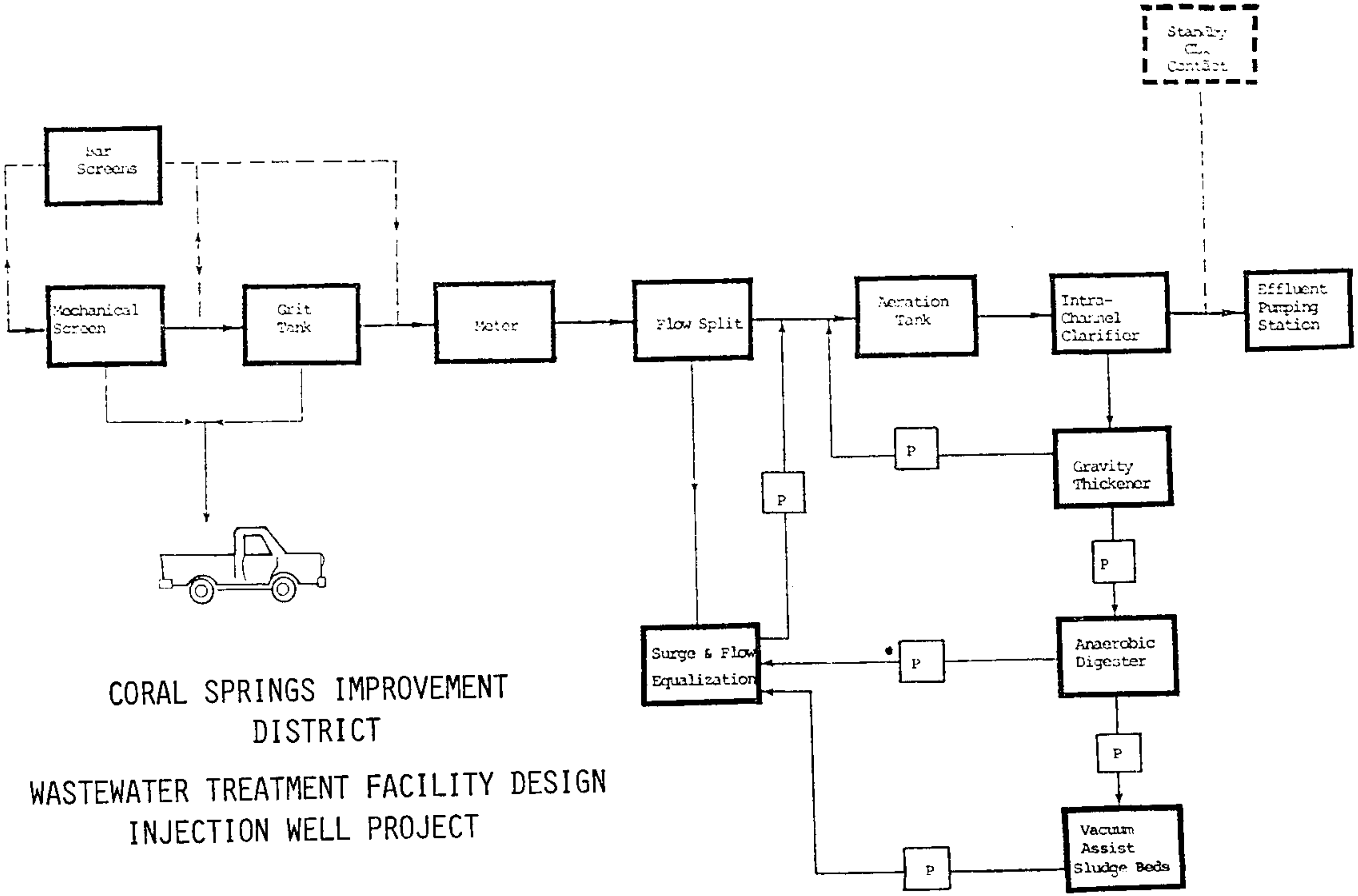
3) Staff recommends conceptual approval of the proposed system, with the provision that Coral Springs Improvement District continue to explore the possibilities of reusing wastewater and implements wastewater reuse when this becomes feasible.

Leslie A. Wedderburn, Ph.D.
Resource Control Department
February 22, 1984



VICINITY MAP
CORAL SPRINGS IMPROVEMENT DISTRICT
WATER AND SANITARY WASTEWATER FACILITIES
PHASE I

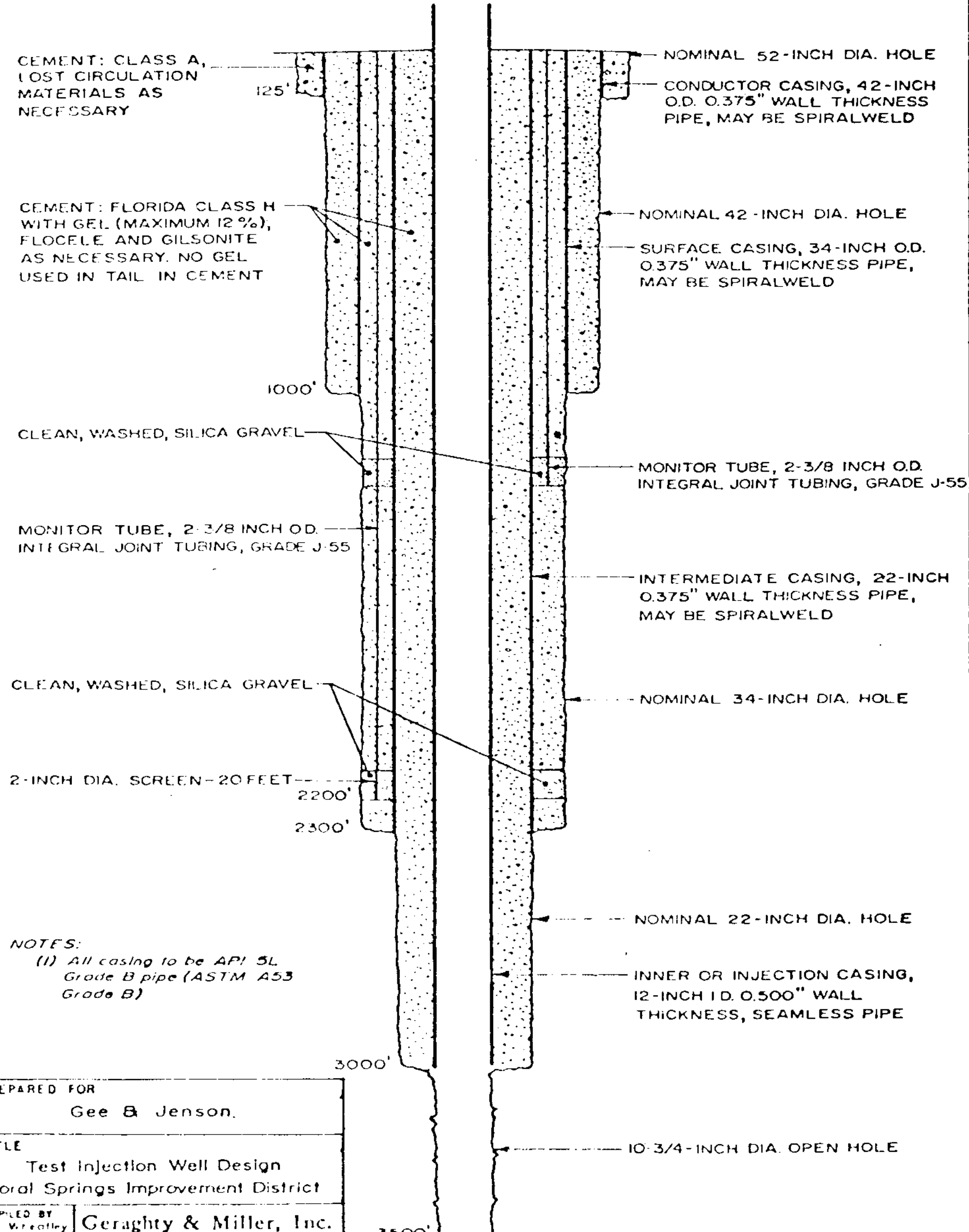
EXHIBIT 1



CORAL SPRINGS IMPROVEMENT DISTRICT

WASTEWATER TREATMENT FACILITY DESIGN
INJECTION WELL PROJECT

EXHIBIT 2



NOTES:
(1) All casing to be API 5L Grade B pipe (ASTM A53 Grade B)

PREPARED FOR Gee & Jenson.			
TITLE Test Injection Well Design Coral Springs Improvement District			
COMPILED BY J.A. Wheatley DRAWN BY P.O. Smith	Geraghty & Miller, Inc. West Palm Beach, Florida		
CHECKED BY V.P. Amy	SCALE None	DATE Nov 1983	

Not to Scale

EXHIBIT 3

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CONSTRUCTION AND TESTING
OF AN
INJECTION WELL
CORAL SPRINGS IMPROVEMENT DISTRICT
BROWARD COUNTY, FLORIDA

March 1986

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CONSTRUCTION and TESTING of an INJECTION WELL CORAL SPRINGS IMPROVEMENT DISTRICT BROWARD COUNTY, FLORIDA

INTRODUCTION

In April 1984, the CSID (Coral Springs Improvement District) obtained approval from the TAC (Technical Advisory Committee) governing underground injection control projects to construct and test a Class I well at its wastewater treatment facility in Coral Springs, Florida. A permit to construct and test the well was subsequently issued by the FDER (Florida Department of Environmental Regulation).

Specifications for the program were issued in January 1984, and bids were accepted on March 8, 1984. The specifications contained provisions for drilling and testing an injection well to approximately 3500 feet; for constructing, testing, and completing two monitor tubes in the annulus of the intermediate casing; and for plugging and abandonment in the event suitable conditions were not found. In addition, the specifications called for controlled pumping tests of selected zones within the borehole to determine the capability for confinement as well as an injection test to demonstrate the ability of the injection zone to accept effluent.

The contract for the drilling and associated site work was issued in April 1984 to Zeni Drilling Company of Morgantown, West Virginia.

Mobilization of equipment began in October 1984 and actual well drilling started on December 15, 1984. A total depth of 3500 feet was reached on May 28, 1985 and the drilling and testing program was completed on June 7, 1985.

During the drilling of the well, geologic and hydrologic data were collected by coring, geophysical logging, formation sampling, straddle-packer pumping tests and injection testing. These data were used to determine the adequacy of the confining sequence and the capability of the injection zone to accept effluent. Data collection and evaluation were conducted by the staff of Geraghty & Miller.

As a condition of the construction permit, the FDER requested that, upon completion of drilling and testing, a final report summarizing the information obtained during the program be submitted along with an application to operate the well. This report documents the results of the investigation and contains information collected during the well construction and testing programs. Conclusions are made regarding the capability of the injection zone to accept effluent and the integrity of the confining sequence. A monitoring program that will provide the information necessary to evaluate well performance during operation of the disposal system is also presented. Copies of the various geophysical logs, geologic logs, and laboratory reports of chemical analyses of water samples and core tests are included in the Appendices.

This information is submitted in support of an application for a permit to operate the CSID well in accordance with Section 17-28.26(1)(e) FAC (Florida Administrative Code) and Specific Condition 9 of the construction permit.

FINDINGS

1. The data demonstrate the presence of an extremely transmissive injection zone saturated with salt water (contains more than 10,000 milligrams per liter of total dissolved solids).

2. The top of the injection zone occurs at 3000 ± feet below land surface with its base at 3500 ± feet, for a total thickness of approximately 500 feet.

3. The injection zone has an extremely high transmissivity which is estimated to be greater than 3,000,000 gpd/ft (gallons per day per foot). This zone is capable of accepting the required volume of effluent from the CSID plant at an acceptable injection pressure.

4. The contact between waters with less than 10,000 mg/l (milligrams per liter) of TDS (total dissolved solids) and non-potable water is gradational and occurs in the interval between 1000 and 1200 feet below land surface.

5. The hydraulic conductivity of the confining sequence, as determined from the straddle-packer pumping tests, ranges from 0.000018 cm/sec (in the lower monitor zone) to 0.0000099 cm/sec (centimeters per second). Permeabilities determined from core tests ranged from 0.000058 cm/sec to 0.0000000034 cm/sec.

6. Two monitor zones were selected. The lower zone is from 2153 feet to 2183 feet and the upper zone is from 1192 feet to 1222 feet below pad level. Monitor tubes were installed in the annulus of the intermediate casing in order to enable sampling of these zones.

7. The presence of favorable geologic conditions (i.e. highly transmissive injection zone filled with water having greater than 10,000 mg/l TDS, suitable confining sequence, and suitable monitor zones) will permit the use of injection wells for the safe, practical, and environmentally sound disposal of treated effluent at the CSID wastewater treatment facility.

RECOMMENDATIONS

1. Well-head injection pressures should be monitored continuously. Monthly averages as well as maximum and minimum values should be reported to the BCEQCB (Broward County Environmental Quality Control Board) and FDER on a monthly basis.

2. The flow rate into the well should be monitored continuously. Average daily flow rates as well as the total volume of effluent pumped into the well should be reported to the BCEQCB and the FDER on a monthly basis.

3. The monitor tubes should be pumped continuously and monitored daily for specific conductivity, pH and temperature. This information should be reported to the BCEQCB and FDER on a monthly basis.

4. Samples from the monitor tubes should be collected and analyzed quarterly for turbidity, total dissolved solids, chloride, nitrate, and total coliform. The results of these analyses should be sent to the BCEQCB and FDER on a quarterly basis.

5. A specific injectivity test should be performed quarterly. The pumping rate should be established at 2100 gpm (gallons per minute) for a one hour period. Well-head pressures should be recorded during this period. Test results should be reported to the BCEQCB and FDER in gpm per specific well-head pressure (psig).

6. The well should be tested for mechanical integrity every 5 years. Mechanical integrity may be tested by pressure testing the injection casing and running a temperature or noise log. Other test methods may be used subject to approval by the FDER.

DATA COLLECTION

A variety of procedures were used to collect the data necessary to accomplish the program's objectives. Some of the procedures used were new; others were methods typically used in injection well programs. These procedures are described in this section, along with comments on their applications and usefulness. Except where noted otherwise, all depth measurements stated in this report are referenced to the concrete drilling pad, which is approximately at land surface.

A log of drilling and related activities (Daily Log) was maintained by the project staff. Items related to the well's construction and testing, time spent on various work tasks (geophysical logging, coring, inclination surveys and related incidents) were described, and events were noted. Materials used in construction, time spent on contract items, and footages drilled were recorded in a separate construction log; they also were noted in the Daily Log. Copies of the Daily Logs were furnished on a weekly basis to the members of the Technical Advisory Committee (TAC) and to representatives of CSID.

Samples of formation cuttings were collected during drilling of the pilot hole and injection zone. Lag times of the cutting discharge (time required for the cuttings to circulate from the bottom to the discharge) were computed on a regular basis to ensure that accurate sample depths were recorded. The samples were washed, dried, and examined microscopically by a Geraghty & Miller geologist and a field lithologic log was prepared.

A geologic log was prepared as drilling progressed. A copy of the geologic log is presented in Appendix A. One set of samples from the well was sent to the Florida Bureau of Geology in Tallahassee, Florida.

Cores were collected during drilling of a 7-7/8-inch diameter borehole. The cores were collected using a core barrel and four-inch-diameter core bit. The cored intervals were approximately ten feet in length. Portions of the cores were sent to a testing laboratory where they were tested to determine their vertical permeability, porosity, and specific gravity. Copies of the laboratory reports are contained in Appendix B.

Various geophysical logs were made in the pilot hole to collect data on the presence and nature of the injection zone, the confining sequence and the suitability of monitor zones. Dual-induction (shallow, medium and deep investigation tools), temperature, caliper, natural gamma ray, borehole compensated neutron, and sonic logs were made. Copies of the various logs are contained in Appendix C.

The Dual-Induction log was used to differentiate between the limestone and dolomite beds, and along with the gamma ray log, was used to aid in the correlation of lithologic units in the hole. The "porosity" logs (sonic and neutron) were useful in identifying not only the injection zone and the confining sequence but also aided in locating zones that could cause problems during cementing.

Inflatable straddle packers leased from TAM International were used to isolate selected zones. Pumping tests were performed in these zones to obtain data on permeability and water-quality. A total of six straddle-packer pumping tests were completed. The tests were conducted at a rate of approximately 50 gpm (gallons per minute) each using a submersible pump set in the drill pipe. Drawdown and recovery measurements were taken and analyzed. The results of the permeability data obtained from these tests are presented subsequently. Laboratory results of the water samples collected during the straddle-packer tests are found in Appendix D.

After installation and cementing of the injection casing, a pressure test was conducted on the casing prior to drilling the open hole section through the injection zone. The casing was filled with water and placed under a pressure of 150 psi (pounds per square inch), over 1.5 times the expected maximum well-head operating pressure, for a one hour period.

After completion of the well, an injection test was conducted. During the test a Geophysical Research Corporation Amerada Gauge (EPG-520) was used to measure temperature and pressure changes in the injection zone. Before the injection test was started, 24 hours of background pressure and temperature data were collected. The injection test was conducted for a 24-hour period. The data-collection frequency ranged from 10 seconds between readings at the start of test to a maximum of 1 minute during the latter part of the test. The test results and their interpretation are presented in subsequent sections of this report.

After completion of the injection test, clear, potable water was pumped into the well and a video tape was made of the completed well. The picture quality of the log was very good and provided visual data on the condition of the well and the nature of the injection zone. Copies of the tapes have been sent to those members the Technical Advisory Committee requesting the information. Additional tapes are available upon request.

Finally, water samples were collected from the monitor zones and analyzed for a variety of constituents. This was done to establish the "natural" or background quality of the water in the various zones prior to the disposal of treated effluent. Copies of the laboratory reports of the analyses are contained in Appendix E. Appendix C also contains a drawing which correlates the data collected during the various testing operations with the geologic log and several of the geophysical logs.

WELL DRILLING AND CONSTRUCTION

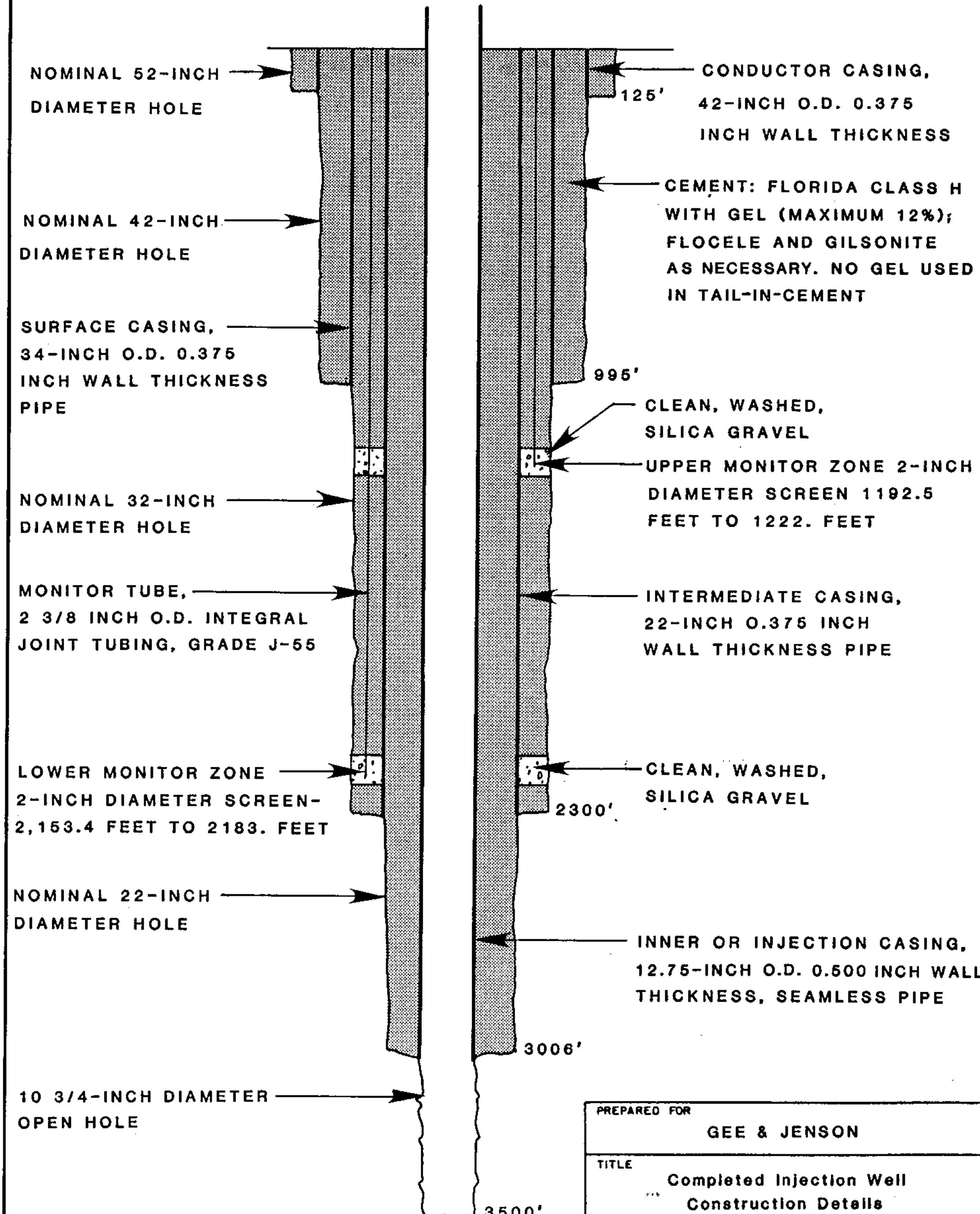
The injection well was drilled and completed in stages. Initially, 125 feet of 42-inch-diameter conductor casing were set inside of a 52-inch diameter hole and cemented in place with ASTM Type II neat cement. After the conductor casing was installed, approximately 995 feet of 34-inch-diameter surface casing were set inside a nominal 42-inch-diameter hole and cemented in place with ASTM Type II cement. Drilling operations then were changed from mud rotary to reverse air and a 7-7/8-inch-diameter pilot hole was drilled to 3100 feet below land surface. The drilling was done using a closed circulation system. No drilling mud or formation fluids were discharged from the drill site. Five cores, approximately 4 inches in diameter and 10 feet long, were taken in the pilot hole. The results of the laboratory analysis of the cores are given in Appendix B.

Upon the completion of the pilot hole to a depth of 3100 feet, the logging/testing phase of the program was conducted. This included geophysical logging, straddle-packer pumping tests and water-quality sampling.

After pilot hole testing was complete, the 7-7/8-inch borehole was reamed to a nominal diameter of 34 inches to a depth of 2300 feet and 22-inch-diameter intermediate casing and the monitor tubes were cemented in place with ASTM Type II cement (with 12% gel). The 7-7/8-inch-diameter borehole from the bottom of the 22-inch casing to a depth of 3010 feet was reamed to a nominal 22 inches in diameter. The 12-inch-diameter injection casing was cemented in place to a depth of 3006 feet with ASTM Type II cement (with 12% gel). The injection well was completed by drilling a nominal 10-3/4-inch-diameter hole from the bottom of the injection casing to a depth of 3500 feet. A construction diagram of the Exploratory Well is shown in Figure 1.

In February, during the 34-inch reaming of the pilot hole, the survey data indicated that the reamed hole was not tracking the pilot hole. On February 8, reaming of the pilot hole was temporarily stopped at a depth of 1504 feet so that further investigations could be made. On February 11, a wash tool and 5-inch drill string was lowered through the bottom of the reamed hole and into the pilot hole to a depth of 1532 feet (28 feet below the bottom of the 34-inch reamed hole). This provided physical proof that two separate holes did not exist.

In conjunction with the TAC, a testing procedure was developed for demonstrating that the reamed hole was tracking the pilot hole as subsequent reaming operations progressed. The testing procedure consisted of (1) running a caliper log from a depth of 1554 feet (50 feet into the pilot hole) to 1494 feet (10 feet above the bottom of the 34-inch reamed hole); (2) removing the cuttings from the pilot hole to a depth of 2400 feet and backfilling with a black, silica material so that tracking of the pilot hole could be established by analysis of cuttings from the well; and (3) running a caliper log (upon completion of the 34-inch ream) from 2330 feet (30 feet into the



PREPARED FOR		
GEE & JENSON		
TITLE: Completed Injection Well Construction Details Coral Springs Improvement District		
COMPILED BY L. SIMS	Geraghty & Miller, Inc.	DATE JUNE 1985
DRAWN BY Y. DIMICK	Palm Beach Gardens, Florida	REVISED
CHECKED BY J. WHEATLEY	SCALE NONE	FIGURE 1

P234CS3

pilot hole) to 2290 feet (10 feet above the bottom of the 34-inch reamed hole). These procedures were followed with successful results and reaming operations were completed on April 28.

In order to help evaluate the adequacy of the cementing job on the injection casing, a Cement Bond Log was run by Schlumberger. This log is included in Appendix C. The log strongly suggests that the mill varnish on the outside of the injection casing allowed very little attenuation of the acoustic signal into the formation. As a result, a majority of the acoustic signal from the transmitter was reflected back to the receivers.

The consistently large amplitude and relatively constant travel time of the first signal arrival as well as the constant arrival time of the first signal on the Variable Density Log display all suggest a lack of acoustic coupling of the cement and casing. The lack of acoustic coupling of the casing and cement is not necessarily indicative of a poor cement seal in the annulus outside the injection casing. Careful review of the cementing records, pressure test, and injection test data indicate that the injection casing is properly cemented and isolation between the injection horizon and overlying sources of drinking water has been achieved.

SUBSURFACE CONDITIONS

BACKGROUND

The final design of the injection well was based on the information collected during drilling and testing of the pilot hole. The drilling and testing program was set up to provide flexibility and allow for changes in well completion that might be dictated by site-specific geologic conditions. The drilling specifications and program were based on available data of regional geologic conditions and data from existing injection wells in the area. The section on subsurface conditions is presented first in this report so that the reader will obtain a good understanding of site-specific geologic conditions and the rationale for the final design of the well.

GEOLOGIC SETTING

A well defined, areally extensive sequence of carbonate sediments is present at the CSID site and throughout the area. The geologic units found during the construction of the well satisfied the requirements of Chapter 17-28 FAC. The injection zone is capable of receiving the required volume of effluent (three million gallons per day, average daily flow) and disposal of the effluent into this zone should not result in contamination of any USDW (Underground Source of Drinking Water). A brief description of the various geologic units follows.

From land surface to approximately 200 feet in depth, the sediments are comprised of sandstone, limestone, and clay with varying amounts of shell and sand. The sandstone is generally light gray to light olive brown, comprised of quartz and phosphatic minerals, is fine- to medium-grained, and exhibits dissolution features. The limestone is a light gray to dark gray micrite which is sparsely located within the sandstone sequence. Various amounts of sand and shell are also present within these sediments. The solution features common in the upper 200 feet of sediment give this unit the high permeability characteristic of the Biscayne aquifer. These sediments are Pleistocene to Miocene in age and correspond to descriptions of the Anastasia and Tamiami Formations.

Below 200 feet deep, the sediment is dominantly composed of an olive gray, plastic, clay with various, usually small, amounts of sand. From 600 feet to about 1100 feet, the sediment is predominantly carbonate mud (marl). The marl is generally pale olive gray, soft, and sandy with interbedded layers of limestone present throughout the interval. The limestone varies from light gray, pale orange, to yellowish gray micrites and biomicrites. Various amounts of sand and shell are present within both sediment types. The sediments in the interval between 200 and 1100 feet are Miocene to Upper Eocene in age and correspond with descriptions of the Hawthorn Formation, Suwannee Formation, and possibly the Ocala Group.

The limestone between 1100 feet and 1600 feet deep is typically a pale orange to grayish orange, fine- to medium-grained, sandy, soft, biomicrite. The limestone in this sequence is upper to middle Eocene in age and is delineated as the Avon Park Formation. The upper Floridan aquifer is contained within this section.

In the interval from 1600 feet to 2100 feet deep, the limestone consists of light gray to pinkish gray, fine- to medium-grained, hard, vuggy biosparites and micrites. The sonic and neutron logs indicate a decrease in formation porosity in this interval. This section is comprised of middle to lower Eocene-age sediments of the lower Avon Park and Lake City limestone Formations.

At approximately 2100 feet deep, dolomite is first encountered. The interval between 2100 feet and 3100 feet deep consists of alternating layers of dolomite and limestone. Below 3100 feet, the rock is composed almost entirely of dolomite. The dolomite in the upper part of this interval is predominantly light brown to moderate brown, massive, and dense with some dissolution features. The interbedded limestone in this interval consists of pale orange to gray, fine- to medium-grained, hard biosparite. The porosity is irregular in the interval. Core samples taken from various locations between 2000 and 2900 feet have total porosities which range between 41.5% and 8.1%. This section contains lower Eocene-age sediments of the lower Lake City limestone and Upper Oldsmar limestone formations.

The injection zone extends from approximately 3000 feet to 3500 feet in depth in the lower section of the Oldsmar Formation. Results from the television survey indicate that the dolomite in the zone exhibits extensive dissolution cavities and fracturing. Open-spaced crystal growth is commonly apparent in the vugs of dolomite in the well cuttings. The bottom of the injection zone was determined by the occurrence of a limestone with evaporite minerals (gypsum) present in the voids. This strata was encountered at a depth of 3495 feet and probably marks the top of the Paleocene-age sediments of the Cedar Keys limestone Formation.

HYDROGEOLOGIC SETTING

Subsurface conditions were determined by evaluation of the drill cuttings, laboratory tests conducted on cores, straddle-packer pumping tests, and through the interpretation of geophysical logs. The straddle-packer tests provided information on the hydraulic conductivity of the confining sequences and on water quality. Core testing conducted in the laboratory yielded additional information on the vertical permeability of the rock comprising the confining sequence. Geophysical logs were useful in measuring the relative porosities and the vertical extent of individual units. Evidence from each of these sources is used in the following text to describe hydrogeologic properties of the various confining sequences and water-bearing zones encountered during the drilling of the Coral Springs Improvement District Well.

Confining Sequence

Based on interpretation of the various data, the injection zone is overlain by a confining sequence in the interval between 1600 and 3000 feet. The most significant section of the confining sequence above the injection zone occurs between 2200 feet and 3000 feet below land surface. The limestone that comprises this sequence is a very fine-grained biomicritic rock interbedded with fine to coarse crystalline dolomite.

Within this confining sequence, five straddle-packer tests were conducted. The recovery data from the packer tests were analyzed using a method described by Schafer (1980) for low yield formations. The values of hydraulic conductivity determined from these tests (Table 1) ranged from 0.0000099 cm/sec to 0.000012 cm/sec. Laboratory tests conducted on the cores taken from this interval showed vertical permeabilities ranging from 0.0000000034 cm/sec to 0.000058 cm/sec. From the core data shown in Table 2, it can be seen that the porosities for the limestone in the confining sequence range from approximately 31 to 41 percent. These porosities are at the high end of generally expected porosity values for limestone. The vertical permeability of the limestone cores average 0.000042 cm/sec. Given these low values of permeability, it can be concluded that not all the pore spaces are interconnected and the effective porosity must be lower than the values obtained from the laboratory analyses.

TABLE 1

HYDRAULIC PROPERTIES OF
STRADDLE-PACKER TEST INTERVALS
CORAL SPRINGS IMPROVEMENT DISTRICT
INJECTION WELL 1
BROWARD COUNTY, 1985

Interval (feet)	Transmissivity (gpd/ft)	Hydraulic Conductivity (cm/sec)	Data Analyzed
1180-1227*			
1699-1746	25.9	2.6 x 10	t versus S/Q
1974-2020	7.8	8.0 x 10	t versus S/Q
2149-2195	11.7	1.2 x 10	t versus S/Q
2451-2498	9.9	9.9 x 10	t versus S/Q
2874-2921	3.0	3.0 x 10	t versus S/Q

* No hydraulic properties determined for this interval.

TABLE 2

RESULTS OF THE ANALYSES OF SELECTED
CORE SAMPLES
CORAL SPRINGS IMPROVEMENT DISTRICT
INJECTION WELL 1
BROWARD COUNTY, 1985

Core No.	Depth (ft.)	Porosity (%)	Permeability (cm/sec)	Description
1	2015.0 - 2016.2	41.5	0.000058	Limestone
2	2111.4 - 2112.0	31.4	0.000079	Limestone
3	2357.9 - 2358.4	34.2	0.0000095	Limestone
4	2704.2 - 2705.2	8.1	0.0000000034	Dolomite
5	2892.0 - 2892.8	35.1	0.000065	Limestone

Notes: (1) Four-inch-diameter cores.
(2) Analysis performed by Professional Service Industries, Inc., Clearwater, Florida.

The top and bottom of the confining sequence is indicated in a general way on the borehole-compensated sonic log. The confining strata are distinguished by relatively uniform traces that vary in amplitude over a limited range and indicate formation material having consistency in composition (limestone) and porosity. Zones containing fractured dolomite show erratic variations in signal amplitude due principally to cycle skipping caused by rock fractures and borehole irregularities.

Injection Zone

The presence of an injection zone was signaled during the drilling by a constant chattering of the drill string, which is characteristic of fractured formation. Confirmation of the presence of the injection zone was made from the cuttings, geophysical logs, TV survey and injection test. The results of the injection test are presented in a subsequent section of this report. Evidence gathered during drilling and testing confirmed that the injection zone consists of a fractured and cavernous dolomite. The top of the zone is approximately 300 feet into the Oldsmar Limestone. The depth to the top of the zone is approximately 3000 feet. The bottom of the zone was encountered at a depth of approximately 3500 feet.

The injection zone and occurrence of dolomite are shown clearly on the dual-induction and borehole-compensated sonic logs presented in

Appendix C. The resistivity profile shown on the dual-induction log varies considerably within the injection zone (3000-3500 feet). This response is due to the presence of massive, dense dolomite (higher resistivity) along with fractures and cavities containing salt water (low resistivity). On the borehole-compensated sonic log, the faster transit velocities and cycle skipping seen between 3000 feet and 3500 feet confirm the presence of dolomite containing large cavities. The presence of large cavities and fractures can also be seen on the television survey.

WATER QUALITY

Water samples were collected from the injection well during each straddle-packer pumping test for analysis of selected major ions. Laboratory test results are given in Appendix D. After the monitor tubes were developed, water samples were collected and analyzed for selected ions to establish background water quality. These analyses are presented in Appendix E.

During the straddle-packer tests, a 47-foot section of the pilot hole was isolated using inflatable packers provided and installed by TAM international. Each zone was pumped for a two-hour period using a submersible pump. Temperature and conductivity readings of the water pumped from the isolated zones were made periodically throughout the tests. The shallowest interval tested (1180 feet to 1227 feet) was not pumped. This zone was allowed to "free flow" for approximately

2.5 hours. Just prior to the end of the pumping tests, samples were collected from each zone for laboratory analysis. As shown by the data in Appendix D, the water quality of these samples is poor. Even the sample from the shallowest zone (1180 feet - 1227 feet) had TDS (total dissolved solids) concentrations greater than 10,000 mg/l (milligrams per liter).

Because the pilot hole was drilled using salt and mud to control flow, and given the high turbidity values of the samples, the monitor zones were developed continuously for a period of three weeks prior to collecting samples for laboratory analysis. As shown by the test results of the monitor zone samples in Appendix E, the TDS concentration in the upper monitor zone (1192 feet to 1222 feet) is greater than 10,000 mg/l, with a turbidity of less than 0.5 NTU's. The laboratory test results from the monitor zones after development show a 15 to 20 percent decline in the TDS concentrations from the straddle-packer test samples collected from the same zones. Because of the lack of turbidity in the sample taken after development of the upper monitor zone, the data should be representative of the native formation water. Based on these data, it can be seen that the contact between potable water (less than 10,000 mg/l TDS) and non-potable waters occurs in the interval between 1000 feet and 1200 feet.

This compares favorably with water-quality data from the monitor well at the City of Fort Lauderdale. The contact between potable and non-potable waters was found to occur in the interval between 1072 feet and 1457 feet deep. The TDS concentration at 1457 feet was 24,036 mg/l and the TDS concentration from 1072 feet was 6,834 mg/l.

The concentrations of nitrate in the monitor-zone samples are very high and not characteristic of typical native formation water at these depths. The chemist performing the analyses suggested that the test method utilized is sensitive to high TDS concentrations. Future samples should be analyzed using a test method which is not as sensitive to TDS concentrations, in order to verify the water quality with respect to nitrate.

The water-quality data obtained during the CSID drilling and testing program show that the injection zone contains water with more than 10,000 mg/l of TDS and the zone can be used for disposal of treated wastewater in compliance with Chapter 17-28 FAC.

INJECTION TEST

On June 2, 1985, an electronic pressure/temperature sensor was installed in the well at a depth of 2995 feet below pad level. Background pressure and temperature readings were collected for a period of 24 hours. The sensor was positioned at 2995 feet (approximately 5 feet above the bottom of the injection casing) so that the data collected during the test would be representative of the injection zone and would not be influenced by turbulence from fluid exiting the injection casing.

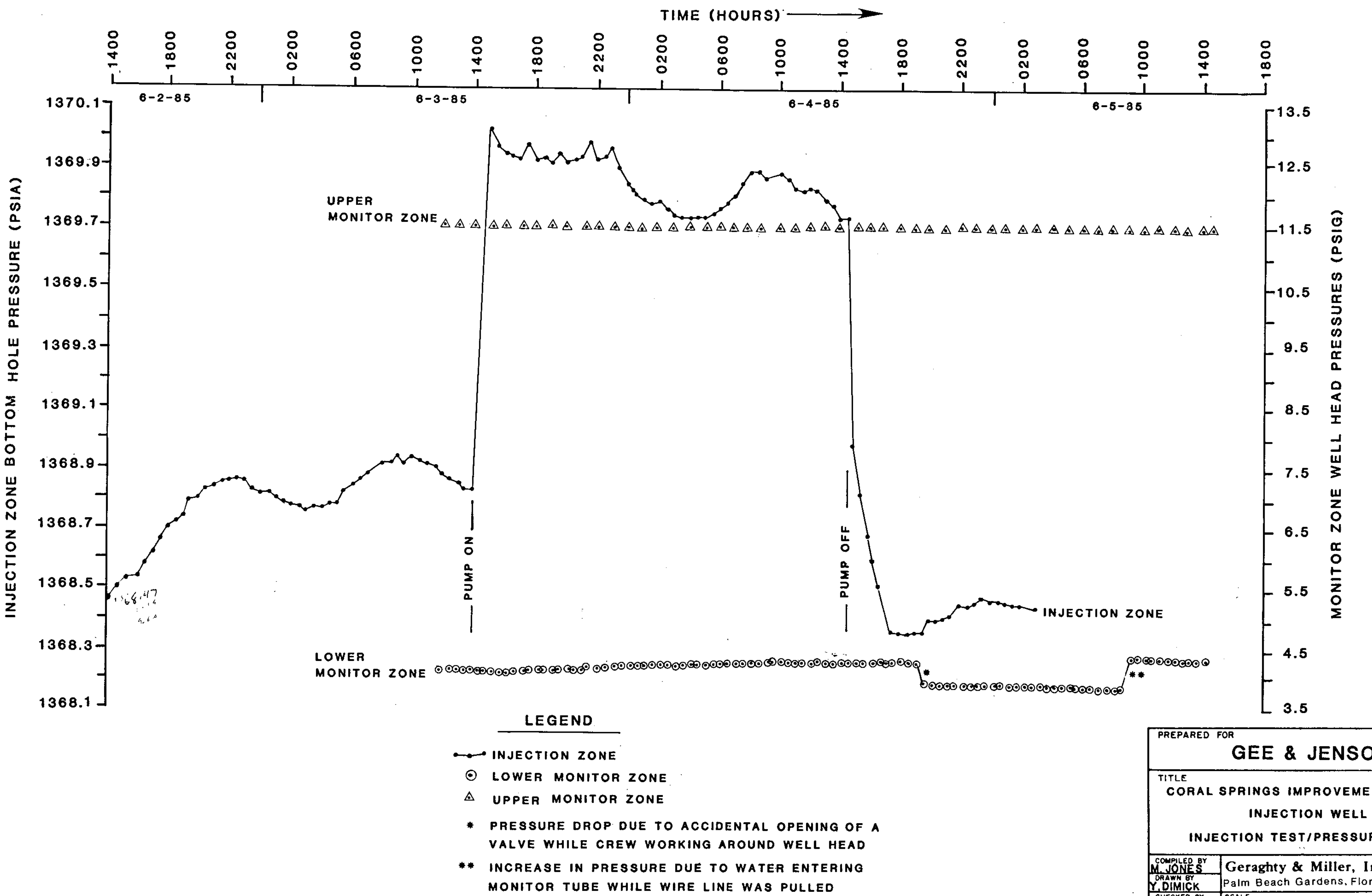
Monitoring during the injection test consisted of (1) water level of the lower monitor zone; (2) well-head pressure of the upper monitor zone; (3) flow in gpm (gallons per minute) through the pipeline to the well; (4) well-head injection pressure and temperature and (5) bottom-hole temperature and pressure at the top of the injection zone.

The pressure data collected from the bottom-hole sensor during the test is shown on Figure 2 along with the potentiometric levels of the monitor zones. Figure 3 shows the temperature data collected from the bottom-hole sensor during the test.

The injection test began at 2:30 p.m. on June 3, 1985, and was stopped 24 hours later. After the test, 12 hours of recovery data were collected from the bottom-hole sensor and 24 hours of data collected from the monitor zones. During the test, water was pumped into the well from a canal approximately 150 feet west of the well location via a 12-inch-diameter pipeline. The flow rate through the pipeline was measured with a Polysonics Hydra model flow meter. Flow to the well was maintained at a rate of 2600 gpm (anticipated peak flow rate) for a period of 24 hours.

TEST RESULTS INTERPRETATION

The following is an interpretation of the data collected during the test as shown on Figure 2 and Figure 3.

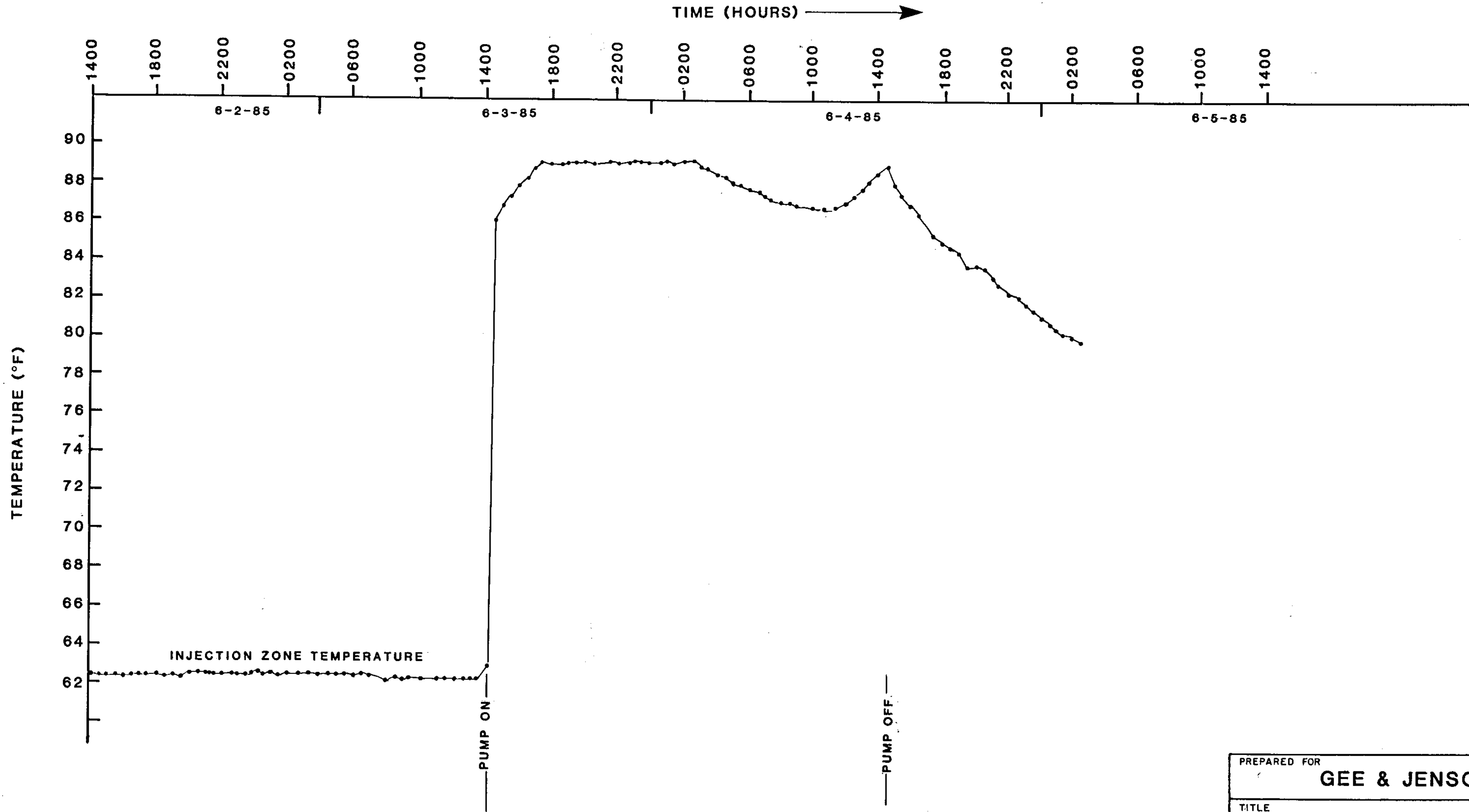


PREPARED FOR
GEE & JENSON

TITLE
CORAL SPRINGS IMPROVEMENT DISTRICT
INJECTION WELL
INJECTION TEST/PRESSURE DATA

COMPILED BY M. JONES DRAWN BY Y. DIMICK	Geraghty & Miller, Inc. Palm Beach Gardens, Florida	DATE JULY 1985 REVISED
CHECKED BY L. SIMS	SCALE AS SHOWN	FIGURE 2

P234C83



PREPARED FOR

GEE & JENSON

TITLE

CORAL SPRINGS IMPROVEMENT DISTRICT

INJECTION WELL

INJECTION TEST /TEMPERATURE DATA

COMPILED BY M. JONES	Geraghty & Miller, Inc.	DATE JULY 1985
DRAWN BY Y. DIMICK	Palm Beach Gardens, Florida	REVISED
CHECKED BY L. SIMS	SCALE AS SHOWN	FIGURE 3

P234C53

Time	Interpretation
1400 (June 3, 1985)	Pump on
1400-1430	Flow rate is established at 2600 gpm. Bottom-hole pressure increases 1.19 psi due to density changes in borehole as a result of temperature and salinity differences between injection fluid and borehole fluid. Pressure increase represents hydrostatic adjustments similar to a surge wave.
1430-1700	Bottom-hole pressure declines 0.10 psi after initial surge effects. Potentiometric level of lower monitor zone decreases slightly (0.01 psi) due to Noordbergum effect.
1700-2300	Bottom-hole pressure stabilized. Minor fluctuations (0.01 psi to 0.06 psi) due to minor fluctuations in flow rate.
2300-0400	Bottom-hole pressure drops 0.23 psi due to tidal fluctuations.
0400-0800	Bottom-hole pressure increases 0.15 psi due to tidal fluctuations and temperature decrease of injected water.
0800-1430	Bottom-hole pressure drops 0.15 psi due to tidal fluctuations and temperature increase of injected water.
1430 (June 5, 1985)	Pump off
1430-1730	Bottom-hole pressure decreases 1.37 psi due to hydrostatic stabilization and tidal fluctuations.

1730-2300	Bottom-hole pressure increases 0.12 psi due to tidal fluctuations.
2300-0230	Bottom-hole pressure decreases 0.04 psi due to tidal fluctuations.

As shown on Figure 2, comparison of the background bottom-hole pressure reading at 0300 hours on June 3, with the pressure reading taken during the injection test at 0400 hours on June 4, results in a pressure difference of 0.97 psi. These two points on the hydrograph correspond to periods of low tide during the diurnal cycle of tidal fluctuations. Similarly, comparison of the background bottom-hole pressure reading at 0900 hours on June 3, with the pressure reading taken during the injection test at 1000 hours on June 4, results in a pressure difference of 0.94 psi. In both instances, the pressure readings taken during the injection test are approximately 0.95 psi greater than those taken during corresponding tidal fluctuations in the background data. A bottom-hole pressure change of approximately 1.19 psi was recorded just after the injection test was started and a pressure change of approximately 1.37 psi was recorded just after the test was stopped. Therefore, the pressure increase attributable to injection is about 1.00 psi. Injection at a rate of 2600 gpm for a period of 24 hours results in a negligible pressure increase at the top of the injection zone.

As shown on Figure 3, the bottom-hole temperature remained relatively constant at about 62^{0} F (Degrees Fahrenheit) during the background period. Once the pump was started, the bottom-hole temperature rapidly increased to the ambient temperature of the canal water which was about 88^{o}F. By 4:30 p.m., the temperature had stabilized at about 88^{o} F and remained relatively constant until about 2 a.m. on June 4, 1985. The temperature decreased a couple of degrees during the period between 2 a.m. and 10 a.m. due to a decrease in the ambient temperature of the canal water during the early morning hours. From 10 a.m. until the pump was shut off at 2:30 p.m., the temperature increased a couple of degrees due to an increase in canal water temperature during the mid morning and early afternoon hours.

The temperature data collected during the recovery period may be useful for future mechanical integrity evaluations which utilize temperature logs. As shown on Figure 3, the temperature decay was nearly linear during the 12-hour recovery period. The temperature decreased at a rate of about 0.765^{o}F/hour during this period. At this rate, it would have taken approximately 34 hours for the temperature at the sensor to reach background values. This may be a conservatively small period of time because the temperature decay rate may not remain linear for the entire period of time required for temperature normalization. Also the effects of long term injection on the temperature decay rate are not known. However, based on the information collected during the injection test and assuming an ambient effluent temperature of 88^{o} F, the well should probably be allowed to remain out of operation a minimum of 48 hours before temperature logs are run for mechanical integrity testing purposes.

The data from the injection test, geophysical logs and television survey all show that the injection zone in the CSID well has the high transmissivity characteristic of the "Boulder Zone" in south Florida. A rough estimate of the transmissivity of the injection zone was made based on the injection test data using a method described by Walton (1970). Assuming that the specific capacity of the well is equal to the specific injectivity measured during the injection test, the transmissivity is estimated to be greater than 3,000,000 gpd/ft.

PLUGGING AND ABANDONMENT PLAN

In the event the CSID well has to be abandoned, it must be effectively sealed or plugged in order to prevent upward migration of fluid from the injection zone or interchange of formation waters through the borehole or along the casing.

In order to effectively plug the well, it will be necessary to mobilize a drill rig, "kill" the well, and remove the valve from the wellhead. The well will be "killed" by filling the casing with 9.0 ppg (pounds per gallon) of drilling mud. After the valve is removed, a bridge plug assembly will be set at the bottom of the injection casing. The plug assembly will consist of a short section of threaded casing with a bottom plug and two cement baskets attached to the outside. Above this section of casing will be approximately 100 feet of threaded casing which contains cement ports and several sets of left-handed threaded couplings. These couplings will be placed at the top and bottom of the top joint of casing. This assembly will be lowered into the well to a depth of 3000 feet on a string of drill pipe.

The cement baskets will be expanded and set by adding about five cubic feet of crushed limestone to the well and allowing it to settle. A mixture of neat cement will be pumped into the hole through the drill pipe and the cement ports above the cement baskets in the bridge plug assembly. The quantity of cement pumped should be equivalent to the volume of slurry required to fill the casing from the top of the crushed limestone to one foot below the lowermost left-hand threaded coupling.

The cement will be allowed to set for 24 hours, and then "tagged" with a wire line to determine if fill-up has been achieved. If not, additional crushed limestone will be added and another stage of cement pumped (a single stage of cement usually is sufficient to build the first portion of the bridge plug). A strain of no more than 1000 pounds above drill string weight will be exerted. If no movement occurs (other than pipe stretching), the plug will be considered set and the Contractor can proceed with disconnecting the assembly by rotating and "backing off" the drill pipe (right-hand rotation will unscrew the pipe from the left-hand threaded coupling). Then two successive small stages of no more than 100 feet of cement fill-up are pumped and given time to set. The remainder of the casing will then be filled with neat cement.

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The success of this program was due largely to the cooperative efforts of a number of individuals on the staffs of Broward County; Gee & Jenson Engineers, Inc.; the U.S. Environmental Protection Agency; the U.S. Geological Survey; the Florida Department of Environmental Regulation; the South Florida Water Management District; the Zeni Drilling Company; and Geraghty & Miller, Inc. All worked together to complete this important project that will enable the CSID to dispose of wastewater safely and protect the area's environment. Special thanks are due to each of the following individuals for their assistance, guidance, and cooperation:

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Terry A. Lawrence
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Respectfully submitted,
GERAGHTY & MILLER, INC.

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APPENDIX A

CSID Injection Well Geologic Log

GEOLOGIC LOG
OF
CORAL SPRINGS INJECTION WELL
WELL 1

Sample Description	Depth Interval (feet)	Thickness (feet)
SAND AND SILT - Sand, 95%, yellowish gray to dusky yellowish brown, quartz, fine-grained, sub-angular to sub-rounded; Silt, 5%, trace, roots, organic material.	0 - 1	1
SAND - Sand, 100%, yellowish gray to pinkish gray and clear, quartz, fine-grained, sub-angular to sub-rounded.	1 - 4	3
SHELLY SAND AND LIMESTONE - Sand, 50%, clear, quartz, fine to medium- coarse-grained, angular to sub-rounded; Shell, 20%, white, tan, very small-sized fragments; Limestone, 30%, grayish orange to dark yellowish orange, very fine-grained, micritic, very well cemented.	4 - 10	6
SHELLY SAND AND LIMESTONE - Sand, 70%, clear and frosted, quartz and calcite, fine to medium- coarse-grained, angular to sub-rounded; Shell, 25%, white, very small-sized fragments, bleached; Limestone, 5%, grayish orange, very fine-grained, micritic, very well cemented.	10 - 13	3
SANDSTONE AND SAND - Sandstone, 50%, quartz, phosphatic, pale yellowish brown, very fine-grained, angular to sub-rounded, well cemented in calcareous matrix, few shell fragments, very small; Sand, 50%, clear, frosted, unconsolidated, quartz and calcite, very fine-grained to medium-grained, angular to sub-rounded.	13 - 24	11

SAND AND LIMESTONE - Limestone, 60%, very pale orange, fine-grained, biomicrite, well cemented; Sand, 40%, quartz and calcite, clear, frosted, fine-grained, angular to sub-rounded.	24 - 31	7
SANDSTONE AND SAND - Sandstone, 90%, light gray to light olive gray, quartz, phosphatic, very fine- to fine-grained, rounded to sub-angular grains, very well cemented, solution cavities, porous; Sand, 10%, clear, frosted to black, quartz, phosphatic, unconsolidated fine-grained, angular to sub-rounded.	31 - 40	9
SANDSTONE AND SAND - Sandstone, 90%, light gray to light olive gray, quartz and phosphatic, very fine- to fine-grained, rounded to sub-angular grains, well cemented few solution cavities; Sand, 10%, clear to black, quartz, phosphatic, very fine- to fine-grained, angular to sub-rounded.	40 - 55	15
SANDY LIMESTONE - Limestone, 95%, grayish orange, phosphatic, fine-grained, biosparite, sandy, very well cemented; Sand, 5%, clear, quartz, very fine-grained, angular to sub-rounded; Marl, trace, yellowish gray, soft.	55 - 65	10
SANDSTONE AND SHELL - Sandstone, 90%, clear, black and light olive brown, quartz, phosphate, very fine- to fine-grained, rounded to sub-angular, well cemented, calcareous cement; Shell, 10%, white, fragments, angular.	65 - 74	9
SHELL AND SANDSTONE - Shell, 90%, very pale orange, fragments, pelecypoda, gastropoda; Sandstone, 10%, clear to black, quartz and phosphate, very fine-grained, rounded to angular, calcareous cement.	74 - 85	11

SANDSTONE AND SHELL - Sandstone, 85%, light olive gray, quartz, phosphatic, fine- to medium-grained, sub-angular, well cemented, calcareous cement; Shell, 15%, very pale orange, fragments, angular.	85 - 99	14
SANDSTONE AND SHELL - Sandstone, 60%, light olive gray, quartz, phosphatic, fine- to medium-grained, sub-angular, well cemented, calcareous cement; Shell, 40%, very pale orange, broken, fragmented.	99 - 119	20
SANDSTONE - Sandstone, 95%, clear to light olive gray, quartz, fine- to medium-grained, sub-angular, well cemented, calcareous cement; Shell, 5%, white, broken, fragments.	119 - 125	6
SANDSTONE AND SHELL - Sandstone, 75%, light olive gray, quartz, fine- to medium-grained, sub-angular, well cemented, calcareous cement; Shell, 25%, very pale orange, fractured, broken.	125 - 132	7
SANDSTONE AND SHELL - Sandstone, 80%, clear, light olive gray to black, quartz, phosphatic, fine- to medium-grained, angular to rounded, poorly cemented, calcareous cement; Shell, 20%, very pale orange and white, fragmented, angular, broken.	132 - 174	42
SANDY CLAY - Clay, 90%, light olive gray, plastic; Sand, 10%, clear to black, quartz, phosphatic, very fine- to medium-grained, sub-angular to sub-rounded, few very small shell fragments.	174 - 195	21
SANDY CLAY - Clay, 90%, grayish olive, plastic; Sand, 10%, clear to black, quartz, phosphatic, very fine- to medium-grained, sub-angular to sub-rounded.	195 - 245	50

SANDY CLAY - Clay, 90%, olive gray, plastic; Sand, 10%, clear and black, quartz, phosphatic, very fine-grained, sub-angular to sub-rounded.	245 - 485	240
SILTSTONE AND SANDY CLAY - Siltstone, 80%, olive gray to light olive gray, fossiliferous, siliceous, solution cavities, very hard; Clay, 15%, grayish olive to light olive gray, plastic; Sand, 5%, clear to black, quartz, phosphatic, very fine-grained to coarse-grained, angular to sub-rounded.	485 - 489	4
CLAY - Clay, 100%, pale olive, plastic, soft.	489 - 551	62
CLAY - Clay, 100%, pale olive, non-plastic, moderately hard.	551 - 563	12
MARLY LIMESTONE - Limestone, 60%, yellowish gray, fine-grained, micrite, calcareous cement, friable; Marl, 40%, yellowish gray, soft.	563 - 574	11
SANDY MARL - Marl, 70%, pale olive gray, soft; Sand, 30%, clear to black, quartz, phosphatic, very fine-grained, sub-angular to sub-rounded.	574 - 580	6
SANDY MARL AND LIMESTONE - Marl, 80%, pale olive gray, soft; Sand, 15%, clear to black, quartz, phosphatic, very fine-grained, sub-angular to sub-rounded; Limestone, 5%, pale olive gray, very fine-grained, micrite, friable, very soft.	580 - 590	10
SANDY MARL - Marl, 90%, pale olive gray, soft; Sand, 10%, clear to black, quartz, phosphatic, very fine-grained, sub-rounded.	590 - 630	40
CLAY - Clay, 100%, yellowish gray, soft, plastic.	630 - 666	36

MARLY LIMESTONE - Limestone, 70%, yellowish gray, fine-grained, biomicrite, friable; Marl, 30%, yellowish gray, plastic, soft.	666 - 672	6
SANDY MARL - Marl, 70%, yellowish gray, soft, plastic; Sand, 30%, clear to black, quartz, phosphatic, very fine to medium-coarse-grained, sub-angular to sub-rounded.	672 - 710	38
LIMESTONE - Limestone, 100%, yellowish gray, fine-grained, biomicrite, friable.	710 - 721	11
SANDY MARL - Marl, 90%, yellowish gray to pale olive, soft to moderately hard; Sand, 10%, clear to black, quartz, phosphatic, fine-grained, sub-angular.	721 - 735	14
MARLY LIMESTONE - Limestone, 70%, yellowish gray, fine-grained, biomicrite, friable; Marl, 30%, yellowish gray, plastic, soft.	735 - 740	5
SANDY MARL - Marl, 90%, yellowish gray to pale olive, soft to moderately hard; Sand, 10%, clear to black, quartz, phosphatic, fine-grained, sub-angular.	740 - 755.5	15.5
MARLY LIMESTONE - Limestone, 70%, yellowish gray, fine- to medium-grained; Marl, 30%, yellowish gray, plastic, soft.	755.5- 757.5	2
SANDY MARL - Marl, 80%, yellowish gray to light olive, soft; Sand, 20%, clear to black, quartz, phosphatic, fine- to medium-grained, sub-angular to rounded.	757.5- 804	46.5
MARLY LIMESTONE - Limestone, 80%, yellowish gray, fine- to medium-grained; Marl, 20%, yellowish gray to light olive, soft to moderately hard.	804 - 810	6

SANDY MARL - Marl, 80%, yellowish gray, soft; Sand, 20%, clear to black, quartz, phosphatic, fine- to medium-grained, sub-angular to rounded.	810 - 815	5
MARLY LIMESTONE - Limestone, 60%, yellowish gray, fine-grained, micrite, soft; Marl, 40%, yellowish gray, soft, sandy.	815 - 822	7
SANDY MARL - Marl, 80%, yellowish gray to light olive, soft; Sand, 20%, clear to black, quartz, phosphatic, fine- to medium-grained, sub-angular to rounded.	822 - 854	32
MARLY LIMESTONE - Limestone, 60%, yellowish gray, fine-grained, micrite, soft; Marl, 40%, yellowish gray, soft.	854 - 865	11
SANDY MARL - Marl, 70%, yellowish gray to light olive, soft; Sand, 30%, clear to black, quartz, phosphatic, fine- to medium-grained, sub-angular to rounded.	865 - 939	74
SANDY MARL AND SHELL - Marl, 60%, grayish olive, soft; Sand, 20%, clear to black, quartz, phosphatic, fine- to medium-grained, sub-angular to sub-rounded; Shell, 20%, white to pale orange, small fragments, bleached.	939 - 961	22
MARLY LIMESTONE - Limestone, 70%, yellowish gray, fine-grained, biomicrite, hard; Marl, 30%, yellowish gray, plastic, soft.	961 - 970	9
SANDY MARL - Marl, 70%, yellowish gray, soft; Sand, 30%, clear to black, quartz, phosphatic, fine- to medium-grained, sub-angular to rounded.	970 - 975	5
SANDY LIMESTONE - Limestone, 70%, yellowish gray, fine-grained, biomicrite, hard; Sand, 30%, clear to black, quartz, phosphatic, very fine-grained, sub-angular to rounded.	975 - 1000	25

SANDY MARL - Marl, 70%, light olive, soft; Sand, 30%, clear to black, quartz, phosphatic, very fine-grained, sub-angular to sub-rounded.	1000 - 1005	5
SANDY MARL AND SHELL - Marl, 50%, light olive, soft; Shell, 40%, pale orange, fragmented, rounded; Sand, 10%, clear to black, quartz, phosphatic, fine- to medium-grained, sub-angular to rounded.	1005 - 1020	15
MARLY LIMESTONE - Limestone, 80%, yellowish gray, fine-grained, biomicrite, soft; Marl, 20%, yellowish gray, plastic, soft.	1020 - 1026	6
LIMESTONE - Limestone, 100%, medium light gray to very pale orange, fine-grained, sparse biomicrite, hard.	1026 - 1030	4
LIMESTONE - Limestone, 100%, light gray to very pale orange, fine-grained, biomicrite, soft.	1030 - 1061	31
LIMESTONE AND SAND - Limestone, 60%, light olive gray to very pale orange, fine-grained, sparse biomicrite, hard; Sand, 40%, clear to black, quartz, phosphatic, very fine to fine-grained, sub-angular to sub-rounded.	1061 - 1075	14
LIMESTONE AND SAND - Limestone, 75%, very light gray to light olive gray, fine-grained, hard; Sand, 25%, clear to black, quartz, phosphatic fine-grained, sub-angular to sub-rounded; Shell fragments and white Clay, trace.	1075 - 1080	5
SANDY MARL AND SHELL - Marl, 50%, very pale orange to light gray; Shell, 35%, very pale orange, fragmented, rounded; Sand, 15%, clear to black, quartz, phosphatic, fine- to medium-grained, sub-angular to sub-rounded.	1080 - 1086	6

SAND - Sand, 100%, very pale orange to light brown, calcareous, medium- to coarse-grained, unconsolidated, sub-angular to sub-rounded.	1086 - 1110	24
SANDY MARL - Marl, 80%, light brown, calcareous, hard; Sand, 20%, clear to very pale orange, quartz, fine- to medium-grained, sub-angular to sub-rounded.	1110 - 1164	54
LIMESTONE - Limestone, 100%, very pale orange to grayish orange, fine- to medium-grained, soft.	1164 - 1235	71
MARLY LIMESTONE - Limestone, 60%, very pale orange, fine- to medium-grained, calcareous soft; Marl, 40%, light olive green, soft, plastic.	1235 - 1240	5
LIMESTONE - Limestone, 100%, very pale orange, fine- to medium-grained, soft.	1240 - 1245	5
LIMESTONE AND MARL - Marl, 60%, grayish olive green, soft, plastic; Limestone, 40%, very pale orange, fine- to medium-grained, soft.	1245 - 1248	3
LIMESTONE - Limestone, 100%, grayish orange, fine- to medium-grained, soft.	1248 - 1302	54
LIMESTONE AND MARL - Limestone, 60%, very pale orange, fine- to medium-grained, soft; Marl, 40%, light olive green, soft, plastic.	1302 - 1306	4
LIMESTONE - Limestone, 100%, very pale orange, fine- to medium-grained soft.	1306 - 1312	6
LIMESTONE AND MARL - Limestone, 70%, very pale orange, fine- to medium-grained, soft; Marl, 30%, light olive green, soft, plastic.	1312 - 1315	3

LIMESTONE - Limestone, 100%, very pale orange, fine- to medium-grained, soft.	1315 - 1347	32
LIMESTONE - Limestone, 100%, very pale orange to medium gray, fine- to medium-grained, soft to moderately hard.	1347 - 1366	19
LIMESTONE AND MARL - Limestone, 95%, very pale orange, fine- to medium-grained, soft; Marl, 5%, light olive green, soft, plastic.	1366 - 1381	15
LIMESTONE - Limestone, 100%, very pale orange to medium gray, fine- to medium-grained, soft to moderately hard.	1381 - 1385	4
LIMESTONE - Limestone, 100%, very pale orange, fine- to medium-grained, soft.	1385 - 1412	27
LIMESTONE - Limestone, 100%, very pale orange to medium gray, fine- to medium-grained, soft to moderately hard.	1412 - 1420	8
LIMESTONE AND MARL - Limestone, 70%, very pale orange to medium gray, fine- to medium-grained, soft to hard; Marl, 30%, light olive green, soft, plastic.	1420 - 1425	5
LIMESTONE - Limestone, 100%, very pale orange to medium gray, fine- to medium grained, soft to hard.	1425 - 1487	62
LIMESTONE AND MARL - Limestone, 70%, very pale orange to white, fine- to medium-grained, soft; Marl, 30%, light olive green, soft plastic.	1487 - 1493	6
LIMESTONE - Limestone, 100%, very pale orange to medium gray, fine- to medium-grained, soft; Chert, trace.	1493 - 1638	145

LIMESTONE - Limestone, 100%, light gray, fine-grained, micrite, solution cavities, moderately hard.	1638 - 1641	3
LIMESTONE - Limestone, 100%, light gray to very pale orange, fine-grained, micrite, solution cavities, moderately hard.	1641 - 1651	10
LIMESTONE - Limestone, 100%, pinkish gray, fine-grained, biosparite, moderately soft; Trace, marly, yellowish gray, soft.	1651 - 1668	17
LIMESTONE - Limestone, 100%, pale yellowish brown, fine-grained, biosparite, moderately soft.	1668 - 1720	52
LIMESTONE - Limestone, 100%, very pale orange to medium gray, fine- to medium-grained, soft.	1720 - 1765	45
LIMESTONE - Limestone, 100%, grayish orange to medium dark gray, fine- to medium-grained, soft.	1765 - 1772	7
LIMESTONE - Limestone, 100%, very pale orange, fine- to medium-grained, very soft.	1772 - 1783	11
LIMESTONE - Limestone, 100%, very pale orange to medium gray, fine-grained, biosparite, fossiliferous.	1783 - 1825	42
LIMESTONE - Limestone, 100%, gray to pale orange, fine-grained, biosparite, solution cavities, moderately soft, fossiliferous; Chert, trace.	1825 - 2003	178
LIMESTONE - Limestone, 100%, very pale orange, fine-grained, biosparite, solution cavities, moderately soft, fossiliferous.	2003 - 2055	52

LIMESTONE - Limestone, 100%, very pale orange to olive gray, fine-grained, biosparite, solution cavities, moderately soft to moderately hard, fossiliferous.	2055 - 2077	22
DOLOMITE AND LIMESTONE - Dolomite, 70%, dark yellowish brown to dusky brown, microcrystalline, hard, solution cavities, pinhole vugs; Limestone, 30%, very pale orange, fine-grained, biosparite, moderately soft, fossiliferous.	2077 - 2078.5	1.5
LIMESTONE - Limestone, 100%, very pale orange to olive gray, fine-grained, biosparite, moderately soft, fossiliferous.	2078.5- 2142	63.5
DOLOMITE AND LIMESTONE (interbedded) - Dolomite, 60%, dark yellowish brown, to olive gray, very hard, solution cavities, vuggy; Limestone, 40%, pinkish gray, fine-grained, moderately soft, biomicrite; Trace, chert, medium light gray.	2142 - 2160	18
DOLOMITE - Dolomite, 90%, pale brown to brown, microcrystalline, solution cavities, very hard; Limestone, 10%, very pale orange, fine-grained, biosparite, soft, fossiliferous.	2160 - 2188	28
DOLOMITE AND LIMESTONE (interbedded) - Dolomite, 70%, brown to pale brown and light gray, microcrystalline, solution cavities, very hard; Limestone, 30%, very pale orange, fine-grained, moderately hard to soft.	2188 - 2205	17
DOLOMITE AND LIMESTONE - Dolomite, 90%, pale brown to brown, microcrystalline, solution cavities, pinhole vugs, moderate to very hard; Limestone, 10%, very pale orange, fine-grained, biosparite, moderately soft.	2205 - 2255	50

LIMESTONE - Limestone, 100%, very pale orange to gray, fine- to medium-grained, biosparite, fossiliferous, moderately hard; Trace, dolomite, pale brown to brown.	2255 - 2357	102
LIMESTONE - Limestone, 100%, very pale orange to gray, fine- to medium-grained, biosparite, fossiliferous, moderately hard; Trace, dolomite, pale brown to brown.	2357 - 2420	63
LIMESTONE AND SAND - Limestone, 80%, very pale orange to gray, fine- to medium-grained, biosparite, fossiliferous, moderately hard; Sand, 20%, clear, quartz, fine-grained, angular.	2420 - 2435	15
LIMESTONE - Limestone, 100%, very pale orange to dark gray, fine- to medium-grained, biosparite, fossiliferous, moderately hard; Dolomite, trace, pale brown to brown.	2435 - 2660	225
DOLOMITE AND LIMESTONE - Dolomite, 80%, pale brown to brown, vuggy, hard; Limestone, 20%, very pale orange to orange, pink, fine- to coarse-grained, biosparite, fossiliferous, soft.	2660 - 2668	8
LIMESTONE AND DOLOMITE - Limestone, 90%, very pale orange to gray, fine- to medium-grained, biosparite, fossiliferous, moderately hard; Dolomite, 10%, pale brown to brown, hard.	2668 - 2672	4
DOLOMITE AND LIMESTONE - Dolomite, 80%, light brown to brown, fine-grained, solution cavities, very hard; Limestone, 20%, very pale orange to gray, fine- to medium grained, biosparite, fossiliferous, moderately hard.	2672 - 2702	30

LIMESTONE - Limestone, 60%, very pale orange to white, medium-grained, biosparite, fossiliferous, moderately hard; Limestone, 40%, dark gray, micrite, solution cavities, hard; Dolomite, trace, light brown.	2702 - 2728	26
DOLOMITE AND LIMESTONE - Dolomite, 80%, light brown to brown, fine-grained, solution cavities, hard; Limestone, 20%, very pale orange to white, fine- to medium-grained, biosparite, fossiliferous, moderately hard.	2728 - 2730	2
LIMESTONE - Limestone, 100%, very pale orange to white, medium-grained, fossiliferous, solution cavities, moderately hard to hard; Dolomite, trace, light brown, trace, micrite, dark gray to grayish black.	2730 - 3087	357
DOLOMITE AND LIMESTONE - Dolomite, 75%, pale yellowish brown to medium dark gray, dense, hard, solution cavities, vuggy; Limestone, 25%, white to very light gray, biosparite, very fine-grained, soft.	3087 - 3100	13
DOLOMITE - Dolomite, 80%, grayish orange, medium- to coarse-grained, vuggy, drusy; Dolomite, 20%, pale yellowish brown to dark yellowish brown, hard, dense.	3100 - 3105	5
DOLOMITE - Dolomite, 100%, pale yellowish brown, hard, dense; Trace, limestone, very pale orange, fine-grained, sparite, well cemented; Limestone, trace, light gray to pinkish gray, microcrystalline, micrite.	3105 - 3115	10
DOLOMITE - Dolomite, 100%, pale yellowish brown to dark gray, hard, dense, microcrystalline.	3115 - 3120	5
DOLOMITE - Dolomite, 100%, pale yellowish brown, hard, dense, microcrystalline, solution cavities.	3120 - 3125	5

DOLOMITE - Dolomite, 100%, pale yellowish brown to very light gray, dense, microcrystalline.	3125 - 3133	8
DOLOMITE - Dolomite, 50%, very pale orange, fractured, microcrystalline, non-porous; Dolomite, 40%, moderate yellowish brown to pale yellowish brown, microcrystalline; Dolomite, 10%, grayish orange to very pale orange, drusy, vuggy, medium-grained, granular.	3133 - 3138	5
DOLOMITE - Dolomite, 60%, light brown to gray, dense, microcrystalline, hard, fractured; Dolomite, 40%, light gray, microcrystalline, non-porous, fractured.	3138 - 3141	3
DOLOMITE - Dolomite, 100%, pale yellowish brown, hard, dense, fractured, microcrystalline, pinhole vugs.	3141 - 3149	8
DOLOMITE - Dolomite, 100%, light olive gray to pale yellowish brown, dense, microcrystalline.	3149 - 3157	8
DOLOMITE - Dolomite, 90%, yellowish gray to pale yellowish brown, dense, microcrystalline; Dolomite, 10%, moderate yellowish brown, drusy, medium- to coarse-grained; Dolomite, trace, dusky yellowish brown to dark yellowish brown, microcrystalline, dense, pinhole vugs.	3157 - 3175	18
DOLOMITE - Dolomite, 90%, light olive gray, pale yellowish brown, and grayish black, dense, microcrystalline, some solution cavity crystal growth; Dolomite, 10%, moderate yellowish brown, medium-grained, sub-rounded.	3175 - 3180	5
DOLOMITE - Dolomite, 100%, very light gray, dense, microcrystalline; Dolomite, trace, very pale orange, fine- to medium-grained, sub-rounded.	3180 - 3183	3

DOLOMITE - Dolomite, 100%, very pale orange, dense, microcrystalline.	3183 - 3188	5
DOLOMITE - Dolomite, 90%, very light gray to light gray, dense, microcrystalline, pinhole, vugs; Dolomite, 10%, very pale orange, dense, microcrystalline, pinhole, vugs.	3188 - 3194	6
DOLOMITE - Dolomite, 100%, pale yellowish brown to light gray, microcrystalline; Trace, white, fine-grained, rounded, good to poor cementing; Trace, light brown to yellowish brown, fractured; Trace, yellowish brown to pale yellowish brown, drusy, fine- to medium-grained, vuggy.	3194 - 3332	138
SANDY CLAY AND DOLOMITE - Clay, 60%, medium bluish gray, plastic, marcasite crystals; Sand, 10%, clear to pale orange, fine- to medium-grained, sub-angular to rounded; Dolomite, 30%, very pale orange to medium light gray, dense, microcrystalline.	3332 - 3335	3
DOLOMITE - Dolomite, 100%, very pale orange to medium light gray, dense, microcrystalline, some solution cavities with crystal growth; Clay, trace, light bluish gray, soft, marcasite crystals.	3335 - 3340	5
DOLOMITE AND CLAY - Dolomite, 90%, yellowish gray to pale yellowish brown, dense, microcrystalline; Clay, 10%, medium bluish gray, plastic.	3340 - 3345	5
DOLOMITE - Dolomite, 100%, pale yellowish gray, dense, microcrystalline, fractured; Clay, trace, medium bluish gray, soft, plastic.	3345 - 3350	5

DOLOMITE - Dolomite, 100%, pale yellowish brown to very pale orange, dense, microcrystalline, fractured; Clay, trace, bluish gray, some iron-stained surfaces.	3350 - 3354	4
DOLOMITE - Dolomite, 100%, pale yellowish brown to dark yellowish brown, dark gray, dense, microcrystalline, fractured; Trace, light brown, drusy crystal growth in solution cavities; Clay, trace, medium bluish gray to medium dark gray, occasional pyrite or marcasite crystals.	3354 - 3375	21
DOLOMITE AND CLAY - Dolomite, 90%, brownish gray to grayish black, dense, microcrystalline, fractured; Clay, 10%, medium bluish gray to grayish black, plastic.	3375 - 3380	5
DOLOMITE - Dolomite, 100%, pale yellowish brown to dusky brown, black, dense, microcrystalline, well fractured; Clay, trace, medium bluish gray, plastic, marcasite or pyrite crystals.	3380 - 3490	110
DOLOMITE - Dolomite, 100%, very pale orange to grayish orange, sucrosic, pinhole.	3490 - 3495	5
DOLOMITE AND GYPSUM - Dolomite, 70%, very pale orange to grayish orange, pinhole, vugs; Gypsum, 30%, clear to white opaque, soft.	3495 - 3500	5+
TOTAL DEPTH	3500	

APPENDIX B

CSID Injection Well
Laboratory Results of Core Analysis

Professional Service Industries, Inc.
Florida Testing Division

Zeni Drilling Company
3600 North Ocean Drive
Apt. 125
Riviera Beach, Florida 33404

February 22, 1985
File No. 384-52013
Report No. 1

Attention: Mr. Bob Harshman

Re: Rock Core Permeability

Gentlemen:

Submitted herein are the results of laboratory tests performed on five (5) core samples shipped to our office. Please find all of the requested data on the Summary of Results included with this cover letter.

The permeability tests were performed with the falling lead method used by the U.S. Corps of Engineers. No confining pressures were used except for the water head pressure of approximately four (4) feet. Specific gravity tests were performed in accordance with A.S.T.M. D-854.

If you should have any questions, or if we may be of further assistance, please do not hesitate to contact us at the Clearwater office.

Sincerely,

PSI/FLORIDA TESTING DIVISION

Curtis M. Karr
Branch Manager

CMK:bjn
Enclosure
Copies: (3)

SUMMARY OF RESULTS

Core Depth (Feet)	Unit Dry Weight (pcf)	Bulk Specific Gravity	Permeability (cm/sec.)	Porosity
2,015 - 2,016.2	99.0	2.71	5.8×10^{-5}	0.415
2,111.4 - 2,112.0	115.7	2.70	7.9×10^{-5}	0.314
2,357.9 - 2,358.4	111.4	2.71	9.5×10^{-6}	0.342
2,704.2 - 2,705.2	164.1	2.86	3.4×10^{-9}	0.081
2,892.0 - 2,892.8	109.4	2.70	6.5×10^{-5}	0.351

APPENDIX C

CSID Injection Well Geophysical Logs

Report: **Construction & Testing of an Injection Well Coral Springs Improvement District Broward County, Florida**

Appendix	Log Name	Date	Depths	
			Top	Bottom
C	Caliper	01/24/1984	3094	0960
	Resistivity/Spontaneous Potential	01/25/1984	3098	0960
(back)	Temperature	01/24/1984	3098	0010
	BHC Sonic	05/29/1985	3166	2997
	Geologic Column, Core & Straddle Packer Data with Sonic, Neutron, Dual Induction Logs	09/01/1985	-	-

GERAGHTY & MILLER, INC.

P234CS3

RESISTIVITY/ SPONTANEOUS POTENTIAL

COMPANY CORAL SPRINGS IMPROVEMENT DISTRICT
WELL WELL #1
LOCATION BROWARD
FLA.

COMPANY CORAL SPRINGS IMPROVEMENT DISTRICT
WELL WELL #1
FIELD
COUNTY BROWARD STATE FLA.
LOCATION: OTHER SERVICES
SEC TWP RGE

PERMANENT DATUM PAD LEVEL ELEV.
LOG MEASURED FROM 0 ft. above perm. datum
DRILLING MEASURED FROM
ELEV. K.B. D.F. G.L. T.O.C.

DATE	1/25/84
RUN No.	
TYPE LOG	
DEPTH - DRILLER	
DEPTH - LOGGER	
BTM LOG INTER	3098
TOP LOG INTER	960
TYPE FLUID IN HOLE	
SALINITY ppm Cl	
DENSITY lb/gal	
LEVEL	
MAX REC. TEMP. °F	
OPER. RIG TIME	
RECORDED BY	
WITNESSED BY	

RUN No.	BORE HOLE RECORD			CASING RECORD			
	BIT	FROM	TO	SIZE	WGT.	FROM	TO

REMARKS:
LOGGING DONE BY: SOUTHERN RESOURCES EXPLORATION

SCALE CHANGES			
Type Log	Depth	Scale Up Hole	Scale Down Hole

Spontaneous Potential
200 millivolts/inch
5 F.P.M.

Resistivity
200 Ohms/inch
5 F.P.M.

GERAGHTY & MILLER, INC.

P234CS3

CALIPER

COMPANY CORAL SPRINGS IMPROVEMENT DISTRICT
WELL WELL #1
LOCATION BROWARD
FLA.

COMPANY CORAL SPRINGS IMPROVEMENT DISTRICT
WELL WELL #1
FIELD
COUNTY BROWARD STATE FLA.
LOCATION: OTHER SERVICES
SEC TWP RGE

PERMANENT DATUM PAD LEVEL ELEV. ELEV. KB
LOG MEASURED FROM 0 ft. above perm. datum DF
DRILLING MEASURED FROM GL
T.O.C.

DATE	1/24/84
RUN No.	
TYPE LOG	
DEPTH - DRILLER	
DEPTH - LOGGER	
BTM LOG INTER	3094
TOP LOG INTER	960
TYPE FLUID IN HOLE	
SALINITY ppm Cl	
DENSITY lb/gal	
LEVEL	
MAX REC TEMP - °F	
OPER RIG TIME	
RECORDED BY	
WITNESSED BY	

RUN No.	BORE HOLE RECORD			CASING RECORD			
	BIT	FROM	TO	SIZE	WGT	FROM	TO

REMARKS:
LOGGING DONE BY: SOUTHERN RESOURCES EXPLORATION

SCALE CHANGES			
Type Log	Depth	Scale Up Hole	Scale Down Hole

HOLE SIZE (INCHES)

6 10 14 18 22 26 30 34

APPENDIX D

CSID Injection Well
Water-Quality Analyses
From Straddle-Packer Tests

APPENDIX D

CHLORIDE AND TOTAL DISSOLVED SOLIDS CONCENTRATIONS
FROM STRADDLE-PACKER WATER SAMPLES
CORAL SPRINGS IMPROVEMENT DISTRICT
INJECTION WELL #1
BROWARD COUNTY, 1985

Interval (feet)	Chloride (mg/l)	TDS (mg/l)
1180 - 1227	10,097	18,900
1699 - 1746	15,095	28,700
1973 - 2020	16,195	33,000
2149 - 2195	16,295	30,500
2451 - 2498	14,995	28,300
2874 - 2920	14,795	28,000

chlorides 250
USDW 10,000

BROWARD TESTING LABORATORY, INC.

LABORATORY CERTIFICATION NUMBER 86137

LABORATORY PARAMETER ANALYSIS REPORT

SITE Zeni Well Drilling

SOURCE 2874'-2920
LAB. NUMBER 850891
GROUNDWATER CLASS
SAMPLED BY Zeni Well Drilling
NO. WELL CASING VOL. PURGED

SAMPLE DATE 1/26 & 1/27/85
SAMPLE TIME
SAMPLE COMPLETION DATE 2/21/85
WELL TYPE: ( ) BACKGROUND
( ) SITE BOUNDRY
( ) INTERMEDIATE
( ) COMPLIANCE

Parameter Monitored	Storet Code	Analysis Method	Analysis Result	Unit
TEMPERATURE	00006	170.1	25.5	°C
P.H.	00403	150.1	6.95	Units
Turbidity	82079	180.1	49	NTU
Color	00080	110.2	5	Units
Sulfate	00945	375.2	1200	mg/l
Iron	01046	236.1	0.352	mg/l
T.D.S.	00530	160.2	28,000	mg/l
Total Hardness	00900	130.2	2220	mg/l
Hydroxide	71830	**	0	mg/l
Hydrogen Sulfide	71875	427.5	Nil	mg/l
Non-Carbonate Hardness	00902	**	2140	mg/l
Bicarbonate Hardness	00440	**	48.8	mg/l
Total Phosphate Phosphorous	00665	365.4	0.01	mg/l
Total Nitrogen	00625	351.4	2.63	mg/l
Nitrate Nitrogen	00620	352.1	0.32	mg/l
Nitrite Nitrogen	00615	354.1	0.01	mg/l
Organic Nitrogen	00605	calculated	0.70	mg/l
Ammonia Nitrogen	00610	350.3	1.6	mg/l
Specific Conductivity	00095	120.1	42300	*
Sodium	00930	273.1	7210.4	mg/l
Calcium	00916	215.1	769.5	mg/l
Magnesium	01056	242.1	352.5	mg/l
Carbon Dioxide	00405	**	17	mg/l
Carbonate Hardness	00901	**	1920	mg/l
Potassium	00937	258.1	188	mg/l
Chloride	00940	408A	14,795	mg/l
Total Alkalinity	00410	310.2	80	mg/l

REMARKS: *Conductivity is expressed in micromhos/cm
**Calculated as $CaCO_3$

Kerry Prescott, Kitty Vagi, Pat Goodwir
Jeff Genualdi

BROWARD TESTING LABORATORY, INC.

LABORATORY CERTIFICATION NUMBER 86137

LABORATORY PARAMETER ANALYSIS REPORT

SITE Zeni Well Drilling

SOURCE 2451'-2498'
LAB. NUMBER 850890
GROUNDWATER CLASS
SAMPLED BY Zeni Well Drilling
NO. WELL CASING VOL. PURGED

SAMPLE DATE 1/26 & 1/27/85
SAMPLE TIME
SAMPLE COMPLETION DATE 2/21/85
WELL TYPE: ( ) BACKGROUND
( ) SITE BOUNDRY
( ) INTERMEDIATE
( ) COMPLIANCE

Parameter Monitored	Storet Code	Analysis Method	Analysis Result	Unit
Temperature	00006	170.1	25.7	°C
P.H.	00403	150.1	6.95	Units
Turbidity	82079	180.1	49	NTU
Color	00080	110.2	15	Units
Sulfate	00945	375.2	1000	mg/l
Iron	01046	236.1	0.55	mg/l
T.D.S.	00530	160.2	28300	mg/l
Total Hardness	00900	130.2	2280	mg/l
Hydroxide	71830	**	0	mg/l
Hydrogen Sulfide	71875	427.5	Nil	mg/l
Non-Carbonate Hardness	00902	**	2180	mg/l
Bicarbonate Hardness	00440	**	61	mg/l
Total Phosphate Phosphorous	00665	365.4	0.01	mg/l
Total Nitrogen	00625	351.4	3.58	mg/l
Nitrate Nitrogen	00620	352.1	0.32	mg/l
Nitrite Nitrogen	00615	354.1	0.055	mg/l
Organic Nitrogen	00605	calculated	1.76	mg/l
Ammonia Nitrogen	00610	350.3	1.44	mg/l
Specific Conductivity	00095	120.1	43200	*
Sodium	00930	273.1	7210.4	mg/l
Calcium	00916	215.1	785	mg/l
Magnesium	01056	242.1	363.3	mg/l
Carbon Dioxide	00405	**	22	mg/l
Carbonate Hardness	00901	**	1960	mg/l
Potassium	00937	258.1	221	mg/l
Chloride	00940	408A	14,995	mg/l
Total Alkalinity	00410	310.2	100	mg/l

REMARKS: *Conductivity is expressed in micromhos/cm

**Calculated as $CaCO_3$

Kerry Prescott, Kitty Vagi, Pat Goodwin
Jeff Genualdi

BROWARD TESTING LABORATORY, INC.

LABORATORY CERTIFICATION NUMBER 86137

LABORATORY PARAMETER ANALYSIS REPORT

SITE Zeni Well Drilling

SOURCE 2149'-2195'
LAB. NUMBER 850889
GROUNDWATER CLASS
SAMPLED BY Zeni Well Drilling
NO. WELL CASING VOL. PURGED

SAMPLE DATE 1/26 & 1/27/85
SAMPLE TIME
SAMPLE COMPLETION DATE 2/21/85
WELL TYPE: ( ) BACKGROUND
( ) SITE BOUNDRY
( ) INTERMEDIATE
( ) COMPLIANCE

Parameter Monitored	Storet Code	Analysis Method	Analysis Result	Unit
Temperature	00006	170.1	26.0	°C
P.H.	00403	150.1	6.9	Units
Turbidity	82079	180.1	40	NTU
Color	00080	110.2	10	Units
Sulfate	00945	375.2	1000	mg/l
Iron	01046	236.1	0.778	mg/l
T.D.S.	00530	160.2	30500	mg/l
Total Hardness	00900	130.2	2900	mg/l
Hydroxide	71830	**	0	mg/l
Hydrogen Sulfide	71875	427.5	Nil	mg/l
Non-Carbonate Hardness	00902	**	2736	mg/l
Bicarbonate Hardness	00440	**	100	mg/l
Total Phosphate Phosphorous	00665	365.4	0.07	mg/l
Total Nitrogen	00625	351.4	3.42	mg/l
Nitrate Nitrogen	00620	352.1	0.32	mg/l
Nitrite Nitrogen	00615	354.1	0.005	mg/l
Organic Nitrogen	00605	calculated	2.28	mg/l
Ammonia Nitrogen	00610	350.3	0.82	mg/l
Specific Conductivity	00095	120.1	47,100	*
Sodium	00930	273.1	8307.1	mg/l
Calcium	00916	215.1	978	mg/l
Magnesium	01056	242.1	467	mg/l
Carbon Dioxide	00405	**	40	mg/l
Carbonate Hardness	00901	**	2240	mg/l
Potassium	00937	258.1	287	mg/l
Chloride	00940	408A	16,295	mg/l
Total Alkalinity	00410	310.2	164	mg/l

REMARKS: *Conductivity is expressed in micromhos/cm
**Calculated as $CaCO_3$

Kerry Prescott, Kitty Vagi, Pat Goodwin
Jeff Genualdi
ANALYSTS:

BROWARD TESTING LABORATORY, INC.

LABORATORY CERTIFICATION NUMBER 86137

LABORATORY PARAMETER ANALYSIS REPORT

SITE Zeni Well Drilling

SOURCE 1973'-2020'
LAB. NUMBER 850888
GROUNDWATER CLASS
SAMPLED BY Zeni Well Drilling
NO. WELL CASING VOL. PURGED

SAMPLE DATE 1/26 & 1/27/85
SAMPLE TIME
SAMPLE COMPLETION DATE 2/21/85
WELL TYPE: ( ) BACKGROUND
( ) SITE BOUNDRY
( ) INTERMEDIATE
( ) COMPLIANCE

Parameter Monitored	Storet Code	Analysis Method	Analysis Result	Unit
TEMPERATURE	00006	170.1	25.5	°C
P.H.	00403	150.1	6.9	Units
Turbidity	82079	180.1	51	NTU
Color	00080	110.2	10	Units
Sulfate	00945	375.2	900	mg/l
Iron	01046	236.1	0.816	mg/l
T.D.S.	00530	160.2	33,000	mg/l
Total Hardness	00900	130.2	2460	mg/l
Hydroxide	71830	**	0	mg/l
Hydrogen Sulfide	71875	427.5	Nil	mg/l
Non-Carbonate Hardness	00902	**	2296	mg/l
Bicarbonate Hardness	00440	**	100	mg/l
Total Phosphate Phosphorous	00665	365.4	0.09	mg/l
Total Nitrogen	00625	351.4	3.68	mg/l
Nitrate Nitrogen	00620	352.1	0.47	mg/l
Nitrite Nitrogen	00615	354.1	0.01	mg/l
Organic Nitrogen	00605	calculated	2.25	mg/l
Ammonia Nitrogen	00610	350.3	0.95	mg/l
Specific Conductivity	00095	120.1	46,800	*
Sodium	00930	273.1	8307.1	mg/l
Calcium	00916	215.1	881.8	mg/l
Magnesium	01056	242.1	383.5	mg/l
Carbon Dioxide	00405	**	40	mg/l
Carbonate Hardness	00901	**	2200	mg/l
Potassium	00937	258.1	254.9	mg/l
Chloride	00940	408A	16,195	mg/l
Total Alkalinity	00410	310.2	164	mg/l

REMARKS: *Conductivity is expressed in micromhos/cm
**Calculated as $CaCO_3$

Kerry Prescott, Kitty Vagi, Pat Goodwin
Jeff Genualdi
ANALYSTS:

BROWARD TESTING LABORATORY, INC.

LABORATORY CERTIFICATION NUMBER 86137

LABORATORY PARAMETER ANALYSIS REPORT

SITE Zeni Well Drilling

SOURCE 1699'-1746'
LAB. NUMBER 850887
GROUNDWATER CLASS
SAMPLED BY Zeni Well Drilling
NO. WELL CASING VOL. PURGED

SAMPLE DATE 1/26 & 1/27/85
SAMPLE TIME
SAMPLE COMPLETION DATE 2/21/85
WELL TYPE: ( ) BACKGROUND
( ) SITE BOUNDRY
( ) INTERMEDIATE
( ) COMPLIANCE

Parameter Monitored	Storet Code	Analysis Method	Analysis Result	Unit
TEMPERATURE	00006	170.1	25.5	°C
P.H.	00403	150.1	6.8	Units
Turbidity	82079	180.1	65	NTU
Color	00080	110.2	20	Units
Sulfate	00945	375.2	1100	mg/l
Iron	01046	236.1	0.739	mg/l
T.D.S.	00530	160.2	28,700	mg/l
Total Hardness	00900	130.2	2040	mg/l
Hydroxide	71830	**	0	mg/l
Hydrogen Sulfide	71875	427.5	Nil	mg/l
Non-Carbonate Hardness	00902	**	1912	mg/l
Bicarbonate Hardness	00440	**	78.1	mg/l
Total Phosphate Phosphorous	00665	365.4	0.05	mg/l
Total Nitrogen	00625	351.4	3.42	mg/l
Nitrate Nitrogen	00620	352.1	0.32	mg/l
Nitrite Nitrogen	00615	354.1	0.005	mg/l
Organic Nitrogen	00605	calculated	1.65	mg/l
Ammonia Nitrogen	00610	350.3	1.45	mg/l
Specific Conductivity	00095	120.1	44,700	*
Sodium	00930	273.1	7576.0	mg/l
Calcium	00916	215.1	717.4	mg/l
Magnesium	01056	242.1	321.4	mg/l
Carbon Dioxide	00405	**	39	mg/l
Carbonate Hardness	00901	**	1790	mg/l
Potassium	00937	258.1	200.0	mg/l
Chloride	00940	408A	15,095	mg/l
Total Alkalinity	00410	310.2	128	mg/l

REMARKS: *Conductivity is expressed in micromhos/cm
**Calculated as $CaCO_3$

Kerry Prescott, Kitty Vaqi, Pat Goodwin
Jeff Genualdi
ANALYSTS:

BROWARD TESTING LABORATORY, INC.

LABORATORY CERTIFICATION NUMBER 86137

LABORATORY PARAMETER ANALYSIS REPORT

SITE Zeni Well Drilling

SOURCE 1180'-1227'
LAB. NUMBER 850886
GROUNDWATER CLASS
SAMPLED BY Zeni Well Drilling
NO. WELL CASING VOL. PURGED

SAMPLE DATE 1/26 & 1/27/85
SAMPLE TIME
SAMPLE COMPLETION DATE 2/21/85
WELL TYPE: ( ) BACKGROUND
( ) SITE BOUNDRY
( ) INTERMEDIATE
( ) COMPLIANCE

Parameter Monitored	Storet Code	Analysis Method	Analysis Result	Unit
TEMPERATURE	00006	170.1	26.0	°C
P.H.	00403	150.1	6.8	Units
Turbidity	82079	180.1	27.5	NTU
Color	00080	110.2	5	Units
Sulfate	00945	375.2	800	mg/l
Iron	01046	236.1	0.739	mg/l
T.D.S.	00530	160.2	18,900	mg/l
Total Hardness	00900	130.2	2240	mg/l
Hydroxide	71830	**	0	mg/l
Hydrogen Sulfide	71875	427.5	Nil	mg/l
Non-Carbonate Hardness	00902	**	2096	mg/l
Bicarbonate Hardness	00440	**	87.8	mg/l
Total Phosphate Phosphorous	00665	365.4	0.01	mg/l
Total Nitrogen	00625	351.4	2.44	mg/l
Nitrate Nitrogen	00620	352.1	0.4	mg/l
Nitrite Nitrogen	00615	354.1	0.04	mg/l
Organic Nitrogen	00605	calculated	0.43	mg/l
Ammonia Nitrogen	00610	350.3	1.57	mg/l
Specific Conductivity	00095	120.1	30,800	*
Sodium	00930	273.1	4468.9	mg/l
Calcium	00916	215.1	303	mg/l
Magnesium	01056	242.1	471	mg/l
Carbon Dioxide	00405	**	44	mg/l
Carbonate Hardness	00901	**	756	mg/l
Potassium	00937	258.1	188.0	mg/l
Chloride	00940	408A	10,097	mg/l
Total Alkalinity	00410	310.2	144	mg/l

REMARKS: *Conductivity is expressed in micromhos/cm
**Calculated as $CaCO_3$

Kerry Prescott, Kitty Vagi, Pat Goodwin
Jeff Genualdi
ANALYSTS:

APPENDIX E

CSID Injection Well
Laboratory Results
of the Analyses of Water
from the Monitor Zones

BROWARD TESTING LABORATORY, INC.

LABORATORY CERTIFICATION NUMBER 86137

LABORATORY PARAMETER ANALYSIS REPORT

SITE ZENI WELL DRILLING

SOURCE CSID INJECTION WELL SHALLOW MONITOR TUBE SAMPLE DATE 5/28/85
LAB. NUMBER 85-1917 SAMPLE TIME 2352
GROUNDWATER CLASS ______ COMPLETION DATE 6/11/85
SAMPLED BY ZENI ~~WELL DRILLING~~ WELL TYPE: ( ) BACKGROUND
NO. WELL CASING VOL. PURGED ______ ( ) SITE BOUNDRY
( ) INTERMEDIATE
(X) COMPLIANCE

PARAMETER MONITORED	ANALYSIS DATE	*STORET CODE*	*ANALYSIS METHOD*	*ANALYSIS RESULT*	*UNIT*
TEMPERATURE	5/28/85	00006	170.1	79°F *	°C
PH	5/28/85	00403	150.1	8.35	UNITS
TURBIDITY	5/29/85	82079	180.1	0.38	NTU
COLOR	5/28/85	00080	110.2	5	UNITS
SULFATE	5/31/85	00945	375.2	1336	MG/L
IRON	6/4/85	01046	236.1	0.10	MG/L
TOTAL DISSOLVED SOLIDS	5/30/85	00530	160.2	14,420	MG/L
TOTAL HARDNESS	5/31/85	00900	130.2	2367	MG/L
HYDROXIDE	5/31/85	71830	**	0	MG/L
HYDROGEN SULFIDE	5/30/85	71875	427.5	0	MG/L
NON-CARBONATE HARDNESS	5/31/85	00902	**	2223	MG/L
BICARBONATE HARDNESS	5/31/85	00440	**	76	MG/L
TOTAL PHOSPHATE/P	6/6/85	00665	365.4	0.2	MG/L
TOTAL NITROGEN	6/5/85	00625	351.4	67.1	MG/L
NITRATE NITROGEN	5/30/85	00620	352.1	65.5	MG/L
NITRITE NITROGEN	5/30/85	00615	354.1	<0.05	MG/L
ORGANIC NITROGEN	6/5/85	00605	CALCULATED	0	MG/L
AMMONIA NITROGEN	6/5/85	00610	350.3	1.7	MG/L
SPECIFIC CONDUCTIVITY	6/4/85	00095	120.1	23,600	*
SODIUM	6/4/85	00930	273.1	5458	MG/L
CALCIUM	6/3/85	00916	215.1	604.1	MG/L
MAGNESIUM	6/4/85	01056	242.1	278.9	MG/L
CARBON DIOXIDE	5/31/85	00405	**	0	MG/L
CARBONATE HARDNESS	5/31/85	00901	**	40	MG/L
POTASSIUM	5/31/85	00937	258.1	136	MG/L
CHLORIDE	5/30/85	00940	408A	9364	MG/L
TOTAL ALKALINITY	5/31/85	00410	310.2	116	MG/L
TOTAL KJELDAHLNITROGEN	6/5/85	00625	351.2	1.64	MG/L
PHENOLPHTHALEIN ALKALINITY	5/31/85	00410	403F	20	MG/L

REMARKS: *ON SITE TEMPERATURE--
TEMPERATURE SHOULD BE MEASURED ON SITE FOR RELIABILITY IN LAB MEASUREMENTS ARE NOT REPRESENTATIVE OF ACTUAL SAMPLE TEMPERATURE.

*CONDUCTIVITY IS EXPRESSED IN MICROMHOS/CM

**CALCULATED AS $CaCO_3$

ANALYSTS: KERRY PRESCOTT, KITTY VAGI, PAT GOODWIN, E. STONE, F. NOBLE

BROWARD TESTING LABORATORY, INC

LABORATORY CERTIFICATION NUMBER 86137

LABORATORY PARAMETER ANALYSIS REPORT

SITE ZENI WELL DRILLING

SOURCE CSID INJECTION WELL DEEP MONITOR TUBE SAMPLE DATE 5/28/85
LAB. NUMBER 85-1918 SAMPLE TIME 2355
GROUNDWATER CLASS COMPLETION DATE 6/11/85
SAMPLED BY ZENI WELL DRILLING WELL TYPE: ( ) BACKGROUND
NO. WELL CASING VOL. PURGED ( ) SITE BOUNDRY
( ) INTERMEDIATE
(x) COMPLIANCE

PARAMETER MONITORED	ANALYSIS DATE	*STORET CODE*	*ANALYSIS METHOD*	*ANALYSIS RESULT*	*UNIT*
TEMPERATURE	5/28/85	00006	170.1	80°F *	°C
PH	5/28/85	00403	150.1	7.43	UNITS
TURBIDITY	5/29/85	82079	180.1	139	NTU
COLOR	5/28/85	00080	110.2	70	UNITS
SULFATE	5/31/85	00945	375.2	1170	MG/L
IRON	6/4/85	01046	236.1	10.52	MG/L
TOTAL DISSOLVED SOLIDS	5/30/85	00530	160.2	25,724	MG/L
TOTAL HARDNESS	5/31/85	00900	130.2	3267	MG/L
HYDROXIDE	5/31/85	71830	**	0	MG/L
HYDROGEN SULFIDE	5/30/85	71875	427.5	0	MG/L
NON-CARBONATE HARDNESS	5/31/85	00902	**	3123	MG/L
BICARBONATE HARDNESS	5/31/85	00440	**	144	MG/L
TOTAL PHOSPHATE/P	6/6/85	00665	365.4	0.4	MG/L
TOTAL NITROGEN	6/5/85	00625	351.4	39.8	MG/L
NITRATE NITROGEN	5/30/85	00620	352.1	37.7	MG/L
NITRITE NITROGEN	5/30/85	00615	354.1	<0.05	MG/L
ORGANIC NITROGEN	6/5/85	00605	CALCULATED	0.12	MG/L
AMMONIA NITROGEN	6/5/85	00610	350.3	2.0	MG/L
SPECIFIC CONDUCTIVITY	6/4/85	00095	120.1	52,800	*
SODIUM	6/4/85	00930	273.1	18786	MG/L
CALCIUM	6/3/85	00916	215.1	675	MG/L
MAGNESIUM	6/4/85	01056	242.1	439.4	MG/L
CARBON DIOXIDE	5/31/85	00405	**	10	MG/L
CARBONATE HARDNESS	5/31/85	00901	**	0	MG/L
POTASSIUM	5/31/85	00937	258.1	207	MG/L
CHLORIDE	5/30/85	00940	408A	15435	MG/L
TOTAL ALKALINITY	5/31/85	00410	310.2	144	MG/L
TOTAL KJELDAHLNITROGEN	6/5/85	00625	351.2	2.12	MG/L

REMARKS: *ON SITE TEMPERATURE--
TEMPERATURE SHOULD BE MEASURED ON SITE FOR RELIABILITY
IN LAB MEASUREMENTS ARE NOT REPRESENTATIVE OF ACTUAL
SAMPLE TEMPERATURE.

*CONDUCTIVITY IS EXPRESSED IN MICROMHOS/CM

**CALCULATED AS $CaCO_3$

KERRY PRESCOTT, KITTY VAGI,
PAT GOODWIN, E.STONE, F.HOBLE
ANALYSTS:

GERAGHTY & MILLER, INC.

TEMPERATURE

P234CS3

COMPANY CORAL SPRINGS IMPROVEMENT DISTRICT
WELL WELL #1
LOCATION BROWARD FLA.

COMPANY CORAL SPRINGS IMPROVEMENT DISTRICT
WELL WELL #1
FIELD
COUNTY BROWARD STATE FLA.
LOCATION: OTHER SERVICES
SEC TWP RGE

PERMANENT DATUM PAD LEVEL ELEV
LOG MEASURED FROM 0 ft above perm. datum
DRILLING MEASURED FROM

ELEV KB
D.F.
G.L.
T.O.C.

DATE	1/24/84
RUN No.	
TYPE LOG	
DEPTH - DRILLER	
DEPTH - LOGGER	
BTM. LOG INTER	3098
TOP LOG INTER	10
TYPE FLUID IN HOLE	
SALINITY ppm Cl	
DENSITY lb/gal	
LEVEL	
MAX. REC. TEMP. - °F	
OPER. RIG TIME	
RECORDED BY	
WITNESSED BY	

BORE HOLE RECORD				CASING RECORD			
RUN No	BIT	FROM	TO	SIZE	WGT	FROM	TO

REMARKS:
LOGGING DONE BY: SOUTHERN RESOURCES EXPLORATION

SCALE CHANGES			
Type Log	Depth	Scale Up Hole	Scale Down Hole

Temperature
7.5 °F/inch
40 F.P.M.

PREPARED FOR
CORAL SPRINGS IMPROVEMENT DISTRICT

TITLE
GEOLOGIC COLUMN.
CORE AND STADDLE PACKER DATA WITH
SONIC, NEUTRON, DUAL INDUCTION LOGS

COMPILED BY L. SIMS	Geraghty & Miller, Inc. Palm Beach Gardens, Florida	DATE SEPT. 1985	REVISED
DRAWN BY Y. DIMICK			
CHECKED BY J. WHEATLEY	SCALE AS SHOWN		

TO309VO

Schlumberger BHC SONIC

COMPANY	GERAGHTY & MILLER
WELL	CORAL SPRINGS IMPROVEMENT DISTRICT #IW1
FIELD	NA
COUNTY	BROWARD
STATE	FLORIDA
LOCATION	NA
API SERIAL NO.	NA
SEC.	NA
TWP	NA
RANGE	NA
Other Services:	DIL/SFL, CBL/VDL, CNL, BHC/SONIC/VDL

COUNTY BROWARD, FLORIDA
FIELD NA
LOCATION SEC
WELL CORAL SPRINGS IMPROVEMENT DISTRICT #IW1
COMPANY GERAGHTY & MILLER

Permanent Datum: PAD LEVEL ; Elev.: NA
Log Measured From NA Ft. Above Perm. Datum
Drilling Measured From NA
Elev.: K.B. NA D.F. NA G.L. NA

Date	29 MAY 85			
Run No.	ONE			
Depth—Driller	3500			
Depth—Logger (Schl.)	3499			
Btm. Log Interval	3166			
Top Log Interval	2997			
Casing—Driller	12 @ 2997	@	@	@
Casing—Logger	3000			
Bit Size	11			
Type Fluid in Hole	SALT MUD			
Dens. / Visc.	– / –			
pH / Fluid Loss	– / – ml	ml	ml	ml
Source of Sample	NONE			
Rm @ Meas. Temp.	– @ – °F	@ °F	@ °F	@ °F
Rmf @ Meas. Temp.	– @ – °F	@ °F	@ °F	@ °F
Rmc @ Meas. Temp.	– @ – °F	@ °F	@ °F	@ °F
Source: Rmf / Rmc	– / –			
Rm @ BHT	– @ – °F	@ °F	@ °F	@ °F
TIME: Circulation Stopped	–			
TIME: Logger on Bottom	2200			
Max. Rec. Temp.	– °F	°F	°F	°F
Equip. / Location	8193 FL MYERS			
Recorded By	BUCHEL			
Witnessed By	SIMS MOORE, PETERS			

FOLD HERE The well name, location and borehole reference data were furnished by the customer.

Run No.	ONE			
Service Order No.	391804			
API Serial No.	–			
Fluid Level	–			

SCALE CHANGES			
Type Log	Depth	Scale Up Hole	Scale Down Hole

EQUIPMENT DATA

SLM	551
SLC	2021
SLS	305
SGT	1288
NLM	65
MCD	1610

REMARKS:
TOOL STICKING AT 3170'. RAN REPEAT AT TOP.

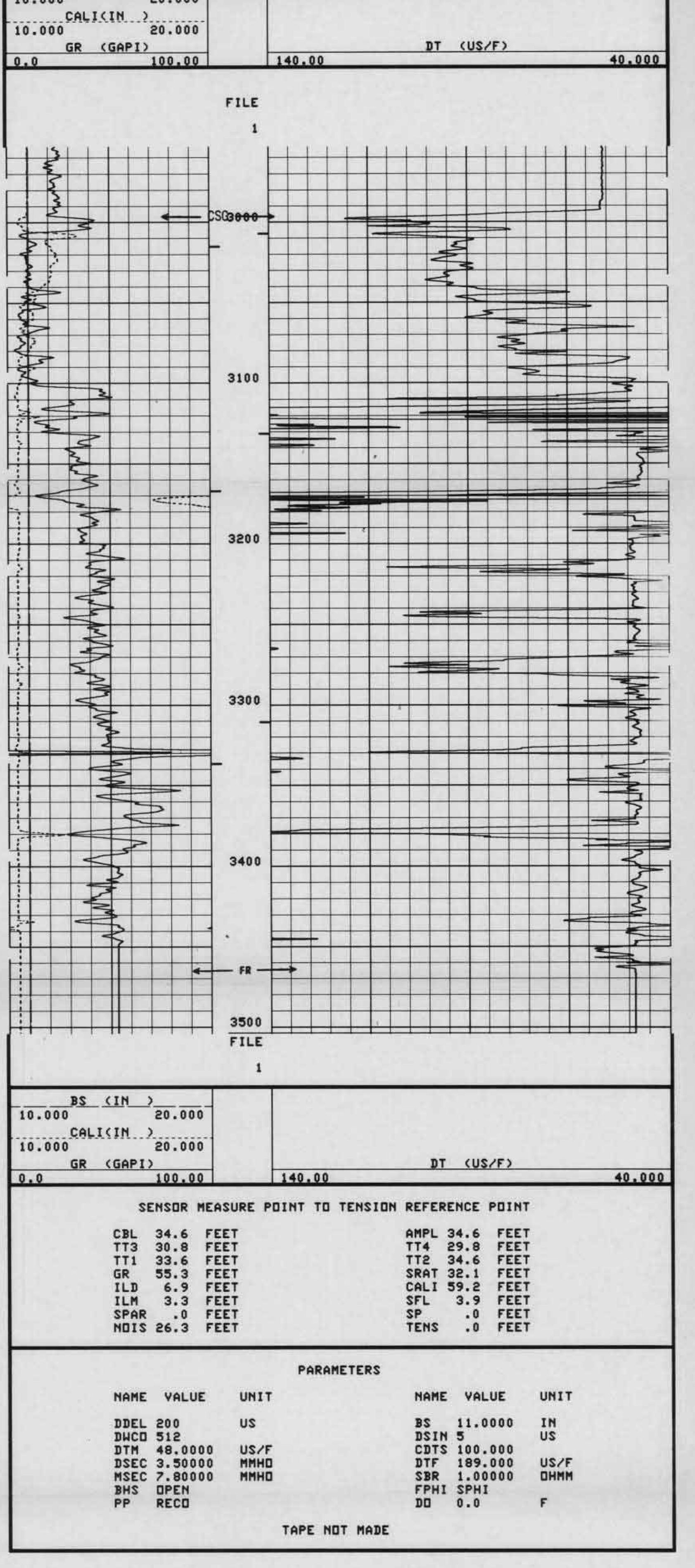
CALIBRATION DATA

Speed - F.P.M.		–
GR	BKG. CPS	–
	Source CPS	–
	Tc	–

BS (IN)		DT (US/F)	
10.000	20.000		
CALI(IN)			
10.000	20.000		
GR (GAPI)			
0.0	100.00	140.00	40.000

FILE

1



FILE

1

BS (IN)		DT (US/F)	
10.000	20.000		
CALI(IN)			
10.000	20.000		
GR (GAPI)			
0.0	100.00	140.00	40.000

SENSOR MEASURE POINT TO TENSION REFERENCE POINT

CBL	34.6	FEET	AMPL	34.6	FEET
TT3	30.8	FEET	TT4	29.8	FEET
TT1	33.6	FEET	TT2	34.6	FEET
GR	55.3	FEET	SRAT	32.1	FEET
ILD	6.9	FEET	CALI	59.2	FEET
ILM	3.3	FEET	SFL	3.9	FEET
SPAR	.0	FEET	SP	.0	FEET
NOIS	26.3	FEET	TENS	.0	FEET

PARAMETERS

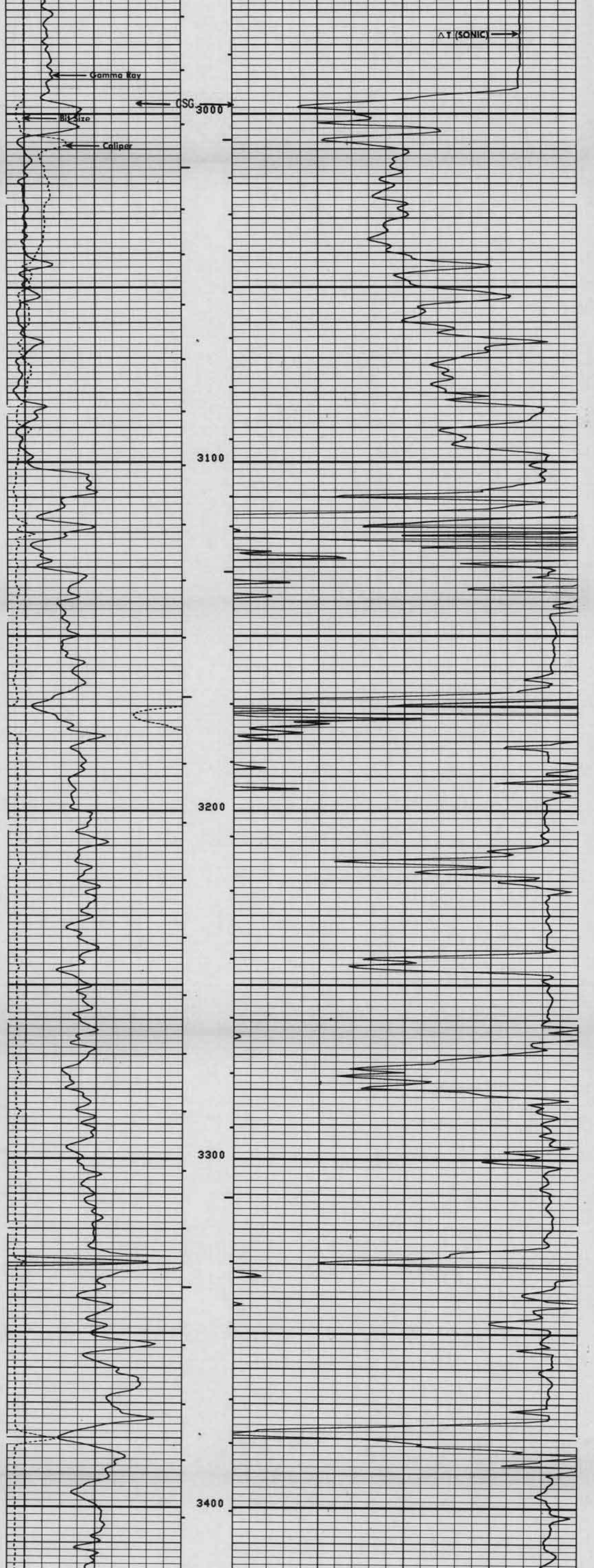
NAME	VALUE	UNIT	NAME	VALUE	UNIT
DDEL	200	US	BS	11.0000	IN
DWCO	512		DSIN	5	US
DTM	48.0000	US/F	CDTS	100.000	
DSEC	3.50000	MMHO	DTF	189.000	US/F
MSEC	7.80000	MMHO	SBR	1.00000	OHMM
BHS	OPEN		FPHI	SPHI	
PP	RECO		DO	0.0	F

TAPE NOT MADE

BS (IN)		DT (US/F)	
10.000	20.000		
CALI(IN)			
10.000	20.000		
GR (GAPI)			
0.0	100.00	140.00	40.000

FILE

1



FILE

1

BS (IN)		DT (US/F)	
10.000	20.000		
CALI(IN)			
10.000	20.000		
GR (GAPI)			
0.0	100.00	140.00	40.000

SENSOR MEASURE POINT TO TENSION REFERENCE POINT

CBL	34.6	FEET	AMPL	34.6	FEET
TT3	30.8	FEET	TT4	29.8	FEET
TT1	33.6	FEET	TT2	34.6	FEET
GR	55.3	FEET	SRAT	32.1	FEET
ILD	6.9	FEET	CALI	59.2	FEET
ILM	3.3	FEET	SFL	3.9	FEET
SPAR	.0	FEET	SP	.0	FEET
NOIS	26.3	FEET	TENS	.0	FEET

PARAMETERS

NAME	VALUE	UNIT	NAME	VALUE	UNIT
DDEL	200	US	BS	11.0000	IN
DWCO	512		DSIN	5	US
DTM	48.0000	US/F	CDTS	100.000	
DSEC	3.50000	MMHO	DTF	189.000	US/F
MSEC	7.80000	MMHO	SBR	1.00000	OHMM
BHS	OPEN		FPHI	SPHI	
PP	RECO		DO	0.0	F

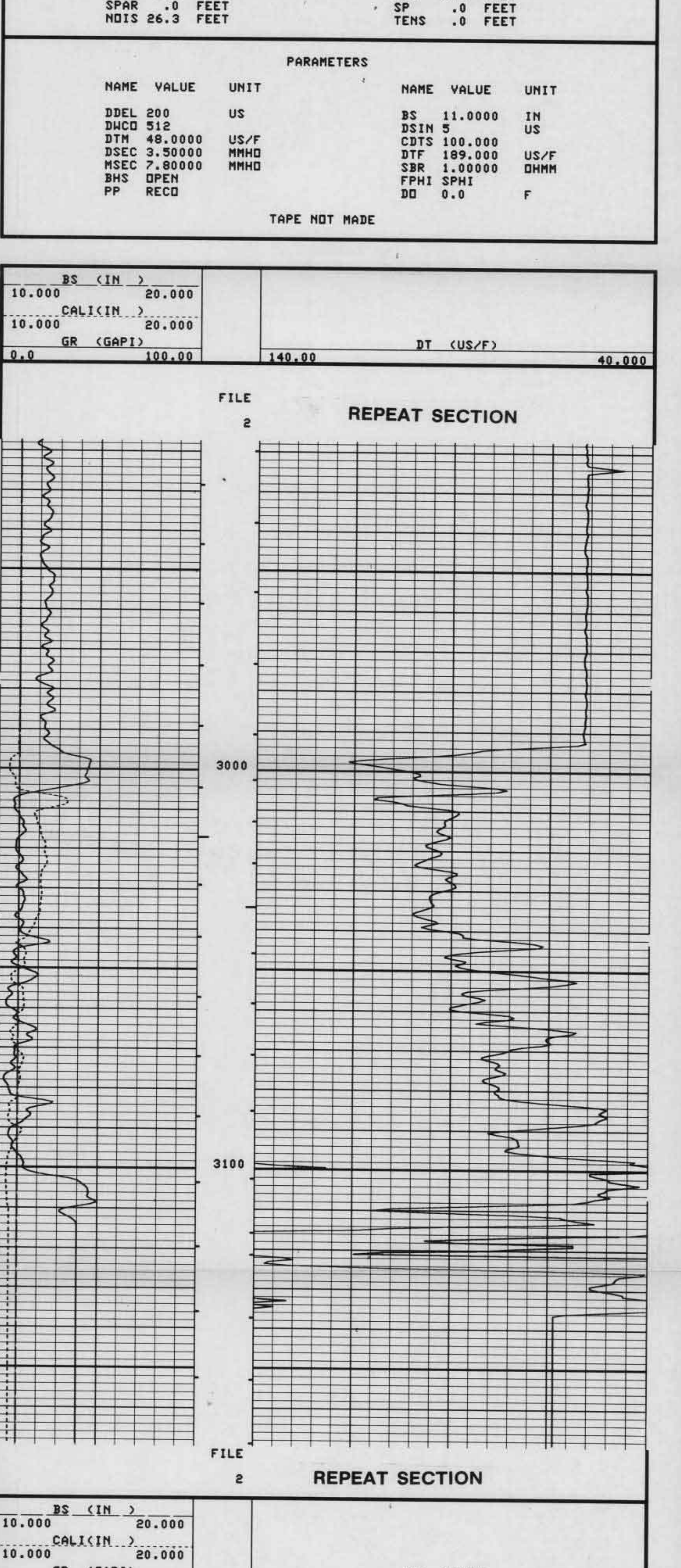
TAPE NOT MADE

BS (IN)		DT (US/F)	
10.000	20.000		
CALI(IN)			
10.000	20.000		
GR (GAPI)			
0.0	100.00	140.00	40.000

FILE

2

REPEAT SECTION



FILE

2

REPEAT SECTION

BS (IN)		DT (US/F)	
10.000	20.000		
CALI(IN)			
10.000	20.000		
GR (GAPI)			
0.0	100.00	140.00	40.000

SENSOR MEASURE POINT TO TENSION REFERENCE POINT

CBL	34.6	FEET	AMPL	34.6	FEET
TT3	30.8	FEET	TT4	29.8	FEET
TT1	33.6	FEET	TT2	34.6	FEET
GR	55.3	FEET	SRAT	32.1	FEET
ILD	6.9	FEET	CALI	59.2	FEET
ILM	3.3	FEET	SFL	3.9	FEET
SPAR	.0	FEET	SP	.0	FEET
NOIS	26.3	FEET	TENS	.0	FEET

PARAMETERS

NAME	VALUE	UNIT	NAME	VALUE	UNIT
DDEL	200	US	BS	11.0000	IN
DWCO	512		DSIN	5	US
DTM	48.0000	US/F	CDTS	100.000	
DSEC	3.50000	MMHO	DTF	189.000	US/F
MSEC	7.80000	MMHO	SBR	1.00000	OHMM
BHS	OPEN		FPHI	SPHI	
PP	RECO		DO	0.0	F

TAPE NOT MADE