APPRAISAL OF HYDROGEOLOGIC CONDITIONS
REGIONAL POLLUTION CONTROL FACILITY
CITY OF WEST PALM BEACH, FLORIDA

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INTRODUCTION

The results of a year-long study completed in the Spring of 1975 showed that a deep, highly permeable horizon saturated with salt water occurred at the site of the new waste-water treatment plant, along with the required sequence of confining beds and monitor zone. Subsequently, work was initiated in January 1976 on the construction of the first three permanent disposal wells to handle the effluent from the 20-mgd (million gallons per day) treatment plant under construction. The last of these was completed in October 1977. In June 1977, a contract was let for the construction of two additional wells to accommodate the load from an expanded treatment plant, giving a total capacity of 44 mgd. Work on these wells is still in progress.

During the time that the permanent wells have been under construction, much additional information on subsurface conditions has been accumulated and personnel involved in the project have changed. Accordingly, this report has been prepared to provide an updated description of subsurface conditions, based on the "new and old" data to show why the wells have been and are being constructed the way they are and to aid in informing those individuals who were not involved in the project at its inception.

Much of the information used in this report can be found in previous reports and logs submitted to Robert and Company Associates by Geraghty & Miller, Inc., and subsequently distributed by them to the various involved government agencies.

CONCLUSIONS

1. The 1974-75 test program demonstrated that a suitable injection horizon, confining bed sequence, and monitor zone exist at the West Palm Beach Regional Pollution Control Facility.

2. Results from the drilling and testing of the permanent disposal wells support the findings of the original investigation; certain differences in subsurface conditions exist.

3. According to the data, fractured dolomite beds are present at the sites of Wells 4 and 5 in depth intervals

which at the sites of the other wells contain beds of competent limestone.

4. The differences appear to be the result of selective dolomitization of the limestone.

5. The confining bed sequence is present at each well site, according to the data, and overlies those zones where the fractured dolomite was found.

6. The disposal wells have been and should be constructed to penetrate well into the confining bed sequence to provide environmental protection and to minimize the potential for collapse and subsequent plugging.

7. Because each disposal well is a critical part of the treatment system, each must be constructed to provide a long, trouble-free life to avoid costly rehabilitation as well as environmental problems.

PHILOSOPHY

In order for an injection well system to function, a number of conditions must be present. Naturally, a suitable injection zone must exist and it must be very permeable to permit the injection of large quantities of treated effluent at high rates and acceptable pumping cost. It should be cavernous, so that the threat of plugging and increased costs for operation and maintenance will be minimized to the greatest degree possible. Also, the horizon selected for injection must contain salty water.

The injection zone must be overlain by rocks having little or no vertical permeability so they will, for all practical purposes, prevent the upward migration of injected fluids. A monitor zone containing salty water must be present in or above the confining sequence.

The purpose of the 1974-75 test program was to determine whether or not these natural conditions were present which would permit the construction and operation of a disposal well system. As noted, suitable conditions were found. Once these were established, it was then necessary to develop design criteria and construction procedures for permanent wells.

In developing these criteria, and during the construction of all the wells, two objectives were kept in mind, both of which are equally important. The wells were designed and constructed to take advantage of naturally-occurring conditions to afford environmental protection and protect quality of water as required by sound practice and statute. Also, they were designed and constructed to provide as long and useful a trouble-free life as possible, utilizing state of the art construction techniques. As a consequence, the various strings of well casings and their depth settings were selected keeping these objectives in mind. All casings were cemented entirely in place; no open annular spaces were left in the first three wells. Additionally, the inner or long string of casing was set (in all wells) deep within the confining sequence to take advantage of these properties and to provide protection from collapse, bridging, and plugging above the injection zone where hole conditions indicated this potential hazard existed.

To aid in achieving a long life with minimum troubles from plugging due to solids contained in the effluent, maximum penetration of the injection zone was required. Data from the test well showed a thickness of about 370 feet; the specifications called for completing each well with 350 feet of open hole in the injection zone. This was achieved in every well except Well 3, where caving conditions in the upper portion of the injection zone made it impossible to maintain an open hole. Subsequent testing has demonstrated that the well is capable of accepting the design quantities of effluent, but that there is a possibility of collapse and plugging which would necessitate reworking. These conditions have been documented in previous reports and presentations by Geraghty & Miller, Inc.

NATURE OF THE INJECTION ZONE

A principal goal of the test injection well program was to establish the presence of a highly permeable zone capable of accepting the design quantities of treated effluent. Its presence was established by means of collection and evaluation of formation samples, cores, geophysical logs, and an evaluation of the drilling records. Its nature was determined by a series of pumping and injection tests performed in the test-injection well. The same procedures were used when the permanent disposal wells were constructed.

The injection zone consists of a massive dolomite which has been apparently fractured and acted on by solution activity. Evidence of the fracturing is demonstrated by the presence of large angular fragments of rock which can collapse into the bore holes. Some of these have been recovered, and examination shows their angular nature. In addition, some of the flat surfaces are coated with deposits of small dolomite crystals, showing that the rock surface is a pre-existing condition and was not the result of breaking during the drilling process.

In general, the dolomite is brown in color, although it can be tinged with gray. It tends to be massive, except, of course, where it has been fractured or acted on by solution activity.

Solution features range from small, individual, isolated vugs to fairly large cavities. Examination of the caliper logs for the various wells shows no distinct pattern of occurrence within the zone. The cavities seem to be more or less randomly distributed. For example, examination of the caliper log and drilling records for Wells 3 and 5 shows rather large cavities occurring at the top of the zone. In Well 5, two cavities, one above the other, were found in the depth interval between 3371 and 3387, but just below 3400 feet. At Well 3, a fairly large cavity was found close to the top of the zone. On the other hand, in Well 1R, cavities were not found in the top of the zone, but are present in the deeper portions penetrated by the drill, as shown by the caliper logs and drilling records. In Well 2, a series of small cavities appears to be present scattered throughout the bore hole, along with numerous smaller cavities occurring at greater depths.

The system of cavities is interconnected, giving rise to the extremely high transmissivity of the zone. Because of the size of the cavities and their interconnected nature, the injection zone possesses an extraordinarily high transmissivity, and therefore it satisfies one of the criteria for injection. Values of transmissivity were estimated based on the data from the pumping and injection tests performed on the test well in 1975 (Geraghty & Miller, 1975). These were based on the Jacob method and values of 1.7×10^6 and 1.3×10^6 gpd (gallons per day per foot) were determined from the injection and pumping tests, respectively. These values are considered to be minimum ones, as it was recognized that the data were affected by outside influences such as barometric, tidal, and temperature changes. In all probability, the actual transmissivity of the zone is much greater, and similar to the values presented by Meyer in 1974 and based on a sophisticated analysis of tidal and barometric fluctuations for a well tapping a highly cavernous zone in the Miami area. Depending on porosity, these values ranged from 4.8×10^6 to 4.3×10^7 gpd/ft. In spite of the distance between the West Palm Beach well site and the Miami well, the values from that study are probably about the same that one might expect to see at the West Palm Beach area because of the similar nature of the zones.

Additional evidence of the high transmissivity of the injection zone has been demonstrated by the pumping-injection tests performed on each well and by the performance of the wells themselves since they were placed in operation. During each of the pumping-injection tests performed after each well was completed, vacuums were registered at the well being injected into (Geraghty & Miller, 1978) even though injection rates of up to 10,000 gpm (gallons per minute) were recorded. As an example, after 1310 minutes of injection into Well 3 at 10,000 gpm, a vacuum equal to 8.7 feet at the well head was recorded.

An excellent idea of the zone's capability to accept treated waste at high rates can be gained from the examination of the monthly operator's reports for the wells since start of injection in December 1977. For example, on November 8, 1978, 10.2 mgd was disposed of with an average injection pressure of 39 psi (pounds per square inch). Most of this pressure is composed of that required to overcome the density difference between fresh, treated effluent and salty water in the injection zone. During the latter part of the month, when the well was not in use, the shut-in pressure was 30 psi. The difference between the two readings is an approximate measure of the injection pressure and is the sum of the friction loss in more than 3000 feet of casing and the bottom-hole driving pressure. A similar relationship is shown by the data from the other wells.

In the test well, the top of the injection zone was found at approximately 3150 feet. The well was completed at a depth of 3579 feet; the last 59 feet of the hole penetrated massive, dense, brown dolomite. Because of caving conditions, the hole could not be kept open below approximately 3330 feet; consequently, no geophysical logs were obtained below this depth.

Based on the results of the test program, the permanent wells were designed to be approximately 3500 feet deep in anticipation of encountering the injection zone at ±3150 feet at the other wells sites located to the west. Field conditions were found to be different and the injection zone was encountered at depths greater than anticipated. At Well 1 it was found at ±3260 feet (pad datum). Shortly before this discovery was made, correlation of the logs from the Well 1 pilot hole, which terminated at 2968 feet (drillers datum), and the test well indicated that the various strata had an apparent dip to the west. Based on this discovery, the top of the zone was predicted to occur at a greater depth than anticipated.

Correlation of logs from the other pilot holes refined the initial discovery and made it possible to predict, rather accurately, the depths to the top of the zone at the other well locations. For example at Wells 2 and 3, which lie roughly on the strike of the beds, it was found at approximately 3350 feet. At Well 5 a rather significant cavity was encountered at 3371 feet, and at Well 4 the top of this zone has yet to be penetrated.

The dip of the various beds and their nature are discussed in a subsequent section of this report, as well as their relationship to the various wells and the disposal well system.

CONFINING BEDS

The presence of confining beds and their properties was determined by a variety of methods. Information was collected from each well as it was drilled and tested and a continuing process of evaluation evolved based on new data as it became available. This has made it possible to take into account site-specific conditions for well construction and has made it possible to develop much valuable knowledge of subsurface conditions in the area.

Information from all of the wells has made it possible to draw a number of important conclusions. For example, the confining bed is not a single bed, but a sequence of beds whose overall vertical permeability is extremely low, according to the data. Permeable beds may also be found in this section. In general, confining properties "improve" with depth. Examination of the samples indicates this may be related to the amount of cementing material (micrite) present. Within the area drilled to date, beds may be correlated quite easily on the basis of the electric, induction, and lateral logs, and the logs indicate the "beds" are dipping in a general southwesterly direction. Also, correlation between "marker" beds indicates a thickening of beds in this direction. Finally, lateral changes in the nature of the rocks occur in the deeper parts of the confining sequence.

Findings about the nature of the confining beds are described in the following paragraphs. These are based on the results of each type of analysis employed.

Core Data

Cores were collected only from the test well. These were taken from the Hawthorn Formation overlying the Floridan aquifer and from limestone beds in the interval between 2500 and 3000 feet. These were sent to an approved laboratory where a variety of tests were performed. Copies of the laboratory reports describing tests performed and the results are given in Appendix A.

Of significance to the investigation are the sample descriptions, and the porosity and permeability values. Results of the analysis of the cores taken from the Hawthorn Formation are included so they can be compared with those from the limestone cores.

Permeability of the Hawthorn cores ranged from 3.15×10^{-5} to 1.175×10^{-6} cm/sec (centimeters per second); one value of 3.113×10^{-8} cm/sec was reported. These materials are described (in the reports) as silty clays and fine sand. By comparison, the limestone cores had permeabilities ranging from 1.18×10^{-6} to 8.66×10^{-6} cm/sec. Porosity values ranged from 13.4 to 40.3 percent; the nature of the limestone cores tested varied from mildly porous to tightly cemented, weathered to fine-grained chalky rock. These tests were performed with the cores oriented so that vertical permeability values were obtained.

It is interesting to note that permeability values from the limestone cores are, for all practical purposes, the same as those from the Hawthorn cores. Furthermore, the Hawthorn Formation's properties as a confining bed are well known since it is a clay and confines the Floridan aquifer, which contains water under pressure.

Pumping-Injection Tests

Additional evidence of the nature of the confining sequence is demonstrated by the results of the various test performed on the wells and from examination of natural water-level fluctuations. Water levels in the injection zone and in the shallower monitor zone respond differently to tidal effects. In the annulus monitor zone (depth interval between 2100 and 2200 feet in the test well) water levels fluctuate about 0.1 foot (Geraghty & Miller, 1975, Figure 4) and about 0.5 foot in the injection zone (Geraghty & Miller, 1975, Figure 3). Copies of these illustrations are given in Appendix B. A copy of a water-level recorder chart from the test well injection zone for the period 12/10-11/77 also is included in Appendix B, as

Figure B, to illustrate these fluctuations. Similar water-level fluctuations have been noted in the monitor tubes at the other wells. This difference in response to tidal loading indicates that the injection zone functions as an independent system hydraulically separated from shallower zones containing brackish water, and is evidence of the competency of the confining sequence.

Test Results

Injection-pumping test results give additional evidence of the effectiveness of the confining sequence. During all tests, observations were made of the water levels in the monitor tube. During the test on the injection test well, anomalous water-level behaviour was noted. Subsequently, this was found to be due to density changes caused by changes of temperature of fluids in the bore hole and monitor tube (Geraghty & Miller, 1975, p 28) based on temperature logs performed by the U. S. Geological Survey.

Comparison of pre- and post-injection test water temperatures in one of the monitor tubes showed that average temperature over the length of the monitor tube changed from 20.45°C to 23.78°C, for an average increase of 3.33°C. As temperature increased, the density decreased, causing the length of the column of fluid to expand, which was reflected as a rise in water level. Comparison of the observed water-level change with what should have occurred based on density change showed remarkably close agreement--1.76 feet observed versus 1.79 feet calculated. Similar results have been obtained from other tests.

Based on these results, it was concluded that density changes were the cause of the build up of water level in the monitor tube and were not due to any hydraulic connection between the injection and monitor zones.

Additional evidence also supports this conclusion. Comparison of water-level changes in the test injection well monitoring tube during the 1975 pumping and injection tests shows an anomaly that cannot be caused by hydraulic connection between the monitoring and injection zones. After nine hours of pumping at 1000 gpm, the water level in the monitoring tube declined 0.73 foot, whereas during the 850-gpm injection test, it rose 1.74 feet after the same interval of time. If a hydraulic connection were to exist between the two zones, any observed water level change would have had to have been proportional to the pumping or injection rates. In other words, if 0.73 foot of decline occurred while pumping 1000 gpm, the water level rise at 850 gpm should have been 85% of 0.73 foot, or 0.62 foot, instead of the 1.74 feet actually observed. Thus, some other cause, not hydraulic interconnection--namely the temperature change and the accompanying density change--must account for the actual change.

Further proof of the competency of the confining sequence can be seen from the results of the injection test of Well 1R in October 1977 (Geraghty & Miller, 1978, Figure 4). A copy of that illustration is contained in Appendix C. Examination of the graph of the water level in the monitor tube for Well 1R shows that the water level declined almost five feet during the test. Well 1R was used for injection, and if there was any "hydraulic" connection across the confining sequence between the monitor and injection zones, a rise in water level, not a decline, would have been observed. The decline was due to the change in density which occurred as a result of cooling of the water in the monitor tube. An explanation of the effect of temperature is contained in the Geraghty & Miller 1975 report.

Television Surveys

After each permanent disposal well was completed, a television survey was performed of the entire casing and bore hole. The purpose of the surveys was to obtain a permanent record of each well in its original condition prior to use so that comparisons can be made with future surveys. Copies of these tapes are on file with the City of West Palm Beach Department of Utilities. Examination of the various tapes reveals some interesting facts about the nature of the limestone beds in the interval between the bottom of the casings and the top of the injection zone. The tapes clearly show the "massive" nature of the rock, and while visual observations cannot be used to determine whether or not they are permeable, correlation between visual data, sample examination, and core analysis supports conclusions reached about their competence. Furthermore, the television pictures attest to their extensive, vertical distribution. The geophysical logs attest to their horizontal distribution. Examination of the tapes also reveals the absence of vertical fractures.

Pressure Test on Well 1

A striking example of the competency of the confining sequence is given by the results of the pressure test on Well 1.

At the time the test was performed, it was assumed that the integrity of the 24-inch casing and 22-inch liner were being evaluated as called for in the specifications. The test was successful; it showed a pressure loss which was well within the limits set by the DER in the construction permit for the well. A copy of the pressure test results is contained in Appendix D. Because of the subcontractor's inability to prove to the satisfaction of the Engineer and Consultant that the well had been successfully completed, a television survey was performed. This showed that the pressure test had been performed on an "open hole" and not on the casing and liner. The tested section extended from $\pm$2450 feet to a few feet above 3000 feet, or across about 550 feet of the confining sequence. The test results provide dramatic evidence of the competency of these beds.

Extent of the Confining Sequence

A description of subsurface conditions is contained in the Geraghty & Miller 1978 report (pages 51 through 62). In general, the carbonate sequence becomes tighter below a depth of approximately 1500 feet in all wells. According to the various geophysical logs, resistivity increases, as does density, while porosity decreases, according to the neutron logs. These latter two logs cannot be used reliably for quantitative purposes because of the influence of variations in bore hole size which are beyond the capabilities of the compensating device in the tools. However, on an overall basis they do indicate trends.

Correlation of the induction and lateral logs from Wells 1R, 2, and 3 show that the dip of eight distinct marker beds ranges between S68°W and S85°W. A ninth horizon at 1142 feet dips N77°W. In general, the dip direction shifts to the south with increasing depth. Also, the dip angle increases with depth, indicating a thickening of the beds.

A copy of a table contained on page 60 of the Geraghty & Miller 1978 report is reproduced below as Table 1.

TABLE 1: Depths to various marker beds in Disposal Wells 1R, 2, and 3, and calculated values for dip and strike (Source: Geraghty & Miller, 1978)

Marker	Depth(1) (Ft.)					
Bed	Well 1R	Well 2	Well 3	Dip (°)	Strike	Dip
A	2785	2878	2882	10.6	N22°W	S68°W
B	2658	2747	2748	10.1	N23°W	S67°W
C	2547	2635	2637	10.0	N23°W	S67°W
D	2231	2301	2312	8.6	N17°W	S73°W
E	1714	1783	1794	8.5	N16°W	S74°W
F	1646	1734	1720	9.4	N14°W	S76°W
G	1609	1672	1683	7.9	N15°W	S75°W
H	1245	1275	1287	4.4	N 5°W	S85°W
I	1130	1151	1174	4.7	N13°E	N77°W

NOTE: (1) Depths are referenced to the drilling pad at elevation +19 feet MSL. Dip calculations are based on all measurements referenced to the drilling pad datum.

Examination of the table clearly shows this relationship. It is interesting to note the low dip angles calculated for Marker Beds H and I. These two horizons are limestone beds, whereas the remainder are formed by dolomite, a "secondary" rock (remnants or ghost fossils have been seen in some of the samples of the dolomite). Thus, the observed values of dip are based on secondary features (Amy, 1978) and may not represent true values for regional dip. Further, detailed fossil and stratigraphic study would be required to resolve this matter. Nevertheless these features do exist, and can be easily seen on the induction and lateral logs contained in Appendices A, B, and C of the Geraghty & Miller 1978 report. Further proof of the existence of this relationship is shown by the fact that the injection zone was found at successively greater depths proceeding in a westerly direction from the test well. For example, it was found at ±3260 in Well 1R and ±3350 at Wells 2 and 3. At Well 5, a large cavity was found at 3371 feet, while the top of the zone has yet to be penetrated at Well 4.

A similar correlation has been made with the induction-lateral logs for Wells 4 and 5, and the same relationship has been found to exist. Each marker horizon was found at greater depths in Wells 4 and 5 than at the sites of the other wells, and some bed thickening was found to be present. The distance between the top and bottom marker beds at Well 5 is greater than at Well 3. Depths to these various horizons are listed in Table 2. Copies of the induction-lateral logs are contained in Appendices E and F. Each marker bed has been identified on the logs so a comparison can be made with the logs contained in the Geraghty & Miller 1978 report (Appendices A, B, and C).

TABLE 2: Depths, in feet, to various marker beds based on log correlation, West Palm Beach, Florida

Marker	Depth (1)				
Bed	Well 1R	Well 2	Well 3	Well 4	Well 5
A	2785	2878	2882	--	2949
B	2658	2747	2748	2809	--
C	2547	2635	2637	2713	2715
D	2231	2301	2312	2373	2387
E	1714	1783	1794	1865	1877
F	1646	1734	1720	1771	1785
G	1609	1672	1683	1733	1747
H	1245	1275	1287	1316	1337
I	1130	1151	1174	1209	1223

NOTE: (1) Depths are referenced to the drilling pads at elevation +19 feet MSL.

It should be noted that marker bed A could not be correlated at Well 4, and marker bed B at Well 5. Both these units occur below 2800 feet; below this depth there is a marked difference in lithology in both wells compared to Wells 1R, 2, and 3.

In Well 4, dark brown, dense dolomite is present in the section beginning at approximately 2800 feet. Between 2700 and 2800 feet it is present also, along with a cream to buff and tan soft limestone. A cavity was found at 2783 feet. The dolomite was found to be present in the interval between 2800 and 3100 feet. Occasionally, the cream limestone is noted as being present, but in very minor amounts. This section or interval caused considerable problems. Dredging was required to penetrate beyond the cavity, probably because the rock is fractured and persisted in caving into the bore hole, thus enlarging the cavity. Also, during the fishing operations between January and April 1978, considerable difficulty was experienced with material caving into the hole. Recently, when an attempt was made to reach the top of the fish at ± 3075 feet, fill was found at a depth of ± 3047 feet after the hole had been undisturbed for some months.

At 3100 feet (in Well 4) the bore hole reenters the cream, soft limestone along with dark tan, medium hard crystalline limestone. This material is present to 3278 feet, the deepest point reached in the well.

In Well 5, a similar situation was found to exist. Dolomite was encountered at a depth of $\pm$2800 feet; between 2700 and 2800 feet it is present along with limestone. No cavity was found at 2783 feet. The dolomite is present beyond 3100 feet, no limestone was found at that depth. Between 3200 and 3387 feet no samples could be taken. Because of continued collapsing of the bore hole throughout much of this interval, the driller could only "make hole" by direct drilling. In order to accomplish this, heavy, fresh drilling mud had to be "spotted" in this interval and penetration was achieved by direct or normal circulation. No returns were obtained at the surface as the cuttings were left in suspension in the column of mud in the lower part of the hole. This operation had to be conducted in order to drill the pilot hole and to ream it out with the 34-inch bit.

By way of contrast, the rock present in the same depth interval at Wells 1R, 2, and 3 are much different. For example, in Well 3 the 2800 to 3350 foot interval is composed almost exclusively of limestone. Only traces of dolomite are present. Also, between 2900 and 3350 feet chert was found; in some places, such as at ±2900 feet, chert constituted 40 percent of the sample. The chert beds or nodules can be seen quite easily on the television tapes. In Wells 1R and 2 the same sequence of limestone and chert, with extremely minor amounts of dolomite is present between 2800 and 3350 feet. Copies of the geologic logs (field notes) for each of the wells are given in Appendices G through K for the depth intervals beginning at approximately 2500 feet and extending to the bottoms of the wells so that these differences can be seen.

The difference in lithologies is not a structural phenomena, according to the data. Correlation of the various logs demonstrates this, and nothing appears which would indicate significant displacement by faulting whereby such a change in lithology over such a short distance would have occurred. Marker beds below 2800 can be correlated. The difference appears to be related to dolomitization. Simply stated, dolomitization of the limestone (in Wells 4 and 5) in the 2800 to 3100 foot interval has occurred whereas in the corresponding intervals at Wells 1R, 2, and 3, it has not, although in these latter wells, chert, a secondary mineral, is present.

In any event, the presence of the dolomite beds in the confining sequence should not affect operations of Wells 4 and 5 and the system, but it will influence construction. This will be discussed subsequently. The data show the extensive nature of the beds and their presence at Wells 4 and 5, above say 2750 feet, and for the reasons discussed previously, they have been demonstrated to function as confining beds. Geologic and geophsyical logs attest to their similarities and extent, and the core data, as well as the pressure test, show their properties.

A mixture of what appears to be effluent and salty water has been detected in the bore hole at Well 4. According to flowmeter logs performed by Schlumberger, the fluid was entering the hole at about 3052 feet and leaving at 2872 feet. Details of this investigation were presented to the Florida Department of Environmental Regulation, the U.S. Environmental Protection Agency, the South Florida Water Management District, and the U. S. Geological Survey on November 21, 1978. At that time copies of the various logs from the survey were distributed to agency representatives.

It is believed the mixture has migrated laterally into the bore hole in Well 4, rather than moving upward through the pilot hole and reamed portion. It is possible for the fluid to enter the hole in the vicinity of 3052 feet, or at some point lower, but probably not below 3100 feet, where the limestone is encountered again. The limestone appears to be tight, according to examination of the samples, and correlates with material known to overlie the injection zone at the other wells where the television surveys show its nature. It is more likely that the mixture has migrated laterally (horizontally and upward) through fractured dolomite. In any event, its occurrence points out the need to collect site-specific data from each well as it is drilled, rather than rely solely on information from a "first" well.

COMPLETION OF WELLS

The disposal wells at the West Palm Beach Regional Pollution Control Facility are designed and constructed with two principal objectives in mind. First, to provide as much assurance as possible that injected fluids will be confined and not migrate upward. Second, to provide a long and useful trouble-free life. Considering the total operation of the facility and the area and population served, such objectives have to be kept in mind and must not be compromised.

The completion of Well 5 required large quantities of material in order to cement the 24-inch casing. That casing was set deep through fractured dolomite. As previously noted, considerable difficulty was experienced in drilling through the dolomite below 2800 feet; direct drilling had to be employed because of severe caving conditions. The casing was set to seal this material off and prevent it from caving in and plugging the well, which would adversely affect its operation--a situation which should be avoided.

While it is conceivable the dolomite beginning at 2800 feet is highly permeable, it should be noted that it does not occur in the wells to the east. It is not known whether or not it exists to the west. Thus, at least one hydrologic boundary exists, possibly more.

Considering both the above factors, the only logical course of action for completing the well was to set the casing deep--deeper than called for originally--in order to assure that the two objectives were met.

The same rationale will apply for the completion of Disposal Well 4. Originally the 24-inch casing was to have been set at 3175 feet in a bed of competent limestone, 75 feet below the contact between limestone and dolomite.

In January 1978, a 24-inch-diameter, lead-filled drill collar and a 34-inch-diameter flat-bottomed bit were lost in the bore hole at approximately 3100 feet. This drilling assembly was being used to aid in straightening the hole. Efforts to "fish" the collar and bit were unsuccessful, and in April 1978 fishing operations were stopped. A principal cause of the failure of the fishing was caving and collapse of the dolomite. Subsequently, the contractor proposed to complete the well by setting a casing and attempting to bypass the fish with a liner which would be set at the prescribed depth of 3175 feet.

Because of the caving problem in the 2800 to 3100 foot zone, this interval should be cased off to provide protection from collapse and plugging. Also the casing should be set to the 3175 foot depth to take as much advantage as possible of the confining sequence, and assure as much protection as possible.

One very important fact should be noted relative to constructing wells to avoid the potential for plugging. The West Palm Beach Regional Pollution Control Facility will handle the waste treatment requirements of a large and increasingly populous area for years to come. The plant is located inland, not adjacent to the coast where an emergency discharge point for treated effluent is readily available. Consequently, the disposal wells must be constructed to provide a long, trouble-free life. Even though standby capacity is designed into the system, the loss, even temporarily, of a well should be avoided.

If rehabilitation because of plugging proves to be necessary, these measures could be time consuming and costly. Simply back-flowing a well will not carry rock fragments out of a bore hole; a drilling rig will be required. This undoubtedly will be very costly, because of the difficult conditions under which it will have to be done. Effluent under pressure will be present in the bore hole and the operations will have to be handled with extreme care if they are to be successful. Thus, every step should be taken now to avoid, as much as possible, such a problem in the future.

Respectfully submitted,
GERAGHTY & MILLER, INC.

Vincent P. Amy

4 February 1979

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APPENDIX A

FLORIDA TESTING LABORATORY REPORTS ON ANALYSIS OF CORES FROM THE TEST WELL

FLORIDA TESTING LABORATORIES, INC. CONSULTING ENGINEERS
6056 ULMERTON ROAD • CLEARWATER • 813/531-1446 • TAMPA • 813/229-2119
P. O. BOX 11064 • ST. PETERSBURG, FLORIDA 33733

November 26, 1974

Geraghty & Miller, Inc.
324 Royal Palm Way
Suite 205
Palm Beach, Florida 33480

ATTENTION: Mr. Vincent P. Amy

RE: Soil Tests
Deep Test Well
City of West Palm Beach
Lab No. 25230

Gentlemen:

Attached herewith are the results of tests performed by this laboratory from samples submitted by Geraghty & Miller, Inc. from the deep well test project. Subject samples were received at this office on November 7, 1974. Tests were conducted from November 11 thru 25, 1974.

Tests performed were in accordance with pervious written correspondence and telephone conversations with Mr. Amy.

PERMEABILITY TESTS

Variable head permeability tests were performed on samples from each sample submitted. Tests on all samples were conducted in the consolidation apparatus with the water introduced from bottom to top of sample as noted on samples received. In each case the tested section appeared to be the most impermeable portion.

As an exception to this, the sample received in the four (4) inch diameter tube (363' to 365') was not completely extruded. The seal at top and bottom of this sample was removed for visual classification. The soil appeared the same at both the top and bottom, consequently a section of tube and soil 0.25 feet long was cut from the bottom of the tube for obtaining test specimen.

Permeameter samples were subjected to total surcharge load of five (5) kips per square foot and allowed to stabilize under compression before testing. Soil sample dimensions before consolidation were as follows:

Sample#	Diameter-Inches	Length-Inches
363'-365'	2.5	0.9474
485'-488'	2.5	0.9218
623'	2.5	0.9448
715'-719'	2.0	0.9378
860'-861'	1.4	1.0000

Hyrdrometer analysis (sand, silt, clay) and gradation were performed in accordance with AASHO Designation T88-70. Specific gravities were performed in accordance with ASTM Designation D854-58. Unit weights were determined from laboratory measurements of permeameter samples.

The remaining portions of all samples submitted are currently stored in a moist room in sealed tubes, for any additional testing you may desire before returning to your office.

If there are any questions regarding the enclosed test results, please feel free to contact this office at your convenience. Thank you for the opportunity to provide this service to you.

Very truly yours,

FLORIDA TESTING LABORATORIES, INC.

Robert T. Smith

Robert T. Smith
S.E.T.

RIL EST. LAB ORI INC.

BY Robert T. Smith

PROJECT: WEST PALM BEACH DEEP TEST WELL
CLIENT: GEHERITY & MILLER, INC.

Robert T. Smith

LAB NO: 25230
DATE: 11/26/74

oring pth-ft.	Sample-Top to Bottom	Soil Description	Permeability Rate	Dry Unit Wt. pcf	G_S	Porosity %	Permeability Surcharge	Remarks
363 to 365	0.00' to 2.26'	Gray silty, clayey fine Sand with very small soft shell fragments-calcareous	2.54×10^{-5} cm/sec.	96.6	2.648	41.5	5 ksf	1. Sample received in 4" I.D. tube 2. Test specimens sampled at 1.90' to 2.15' 3. Dry unit weight is as received in Lab.
485 to 488	0.00' to 1.07'	Grayish Tan silty clay-mottled with very soft to medium firm areas; calcareous; appears disturbed						No Tests
	1.07' to 1.60'	Dark green very silty, clayey fine Sand;calcareous	1.87×10^{-6} cm/sec.	92.9	2.648	43.7	5 ksf	1. Sample received in shelby tube 2. Test specimen sampled at 1.35' to 1.60' 3. Dry unit weight is as received in Lab.
	1.60' to 2.50'	Damaged Shelby tube						
23'	0.00' to 0.83'	Green slightly sandy clayey Silt; calcareous	1.175×10^{-6} cm/sec.	71.4	2.524	54.6	5 ksf	1. Sample received in shelby tube. 2. Test specimens sampled at 0.60' to 0.83' 3. Dry Unit weight is as received in Lab.

FLORIDA TESTING LABORATORIES, INC.

BY ______ DATE ______
CHKD. BY ______ DATE ______
SUBJECT ______
SHEET NO. ______ OF ______
JOB NO. ______

FLORIDA TESTING LABORATORIES, INC.

BY Robert T. Smith

Robert T. Smith

PROJECT: WEST PALM BEACH DEEP TEST WELL
CLIENT: GEHERITY & MILLER, INC.

LAB NO: 25230
DATE: 11/26/74

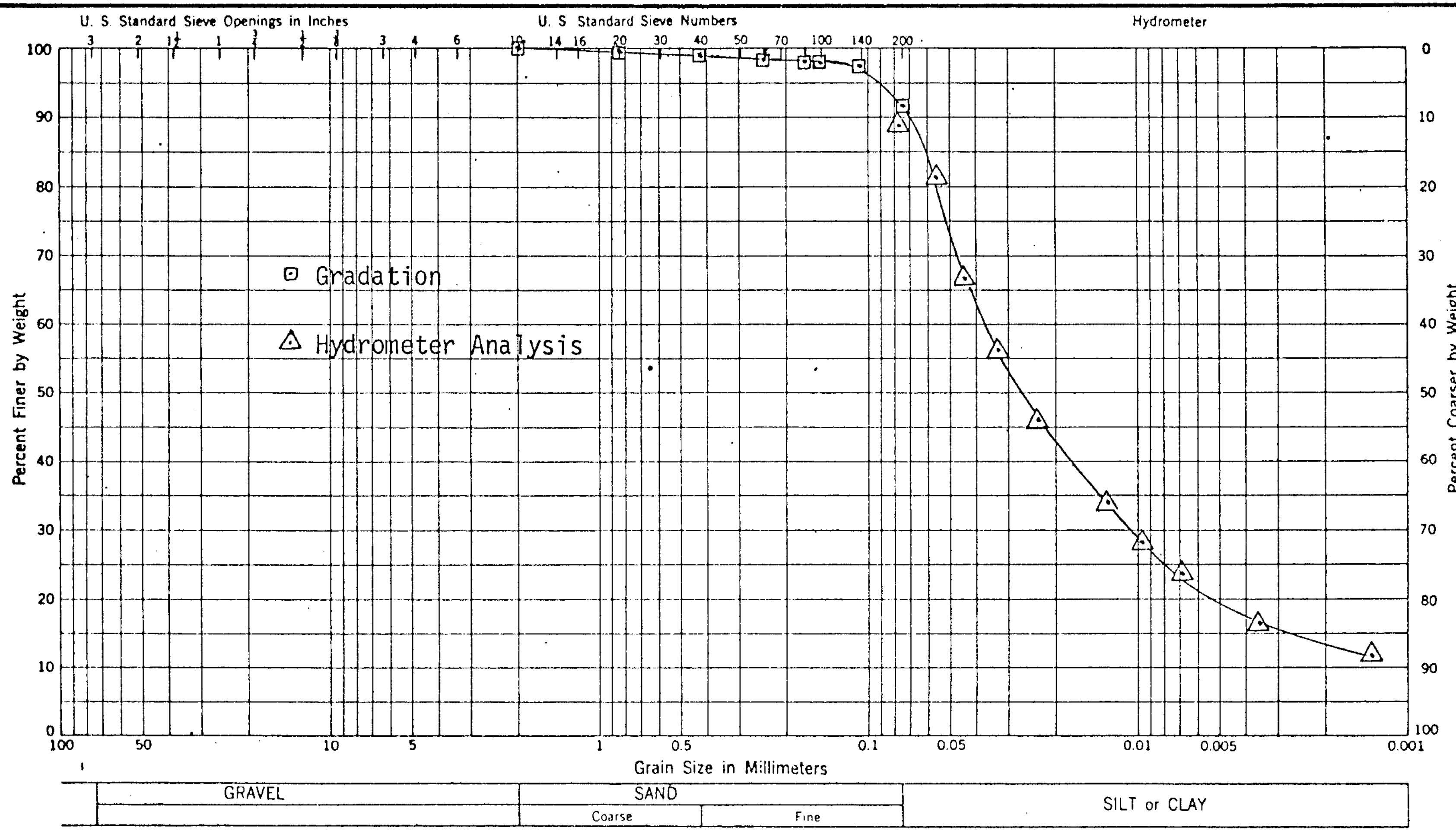
Boring Depth-ft.	Sample-Top to Bottom	Soil Description	Permeability Rate	Dry Unit Wt. pcf.	G_S	Porosity %	Permeability Surcharge	Remarks
715' to 719'	0.00' to 1.00	Light tan to white cemented very silty, clayey fine Sand with traces of small shell fragments and fine phosphate-calcareous	3.151×10^{-5}	104.0	2.691	38.0	5 ksf	1.Sample received as .2"± core wrapped in plastic 2.Core contained horizontal fractures at each 0.2' length throughout sample length 3.Test specimens sampled at 0.00 to 0.15' and 0.75' to 1.00' 4.Dry unit weight is as received in Lab.
860' to 861'	0.00' to 1.00'	Greenish gray slightly sandy, silty clay-slightly calcareous with random small phosphate pellets	3.113×10^{-8}	60.8	2.653	63.2	5 ksf	1.Sample received as 1.5"± core wrapped in plastic 2.Core contained horizontal fractures at approximately 0.2' intervals 3.Test specimens sampled at 0.00' to 0.20' and 0.80' to 1.00' 4.Dry unit weight is as received in Lab.

BY.____ DATE____ CHKD. BY.____ DATE____ SUBJECT____ SHEET NO.____ OF____ JOB NO.____

FLORIDA TESTING LABORATORIES, INC.

FLORIDA TESTING LABORATORIES, INC.

St. Petersburg, Florida



Number	Depth	Natural Moisture	L. L.	P. L.	P. I.	Classification
1	623'	47.0	-	-	-	Sand: 8.6%
						Silt: 71.9%
						Clay: 19.5%

PROJECT: West Palm Beach Deep Test Well
CLIENT: Geherity & Miller, Inc.
SOIL DESCRIPTION: Green slightly sandy clayey Silt; calcareous

FTL-31 - REV. 62

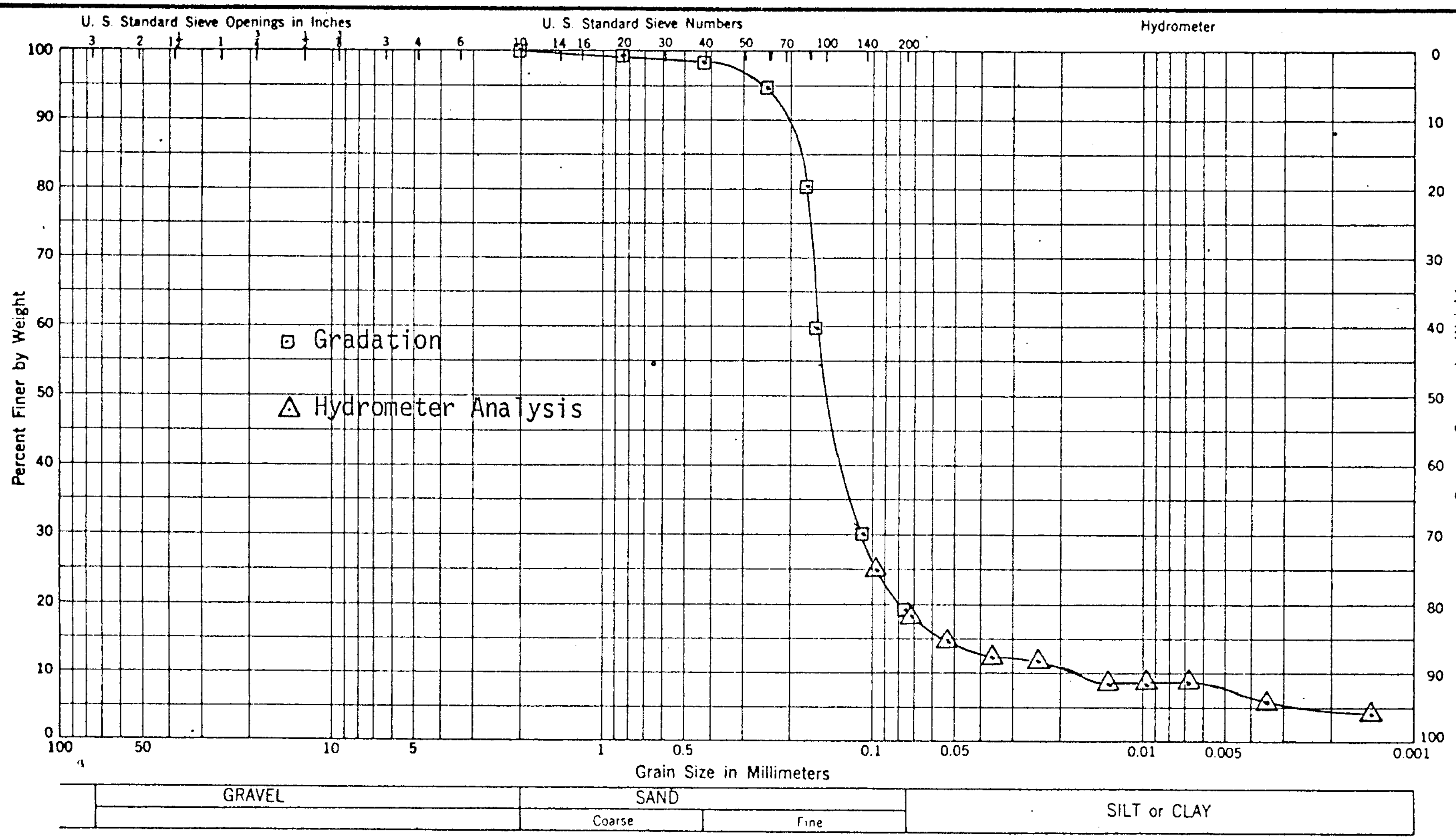
DATE: 11/26/74

FLORIDA TESTING LABORATORIES, INC.

BY Robert S. Smith

LAB.NO. 25230

FLORIDA TESTING LABORATORIES, INC.
St. Petersburg, Florida



Number	Depth	Natural Moisture	L. L.	P. L.	P. I.	Classification
1	363' to 365'	24.4	-	-	-	Sand: 81.0%
						Silt: 11.0%
						Clay: 8.0%

PROJECT: West Palm Beach Deep Test Well
CLIENT: Geherity & Miller, Inc.
SOIL DESCRIPTION: Gray silty, clayey Sand with very small soft shell fragments-calcareous

FTL-31 - REV. 62

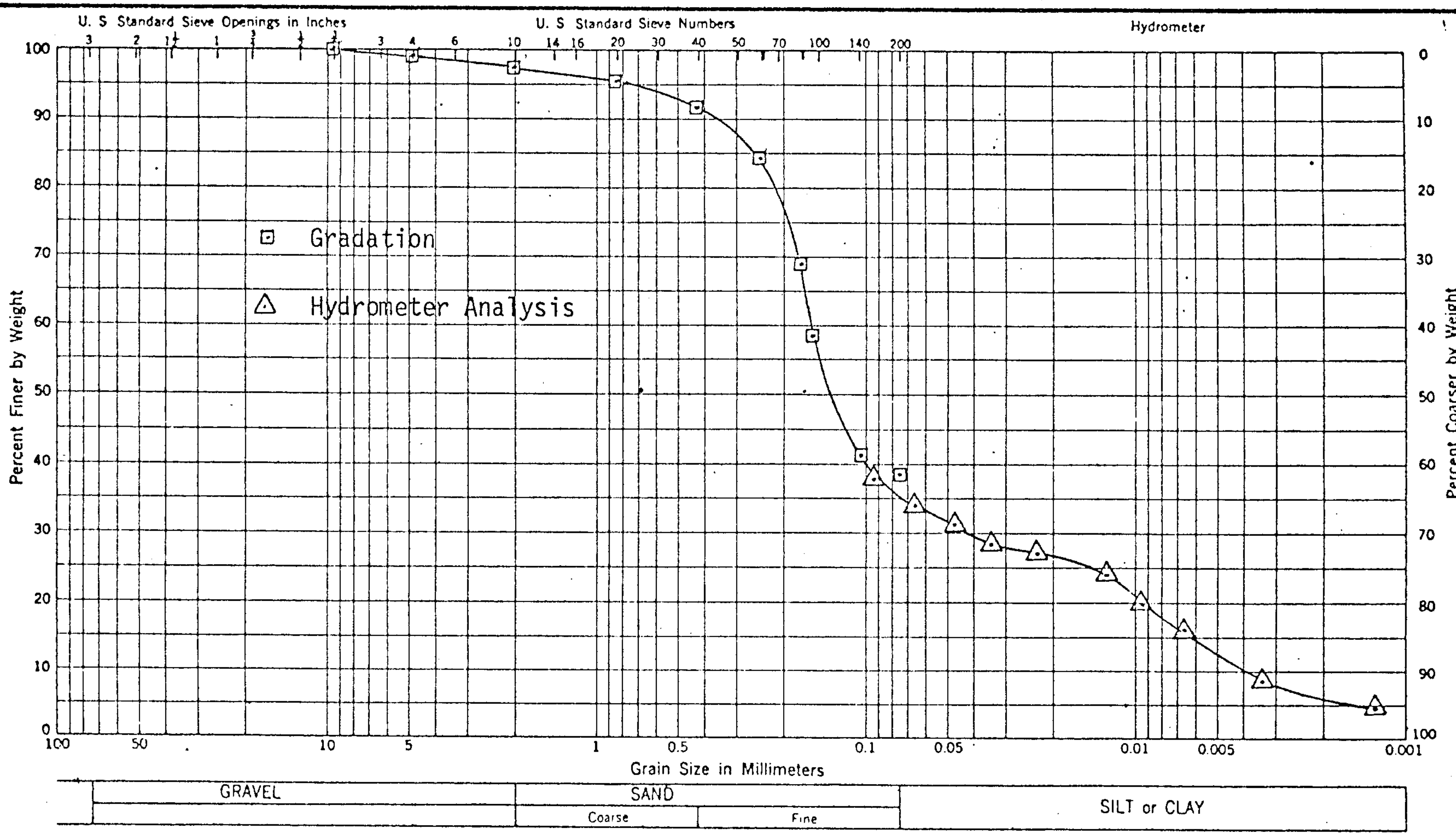
DATE: 11/26/74

FLORIDA TESTING LABORATORIES, INC.

BY Robert T Smith

LAB NO. 25230

FLORIDA TESTING LABORATORIES, INC.
St. Petersburg, Florida



Number	Depth	Natural Moisture	L. L.	P. L.	P. I.	Classification
	715' to	22.2				Sand: 65.0%
	719'					Silt: 22.5%
						Clay: 12.5%

PROJECT: West Palm Beach Deep Test Well
CLIENT: Geherity & Miller, Inc.
SOIL DESCRIPTION: Light tan to white cemented very silty clayey Sand with traces of small shell fragments and fine phosphate- calcareous

FTL-31 - REV. 82

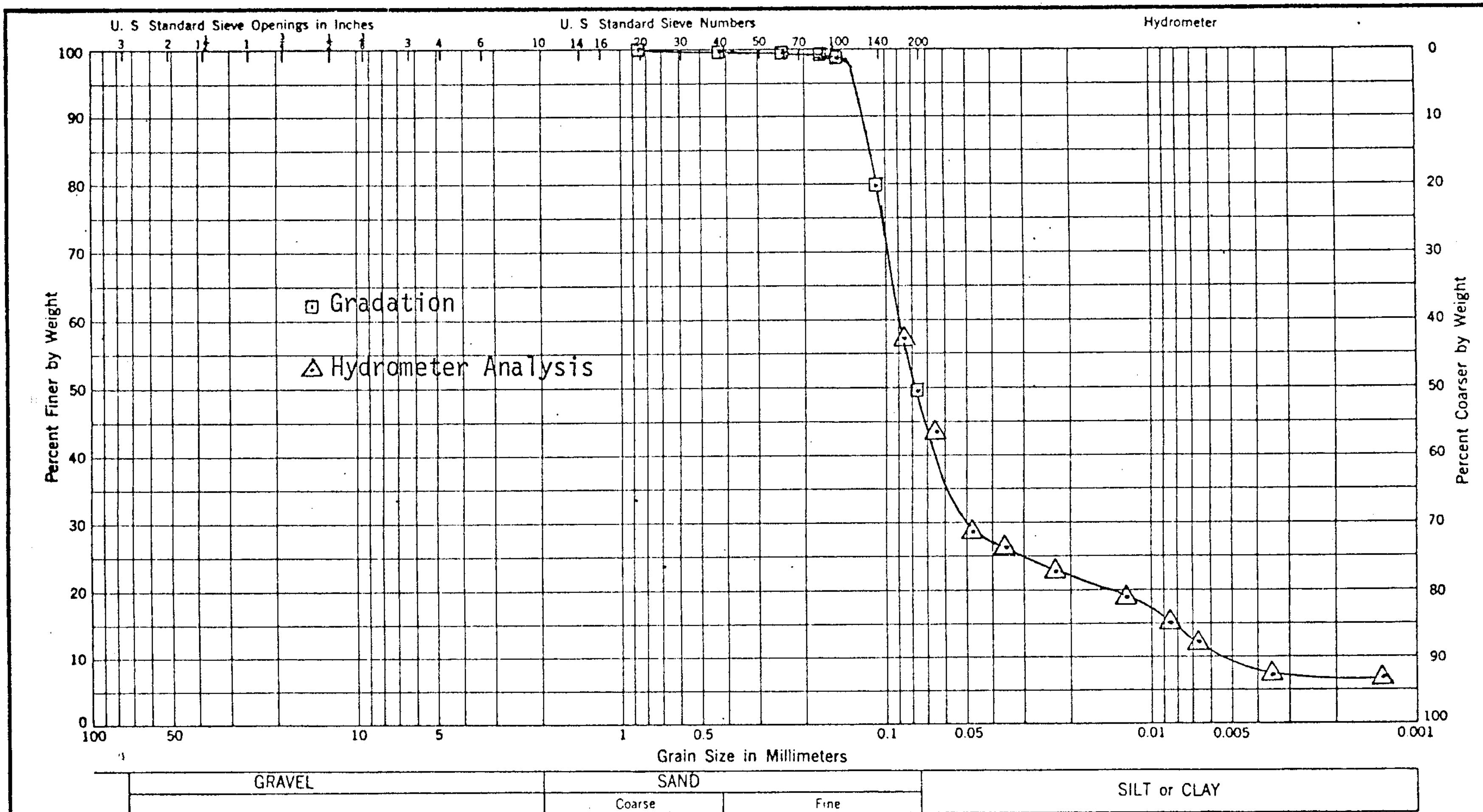
DATE: 11/26/74

FLORIDA TESTING LABORATORIES, INC.

BY Robert L. [illegible]

LAB.NO. 25230

FLORIDA TESTING LABORATORIES, INC.
St. Petersburg, Florida



Number	Depth	Natural Moisture	L. L.	P. L.	P. I.	Classification
1	485' to	28.4	-	-	-	Sand: 51.2%
	488'					Silt: 39.3%
						Clay: 9.5%

PROJECT: West Palm Beach Deep Test Well
CLIENT: Geherity & Miller, Inc.
SOIL DESCRIPTION: Dark green very silty clayey Sand; calcareous

FTL-31 - REV. 62

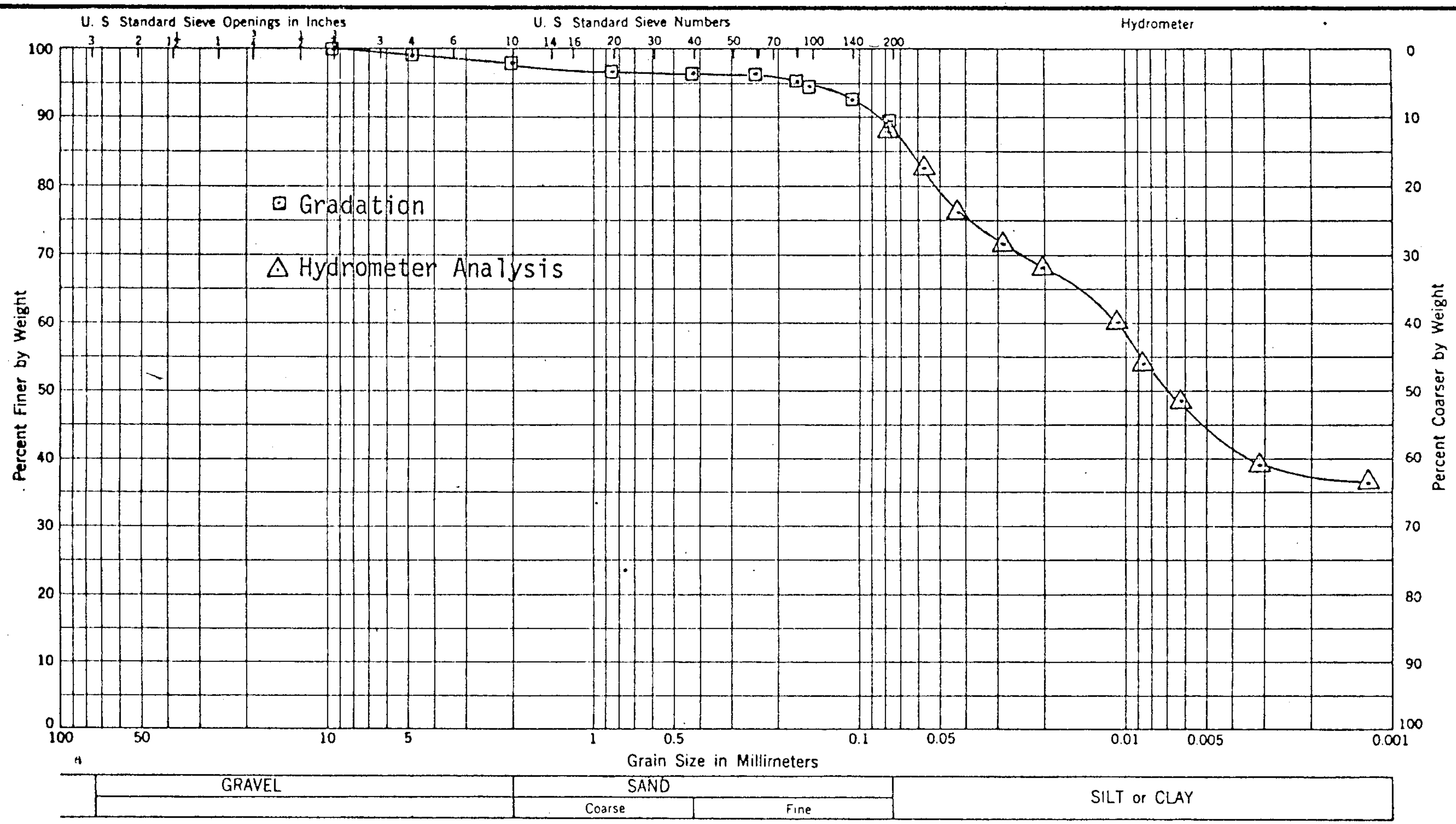
DATE: 11/26/74

FLORIDA TESTING LABORATORIES, INC.

BY [signature]

LAB.NO. 25230

FLORIDA TESTING LABORATORIES, INC.
St. Petersburg, Florida



Number	Depth	Natural Moisture	L. L.	P. L.	P. I.	Classification
	860' to	65.6	-	-	-	Sand: 10.9%
	861'					Silt: 44.6%
						Clay: 44.5%

PROJECT: West Palm Beach Deep Test Well
CLIENT: Geherity & Miller, Inc.
SOIL DESCRIPTION: Greenish gray slightly sandy silty Clay with random phosphate pebble, slightly calcareous

FTL-31 · REV. 62

DATE: 11/26/74

FLORIDA TESTING LABORATORIES, INC.

BY Robert L. Smith

LAB NO: 25230

FLORIDA TESTING LABORATORIES, INC. CONSULTING ENGINEERS
6056 ULMERTON ROAD • CLEARWATER • 813/531-1446 • TAMPA • 813/229-2119
P. O. BOX 11064 • ST. PETERSBURG, FLORIDA 33733

March 19, 1975

Geraghty & Miller, Inc.
324 Royal Palm Way
Suite 205
Palm Beach, Florida 33280

Attention: Mr. Vincent P. Amy

Re: Rock Core Tests
Deep Test Well
City of West Palm Beach
Lab #27211

Gentlemen:

Attached please find the results of tests performed by this laboratory from rock samples submitted by Geraghty & Miller, Inc. from the deep well test project. Tests were conducted from February 11th thru March 7, 1975, and performed in accordance with previous written correspondence and telephone conversations with Mr. Amy.

PERMEABILITY TESTS

Variable head permeability tests were performed on sections of cores trimmed from specimens received in the lab. Test specimen dimensions are as indicated hereafter. Tests on all trimmed sampled were conducted in the consolidation apparatus using non-shrinking paraffin as the sealing agent.

Core specimen at 2503'-2510' was marked for top identification and water flow was directed from bottom to top accordingly. The top of the core specimens at 2750' and 2957' was unidentifiable. Test sections from these two locations were trimmed from the largest section available with the water flow parallel to the longitudinal axis of the core.

Permeameter samples were trimmed in the laboratory with the use of a carborundum saw blade and all sides were brushed with sand paper before assembly for test. Core test dimensions were as follows:

Sample	Width-Inches	Length-Inches	Height-Inches
2503'-2510'	1.110	1.400	0.715
2520'	0.669	0.830	0.752
2750'	1.165	1.660	1.007
2957'	1.235	1.650	0.983

Re: Rock Core Tests
Deep Test Well
City of West Palm Beach
Lab #27211

Unit weights were determined from laboratory measurements of permeameter samples with measurements to the nearest .001 inch and weights to nearest .01 grams.

Apparent specific gravities were performed in accordance with ASTM D 854-58 from the broken portions of the permeameter sample.

The remaining portions of the cores submitted will be retained at this office until the test results are observed by the applicable parties and will be returned at Mr. Amy's request.

Florida Testing Laboratories, Inc. appreciates the privilege of providing these test services to you. Please call if there are any questions regarding the enclosed test results.

Very truly yours,

FLORIDA TESTING LABORATORIES, INC.

Robert T. Smith
Robert T. Smith

STOCK NO 150

PROJECT: West Palm Beach Deep Test Well FLORIDA TESTING LABORATORIES, INC. LAB NO: 27211

CLIENT: Geherity & Miller, Inc. BY Robert T. Smith DATE: 3-18-75

Core Depth Feet	Core Description	Permeability Rate	Dry Unit wt-PCF	Gs	Porosity %	Perme-ability Surcharge	Remarks
2503 to 2510	Grayish-brown, mildly porous granular limestone (well cemented)	5.668×10^{-6}	151.7	2.810	13.4	2.5KSF	1. Permeability specimen trimmed from largest undisturbed portion. 2. Water flow from bottom thru top as core marked. 3. Dry Unit weight determined from trimmed core measurements
2520 Welex	White, lightly cemented, weathered limestone	8.809×10^{-6}	105.6	2.836	40.3	5 KSF	1. Permeability specimen trimmed approximately square from round section. 2. Dry unit weight determined from trimmed core measurement
2750	Lt. Gray, fine grained, chalky limestone	4.080×10^{-6}	120.2	2.742	29.7	1.5 KSF	1. Permeability specimen trimmed from largest undisturbed portion. 2. Dry Unit weight determination from trimmed core measurements.
2957	Off-white, fine grained, chalky limestone	1.186×10^{-6}	124.9	2.814	28.8	1.5 KSF	1. Permeability specimen trimmed from largest undisturbed portion. 2. Dry unit weight determined from trimmed core measurements.

BY___ DATE___ CHKD. BY___ DATE___ SUBJECT___ SHEET NO. 1 OF 2 JOB NO.___

APPENDIX B

FIGURES 3 AND 4
GERAGHTY & MILLER 1975 REPORT

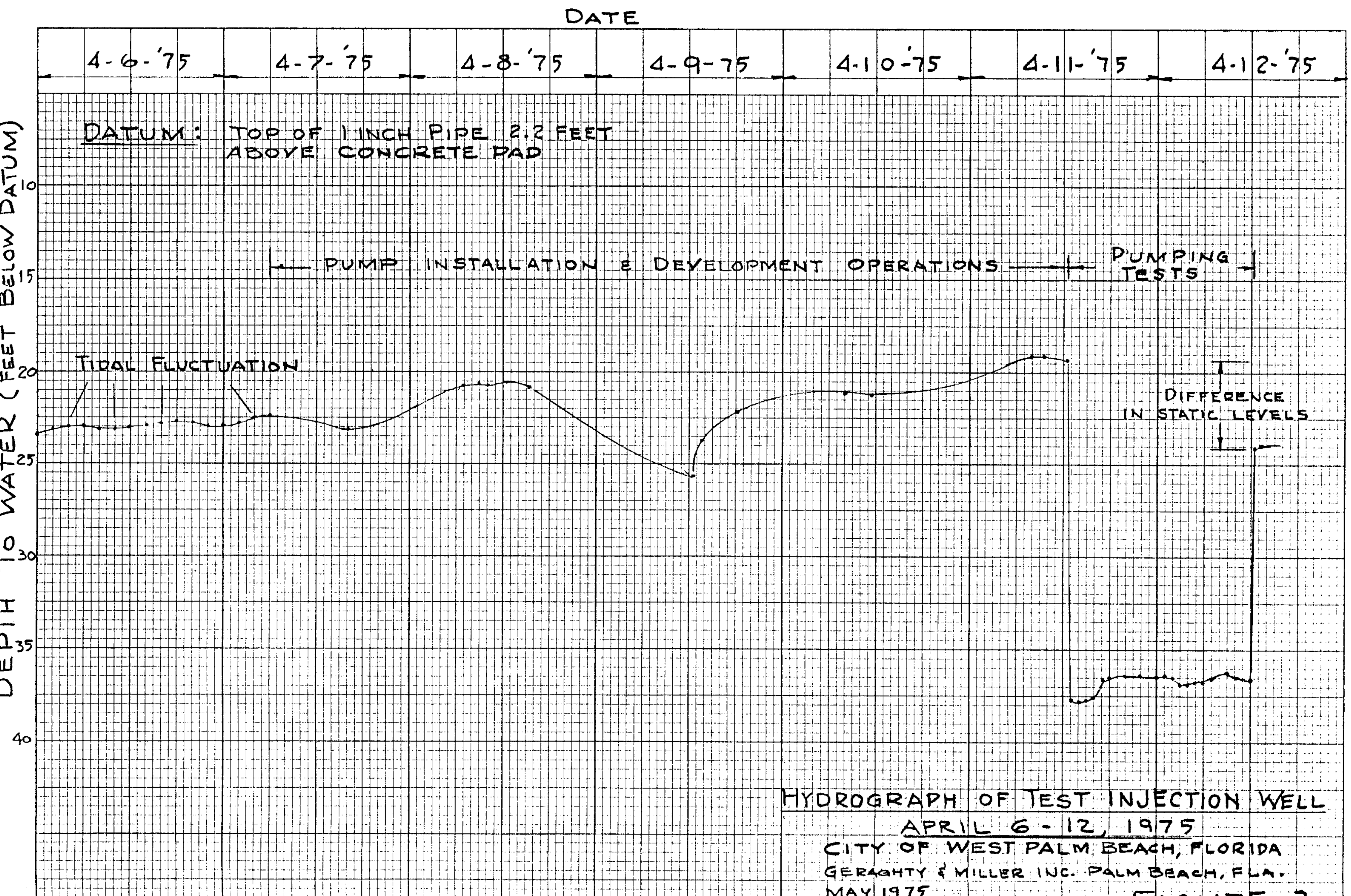

DATE
4-6-'75
4-7-'75
4-8-'75
4-9-75
4-10-'75
4-11-'75
4-12-'75
DATUM: TOP OF 1 INCH PIPE 2.2 FEET ABOVE CONCRETE PAD
PUMP INSTALLATION & DEVELOPMENT OPERATIONS
PUMPING TESTS
TIDAL FLUCTUATION
DIFFERENCE IN STATIC LEVELS
DEPTH TO WATER (FEET BELOW DATUM)
10
15
20
25
30
35
40
HYDROGRAPH OF TEST INJECTION WELL
APRIL 6 - 12, 1975
CITY OF WEST PALM BEACH, FLORIDA
GERAGHTY & MILLER INC. PALM BEACH, FLA.
MAY, 1975

FIGURE 3

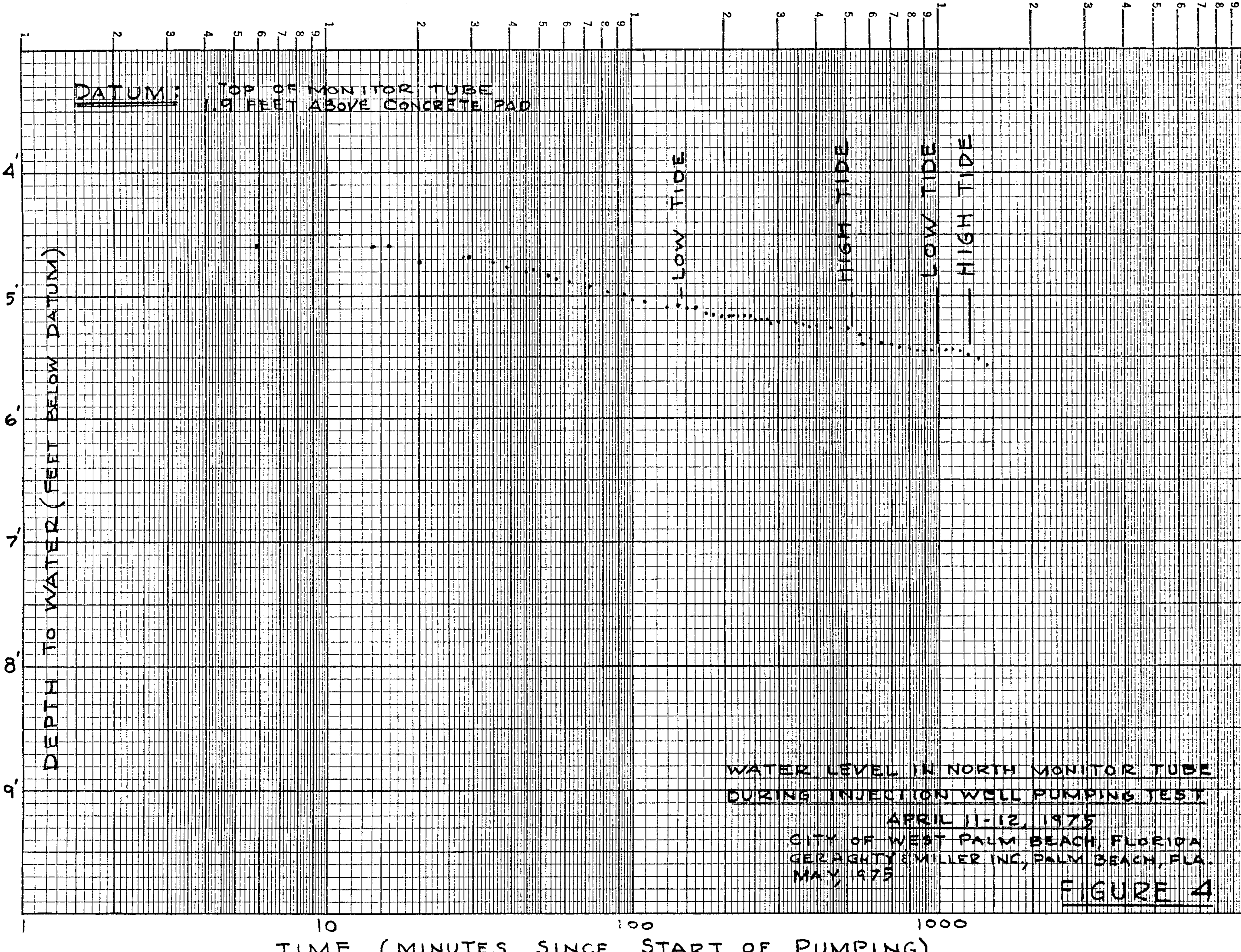
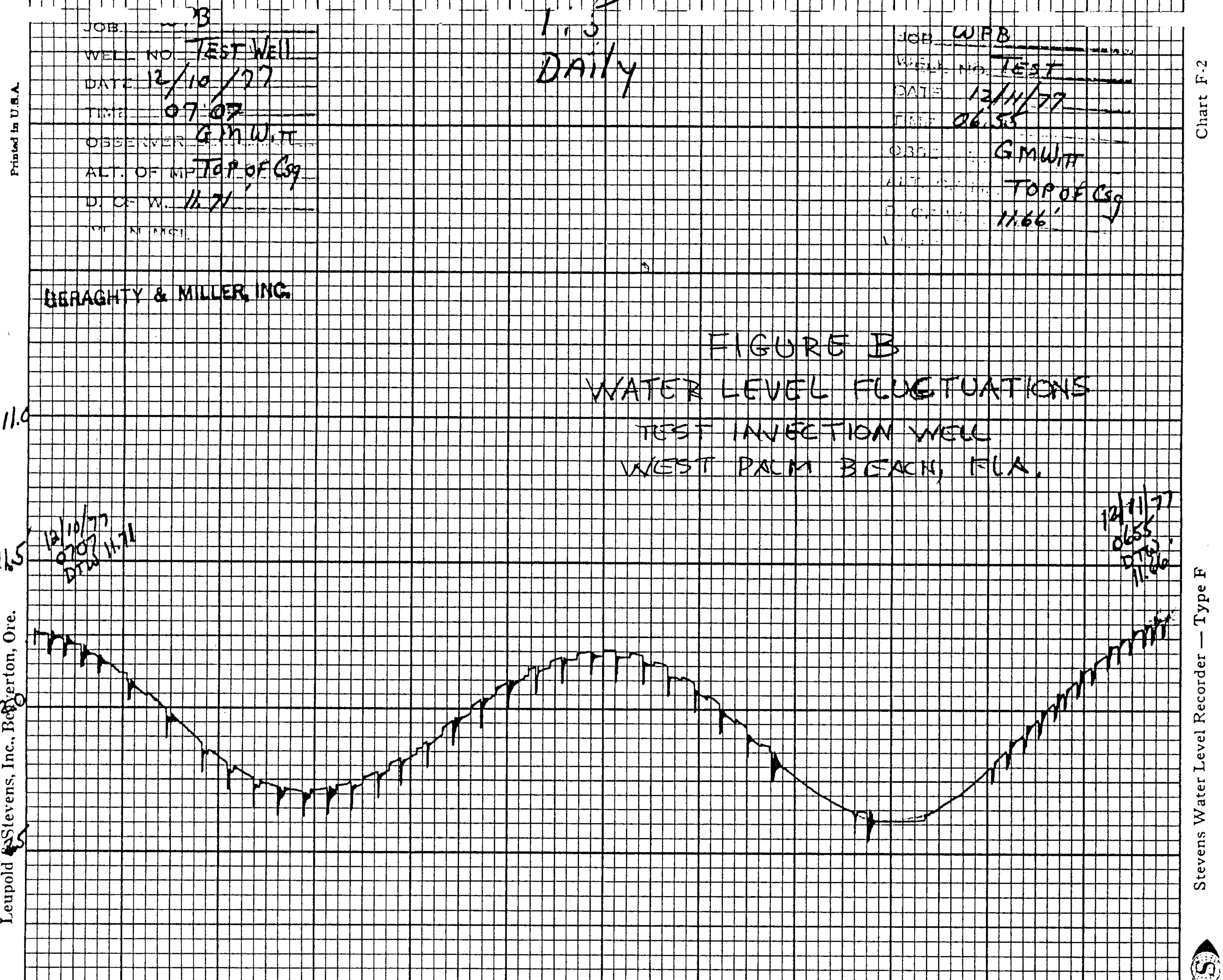

DATUM: TOP OF MONITOR TUBE
1.9 FEET ABOVE CONCRETE PAD
LOW TIDE
HIGH TIDE
LOW TIDE
HIGH TIDE
4'
5'
6'
7'
8'
9'
DEPTH TO WATER (FEET BELOW DATUM)
1
10
100
1000
TIME (MINUTES SINCE START OF PUMPING)
WATER LEVEL IN NORTH MONITOR TUBE
DURING INJECTION WELL PUMPING TEST
APRIL 11-12, 1975
CITY OF WEST PALM BEACH, FLORIDA
GERAGHTY & MILLER INC, PALM BEACH, FLA.
MAY 1975

FIGURE 4


JOB B
WELL NO. TEST Well
DATE 12/10/77
TIME 07 07
OBSERVER GMW,TT
ALT. OF MP TOP OF Csg
D. OF W. 11.71'
1.5
DAILY
JOB WPB
WELL NO. TEST
DATE 12/11/77
TIME 06.55
OBSERVER GMW,TT
TOP OF Csg
11.66'
GERAGHTY & MILLER, INC.
FIGURE B
WATER LEVEL FLUCTUATIONS
TEST INJECTION WELL
WEST PALM BEACH, FLA.
11.0
11.5
12/10/77 0707 DTW 11.71
12/11/77 0655 DTW 11.66'
Printed in U.S.A.
Chart F-2
Leupold & Stevens, Inc., Beaverton, Ore.
Stevens Water Level Recorder — Type F

APPENDIX C

FIGURE 4
GERAGHTY & MILLER 1978 REPORT

FIGURE 4

WATER LEVELS AND PUMPING RATES

PUMPING-INJECTION TEST 3
OCTOBER 17-20, 1977

REGIONAL POLLUTION CONTROL FACILITY
CITY OF WEST PALM BEACH, FLORIDA

GERAGHTY & MILLER, INC., WEST PALM BEACH, FL 8-78

APPENDIX D

RESULTS OF PRESSURE TEST
ON 24-INCH CASING AND 22-INCH LINER
DISPOSAL WELL 1
CITY OF WEST PALM BEACH
OCTOBER 25, 1976

Geraghty & Miller, Inc.

MEMORANDUM

25 October 1976

Pressure Test on Disposal Well #1
at the
West Palm Beach Water Pollution Control Plant

. . . .

Two pressure tests were conducted on the 24-inch casing and the 22-inch liner on Disposal Well #1 at the West Palm Beach Water Pollution Control Plant site on October 23, 1976. Prior to the testing, the cement had been cleaned out to a depth of 2819 feet. The bottom of the 22-inch liner is 3001 feet. Immediately prior to the tests, pressures of 50, 220, and 200 psi (pounds per square inch) were applied and subsequently blown off following each application in order to compress and drive into solution air entrained in the drilling mud contained in the casing and liner.

The initial pressure gauge reading for Test #1 was 164 psi; after 30 minutes the reading was 153 psi. Thus, a pressure drop of 11 psi was recorded, for a loss of 6.7 percent. For Test #2, the observed values were 161 psi, 150 psi, 11 psi, and 6.8 percent, respectively. For both tests the pressure loss was less than the maximum allowable loss of 10 percent that is stipulated in the specifications.

The attached table lists the gauge readings for both tests. Test #1 began at 2252 and ended at 2322 hours. Test #2 began at 2330 and ended at 2400 hours. The pressure gauge used was a Marsh Mastergauge, Type 100-3, 316 stainless tube with a 0-600 psi range and 5 psi subdivisions.

GERAGHTY & MILLER, INC.

Ronald P. Rioux

Ronald P. Rioux
Field Hydrogeologist

APPENDIX E

INDUCTION LOG
WELL 4

Schlumberger

DUAL INDUCTION - LATEROLOG

COMPANY Progress Supply Co.

WELL Palm Beach Disposal #4

FIELD City of West Palm Beach

COUNTY Palm Beach STATE Fla

LOCATION	API SERIAL NO.	SEC.	TWP.	RANGE
		10	43S	42E

Other Services: BHC-GOL, FDC-CNL-GR, HRT

Permanent Datum: Ground level ; Elev.: 19

Log Measured From K.B. 16.8 Ft. Above Perm. Datum

Drilling Measured From K.B.

Elev.: K.B. 35.8, D.F. —, G.L. 19.0

COUNTY

FIELD

LOCATION

WELL

COMPANY

Date	10-10-77			
Run No.	One			
Depth—Driller	3288			
Depth—Logger (Schl.)	3287			
Btm. Log Interval	3284			
Top Log Interval	1057			
Casing—Driller	36 @ 1055	@	@	@
Casing—Logger	1057			
Bit Size	8 3/4			
Type Fluid in Hole	Water			
Dens. | Visc.	8.8 | —			
pH | Fluid Loss	— | — ml	ml	ml	ml
Source of Sample	Flowline			
Rm @ Meas. Temp.	.163 @ 84 °F	@ °F	@ °F	@ °F
Rmf @ Meas. Temp.	— @ — °F	@ °F	@ °F	@ °F
Rmc @ Meas. Temp.	— @ — °F	@ °F	@ °F	@ °F
Source: Rmf | Rmc	— | —			
Rm @ BHT	@ 101 °F	@ °F	@ °F	@ °F
Circulation Stopped	0200			
Logger on Bottom	0500			
Max. Rec. Temp.	101 °F	°F	°F	°F
Equip. | Location	7641 | Ft. Myers			
Recorded By	Barre			
Witnessed By Mr.	Hawkes			

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

Run No.	One			
Service Order No.	476			
Fluid Level	Full			
Speed F.P.M.	70			
Salinity ppm. cl				
EQUIPMENT DATA				
Panel DIP DC	460			
Cartridge DIC B	113			
Sonde DIS DB	83			
Memorizer Panel ILPBA	340			
Centralizer Type	Rim			
Stand-off - Inches	1 1/2			
G.R. Panel ILPBA	340			
G.R. Cartridge SGCJ	127			
CALIBRATION DATA				
ILD Sonde Error	300			
ILM Sonde Error	180			
G.R. Background	60			
G.R Source	460			
T.C. - Cal.	Auto			
LOGGING DATA				
ILD Sonde Error	300			
ILM Sonde Error	180			
G.R. Scale per 100 Div.	100			
G.R. - T.C. - Log	Auto			

SCALE CHANGES

Type Log	Depth	Scale Up Hole	Scale Down Hole

REMARKS

SPONTANEOUS POTENTIAL 10 MILLIVOLTS

GAMMA RAY API UNITS 0 100

RESISTIVITY OHMS. M²/M

DEEP INDUCTION LOG 0.2 1.0 10 100 1000 2000

MEDIUM INDUCTION LOG 0.2 1.0 10 100 1000 2000

LATEROLOG — 8 0.2 1.0 10 100 1000 2000

APPENDIX F

INDUCTION LOG
WELL 5

APPENDIX G

GEOLOGIC LOG
WELL 1R
FROM 2550 TO 3628 FEET

GERAGHTY & MILLER, INC.

WELL LOG

PROJECT: WPB Sewage Disposal DATE: 25 July 77 SHEET: ____ OF ____

LOCATION: WPB DRILLING CONTRACTOR: APCO

WELL NUMBER: 1R DRILLING METHOD: Reverse Air (Mud)

SAMPLE DESCRIBED BY: Wheatley / Rioux SAMPLING METHOD: Washed / Strained

SAMPLE DESCRIPTION	DEPTH INTERVAL (FEET)	THICKNESS (FEET)
Limestone, off white, soft to moderately hard Poor porosity, loosely cemented w/15% light brown dolomite, Poor porosity	2550-2560	10
Limestone, off white, soft to moderately hard Poor porosity, loosely cemented Trace of light Brown dolomite	2560-2570	10
Same	2570-2580	10
Same	2580-2590	10
Same	2590-2600	10
Limestone, Cream, Soft To Moderate Hardness (Mostly Soft), Poor Porosity; Small Amount of Light Brown Dolomite Ranging From Poor To Good Porosity; Wafer-Shaped Fossils.	2600-2610	10
Limestone, Cream, Soft To Moderate Hardness (Mostly Soft), Poor Porosity; Trace Fossils	2610-2620	10
Same w/ Greater Number of Fossils & A Trace of ~~Light~~ Brown Dolomite.	2620-2630	10
Same	2630-2640	10
Limestone, Cream, Soft To Moderate Hardness (Mostly Soft), Poor Porosity; Small Amount of Brown, Moderately Hard Dolomite; Small Amount of Wafer-Shaped Fossils.	2640-2650	10
Same	2650-2660	10

GERAGHTY & MILLER, INC.

WELL LOG

PROJECT: WPB Sewage Disposal DATE: 26 July 77 SHEET: ______ OF ______

LOCATION: WPB DRILLING CONTRACTOR: APCO

WELL NUMBER: 1R DRILLING METHOD: Reverse Air (Mud)

SAMPLE DESCRIBED BY: Rioux/Wheatley SAMPLING METHOD: Washed/Strained

SAMPLE DESCRIPTION	DEPTH INTERVAL (FEET)	THICKNESS (FEET)
Dolomite, Light Brown, Moderate Hardness, Generally Poor Porosity But w/ Some Fair Porosity; Small Amount of Soft White L.S. Dolomite First Encountered At 2663' (Pad Datum).	2660-2670	10
Same w/ Greater Amount of Soft White L.S. (~25%) Than Prior Sample; Trace Fossils.	2670-2680	10
Limestone, off white, soft to moderate Hardness, loosley cemented, poor to fair porosity, 10% Light Brown Dolomite, poor Porosity	2680-2690	10
	2690-2700	10
Same	2700-2710	10
Same	2710-2720	10
Same	2720-2730	10
Same	2730-2741	10
Same	2740-2750	10
Same		
Limestone, off white soft to moderate Hardness loosley cemented, poor to fair porosity 30% Light Brown Dolomite, Poor Porosity	2750-2760	10
Same	2760-2770	10
Same	2770-2780	10

GERAGHTY & MILLER, INC.

WELL LOG

PROJECT: WPB Sewage Disposal DATE: 26 July 77 SHEET: ______ OF ______

LOCATION: WPB DRILLING CONTRACTOR: APCO

WELL NUMBER: 1R DRILLING METHOD: Reverse Air (Mud)

SAMPLE DESCRIBED BY: Rioux/Wheatley SAMPLING METHOD: Strained/Washed

SAMPLE DESCRIPTION	DEPTH INTERVAL (FEET)	THICKNESS (FEET)
Limestone, Light Gray, Mostly Soft w/ Some of Moderate Hardness, Poor Porosity; Small Amount of Light Brown Dolomite of Moderate Hardness And Poor Porosity; Wafer-Shaped Fossils, Fossil & Shell Fragments.	2780-2790	10
Same (Poor Returns)	2790-2800	10
Limestone, Cream, Mostly Soft w/ Some of Moderate Hardness, Poor Porosity; Light Gray & Gray Chert; Trace Lt. Brown Dolomite; Wafer-Shaped Fossils.	2800-2810	10
Same w/ Trace of White Marl.	2810-2820	10
Same	2820-2830	10
Same w/ No Dolomite & Brown Chert & Gray Chert.	2830-2840	10
Limestone, Cream, Mostly Soft w/ Some of Moderate Hardness, Poor Porosity & Light Brown Dolomite of Moderate Hardness, Poor to Fair Porosity; Some Brown & Light Gray Chert.	2840-2850	10
Limestone, Cream, Mostly Soft w/ Some of Moderate Hardness, Poor Porosity; Small Amount of Brown & Light Gray Chert; Trace Fossils.	2850-2860	10
Same w/ Greater Amount of Chert & Trace Light Brown Dolomite	2860-2870	10
Same w/ Greater Amount of Chert.	2870-2880	10

GERAGHTY & MILLER, INC.

WELL LOG

PROJECT: WPB Sewage Disposal DATE: 7-27-77 SHEET: ____ OF ____

LOCATION: WPB DRILLING CONTRACTOR: APCO

WELL NUMBER: 1R DRILLING METHOD: Reverse Air (mud)

SAMPLE DESCRIBED BY: Wheatley SAMPLING METHOD: Strained

SAMPLE DESCRIPTION	DEPTH INTERVAL (FEET)	THICKNESS (FEET)
Limestone, off white, soft to moderate Hardness, wackestone, poor porosity w/40% Dark Brown chert	2880-2890	10
Same	2890-2900	10
Same	2900-2910	10
Same	2910-2920	10
Limestone Cream, Soft To Moderate Hardness, Poor Porosity; Some Brown & Light Gray Chert; Wafer-Shaped Fossils. (Poor Returns. There Is A Good Possibility That Cuttings Are Remaining Suspended In The Hole & Not Coming To The Surface).	2920-2930	10
Same w/ Good Returns.	2930-2940	10
Same w/ Less Chert	2940-2950	10
Same w/ Less Chert	2950-2960	10
Same w/ Less Chert	2960-2970	10
Limestone, cream, Soft to moderate Hardness Poor porosity, packstone, w/trace of Brown chert	2970-2980	10
Same	2980-2990	10
Same	2990-3000	10

GERAGHTY & MILLER, INC.

WELL LOG

PROJECT: WPB Sewage Disposal DATE: ______ SHEET: ______ OF ______

LOCATION: WPB DRILLING CONTRACTOR: ______

WELL NUMBER: 1R DRILLING METHOD: ______

SAMPLE DESCRIBED BY: Wheatley SAMPLING METHOD: ______

SAMPLE DESCRIPTION	DEPTH INTERVAL (FEET)	THICKNESS (FEET)
Limestone, cream, soft to moderate hardness, poor porosity, packstone, w/ trace of brown chert	3000-3010	10
Same	3010-3020	10
Same	3020-3030	10
Same	3030-3040	10

GERAGHTY & MILLER, INC.

WELL LOG

PROJECT: WPB Sewage Disposal DATE: ______ SHEET: ____ OF ____

LOCATION: WPB DRILLING CONTRACTOR: APCO

WELL NUMBER: 1R DRILLING METHOD: Reverse Air

SAMPLE DESCRIBED BY: Pearce SAMPLING METHOD: ______

SAMPLE DESCRIPTION	DEPTH INTERVAL (FEET)	THICKNESS (FEET)
Limestone, white, moderately Hard poor porosity Trace of Blue gray Limestone	3040-3050	10
Limestone, white, moderately Hard, poor porosity Sample very marley	3050-3060	10
Same	3060-3070	10
Limestone, white, Soft, ~~Bo~~ dense, poor porosity	3070-3080	10
Same	3080-3090	10
Dolomitic Limestone - off white, hard, poor porosity trace fossils visible in many pieces Trace of - Limestone, soft, white fair to poor porosity	3090 3100	10
As Above	3100 3110	10
As Above w/ Trace Brn, soft, fine grained Limestone	3110 3120	10
Limestone - slightly Dolomitic, white, soft Biomicrite - poor porosity	3120 3130	10
Dolomitic Limestone - more dolomitized than ~~last~~ last Sample - White & off white (cont)		

GERAGHTY & MILLER, INC.

WELL LOG

PROJECT: WPB Sewage Disposal DATE: 9/12 SHEET: ______ OF ______

LOCATION: WPBF1 DRILLING CONTRACTOR: APCO

WELL NUMBER: 1R DRILLING METHOD: Reverse Air

SAMPLE DESCRIBED BY: Pearce/Witt SAMPLING METHOD: Strained Washed

SAMPLE DESCRIPTION	DEPTH INTERVAL (FEET)	THICKNESS (FEET)
(cont.) moderately hard - only a few distinguishable fossils - poor porosity	3130 -3140	10
Dolomitic Limestone - White, moderately hard, poor porosity, only a few distinguishable fossils.	3140 3150	10
As Above	3150 3160	10
As Above w/ Trace Light grey Dolomitic Limestone - very fine grained - poor porosity, hard w/ a few ghost fossils.	3160 3170	10
As above	3170-3180	10
as Above.	3180-3190	10
as above - somewhat courser granular.	3190-3200	10
as above - courser, granular, Intraclast dolomitic limestone porosity fair to poor soft - to moderately hard transition from previous two samples	3200-3210	10
as above w/ trace of light grey dolomite	3210-3220	10
Limey Dolomite, light grey, hard dense granularly ghost fossils micritized well cemented 60% of sample. 50% light cream Dolomitic limestone - as above.	3220-3230	10

GERAGHTY & MILLER, INC.

WELL LOG

PROJECT: WPB Sewage Disposal DATE: ________ SHEET: ____ OF ____

LOCATION: WPB DRILLING CONTRACTOR: APCO

WELL NUMBER: 1R DRILLING METHOD: Reverse Air

SAMPLE DESCRIBED BY: GMWH SAMPLING METHOD: Strained washed.

SAMPLE DESCRIPTION	DEPTH INTERVAL (FEET)	THICKNESS (FEET)
Dolomite (limey) wt grey dolomite, dolomitic limestone grey to tan well cemented · dolomitic matrix with calcareous intraclast - micritigation (dolomitic) in evidence poor porosity drilling some what harder.	3230 - ~~3240~~ 3238	8
☆ Dolomite Hard, Dense, non porous, crystaline (crypto) some Dolomite Rhombolhedric crystals - weak - to no reaction with Dilute HCL 10% solution few pore space - crystal rombs infilled. trace of grey dolomite as above discription.	3238 ft - 3241 ft	3
Limestone (Dolomitic) Moderately hard · dense poor porosity well cemented traces of grey dolomite, ~~[illegible]~~ sucrosic - to granular texture - fine lime matrix.	3241 - 3250	9
Dolomite, Tan, Hard, Dense, non porous, fine 20x mag. sucrosic dolomite crystals - rhoms, Top of "Boulderzone." 3250 ft.	3250 - 3260	10
As Above.	3260 - 3270	10
As Above	3270 - 3280	10
As Above wt 20% grey dolomite with calcite Inclusions.	3280 - 3290	10
As Above	3290 - 3300	10

GERAGHTY & MILLER, INC.

WELL LOG

PROJECT: WPB Sewage Disp. DATE: 9/13 SHEET: ______ OF ______

LOCATION: WPB Fl DRILLING CONTRACTOR: APCO

WELL NUMBER: 1R DRILLING METHOD: Reverse Air

SAMPLE DESCRIBED BY: Pearce SAMPLING METHOD: Strained - Washed.

SAMPLE DESCRIPTION	DEPTH INTERVAL (FEET)	THICKNESS (FEET)
Dolomite - TAN, Hard, Dense, poor porosity subcrystalline Texture, micro fracturing - A few Vugs w/ Dolomite rhombs Slightly Calcitic due to ghost fossils which have not fully recrystallized	3300 3310	10
As Above	3310 3320	10
As Above w/ no Vugs + very little fractureing	3320 3330	10
Dolomitic Limestone 60% - White, moderately soft, Texture grainy - sucrosic, friable w/ some foram tests still visible - Biomicrite fair porosity 40% - Dolomite, TAN, Hard, Dense poor porosity, subcrystalline	3330 3340	10
Dolomite - slightly calcitic, TAN, Hard Dense, poor porosity, subcrystalline.	3340 3350	10
As Above - w/ 10% soft white Limestone	3350 3360	10
Dolomite - Medium Brown, Hard (H=6-7), Subcrystalline to Rhombic texture. fair to good porosity Trace - Darker Brown Dolomite w/ perfect Dolomite Rhombs covering surface	3360 3370	10

GERAGHTY & MILLER, INC.

WELL LOG

PROJECT: WPB Sewage Disposal DATE: 9/13 SHEET: ____ OF ____

LOCATION: WPB Fl. DRILLING CONTRACTOR: APCo

WELL NUMBER: 1R DRILLING METHOD: Reverse Air

SAMPLE DESCRIBED BY: Pearce SAMPLING METHOD: Washed/Strained

SAMPLE DESCRIPTION	DEPTH INTERVAL (FEET)	THICKNESS (FEET)
Limestone - slightly Dolomitic - White, soft sucrosic, friable - grainy to sub-crystalline - poor to fair porosity 10% Dolomite - Tan, hard, Subcrystalline poor to no porosity	3370 3380	10
Dolomite 70% - Offwhite to Tan - hard Subcrystalline (some cutting have a few Dolomite Rhombs) poor to no porosity 30% - Limestone - soft, white, poor porosity	3380 3390	10
Dolomite - Off white to tan, Hard crystaline - sub crystiline numerous surfaces covered with Dolomite Rhomb- indicative of good porosity however pore spaces are not evedint. 50% grey dolomite as discribed above -	3390 3400	10
Dolimite Tan, massive, no crystal surfaces Hard, Dense - poor porosity. somewhat sucrosic granular texture in some of sample	3400- 3410	10
Dolomite As above wt few crystal surfaces - in non interconeded - Vugs.	3410-34~~18~~	8
Cavity	34~~18~~-3420	2
Dolomite, Tan Hard dense subcrystaline massive no crystal surfaces, non porous	3420 - 3430	10

GERAGHTY & MILLER, INC.

WELL LOG

PROJECT: WPB Sewage Disposal DATE: Sept 14, 1977 SHEET: 1 OF

LOCATION: WPB DRILLING CONTRACTOR: APCO

WELL NUMBER: 1R DRILLING METHOD: Reverse Air

SAMPLE DESCRIBED BY: GM Witt/Pearce SAMPLING METHOD: Washed/Strained

SAMPLE DESCRIPTION	DEPTH INTERVAL (FEET)	THICKNESS (FEET)
Dolomite 20% Grey, Hard, Dense, massive subcrystaline Vugs porous - crystaline surfaces with Dolomite Rhombs 50% Tan Dolomite Hard ~~&~~ Dense to ~~Porous~~, Massive with traces of sucrosic porous - Dolomite crystaline surfaces dolomite Rhombs- 30% Light Tan - Cream Dolomite with crystaline infilled pore spaces Hard Dense massive	3430 - 3433	
Cavity dredging for 3/4 of an hour	3433 - 3435	2
Dolomite Tan - light brown Hard Dense abundant crystal surfaces indicative of good porosity ROCK ~~the~~ cutting themself are massive.	3435 - ~~3450~~ 3442 ~~3442-3443~~	~~15~~ 7
Cavity	3442 - 3443	1
Dolomite Tan, sucrosic excellent porosity light, soft, granular, friable, crystaline	3442 - 3450	7
Dolomite - TAN, Hard, Dense, subcrystalline texture - poor to no porosity. Trace - gray Dolomite w/ Calcite inclusions	3450 3460	10
AS ABOVE	3460 3470	10
AS ABOVE w/ no Grey Dolomite	3470 3480	10

GERAGHTY & MILLER, INC.

WELL LOG

PROJECT: WPB Sewage Disposal DATE: 9/14 SHEET: ____ OF ____

LOCATION: WPB, Fl. DRILLING CONTRACTOR: APCO

WELL NUMBER: 1R DRILLING METHOD: Reverse Air

SAMPLE DESCRIBED BY: Pearce SAMPLING METHOD: Washed/Strained

SAMPLE DESCRIPTION	DEPTH INTERVAL (FEET)	THICKNESS (FEET)
Dolomite - 75% Tan to medium Brown, Hard, Dense, subcrystalline, poor to no porosity 25% Light Tan - moderately Hard, subcrystalline to Sucrosic texture, friable, very porous.	3480 3440	10
Dolomite - Tan, Hard, Dense, subcrystalline w/ shallow Vugs - scattered Rhombs in deeper Vugs - fair to poor porosity	3440 3500	10
Dolomite - Tan to Medium Brown, Hard Dense, Subcrystalline, poor to no ~~porosity~~ porosity - Some micro-fracturing	3500 3510	10
Dolomite - light Tan - Hard, Dense, many recrystallized fossils visible (ghost fossils) subcrystalline, poor to no porosity	3510-3520	10
Dolomite, Tan - lt Brown Hard, Dense, subcrystalline massive - poor porosity no fossils.	3520-3530	10
Dolomite lt Tan - off white Hard dense, massive, ghost fossils - sparite crystals in chambers of what appears to be foram test some micro fracturing, porosity poor - fair.	3530 3540	10

GERAGHTY & MILLER, INC.

WELL LOG

PROJECT: WPB Sewage Disp. DATE: Sept 15 SHEET: ______ OF ______

LOCATION: WPB DRILLING CONTRACTOR: Apco

WELL NUMBER: 1R DRILLING METHOD: Reverse Air

SAMPLE DESCRIBED BY: GM With SAMPLING METHOD: Strained/washed

SAMPLE DESCRIPTION	DEPTH INTERVAL (FEET)	THICKNESS (FEET)
Dolomite, Light Tan - Cream. Hard Dense massive. Vissible crystaline surfaces some Vugs - Cuttings show surface containing sparite inclusion Indicative of ~~[illegible]~~ crystal growth in chambers of "Animal" test some micro fractures infilled with dolomite Rhombs -	3540 - 3550	10
Dolomite light Tan - Cream 70% Hard Dense massive Vissable crystaline surface with Dolomite Rhombs no apparent Vugs. Cutting indicate sparite crystal in remnants of Foram Test some ghost fossils Effedent Nondecernable internal structure. 30% Dark Brown - Dark grey Dolomite Hard dense massive crystaline surfaces wt Dolomite Rhoms.	3550-3560	10
Dolomite - TAN - VARIES FROM Hard, sub-crystalline texture w/ ghost fossils fully recrystallized ~no porosity, to Hard, Rhombic texture w/ surface covered w/ Dolomite Rhombs, ~no porosity to Light, sucrosic to Rhombic texture, very vuggy w/ scattered Rhombs, excellent porosity	3560 3570	10
Dolomite - Medium to Dark brown, Hard Dense, subcrystalline texture, both partially + fully recrystallize fossils present. ~no porosity	3570 3580	10

GERAGHTY & MILLER, INC.

WELL LOG

PROJECT: WPB Sewage Disposal DATE: 9/15/72 SHEET: ____ OF ____

LOCATION: WPB Fla DRILLING CONTRACTOR: Apco

WELL NUMBER: 1R DRILLING METHOD: Reverse Air

SAMPLE DESCRIBED BY: Pearce / Witt SAMPLING METHOD: Strained Washed

SAMPLE DESCRIPTION	DEPTH INTERVAL (FEET)	THICKNESS (FEET)
* Dolomite - Tan - varies from Hard sub-crystalline texture w/ ghost fossils fully recrystalized & no porosity to Hard but light, sucrosic to Rhombic texture "very "vuggy" w/ scattered Rhombs excellant porosity. WP/gw	3580 3590	10
* As Above w/ some Dark brown Dolomite sub crystalline, no porosity. WP/gw	3590 3600	10
* Dolomite Medium to dark brown Hard Dense cutting are either subcrystalline 60% or Rhombic (40%) texture poor to No porosity, some microfracturing. WP/gw	3600 - 3610	10
* Dolomite - light Tan, Hard, Dense, subcrystaline to massive traces of calcite inclusions poor porosity. Traces of rhombic crystals however no free crystal faces.	3610 - 3620	10
* As Above somewhat Darker shade of Tan.	3620 3628	8

3628 ft T.D. Pilot hole

There was some discrepency in drill pipe tally compared to Geolograph this occurred in interval from 3580 - 3610 ft. The last two intervals on this page are correct - for this reason the log was carried over

This discrepency is only for the interval of 3580-3610 ft. 9/MW.

APPENDIX H

GEOLOGIC LOG
WELL 2

FROM 2470 TO 3680 FEET

GERAGHTY & MILLER, INC.

WELL LOG

PROJECT: WPB Sewage Disp. DATE: 11-11-'76 SHEET: ______ OF ______

LOCATION: WPB, Fla. DRILLING CONTRACTOR: APCO

WELL NUMBER: 2 DRILLING METHOD: reverse air/mud

SAMPLE DESCRIBED BY: C Burke/G. Witt SAMPLING METHOD: strained/washed

SAMPLE DESCRIPTION	DEPTH INTERVAL (FEET)	THICKNESS (FEET)
Limestone - sucrosic, granular, soft, with good porosity, gritty matrix with clay, med. size grains, buff-tan, with uniform texture	2470-2480	10
Limestone - buff-tan, sucrosic, med-hardness, fair to good porosity, gritty matrix with some clay. med. size grains, uniform texture, no microfauna.	2480-2490	10
Limestone - buff-tan; as above.	2490-2500	10
Limestone - buff-tan, sucrosic, granular - med. size, fair-good porosity, soft, uniform texture, gritty matrix, no fossils.	2500-2510	10
Limestone - Buff-tan sucrosic, granular fine - silt size, micrite matrix, fair-good porosity, soft. Few fossils	2510-2520	10
Dolomite - tan-Brown Dense low porosity Hard	2520-2522	2
Limestone - Soft good ~~p~~ fair porosity fine grained	2522-2527	5
Dolomite - tan Brown Dense low porosity Hard.	2527-2530	3
~~Limestone~~ Dolomite - tan-Brown, Dense, crystaline - fine puesdo cryptocrystaline, poor porosity, Hard, some calcareous fossils. ~~Dolomite~~ → Limestone/→ Dolomite	2530-2540	10
Limestone - Buff-tan, sucrosic, granular - med to fine sand, micrite matrix, fair-good porosity, poorly sorted, packing random,	2540-2550	10
similar to above fossils more abundant	2550-2560	10
Limestone, white - Buff, good porosity, soft, med - fine sand, No cementation, loose Sediment. extremely good drilling, no sorting or packing evident.	2560-2570	10

GERAGHTY & MILLER, INC.

WELL LOG

PROJECT: WPB Sewage Disp DATE: Nov 12, 1971 SHEET: ______ OF ______

LOCATION: WPB DRILLING CONTRACTOR: APCO

WELL NUMBER: #2 DRILLING METHOD: Reverse Air/Mud

SAMPLE DESCRIBED BY: GMWith/CBurke SAMPLING METHOD: Strained & Washed

SAMPLE DESCRIPTION	DEPTH INTERVAL (FEET)	THICKNESS (FEET)
Limestone, white-Buff, porosity fair-good, soft. loose, poorly cemented, micrite matrix, med Sand texture - Abundant micro fauna.	2570-2580	10
As Above	2580-2590	10
As Above-	2590-2600	10
Limestone, white-buff, good porosity, soft-med hardness, poorly cemented, sucrosic granular even texture, no fossils in sample.	2600-2610	10
Limestone, white-buff, fair-good porosity, soft-med. hardness, poorly cemented, sucrosic even texture, no fossils.	2610-2620	10
Limestone, white, sucrosic, poor porosity, med. hardness. uniform texture, no fossils.	2620-2630	
Dolomitic limestone - buff-brown, sucrosic, granular, well-cemented, no microfauna, uniform texture, color + grain-size. hard. small amount of grey dolomite (<1%) sucrosic, hard, uniform granular, low porosity throughout.	2630-2640	
Dolomite with limestone - Dolomite - brown, hard, nonporous, sucrosic, well-cemented (~40% of sample). Limestone - white-buff, soft, poorly cemented, sucrosic, good porosity, no microfauna.	2640-2650	
Limestone - white-buff, poorly cemented, good porosity, sucrosic, with some vugs, no fossils, uniform texture, med. size grains.	2650-2660	

GERAGHTY & MILLER, INC.

WELL LOG

PROJECT: WPB Sewage Disposal DATE: 11-12-76 SHEET: 4 OF

LOCATION: WPB, Fla. DRILLING CONTRACTOR: APCO

WELL NUMBER: 2 DRILLING METHOD: reverse air/mud

SAMPLE DESCRIBED BY: C Burke/G. Witt SAMPLING METHOD: strained/washed

SAMPLE DESCRIPTION	DEPTH INTERVAL (FEET)	THICKNESS (FEET)
Limestone - white - buff, good porosity, soft, poorly cemented. med. grains. Uniform texture, gritty matrix, no fossils.	2660-2670	10
Limestone - white - buff, good porosity, soft - med. hard. med-lg. grains, gritty matrix, no fossils with small (<1%) amount of hard crystalline buff-brown limestone-calcite	2670-2680	10
Dolomite, Hard, Tan-Buff, Dense, poor porosity, xstline with very fine silty limestone - sample of this was ~~una~~obtainable ~~do~~ ~~do~~ the nature of the sediment and/or bed.	2680-2690	10
Limestone tan - Buff, ~~G~~ good - fair porosity, poorly cemented well sorted v. fine sand - clay particls. soft, [Rare] fossils	2690-2700	10
Limestone white-Buff, ~~good~~ fair porosity, extremly fine silt-clay, well sorted, marl matrix Surrounding fine silt extreamedly soft.	2700-2710	10
As Above	2710-2720	10
As above only with more marl/sample, sample Returns poor propably due to desintegration of the marl.	2720-2730	10
Limestone - soft, white, porous with poor cementation, fine-grained x-line grains, with some vugs and black specks of fine-grained dolomite(?).	2730-2740	10
Dolomitic Limestone, - tan - buff, med-hard., white crystalline granular, sucrosic, fine grained well-cemented with few vugs, no fossils, fair-~~good~~) porosity.	2740-2750	10

GERAGHTY & MILLER, INC.

WELL LOG

PROJECT: WPB Sewage Disposal DATE: 11-12-76 SHEET: ______ OF ______

LOCATION: WPB, Fla. DRILLING CONTRACTOR: APLO

WELL NUMBER: 2 DRILLING METHOD: reverse air/mud

SAMPLE DESCRIBED BY: C Burke/G. Witt SAMPLING METHOD: strained/washed

SAMPLE DESCRIPTION	DEPTH INTERVAL (FEET)	THICKNESS (FEET)
Dolomite - brown, hard - med hard, x-line, sucrosic, well cemented, no fossils, ~~low~~-fair porosity, even texture.	2750-2760	10
Limestone - soft - white - buff, sucrosic, fair-good porosity, uneven texture, poorly cementedly, [redacted], with some brown dolomite (40%) as above.	2760-2770	10
Limestone - soft - white - buff, sucrosic, good porosity, granular, poorly cemented - no dolomite.	2770-2780	10
Limestone Brown-tan crystaline, with micrite matrix fair-poor porosity, poorly cemented soft-med hard.	2780-2790	10
Limestone Brown-tan, crystaline, with micrite matrix, fair-porosity, poorly cemented soft to med hard.	2790-2800	10
Limestone Brown-Buff, fine crystal gains with micrite matrix fair-good porosity poorly cemented, soft to med hard.	2800-2810	10
Limestone - As above.	2810-2820	10
Dolomitic Limestone - Bown-tan, fine crystaline grains with micrite matrix, Dense Fair-poor porosity, well cemented. Med Hard	2820-2830	10
Limestone - Brown-White, fine crystaline grains with micrite matrix, Dense porosity fair. Soft-med hard	2830-2840	10

GERAGHTY & MILLER, INC.

WELL LOG

PROJECT: WPB Sewage Dispos. DATE: Nov 14, 1976 SHEET: ____ OF ____

LOCATION: WPB DRILLING CONTRACTOR: APCO

WELL NUMBER: #2 DRILLING METHOD: Reverse Air/Mud

SAMPLE DESCRIBED BY: GMWitt/C. Bucke SAMPLING METHOD: Strained/Washed

SAMPLE DESCRIPTION	DEPTH INTERVAL (FEET)	THICKNESS (FEET)
Limestone - Buff-White, fair porosity, fine crystaline particals (silt), with micrite matrix, soft. few fossils loosely cemented.	2840-2850	10
Dolomite - buff-brown, fair-poor porosity, well cemented crystalline, no fossils, sucrosic even texture, med.-hard.	2850-2860	10
Dolomitic limestone - buff-brown, med. hardness fair porosity, well cemented, no microfauna, sucrosic & granular.	2860-2870	10
Limestone - buff-tan, soft-med. hardness, fair porosity, poorly cemented, granular, sucrosic.	2870-2880	10
Limestone as above	2880-2890	10
Dolomitic limestone - buff-brown, med. hardness. fair porosity, vugs, sucrosic + granular, no fossils.	2890-2900	10
Dolomitic limestone with chert. buff-~~brown~~, med-hard, fair porosity, sucrosic, no microfauna, chert < 30%, hard, nodular, black-green, uniform texture, non-porous.	2900-2910	10
Dolomitic limestone (as above) with chert ~40%.	2910-2920	10
Limestone (<5%) and Chert. Limestone - tan-buff, sucrosic. poorly cemented, soft-med. hardness, good porosity. Chert - gray-green, hard, nodular, non-porous, uniform texture,	2920-2930	10

GERAGHTY & MILLER, INC.

WELL LOG

PROJECT: WPB Sewage Disposal DATE: Nov 14, 1976 SHEET: ______ OF ______

LOCATION: WPB DRILLING CONTRACTOR: APCO

WELL NUMBER: #2 DRILLING METHOD: Reverse Air / Mud

SAMPLE DESCRIBED BY: GM With SAMPLING METHOD: Strained / washed

SAMPLE DESCRIPTION	DEPTH INTERVAL (FEET)	THICKNESS (FEET)
Limestone (50%) + Chert. 50% Limestone Tan - Buff, sucrosic, good - fair porosity poorly cemented, Soft - med Hard. Chert - grey - green dense, hard ~~non~~ porosity poor, dense cryptocrystaline	2930-2940	10
Limestone - Tan - White, sucrosic, good - fair porosity Poorly sorted, poorly cemented, soft - med Hard, Some fossils. No Chert in this sample.	2940-2950	10
Limestone - 80% Tan White, sucrosic, good - fair porosity, poorly sorted, poorly cemented, soft med Hard, 20% Grey ~~quartzitic~~ silliceous limestone - still has individual grains - silica cementation however it is not cryptocrystaline.	2950-2960	10
Limestone + Chert limestone (60%) tan - Buff, good - fair porosity, poorly sorted poorly cemented, Soft - med Hard, Chert (40%) Grey - Green Brown, dense, non porous. Hard,	2960-2970	10
Chert (90%) Green Brown, dense, porosity None, Hard, Limestone (10%) tan - Buff poorly sorted, Poorly cemented, Soft to med Hard	2970-2980	10
Limestone + Chert Chert 20-30% Limestone 70-80% of sample discription as above	2980-2990	10

GERAGHTY & MILLER, INC.

WELL LOG

PROJECT: WPB Sewage Disposal DATE: Nov 15, 1976 SHEET: ______ OF ______

LOCATION: WPB DRILLING CONTRACTOR: APCO

WELL NUMBER: #2 DRILLING METHOD: Reverse Air/Mud

SAMPLE DESCRIBED BY: G.K. Witt SAMPLING METHOD: Strained/washed

SAMPLE DESCRIPTION	DEPTH INTERVAL (FEET)	THICKNESS (FEET)
Limestone & Chert - limestone 60% of sample, soft, good-fair porosity, poorly cemented, Chert Green-Brown hard, dense, Non-porous.	2990-3000	10
Limestone, white-tan, good-fair porosity, soft, poorly cemented, Some fossils, Some Chert Green-Brown. Hard, dense, non-porous.	3000-3010	10
Same	3010-3020	10
Same	3020-3030	10
Limestone, tan & buff, soft good porosity, trace of Chert brown	3030-3040	10
Same with Chert about 5%	3040-3050	10
Chert, Brown, with 30% limestone, soft, tan good porosity	3050-3060	10

GERAGHTY & MILLER, INC.

WELL LOG

PROJECT: WPB Sewage Disposal DATE: 16 Nov 76 SHEET: 1 OF

LOCATION: WPB DRILLING CONTRACTOR: APCO

WELL NUMBER: 2 DRILLING METHOD: Reverse mud

SAMPLE DESCRIBED BY: Wheatley SAMPLING METHOD: Strain/wash

SAMPLE DESCRIPTION	DEPTH INTERVAL (FEET)	THICKNESS (FEET)
Limestone, Tan, soft, ~~good~~ fair porosity w/ Trace of Chert and ~~of~~ about 1% white marl.	3060-3070	10
Same	3070-3080	10
Same	3080-3090	10
Same	3090-3100	10
Limestone, Tan, soft, fair porosity w/ 1% white marl, 30-40% Brown chert	3100-3110	10
Same	3110-3120	10
Same	3120-3130	10
3137' (KB) Formation Becoming Harder. Told By Joe, The Driller. Increased Hardness Probably Due To Chert Found In Subsequent Sampling (Small Amount of Chert.)	~~3130-3140~~	~~10~~
Limestone, Cream, Marly To Soft, Poor Porosity; Trace Brown Chert. (Note: Decreased Drilling Rate May Be Attributable To Softness of Formation, i.e. Limestone Clogging Buttons On Button Bit.).	3130-3140	10
Limestone, Cream & Light Gray, Marly To Soft, Poor Porosity; Brown & Light Gray Chert ~ 30%	3130-3144	4
3146 Ft. Encountered Hard Material. Increased WOB To 5000# To No ~~Aval~~ Avail		
Chert, Brown & Light Gray (>95%) w/ Trace Soft, Cream L.S.	3144-3147	3

GERAGHTY & MILLER, INC.

WELL LOG

PROJECT: WPB Sewage Disposal DATE: 16 Nov 76 SHEET: 2 OF

LOCATION: WPB DRILLING CONTRACTOR: APCO

WELL NUMBER: 2 DRILLING METHOD: Reverse Mud

SAMPLE DESCRIBED BY: Rioux SAMPLING METHOD: Stram / Wash

SAMPLE DESCRIPTION	DEPTH INTERVAL (FEET)	THICKNESS (FEET)
Chert, Brown w/ Some Light Gray (Chert = 90%); ~~Some~~ Soft Cream & Buff L.S. w/ Poor Porosity - Small Amount.	3147-3150	3
Limestone, Cream, Marly To Soft, Poor Porosity; Trace Brown Chert	3150-3151	1
Chert, Brown w/ Some Light Gray (Chert = 80%); Soft ~~Cream~~ Cream L.S. w/ Poor Porosity.	3151-3152	1
Limestone, Cream, Marly To Soft, Poor Porosity; Trace Brown Chert	3152-3154	2
Chert, Brown (>90%); ~~tot~~ Cream, Soft, L.S. of Poor Porosity	3154-3155	1
Limestone, Cream, Marly To Soft, Poor Porosity; 20% Brown Chert w/ Trace ~~white~~ cream Chert.	3155-3157	2
Chert, Brown (70%); Soft, Cream, L.S. of Poor Porosity.	3157-3160	3

GERAGHTY & MILLER, INC.

WELL LOG

PROJECT: WPB Sewage Disposal DATE: 9 APR 77 SHEET: 1 OF

LOCATION: WPB DRILLING CONTRACTOR: APCO

WELL NUMBER: 2 DRILLING METHOD: Reverse Air

SAMPLE DESCRIBED BY: Wheatley - Rioux SAMPLING METHOD: Washed/Strained.

SAMPLE DESCRIPTION	DEPTH INTERVAL (FEET)	THICKNESS (FEET)
Lime Stone, White to buff Poor porosity with, marl white and Trace of Brown chert. Sample is contamined with app 40% Cement.	3160-3170	10
Limestone, Cream, Soft, Poor Porosity; Trace Brown Chert; Sample Contaminated w/ Cement.	3170-3180	10
Limestone, Buff, Moderate Hardness, Poor To Fair Porosity, Granular & Non-Granular; Trace Soft White L.S.	3180-3190	10
Limestone, Buff, Moderate Hardness, Poor To Fair Porosity, Granular & Some Non-Granular; Trace Light Gray L.S., Soft, Poor Porosity.	3190-3200	10
Limestone, White, Soft, Poor Porosity, Granular (Fine); Buff Granular L.S. of Moderate Hardness & Poor w/ Some Fair Porosity; Some Light Gray L.S. of Moderately Hard To Hard, & Poor Porosity.	3200-3210	10
Limestone, White, Soft, Poor Porosity; Trace Light Gray L.S. of Moderate Hardness.	3210-3220	10
Limestone, Cream, Soft, Granular, Poor To Fair Porosity; Some Cement Contamination.	3220-3230	10
Limestone, ~~Cr~~ White, Soft, Granular, Poor To Fair Porosity; Trace Green-Gray Marl.	3230-3240	10
Same w/ A Trace ~~Of~~ Of Hard Brown L.S. of Poor Porosity	3240-3250	10

GERAGHTY & MILLER, INC.

WELL LOG

PROJECT: WPB Sewage Disposal DATE: April 11, 1977 SHEET: ______ OF ______

LOCATION: WPB DRILLING CONTRACTOR: APCO

WELL NUMBER: #2 DRILLING METHOD: Reverse Air

SAMPLE DESCRIBED BY: GM Witt SAMPLING METHOD: Stream cd washed

SAMPLE DESCRIPTION	DEPTH INTERVAL (FEET)	THICKNESS (FEET)
Soft-White sucrosic limestone, fair porosity fine gritty matrix	3250-3260	10
as above	3260 - 3270	10
Limestone, dolomitic, grey-Buff moderately hard fine well cemented allocthanous. poor - fair porosity	3270 -3280	10
Limestone, tan, sucrosic moderately soft, fine matrix cementation poor, fair-good porosity	3280-3290	10
as above	3290-3300	10
as above	3300 - 3310	10
as above	3310 - 3320	10
Geolograph Corrected to pipe tally 8 ft discrepancy occurred samples ∴ have to be moved up.	3320 - 3330	10
Dolomitic limestone, Tan - Buff sucrosic poor - fair porosity	3330 - 3340	10
Dolomite, Dolomitic limestone + limestone, Dense poor-fair porosity Tan - Buff sucrosic well cemented.	3340 - 3350	10
Dolomite - Hard Dense, light Brown + Tan, poor porosity Boulder zone 3358 ft	3350 - 3360	10

GERAGHTY & MILLER, INC.

WELL LOG

PROJECT: WPB Sewage Disposal DATE: April 11 SHEET: * OF

LOCATION: WPB DRILLING CONTRACTOR: APCO

WELL NUMBER: #2 DRILLING METHOD: Reverse Air/Circulation

SAMPLE DESCRIBED BY: GM-W.H + Wlemue SAMPLING METHOD: Washed/Strained

SAMPLE DESCRIPTION	DEPTH INTERVAL (FEET)	THICKNESS (FEET)
Dolomite - Tan, Hard, dense poor porosity limestone white sucrosic poor-fair porosity	3360-3370	10
as above	3370-3880	10
as above	3380-3390	10
Dolomite - Tan, Hard Dense - poor porosity	3390-3400	10
Same As Above	3400-3410	10
Same As Above	3410-3420	10
Dolomite Tan to Medium Brown, Hard, Dense poor porosity	3420-3430	10
Dolomite Tan, Medium Brown + Grey Hard, Dense poor porosity w/ white limestone, soft, fair porosity.	3430-3440	10
Same as above	3440-3450	10
Medium brown Dolomite, hard, dense, non porous. w/ traces of gray dolomite + soft white Lst.	3450-3460	10

GERAGHTY & MILLER, INC.

WELL LOG

PROJECT: WPB Sewage Disposal DATE: April 12 SHEET: ____ OF ____

LOCATION: WPB Fla DRILLING CONTRACTOR: APCO

WELL NUMBER: #2 DRILLING METHOD: Reverse Air/circulation

SAMPLE DESCRIBED BY: W. Pearce / G.Witt SAMPLING METHOD: Washed/strained

SAMPLE DESCRIPTION	DEPTH INTERVAL (FEET)	THICKNESS (FEET)
Soft White Lst + Med Brown to Gray Dolomite Dolomite hard, dense, poor porosity	3460 - 3470	10
Same as above	3470 3480	10
Tan-Med Brown, Dolomite crystaline, poor porosity Void from 3480-3484 ft., dense crystal surfaces indicative of Voids.	3480-3490	10
as above, no void	3490-3500	10
Dolomite, tan-Brown Hard dense crystal surface indicative of Vugs. Grey dolomite with crystal surface, Some "Boulders" drilling hard Porosity fair in grey poor in tan.	3500-3510	10
Dolomite, cream Hard porous many crystalin surfaces. Tan dolomite w/ crystal surfaces grey dolomite as above. drilling rate slowed harder drilling	3510-3520	10
Brown Dolomite, Hard. fractured crystal surfaces abundant, porosity fair to good. Cream dolomite Hard fractured ~~gso~~ crystaline surfaces	3520-3530	10
Dolomite, Hard, fractured crystaline surfaces Brown dark Brown to light ~~tan~~ extremely porous dolomite	3530-3540	10
as above.	3540-3550	10

GERAGHTY & MILLER, INC.

WELL LOG

PROJECT: WPB Sewage Disposal DATE: April 12, 77 SHEET: ______ OF ______

LOCATION: WPB

DRILLING CONTRACTOR: APCO

WELL NUMBER: #2

DRILLING METHOD: Reverse Air Circulation

SAMPLE DESCRIBED BY: G Witt / McPearce

SAMPLING METHOD: Strained washed

SAMPLE DESCRIPTION	DEPTH INTERVAL (FEET)	THICKNESS (FEET)
Tan Dolomite, Hard Dense, crystaline crystaline surface - low - fair porosity.	3550-3560	10
Tan Dolomite, Hard, Dense, non X-line - non porous	3560 3570	10
Same as above	3570 3580	10
Dolomite - Tan to Medium Brown w/ traces of gray Hard, Dense, non crystaline - non porous	3580 3590	10
Same as above	3590 3600	10
Dolomite, Tan-dark Brown Hard dense w/ traces of grey Dolomite Hard dence non crystaline - non porous.	3600-3610	10
as above	3610-3620	10
Dolomite grey - tan-brown hard, dense, crystaline Crystal surface - (some) Nonporous) porosity poor.	3620-3630	10
as above	3630-3635	5
Dolomite Hard dens brown no crystal surfaces non pourous - drilling rate slowed because of bit bearing and metal in sample part of "buttons" on bit.	3635-3650	15

GERAGHTY & MILLER, INC.

WELL LOG

PROJECT: WPB Sewage Disposal DATE: April 13, 197? SHEET: ______ OF ______

LOCATION: WPB DRILLING CONTRACTOR: APCO

WELL NUMBER: #2 DRILLING METHOD: Reverse Air/circulation

SAMPLE DESCRIBED BY: G M Witt SAMPLING METHOD: Strained/washed

SAMPLE DESCRIPTION	DEPTH INTERVAL (FEET)	THICKNESS (FEET)
Dolomite, CREAM, hard, dense, indicates same fracturing some xstline surfaces. Some (poor-fair) porosity.	3650-3660	10
Dolomite, BROW-TAN- hard, dense, no crystaline surfaces. fair-poor porosity	3660-3670	10
as above	3670-3680	10
Note	(3675-3676) Cavity	1
3680 T.D.		

APPENDIX I

GEOLOGIC LOG
WELL 3
FROM 2490 TO 3690 FEET

GERAGHTY & MILLER, INC.

WELL LOG

PROJECT: DATE: SHEET: OF

LOCATION: WPB DRILLING CONTRACTOR: APCO

WELL NUMBER: #3 DRILLING METHOD: Reverse mud

SAMPLE DESCRIBED BY: Wheatley / C. Burke SAMPLING METHOD: strained/washed.

SAMPLE DESCRIPTION	DEPTH INTERVAL (FEET)	THICKNESS (FEET)
Limestone, Tan, granular, soft, good porosity	2490-2500	10
Limestone, white, granular, soft, good porosity Same	2500-2510	10
Same	2510-2520	10
	2520-2530	10
Limestone, white, granular, soft with fair porosity, gritty matrix with some fine sand, with traces of marl.	2530-2540	10
Limestone, white, granular (small grains) soft, friable, fair porosity, gritty matrix, some fine shell fragments visible in sample (trace <5%)	2540-2550	10
Limestone, white, granular, soft, fair porosity, gritty matrix, bryozoan fragments in evidence (trace)	2550-2560	10
Limestone, white, x-lin soft, fair porosity, with large crystals, gritty matrix, no visible microfauna in sample, light brown dolomitic limestone in small quantity (<10%) in sample, large crystals with good porosity, very hard.	2560-2570	10
Limestone, white, granular with some small x-stal, low porosity and soft.	2570-2580	10
Same as above	2580-2590	10
Limestone, white, granular with some x-lin, soft, fair porosity, gritty matrix, no visible microfauna,	2590-2600	10

GERAGHTY & MILLER, INC.

WELL LOG

PROJECT: WPB Sewage Disposal DATE: Sept 13,14 197[illegible] SHEET: 1 OF ______

LOCATION: WPB DRILLING CONTRACTOR: Apco

WELL NUMBER: 3 DRILLING METHOD: Reverse mud / Air

SAMPLE DESCRIBED BY: Gil W. H SAMPLING METHOD: Screened washed

SAMPLE DESCRIPTION	DEPTH INTERVAL (FEET)	THICKNESS (FEET)
White limestone good porosity. Micro fauna 10% Soft-med Hard sucrosic with micrite matrix.	2600-2610	10
White-Buff limestone good porosity Micro fauna 10% Foraminiferan + peloids. Soft to med Hard sucrosic with micrite matrix	2610-2620	10
Buff - White limestone - fair porosity Micro fauna 5% some dolomitization - ~~soft~~ med Hard Sucrosic. crystalline	2620-2630	10
Buff Dolomitic limestone poor porosity ~~Micro fauna 30%~~ Med-hard sucrosic crystalline Micro fauna 30% Planispiral foraminifera Dominant; fossil are micritized.	2630-2640	10
Buff-White Limestone. fair porosity - med Hard sucrosic Crystaline. Microfauna 30% Planispiral forminifera Dominant.	2640-2650	10
Buff White Dolomitic limestone - poor porosity med hard sucrosic Crystaline. Microfauna 10% of sample planispiral Foraminifera Dominant	2650-2660	10

GERAGHTY & MILLER, INC.

WELL LOG

PROJECT: WPB Sewage Disposal DATE: Sept 14 SHEET: ______ OF ______

LOCATION: WPB DRILLING CONTRACTOR: Apco

WELL NUMBER: 3 DRILLING METHOD: Reverse Mud/Air

SAMPLE DESCRIBED BY: GM Wit/Burke SAMPLING METHOD: Strained/Washed

SAMPLE DESCRIPTION	DEPTH INTERVAL (FEET)	THICKNESS (FEET)
Dolomite Buff-tan, some fossils calcareous, dolomite crystaline Hard, dense, low porosity.	2660-2670	10
limestone - with white marl matrix fossils 40% of sample Planospiraled foraminifer Similar Chambers as peneroplis Limestone Sucrosic med-hard ~~good~~ Poor Porosity - probably marl matrix Around most hard limestone Fragments	2670-2680	10
Limestone with white marl matrix, fossils 30% of Sample Planespiraled Foraminifer, limestone Buff, Sucrosic, med Hard, Fair porosity.	2680-2690	10
Dolomite - buff-tan, crystaline, hard, with fair-good porosity, some sucrosic appearance, no micro fauna apparent	2690-2700	10
Dolomite - buff-tan, x-stalline, hard with good porosity, grains visible.	2700-2710	10
Dolomite buff-tan with white limestone (70%) soft, good porosity.	2710-2720	10
Limestone - white, fine crystalline, sucrosic, fair-poor porosity, marly matrix, uneven texture, (fine sample)	2720-2730	10
Limestone - buff/white, fine grained crystalline, sucrosic, fair-poor porosity, marly matrix, foraminifera common in sample.	2730-2740	10

GERAGHTY & MILLER, INC.

WELL LOG

PROJECT: WPB Sewage Disposal DATE: September [illegible] SHEET: ____ OF ____

LOCATION: WPB DRILLING CONTRACTOR: A[illegible]

WELL NUMBER: 3 DRILLING METHOD: Reverse [illegible]/Air

SAMPLE DESCRIBED BY: G&M Lith/Burke SAMPLING METHOD: Strained/washed

SAMPLE DESCRIPTION	DEPTH INTERVAL (FEET)	THICKNESS (FEET)
limestone, ~~B~~ Buff-White, med porosity, med hardness, Sucrosic Abundant fossils 20%	2740-2750	10
Dolomite Buff-tan poor-fair porosity med hard ~~cr~~ crystalline (Dolomite Beds are running approx 6-8 ft thick - limestone Beds (lense) somewhat less)	2750-2760	10
Limestone White to Buff, good porosity med hard, sucrosic fossils Abundant 30% planispiral Foraminifera dominant.	2760-2770	10
Limestone White-buff good porosity, med hard, sucrosic fossils Abundant 30%.	2770-2780	10
Limestone - white-buff, good porosity, soft-medium hardness, sucrosic, gritty marly matrix, with some dolomitization, foraminifera abundant.	2780-2790	10
Limestone - white-buff, good porosity, soft, gritty, sucrosic, some dolomitization, foraminifera common	2790-2800	10
Limestone - soft, buff, porous, gritty matrix, some dolomitization, no microfauna in sample, marly matrix.	2800-2810	10
Limestone - gray-buff - porous, foraminifera abundant, soft, with some dolomite (~40%) medium hardness, good porosity, brittle.	2810-2820	10
Limestone, as above with dolomite (~50%) soft, brittle, brown-buff colored, good porosity.	2820-2830	10

GERAGHTY & MILLER, INC.

WELL LOG

PROJECT: WPB Sewage Disposal DATE: Sept 15 ... SHEET: ____ OF ____

LOCATION: WPB DRILLING CONTRACTOR: Apex

WELL NUMBER: 3 DRILLING METHOD: Reverse Mud/Air

SAMPLE DESCRIBED BY: GM W.H SAMPLING METHOD: strained Rinsed

SAMPLE DESCRIPTION	DEPTH INTERVAL (FEET)	THICKNESS (FEET)
Dolomite, limestone and Dolomitic Limestone, white to Tan traces of fossil in both limestone + Dolomitic limestone fair - poor porosity soft - med hardness sucrosic. Evidence for recrystallization of Limestone → dolomite.	2830-2840	10
Limestone white - Buff good porosity traces dolomitic Limestone, med hardness sucrosic fossils Abundant foraminifera dominant molusca fragments some Calcareous algea.	2840-2850	10
Limestone white - Buff med porosity, med hardness, sucrosic, fossils ~~Abundant~~ 10% foraminifera molusca traces of grey silt - ~~fine~~ very fine sandstone. It is not Cryptocrystalline ~~[illegible]~~ Qtz.	2850-2860	10
Limestone white - Buff, med porosity - poor porosity Sucrosic fossils 10% sample. Buff color dominant traces of grey siltstone.	2860-2870	10
Limestone Buff - white med porosity, poor porosity sucrosic fossils 15% sample. foraminifera molusca frag. Traces of brown dolomite.	2870-2880	10
Limestone White, med porosity - poor porosity, some white marl, fossils 5% sample sucrosic, med Hard - Soft. Wt chert picked up @ ~~[illegible]~~ 2888 Chert Brown Green, hard, uniform texture	2880-2890	10

GERAGHTY & MILLER, INC.

WELL LOG

PROJECT: WPB Sewage Disposal DATE: 16 Sept.'76 SHEET: ____ OF ____

LOCATION: WPB, Fla. DRILLING CONTRACTOR: APCO

WELL NUMBER: 3 DRILLING METHOD: Reverse mud/air

SAMPLE DESCRIBED BY: C Burke SAMPLING METHOD: strained/rinsed

SAMPLE DESCRIPTION	DEPTH INTERVAL (FEET)	THICKNESS (FEET)
Limestone - buff - gray, soft, fair porosity, with fine grains, sucrosic appearance, marly matrix, with Chert (~40%) gray-green-brown, even texture, fairly brittle, med. hardness.	2890-2900	10
Limestone with Chert (<40%) buff gray, soft, good porosity, granular, sucrosic, with chert - brown - gray, even texture, hard, chips and flakes, nodules or rounded pieces in sample.	2900-2910	10
Limestone with Chert (40%) L.S - buff - gray, soft, fair porosity, marly matrix, sucrosic, fine grained, Chert - gray-green, even texture, good nodules.	2910-2920	10
Limestone with Chert (10%) L.S - buff gray, soft, fair porosity, marly matrix, sucrosic, small grain. Chert - green/gray, hard, flakes, even texture.	2920-2930	10
Limestone with Chert (20%) L.S buff gray soft, good porosity, marly-gritty matrix, chert - hard, gray - green, hard even texture.	2930-2940	10
Limestone w Chert L.S. - grey-buff, soft, good porosity, marly, gritty matrix, chert - hard, grey - black, (~50%) even texture.	2940-2950	10

GERAGHTY & MILLER, INC.

WELL LOG

PROJECT: WPB Sewage Disposal DATE: 9/6/76 SHEET: ______ OF ______

LOCATION: WPB DRILLING CONTRACTOR: Apco

WELL NUMBER: 3 DRILLING METHOD: Reverse Mud/Air

SAMPLE DESCRIBED BY: GM Witt SAMPLING METHOD: Strained washed

SAMPLE DESCRIPTION	DEPTH INTERVAL (FEET)	THICKNESS (FEET)
Limestone-Sucrosic porosity fair, med Hard White to Buff, Some Micro organism Evident small Splinters of Chert < 2%	2950-2960	10
limestone Sucrosic porosity fair. med Hard White to Buff Some Micro-organism. Evident small splinter of Chert. < 2%	2960-2970	10
limestone Sucrosic white Buff porosity fair med HARd Some micro organism 60-70% of Sample. Chert 30-40% brown-green grey. Chert has Calcarious inclusions.	2970-2980	10
limestone Sucrosic White-Buff porosity fair med Hard Some micro organism. 60% of Sample. Chert green-green Brown dense with Calcite inclusion also with Calcite veinlets	2980-2990	10
Limestone Sucrosic White-Buff porosity fair med-hard, Some micro organism more prevalent than last Sample. 50% sample Chert Green-green Brown dense with Calcitic inclussions	2990-3000	10
Limestone Sucrosic White-Buff porosity fair med Hard, Some microorganism 60-70% sample Limestone. 40-30% sample Chert green-green Brown dense noted Pelecypod shel ~~enveloped~~ By Quartz again calcitic inclussions inside Chert. Chert is nodular in form transition area between Qtz and Limestone coating.	3000-3010	10

GERAGHTY & MILLER, INC.

WELL LOG

PROJECT: WPB Sewage Disposal DATE: Sept 17 SHEET: ______ OF ______

LOCATION: WPB DRILLING CONTRACTOR: APCO

WELL NUMBER: #3 DRILLING METHOD: Reverse Mud / Air

SAMPLE DESCRIBED BY: GMWH / C. Burke SAMPLING METHOD: Strainer / Circas box

SAMPLE DESCRIPTION	DEPTH INTERVAL (FEET)	THICKNESS (FEET)
Limestone White to buff, 70% of sample, Sucrosic, fair porosity med-hardness, Fossils are 10% of sample Chert 20% of Sample Green to grey Calcitic inclussions,	3010-3020	10
Limestone - buff - gray, 80% of sample, sucrosic, soft, fair porosity, abundant foraminifera, 20% Chert, brown - gray, hard, even texture	3020-3030	10
Limestone - buff & gray, 70% of sample, sucrosic with marly matrix, soft, fair porosity, abundant foraminifera, 20% Chert - brown/gray, hard even texture.	3030-3040	10
Limestone - buff & gray, 80% of sample, sucrosic with marly matrix, soft, fair porosity, abundant foraminifera 20% Chert, brown/gray, hard, even texture.	3040-3050	10
Limestone - buff & gray >80% of sample, sucrosic with marly matrix, soft, fair - good porosity some foraminifera, <20% Chert - brown-gray, hard, even texture.	3050-3055	5

GERAGHTY & MILLER, INC.
Pilot hole for 23" Ream to

WELL LOG

PROJECT: WPB Sewage Disposal DATE: Jan 21 SHEET: ______ OF ______

LOCATION: WPB DRILLING CONTRACTOR: Apco

WELL NUMBER: #3 DRILLING METHOD: Reverse Air

SAMPLE DESCRIBED BY: GWH/C. Burke SAMPLING METHOD: Strained/washed

SAMPLE DESCRIPTION	DEPTH INTERVAL (FEET)	THICKNESS (FEET)
Chert 90% green to green Brown hard dense Non porous some soft tan limestone fine grained no fossils evident in this sample - porosity fair to poor in limestone.	3055-3060	5
Limestone, dolomitic, buff fine grained poorly cemented. Some Numalitic fossils, porosity poor fine grain micrite ~~(hard gray dolomite)~~	3060-3070	10
As above.	3070-3080	10
Limestone - buff - white, fine grained, poorly cemented, soft, brittle, uniform texture, poor porosity, no fossils evident.	3080-3090	10
Limestone - as above.	3090-3100	10
Limestone - buff - white, fine grained, soft, poor porosity with black-green chert (35%) hard, uniform texture, nodular, no porosity.	3100-3110	10
As Above with chert ~40%)	3110-3120	10
Limestone as above - white - buff, soft, poorly cemented, no fossils evident. Low porosity, with black-green chert with uniform texture, hard, no porosity, nodular.	3120-3130	10
Limestone white buff soft poorly cemented porosity - fair - rock micro-fossils evident with black-green chert. Hard dense no porosity	3130-3140	10
Limestone - white - buff, soft, good porosity, fair - poorly cemented, no vugs, microfossils in evidence, some black-green chert - hard, nonporous, with uniform texture.	3140-3150	10

GERAGHTY & MILLER, INC.

WELL LOG

PROJECT: WPB Sewage Disposal DATE: 24 JAN SHEET: ______ OF ______

LOCATION: WPB, Fla. DRILLING CONTRACTOR: APCO

WELL NUMBER: #3 DRILLING METHOD: Reverse Air

SAMPLE DESCRIBED BY: C Burke/R. Rioux SAMPLING METHOD: Strained/washed

SAMPLE DESCRIPTION	DEPTH INTERVAL (FEET)	THICKNESS (FEET)
Limestone - white, buff, poorly cemented, fair-good porosity, uniform texture, some shell fragments, crinoid stems, microfauna visible; small amount of gray hard limestone and chert in sample (<2%)	3150 - 3160	10
Limestone, Cream, Soft, Poor Porosity; Some Brown & Gray Chert (~15%); Trace Shell Fragments; Traces Cement contamination (?) In Evidence.	3160 - 3170	10
Same w/ Slightly More Chert	3170 - 3180	10
Limestone, Cream, Very Soft To Soft, Poor Porosity; Trace Brown Chert	3180 - 3190	10
Limestone, Cream, Soft, Granular, Poor Porosity; Trace Brown Chert & Trace Shell Fragments.	3190 - 3200	10
Limestone, Cream, Soft, ~~[illegible]~~ Fair Porosity	3200 - 3210	10
Same	3210 - 3222	12
Cavity (void)	3222 - 3233	11
Limestone, white & cream, soft, poor porosity	3233 - 3240	7
Same	3240 - 3250	10
Same	3250 - 3260	10
Same	3260 - 3270	10

GERAGHTY & MILLER, INC.

WELL LOG

PROJECT: WPB Sewage Disposal DATE: 25 Jan 77 SHEET: ______ OF ______

LOCATION: WPB DRILLING CONTRACTOR: APCO

WELL NUMBER: 3 DRILLING METHOD: Reverse Air

SAMPLE DESCRIBED BY: Rioux SAMPLING METHOD: Strained / Washed

SAMPLE DESCRIPTION	DEPTH INTERVAL (FEET)	THICKNESS (FEET)
Limestone, Soft, Granular, Poor Porosity (Dense Material); ~~Same~~ L.S., Cream, Moderate Hardness, Fair Porosity; Trace Glauconite (Green Material Identified By G. Wirth).	3270-3280	10
Limestone, Soft, Granular, Poor Porosity (Dense Material); More L.S., Cream, Moderate Hardness, Fair Porosity Than In Prior Sample.	3280-3290	10
Same w/ Small Amount of Buff Granular L.S. of Poor Porosity And A Trace of Light Gray Crystalline L.S.	3290-3300	10
Limestone, Cream, Granular Soft w/ Some of Moderate Hardness Poor Porosity; Small Amount ~~Har~~ Hard, Light Gray L.S. of Poor To Fair Porosity; Trace Light Brown L.S.	3300-3310	10
Same	3310-3320	10
Same w/ Some Gray Dolomite (Hard & Dense) & Trace Light Brown L.S. Dolomitic Material Was First Encountered From 3321'-3322' (Pad level). A Small Amount of Gray & Brown Dolomite Was In The Cuttings.	3320-3330	10
Limestone cream, Soft (DensE), granular, Poor porosity Trace of L. Brown Chert.	3330-3340	10
Limestone, cream, soft (DensE), granular, poor porosity w/app 30% Lt. Brown Dolomite.	3340-3353	13
Dolomite, Brown to gray, hard good porosity Top of Boulder Zone. Trace of Cream limestone	3354-3360	7

GERAGHTY & MILLER, INC.

WELL LOG

PROJECT: WPB Sewage Disposal DATE: 26 Jan 77 SHEET: ______ OF ______

LOCATION: WPB DRILLING CONTRACTOR: APCO

WELL NUMBER: 3 DRILLING METHOD: Reverse Air

SAMPLE DESCRIBED BY: Rioux/J. Wheatly SAMPLING METHOD: Strained/Washed

SAMPLE DESCRIPTION	DEPTH INTERVAL (FEET)	THICKNESS (FEET)
Around Depth 3360 Feet, Extensive Caving Has Occurred. The Cuttings Consist of Both White Limestone & Brown & Brown-Gray Dolomite. When The Kelly Was Down At 3360 Feet, The Driller Circulated For 45 Minutes Prior To Adding A Joint. The Returns During This Period Were Primarily White Limestone Indicating That A Large Portion of The Caving Is Occurring Above The Boulder Zone Although It Appears That The Boulder Zone Is Contributing Cuttings (From Caving As Well As From Penetration) As Well. Drilling Is Proceeding Slowly. It Should Be Noted That Due To Caving, Samples May Be Contaminated For An Indeterminate Number of Intervals Especially In View of The ~~Fact~~ Possibility That A Large Portion of The Caving Material May Have Originated Somewhere Up Hole.	~~3360-3370~~	~~10~~
Dolomite, ~~Light~~ Light Brown Crystalline Hard, Poor To Fair Porosity; Limestone, White, Soft, Poor Porosity (Possibly Up Hole Contamination); Trace Hard Gray Dolomite of Poor Porosity; Small Amount of Hard, Brown, Crystalline Dolomite w/ Excellent Porosity & Permeability.	3360-3370	10
Dolomite, Light Brown, crystalline, Poor Porosity Trace Dark Brown, crystalline Dolomite with fair porosity	3370-3380	10
Dolomite, Light Brown, Poor porosity.	3380-3390	10
Dolomite, Light to Dark Brown, Very Hard, Good porosity	3390-3400	10

GERAGHTY & MILLER, INC.

WELL LOG

PROJECT: WPB Sewage Disposal DATE: Feb 1, 1977 SHEET: ______ OF ______

LOCATION: W.P.B. DRILLING CONTRACTOR: Apco

WELL NUMBER: #3 DRILLING METHOD: Reverse Air

SAMPLE DESCRIBED BY: G. Witt/W. Pearce SAMPLING METHOD: Strained/Washed

SAMPLE DESCRIPTION	DEPTH INTERVAL (FEET)	THICKNESS (FEET)
Dolomite, White, Hard dense. Fractures filled with Dolomite crystals poor porosity. Brown Dolomite Hard Dense, Non porous, xstline, light tan, good porosity soft-med hardness. Dredging from 3398-3402 ft.	3400-3410	10
Dolomite, Brown, Hard dense, X/N, Poor Porosity. Dredging the interval Between 3400 - 3424 was Extensive 10 Days of Dredging ~~Started~~ ~~Continued~~ ~~pilot hole~~ @: 3424 on Feb 14th 12:30 hrs.	3410-3420	10
19:00 - Dolomite, Dark brown, Hard, Dense crystaline surfaces, poor porosity	3420-3430	10
2010 Dolomite, Medium to dark brown Dark - Hard Dense - X/N poor porosity Medium - Less dense + more porous lacks crystals	3430-3440	10
21:05 Dolomite - Dark brown, hard, dense, X/N to light brown, less dense, more porous non ~~X/N~~	3440-3450	10
Dolomite, Brown, Hard; Poor To Fair Porosity; Small Amount of Dolomite Ranging In Color From Cream-Buff To Dark Brown & Hard w/ Poor Porosity; ~~Small Amount~~ Some White Soft, Granular L.S.; Trace Brown Dolomite w/ Excellent Porosity; Small Amount of Cement In Sample.	3450-3460	10
Dolomite, Brown, Buff, Some Gray, Hard; Fair To Good Porosity; Trace White L.S. (Soft); Some Buff Dolomite of Moderate Hardness & Good Porosity.	3460-3470	10
	~~3470-3480~~	~~10~~

GERAGHTY & MILLER, INC.

WELL LOG

PROJECT: WPB Sewage Disposal DATE: 26 Feb 77 SHEET: 1 OF

LOCATION: WPB DRILLING CONTRACTOR: APCO

WELL NUMBER: 3 DRILLING METHOD: Reverse Air

SAMPLE DESCRIBED BY: Rioux / Thig, W.P., G.W. SAMPLING METHOD: Strained / Washed

SAMPLE DESCRIPTION	DEPTH INTERVAL (FEET)	THICKNESS (FEET)
Dolomite, Brown, Hard, Poor Porosity; Some Cream & Trace Dark Brown Dolomite, Hard, Poor Porosity; Some White, Moderately Hard, L.S. of Poor To Fair Porosity; Trace Light Brown Dolomite of Moderate Hardness & Good Porosity.	3470-3480	10
Same	3480-3490	10
Dolomite, Brown w/ Some Gray, Hard, Dense, Poor Porosity; Light Brown Dolomite of Moderate Hardness & Good To Excellent Porosity; Trace Soft White L.S. (Easy Drilling < 1000 # WOB & Making Progress).	3490-3500	10
Dolomite, Brown, Hard, Dense, Poor Porosity — Some Light brown moderate hardness with good porosity	3500-3510	10
	~~[illegible]~~	~~10~~
Dolomite - Predominantly Light Brown w/ grades of medium + Dark brown + gray. Light brown is porous + moderately hard. Darker browns + grays are hard, dense + impermeable, Some darker cutting are X/N Some white dolomitic limestone	3510-3520	10
Dolomite light brown to greys some porosity most dense crystaline, Crystals on some surfaces indications of Vugs Some crystal filled cavities	3520-3530	10
Dolomite - Light brown + Light greys mostly non porous, dense. ~~Some are~~ X/N. Dense, dark gray dolomite in lesser amounts driller Noel notes cavity in his log. MHW	3530-3540	10
	3529-3530	P.B. 1

GERAGHTY & MILLER, INC.

WELL LOG

PROJECT: WPB Sewage Disposal DATE: ____________ SHEET: 2 OF ______

LOCATION: WPB DRILLING CONTRACTOR: APCO

WELL NUMBER: 3 DRILLING METHOD: Reverse Air

SAMPLE DESCRIBED BY: AR/JW/GW/WP SAMPLING METHOD: Straining/Washed

SAMPLE DESCRIPTION	DEPTH INTERVAL (FEET)	THICKNESS (FEET)
Dolomite - mostly medium brown. Hard, Dense, non porous. Some x/n Also White dolomite, moderately hard, and white limestone, probably from up hole	3540 3550	10
Dolomite, light tan-grey. Hard, Dense, crystaline non porous Also white dolomitic limestone fine grained, similar to cutting from 3080-3830 ± feet no chert however.	3550-3560	10
Dolomite lightgrey, Hard, Dense crystaline, nonporous, no crystal surfaces noted. Also white Dolomitic limestone as above.	3560-3570	10
Dolomite lightgrey-tan Hard, Dense crystaline nonporous, no crystal surfaces noted white dolomitic limestone	3570-3580	10
Dolomite, Tan, Hard dense poor porosity. 20% limestone soft dense poor porosity	3580-3590	10
Same	3590-3600	10
Same	3600-3610	10

GERAGHTY & MILLER, INC.

WELL LOG

PROJECT: WPB Sewage Disposal DATE: 7 Mar 77 SHEET: 1 OF ____

LOCATION: WPB DRILLING CONTRACTOR: APCO

WELL NUMBER: 3 DRILLING METHOD: Reverse Air

SAMPLE DESCRIBED BY: Rioux SAMPLING METHOD: Strained/Washed

SAMPLE DESCRIPTION	DEPTH INTERVAL (FEET)	THICKNESS (FEET)
Dolomite, Brown, Moderate Hardness, Poor Porosity, Crystalline Soft, White, Microgranular Limestone w/ Poor To Fair Porosity.	3610-3620	10
Same	3620-3630	10
Same w/ Trace Brown Chert.	3630-3640	10
Dolomite, Lt. Brown, Dense, very Hard, Poor Porosity w/25% Limestone white soft, fair to poor porosity	3640-3650	10
Dolomite, gray to lt brown, Dense, poor porosity w/5% limestone white, soft fair to Poor porosity	3650-3660	10
Dolomite, Brown, Dense, very hard, Poor Porosity w/20% limestone white soft, fair to poor porosity	3660-3670	10
Same w less limestone	3670-3680	10
Dolomite, Lt to Dark brown, very hard, poor Porosity w/5% limestone white soft, fair Porosity	3680-3690	10

APPENDIX J

GEOLOGIC LOG
WELL 4

FROM 2540 TO 3272 FEET

GERAGHTY & MILLER, INC.

WELL LOG

PROJECT: West Palm Beach Disposal Plant DATE: 9/24/77 SHEET: 1 OF ____

LOCATION: W. P. B. DRILLING CONTRACTOR: Progress

WELL NUMBER: #4 DRILLING METHOD: Rev./Air

SAMPLE DESCRIBED BY: J Roland & Wheatly SAMPLING METHOD: Sieve/Washed

SAMPLE DESCRIPTION	DEPTH INTERVAL (FEET)	THICKNESS (FEET)
LIMESTONE - CREAM, MED. SOFT, GRANULAR, FAIR POROSITY, MED. INDURATION, TRACE - LIMESTONE - TAN, F. GR. XTALINE, HARD, LOW POROSITY	2540 2550	10'
LIMESTONE - CREAM TO TAN, MED SOFT, GRANULAR WITH XTALINE CALCITE RHOMBS IN MATRIX, LOW POROSITY, POOR TO GOOD INDURATION. TRACE - LIMESTONE, TAN, F. GR. XTALINE, HARD, LOW POROSITY MORE THAN BEFORE. *SLOWER PENETRATION RATE.	2550' 2560'	10'
Limestone, cream, Soft, granular, Clxn calcite present, good porosity	2560-2570	10
Limestone, Lt Tan, Clxn Calcite present, Fair porosity, Fine grain	2570-2580	10
Dolomite, Tan, moderatly Hard, poor porosity w/90% Limestone Cream, soft, granular good porosity	2580-2590	10
SAme	2590-2600	10
LIMESTONE - CREAM TO V. LT. GRAY, SOFT, GRANULAR, FAIR TO GOOD POROSITY, POOR INDURATION, + CALCITE RHOMBS IN L.S. MATRIX + ORGANICS - BLK. PEAT - SOME LAMINATIONS INCLUSIONS.	2600' 2610'	10'
LIMESTONE - CREAM, SOFT, GRANULAR, good POROSITY POOR INDURATION. + CALCITE ~~[illegible]~~, CRYSTALLINE, LESS THAN ABOVE + BLK PEAT - MUCH LESS THAN ABOVE.	2610 2620'	10'

GERAGHTY & MILLER, INC.

WELL LOG

PROJECT: West Palm Beach Disposal Plant DATE: 9/24/77 SHEET: 1 OF ____

LOCATION: W.P.B. DRILLING CONTRACTOR: Progress

WELL NUMBER: #4 DRILLING METHOD: Rev./Air

SAMPLE DESCRIBED BY: J. Roland SAMPLING METHOD: Sieve/Washed

SAMPLE DESCRIPTION	DEPTH INTERVAL (FEET)	THICKNESS (FEET)
Limestone - cream, soft, granular, good porosity poor induration, abundant forams (cone shaped) & fecal pellets. Trace - Calcite - amber, xtaline, rhombs & veinlets	2620' - 2630'	10'
Limestone - cream, soft, brittle, granular, good porosity, med. induration, cone shaped forams; calcite, amber veinlets.	2630 - 2640	10'
Limestone - cream, soft, brittle, granular, good porosity. Globorotalia & cone shaped forams. Calcite - as amber rhomb habit xtals and veinlet fills.	2640 - 2650	10
Limestone - cream, soft, granular, good porosity, primarily poorly indurated pellets & forams. Calcite - clear and amber, veinlet fills.	2650 - 2660'	10
Limestone - cream, v. soft, granular, good porosity poor to med. induration, fewer forams. Calcite - amber, rhomb habit in L.S. matrix	2660 - 2670	10
Limestone - cream, soft, fine granular, good porosity, med. induration, cone shaped forams. Trace - ~~p~~ black-brown peat.	2670 - 2680	10
Limestone - cream, soft, fine granular - well cemented - poor porosity disc shaped forams abundant!	2680 - 2690	10

GERAGHTY & MILLER, INC.

WELL LOG

PROJECT: W.P.B. Sewage Disposal DATE: Sept 25, 1977 SHEET: 1 OF ____

LOCATION: W.P.B. DRILLING CONTRACTOR: Progress

WELL NUMBER: 4 DRILLING METHOD: Reverse Air

SAMPLE DESCRIBED BY: G McWitt & J Roland SAMPLING METHOD: Strained Washed

SAMPLE DESCRIPTION	DEPTH INTERVAL (FEET)	THICKNESS (FEET)
Limestone - cream - lt Buff - sucrosic soft biomicrite, well cemented some microporosity fair to poor porosity. some sparite some calcite crystals - abundant forams	2690-2700	10
As above	2700 2710	10
Dolomite Brown - Dark Tan, Hard, Dense crystaline - low porosity Trace of white - cream limestone probably up hole contamination caused By side wall reamers -	2710 - 2720	10
Dolomite - Dk. tan - Lt. Brown, med. hard, med to coarse xtaline, low porosity. Limestone - (≈30% sample) cream to tan, soft, low to med. porosity. more than above sample w/ dolomite - prob. stringers.	2720 2730	10
Limestone - cream to buff, soft, granular, low to fair porosity, low induration, abundant foram - Lepidocyclina ocalana - pseudo-marginata ?	2730 2740	10
Limestone - As above, with calcite - xtals, rhomb habit.	2740 2750	10

GERAGHTY & MILLER, INC.

WELL LOG

PROJECT: West Palm Beach Disposal Plant DATE: 9/25/77 SHEET: 1 OF

LOCATION: W. P. B. DRILLING CONTRACTOR: Progress

WELL NUMBER: #4 DRILLING METHOD: Rev/Air

SAMPLE DESCRIBED BY: J. Roland SAMPLING METHOD: Sieve

SAMPLE DESCRIPTION	DEPTH INTERVAL (FEET)	THICKNESS (FEET)
Limestone – cream to buff, soft, friable, low to fair porosity, granular. Calcite – abundant show of clear to amber calcite rhombs in LS. matrix and in clumps.	2750 2760	10'
Dolomite – Dk. tan to Lt. brown, hard, brittle, med. to coarse xtaline, fair porosity. Note: Drilling break was at ≈2762' Trace – cream, soft, limestone. prob. from up hole,	2760 2770	10'
As Above	2770- 2780.	10'
Dolomitic Limestone 90% – White · Soft to moderately hard Biomicrite + Intramicrite, fair to poor porosity, A few foram test visible both loose + cemented. Dolomite 10% – Tan, hard, poor porosity, subcrystalline to vuggy	2780 -2790	10
As Above	2790 2800	10
Dolomitic Limestone – White, soft to moderately hard Biomicrite – poor porosity, mostly foram tests, partially recrystallized, both cemented + loose. Trace, Tan Hard Dolomite, poor porosity – subcrystalline.	2800 2810	10

GERAGHTY & MILLER, INC.

WELL LOG

PROJECT: WPB Sewage Disposal DATE: ______ SHEET: ______ OF ______

LOCATION: WPD DRILLING CONTRACTOR: Progress

WELL NUMBER: 4 DRILLING METHOD: Reverse Air

SAMPLE DESCRIBED BY: GMWH/Pearce SAMPLING METHOD: Strained Washed

SAMPLE DESCRIPTION	DEPTH INTERVAL (FEET)	THICKNESS (FEET)
Dolomite; Tan - Light Brown, Hard, crystaline, good-fair porosity somewhat calcareous crystaline sucrosic Rhombic crystals some Vugs.	2810-2820	10
As Above	2820-2830	10
As Above wt 50% limestone cream biomicrite soft - moderately hard - microporosity ~~po~~porosity poor well cemented-	2830 2840	10
As Above - w/ trace of Limestone -	2840- 2850	10
Dolomite - Brown, Hard, Dense, poor to no porosity, subcrystalline Trace - White, Dolomitic Limestone Biomicrite, poor porosity, subcrystalline to grainy.	2850 2860	10
Dolomite, Brown, Hard, good to poor porosity, Subcrystalline to Vuggy	2860 2870	10
As Above w/ Trace White, soft Limestone, slightly Dolomitic, Biomicrite	2870 2880	10

GERAGHTY & MILLER, INC.

WELL LOG

PROJECT: WPB Sewage Disposal DATE: OCT 1 SHEET: ______ OF ______

LOCATION: WPB DRILLING CONTRACTOR: Progress

WELL NUMBER: 4 DRILLING METHOD: Reverse Air

SAMPLE DESCRIBED BY: GWITT / PEARCE SAMPLING METHOD: Strained washed

SAMPLE DESCRIPTION	DEPTH INTERVAL (FEET)	THICKNESS (FEET)
Dolomite - HARD, Dense, sucrosic crystalline Rhombs. ~~Tan to~~ Brown, good to Fair porosity, However effective ~~poor~~ porosity poor.	2880-2890	10
As Above	2890 2900	10
Dolomite, brown, Hard, Dense, subcrystalline to 'Vuggy' - good to fair porosity 5% - White Dolomitic Limestone moderately hard, poor porosity	2900 2910	10
Dolomite, Brown, Hard, Fair Porosity Crystalline, Trace soft white Limestone	2910-2920	10
Same	2920-2930	10

GERAGHTY & MILLER, INC.

WELL LOG

PROJECT: West Palm Beach Disposal Plant DATE: 10/4/77 SHEET: 1 OF

LOCATION: W. P. B. DRILLING CONTRACTOR: Progress

WELL NUMBER: #4 DRILLING METHOD: Rev/Air

SAMPLE DESCRIBED BY: J. Roland SAMPLING METHOD: Sieve

SAMPLE DESCRIPTION	DEPTH INTERVAL (FEET)	THICKNESS (FEET)
Dolomite - Dk. tan to Lt. Brown, med. hard, med. to coarse xtaline, med. induration, low to fair primary porosity, fair to good secondary porosity. Many cuttings show abundant ghost fossil forams with secondary calcitic replacement. Dolomite - Dk Brown, hard, dense, micro-xtaline, low porosity, fractured.	2930' 2940	10'
Dolomite - Dk. tan to Brown, med. to coarse xtaline, med. soft to hard, med. induration, low to fair porosity, calcitic, (soft, white, lining in foram molds, extensive in some cuttings). Also calcite xtals are present. 45% *Dolomite - Dk. Brown, hard, dense, micro to fine xtaline, gen. low porosity as solution pinholes & micro vugs; Trace - ~~L.~~S. - soft, white, granular. Prob. from up-hole.	2940 2950 *Note: Hard at 2944' to 2948 - Dk Brown Dolomite.	10
Dolomite & calcitic dolomite, Dk. tan to Brown, as above. 80% of sample Dolomite, Dk Brown, as above - less material than above.	2950 2960'	
Dolomite, Tan to Brown, micro xtln, fair porosity Trace, white limestone soft.	2960-2970	10
[redacted]	[redacted]	[redacted]

GERAGHTY & MILLER, INC.

WELL LOG

PROJECT: WPB Sewage Disposal DATE: ______ SHEET: ______ OF ______

LOCATION: WPB DRILLING CONTRACTOR: Progress

WELL NUMBER: 4 DRILLING METHOD: Reverse Air

SAMPLE DESCRIBED BY: Wheatly / Roland SAMPLING METHOD: ______

SAMPLE DESCRIPTION	DEPTH INTERVAL (FEET)	THICKNESS (FEET)
Dolomite, Lt Tan to Brown, Hard, mirco X/N, Fair micro porosity, Trace white soft Limeston	2970-2980	10
Dolomite - Lt. Brown, med. hard, med to coarse xtaline, low to med. induration, fair micro-porosity (secondary), calcitic dolomite. + abundant variety of foram molds with a white, v.f. gr., calcitic linings. Dolomite, Dk. Brown, hard, dense, micro-xtaline, low porosity - as solution pinholes, non-fossilif. Trace - cream, soft, granular L.S. (prob. up hole cavings.)	2980' 2990'	10'
Dolomite - Lt. Brown to Dk. Brown, hard, dense, micro. to medium xtaline, low porosity - as micro vugs. + Some secondary mineralization in foram molds as above, but to a much lesser degree. Trace - cream soft, granular L.S	2990' 3000' * Harder from 2994'	10'
Limestone, Tan, ~~[illegible]~~, moderate Hardness, dense, Poor porosity 40% Dark Brown Dolomite, Hard, Good porosity.	3000-3010	10

GERAGHTY & MILLER, INC.

WELL LOG

PROJECT: WPB Sewage Disposal DATE: 10/5/77 SHEET: ______ OF ______

LOCATION: WPB DRILLING CONTRACTOR: Progress

WELL NUMBER: 4 DRILLING METHOD: Reverse Air

SAMPLE DESCRIBED BY: Wheatley / Roland SAMPLING METHOD: ______

SAMPLE DESCRIPTION	DEPTH INTERVAL (FEET)	THICKNESS (FEET)
Dolomite, Tan to Dark Brown, Hard, good micro porosity, micro X/N	3010-3020	10
DOLOMITE - BROWN to DK. BROWN, HARD, DENSE, MICRO to FINE XTALINE, MICRO POROSITY IS FAIR (AS MICRO VUGS). SOME GOOD DOLOMITE XTAL DEVELOPMENT IN VUGS & FRACTURES. Dolomite - DK. TAN, SOFT TO MED. HARD, LOW POROSITY, FINE to MED. XTALINE. + SMALL AMT. OF CALCITE, CLEAR, IN MATRIX, + SEVERAL CUTTINGS SHOW A GREEN, SOFT, MINERAL; GLAUCONITE? NO SILICA SAND. PRESENT.	3020' 3030	10'
Dolomite AS ABOVE: DK BROWN DECREASING DK. TAN MORE ABUNDANT + ≈ 5-10% of sample for ≈ 3-5' only. ✱ + LIMESTONE, white to CREAM, V. F GR., LOW POROSITY, WITH ELONGATE 'ghost' FORAM MOLDS, CALCITIC AND/OR ARAGONITE ~~[illegible]~~ FILLING. NUMMULITES? ✱ ✱ - L.S. COMING & GOING.	3030 SOFTER ↓ 3040	10'
~~Dolomite~~		

GERAGHTY & MILLER, INC.

WELL LOG

PROJECT: W. P. B. Sewage Disposal DATE: 10/6/77 SHEET: 1 OF ____

LOCATION: W. P. B. DRILLING CONTRACTOR: Progress

WELL NUMBER: #4 DRILLING METHOD: Rev/Air

SAMPLE DESCRIBED BY: J. Roland SAMPLING METHOD: Sieve/Washed

SAMPLE DESCRIPTION	DEPTH INTERVAL (FEET)	THICKNESS (FEET)
Dolomite - Dk. tan, med. hard, med. to coarse gr. xtaline, med. to good induration, low porosity. (some inter-granular) Dolomite - Brown to Dk. Brown, hard, dense, micro. to fine gr. xtaline, low porosity (small amt. of micro vugs.) Limestone - Lt. tan, v. f. to fine grain xtaline, <5% of sample, white, foram molds in matrix, Nummulites?	3040' 3050	10
Dolomite, Dark Brown, Hard, micro XTAline, Some microporosity,	3050-3060	10
Dolomite, Dark Brown, micro xtaline, poor porosity w/ 30% Tan Limestone, Soft, granular Poor porosity 10% White Limestone, soft, Dense Poor porosity	3060-3070	10
Dolomite, Dark Brown, micro xTaline, Poor porosity w/ 5% white Limestone, soft, Dense, Poor porosity 1% Tan Limestone, Soft, granular, Poor porosity	3070-3080	10

GERAGHTY & MILLER, INC.

WELL LOG

PROJECT: W.P.B. Sewage Disposal Plant DATE: 10/7/72 SHEET: 1 OF ____

LOCATION: W. P. B. DRILLING CONTRACTOR: Progress

WELL NUMBER: #4 DRILLING METHOD: Rev/Air

SAMPLE DESCRIBED BY: J. Roland / J Wheatley SAMPLING METHOD: Sieve / Washed

SAMPLE DESCRIPTION	DEPTH INTERVAL (FEET)	THICKNESS (FEET)
Calcareous Dolomite - Lt. to Dk. tan, med. gr. xtaline, fair micro. porosity (micro vugs), dark tan - good induration, light tan - poor induration, white foram casts - Nummulites? Dolomite - Dk. brown, hard, dense, micro. xtaline, low porosity. Calcareous Dolomite, white, med. hard, micro. xtaline, low porosity (a few sol. pinholes) some cuttings are quite soft - most hard	3080 - 3090	10
Same as above: except slightly less Dk. brown, hard xtaline Dolomite	3090 - 3100	10
Hole is dredging in places, large rounded cuttings w/no		W.O.B.
Limestone - cream, soft to med. soft, F. xtaline in v.f. gr. matrix, low porosity, white foram molds. ≈ 60% of sample. Calcareous Dolomite, Lt. tan to Dk. tan, soft, med gr. xtaline, low induration. Fair intergranular porosity Dolomite - Dk. Brown, hard, dense, micro. xtaline	3100 - 3110	10
Limestone, Cream, soft, poor porosity, Dense w/ 5% Brown Dolomite, micro xtaline, Hard, Dense, poor porosity 1% Tan ~~Dolomite~~ Dolomitic Limestone soft, granular, Poor porosity	3110-3120	10

GERAGHTY & MILLER, INC.

WELL LOG

PROJECT: WPB Sewage Disposal DATE: 10/8/72 SHEET: 1 OF

LOCATION: WPB DRILLING CONTRACTOR: Progress

WELL NUMBER: 4 DRILLING METHOD: Reverse Air

SAMPLE DESCRIBED BY: Wheatley / ROLAND SAMPLING METHOD: Sieve / washed

SAMPLE DESCRIPTION	DEPTH INTERVAL (FEET)	THICKNESS (FEET)
Limestone, Cream, Dense, soft, poor porosity w/ Trace - Brown Dolomite, micro xtalene, poor porosity Trace, Tan Dolomitic Limestone, soft granular, poor porosity	3120-3130	10
Same	3130-3140	10
Limestone, Tan, Dolomitic, soft, Dense poor porosity w/ 30% - Limestone, cream, soft, Dense, poor porosity Trace - Dolomite, Brown, Hard micro Xtalene, micro porosity	3140-3150	10
LIMESTONE - CREAM, SOFT, FRIABLE, FINE XTALS. IN A V. F. GRAIN MATRIX, LOW POROSITY. FORAMS - LEPIDOCYCLINA OCALANA. LIMESTONE, Dolomitic - DK. TAN, MED. XTALINE, ≈5% of SAMPLE MED. HARD., SOME INTERGRANULAR - MICRO - POROSTY	3150' 3160'	10
SAME AS ABOVE.	3160' 3170'	10'
LIMESTONE - CREAM TO Lt. GRAY - CREAM, SOFT, LOW POROSITY, LESS V. f. chalky MATRIX MATERIAL. LIMESTONE - tan to Dk. tan, MED. XTALINE, MED HARD, ≈5% DoLomITE - BROWN, MICRO. XTALINE. UP HOLE CONTAMINATION.	3170 3180'	10'

GERAGHTY & MILLER, INC.

WELL LOG

PROJECT: West Palm Beach Disposal Plant DATE: 10/8/77 SHEET: 2 OF ____

LOCATION: W. P. B DRILLING CONTRACTOR: Progress

WELL NUMBER: #4 DRILLING METHOD: Rev/Air

SAMPLE DESCRIBED BY: Roland SAMPLING METHOD: Sieve/Washed

SAMPLE DESCRIPTION	DEPTH INTERVAL (FEET)	THICKNESS (FEET)
Limestone - cream to white, soft, friable, fine xtals. in a v.f. grain matrix. Forams - Lepidocyclina ocalana. Low porosity. Limestone, Dolomitic - Dk. tan, med to coarse xtaline, med hard. ~~5%~~ 5% to 10% of sample.	3180' 3190'	10
Same as above + Trace - Limestone, Dolomitic - white, med hard to hard, micro xtaline low porosity	3190 3200	10
Limestone - cream, soft, friable, v.f. gr. matrix w/ xtaline inclusions, low porosity, chalky. ≈85%. Forams - less abundant - ~~[illegible]~~ Nummulites. Trace - Dolomite - Brown, hard micro xtaline. Trace - ~~Dolomite~~, Limestone, dolomitic - Dk. tan, med gr. xtaline,	3200 3210	10
Limestone, Cream, Soft, Dense, V.F. grain, poor porosity w/ Trace - Limestone, Tan, Dolomitic, soft Poor porosity. Trace - Brown Dolomite, Hard, poor porosity. This ~~[illegible]~~ could be from up Hole	3210-3220	10

GERAGHTY & MILLER, INC.

WELL LOG

PROJECT: West Palm Disposal Plant DATE: 10/3/77 SHEET: 1 OF

LOCATION: W. P. B. DRILLING CONTRACTOR: Progress

WELL NUMBER: #4 DRILLING METHOD: Rev/Air

SAMPLE DESCRIBED BY: J Wheatly & J Roland SAMPLING METHOD: Sieve/Washed

SAMPLE DESCRIPTION	DEPTH INTERVAL (FEET)	THICKNESS (FEET)
Limestone, cream, soft, Dense, V.F grain, poor porosity w/ Trace - Limestone, Tan, Dolomitic, soft poor porosity Trace - Dolomite, Brown, Hard, poor Porosity note: This could be from up Hole	3220-3230	10
Same	3230-3240	10
Limestone, cream, soft, Dense, V.F. grain poor, porosity, Trace - Limestone, Tan, Dolomitic, soft poor porosity note This could be from up Hole	3240-3250	10
Limestone, cream, soft, Dense, VF grain, poor, porosity Trace - Dolomite, Blue gray, very Hard. poor porosity Trace - Dolomite, Brown, Hard, poor porosity ~~note This may be from up Hole~~	3250-3260	10
LIMESTONE - BROWN, MED. TO COARSE GR. XTALINE, SOFT, POOR INDURATION, FAIRLY GOOD INTERGRANULAR POROSITY. 50% LIMESTONE - CREAM, SOFT, V. F. GRAIN, LOW POROSITY 45% DOLOMITE - BROWN, HARD, DENSE, MICRO. XTALINE LOW POROSITY. PROB UP HOLE CONTAMINATION TRACE	3260 - 3272	12

~~TD 8 3/4" PILOT HOLE.~~

APPENDIX K

GEOLOGIC LOG
WELL 5

FROM 2560 TO 3800 FEET

GERAGHTY & MILLER, INC.

WELL LOG

PROJECT: W.P.B. Sewage Disposal Plant DATE: 5/7/78 SHEET: 26 OF ______

LOCATION: W.P.B. DRILLING CONTRACTOR: Progress Supply

WELL NUMBER: # 5 DRILLING METHOD: Reverse/Air

SAMPLE DESCRIBED BY: J.Roland / G.Witt SAMPLING METHOD: Sieve/Washed

SAMPLE DESCRIPTION	DEPTH INTERVAL (FEET)	THICKNESS (FEET)
LIMESTONE - CREAM TO LIGHT TAN, MODERATLY HARD, BRITTLE, FINE TO MEDIUM GRAIN, LOW [redacted] POROSITY, SOME VERY FINE GRAIN SOLUTION DEPOSITS IN VUGS & VEINLETS. DOLOMITE - LIGHT BROWN, HARD, COARSE GRAIN, LOW TO FAIR SECONDARY POROSITY.	2560 - 2570	10
LIMESTONE - CREAM TO LIGHT TAN, MODERATLY HARD, BRITTLE, FINE TO MEDIUM GRAIN, [redacted] LOW [redacted] POROSITY, CONE SHAPED FORAMS. CALCITE - AMBER, XTALINE.	2570 - 2580	10
SAME AS ABOVE	2580 - 2590	10
SAME AS ABOVE	2590 - 2600	10
SAME AS ABOVE	2600 - 2610	10
SAME AS ABOVE	2610 - 2620	10
SAME AS ABOVE	2620 - 2630	10
SAME AS ABOVE	2630 - 2640	10
SAME AS ABOVE	2640 - 2650	10
SAME AS ABOVE	2650 - 2660	10
SAME AS ABOVE	2660 - 2670	10
SAME AS ABOVE	2670 - 2680	10
SAME AS ABOVE	2680 - 2690	10
SAME AS ABOVE	2690 - 2700	10

GERAGHTY & MILLER, INC.

WELL LOG

PROJECT: WPB Sewage Disposal DATE: 5/8/78 SHEET: 27 OF

LOCATION: WPB DRILLING CONTRACTOR: Progress Supply

WELL NUMBER: 5 DRILLING METHOD: Reverse Air

SAMPLE DESCRIBED BY: GMWitt/EW Pearce SAMPLING METHOD: Strained/Washed

SAMPLE DESCRIPTION	DEPTH INTERVAL (FEET)	THICKNESS (FEET)
Dolomite Tan, Hard, Dense, non porous, crystalline, 75% sample, Limestone* 25% of sample soft, Cream, poor porosity, many fossils forams, sucrosic texture. *Limestone probably from up hole contamination Drilling rate extremely slow 10,000lb WOB. 1ft/½ hr.	2700-2710	10
As Above Dolomite, less Dense, some porosity softer	2710-2725	15
Limestone off White, soft, sucrosic, Biomicrite some dolomitization, granular loose poorly cemented, w/ abundant loose forams and shell fragments, Poor-fair porosity	2725-2730	5
As Above	2730-2740	10
As Above 40% of sample Dolomite, TAN, fair porosity crystaline hard dense. Dolomite ~~probably up hole contamination caused by Roller Reamer.~~	2740-2750	10
Dolomite TAN, HARD, Dense, crystaline, w/ some porosity, 95% Limestone offwhite soft, poor porosity, biomicrite.	2750-2760	10
Dolomite, TAN, Hard, subcrystalline, poor to no porosity, 75%. Limestone, soft, white to beige, fair to poor porosity; biomicrite 25% Trace of Dolomite as above, "marbled" with black material	2760 2770	10

GERAGHTY & MILLER, INC.

WELL LOG

PROJECT: WPB Sewage Disposal DATE: 5/19/78 SHEET: 28 OF ____

LOCATION: WPB, Fl DRILLING CONTRACTOR: Progress Supply

WELL NUMBER: 5 DRILLING METHOD: Reverse Air

SAMPLE DESCRIBED BY: Pearce / G WiH SAMPLING METHOD: Strained / Washed.

SAMPLE DESCRIPTION	DEPTH INTERVAL (FEET)	THICKNESS (FEET)
Limestone - Beige, soft, Biomicrite, poor porosity, Grainy to Micro-sucrosic. Some loose foram tests. Trace - Tan, hard, poor to no porosity (as Above)	2770 - 2780	10
Dolomite - Medium Brown, hard, poor to no porosity, subcrystalline 95% Limestone, Beige, soft, Biomicrite poor porosity, friable, grainy sucrosic	2780 - 2790	10
As Above	2790 2800	10
Limestone - lt tan, mod soft, Biomicrite, poor-fair porosity, microsucrosic w/ loose and cemented foram test, Dolomitic	2800 - 2810.	10
Limey Dolomite - lt tan - tan, Biomicrite, soft to mod hard poor - fair porosity crystalline - microcrystalline, well cementing, Dolomite - limy Dolomite matrix Calcite ~~inclusions~~ particles consisting of foram test in various stages of recrystallizations. Som cuttings show laminations with brown organic staining	2810 - 2820	10
Dolomite - tan, moderately hard, crystalline, poor porosity, sucrosic texture - Trace of Limestone mostly of fossils probably up hole contamination	2820 - 2830	10

GERAGHTY & MILLER, INC.

WELL LOG

PROJECT: WPB Sewage Disposal DATE: ________ SHEET: 29 OF ______

LOCATION: WPB Fl DRILLING CONTRACTOR: Progress Supply

WELL NUMBER: 5 DRILLING METHOD: Reverse Air

SAMPLE DESCRIBED BY: G Witt / Pearce SAMPLING METHOD: Strained / washed

SAMPLE DESCRIPTION	DEPTH INTERVAL (FEET)	THICKNESS (FEET)
Dolomite - Light to Medium Brown, Light Brown is hard, fair to good porosity, Sucrosic friable, vuggy. Medium Brown is hard, denser, poor to no porosity, Subcrystalline. 5% Soft, Beige, Limestone, Biomicrite (probably from up hole)	2830- 2840	10
As Above - Very little Light Brown Dolomite	2840 2850	10
Dolomite - Light Brown - hard, fair to good porosity, less sucrosic & friable than above. 5% soft, Beige Limestone, Biomicrite	2850 2860	10
Dolomitic Limestone - light TAN, mod soft, Biomicrite poor to fair porosity Dolomite ~~as~~ calcareous micrite matrix, particals consist mostly of skeletal remains. forams loose and cemented.	2860 - 2870	10
Dolomite, lt Brown hard- poor porosity, crystaline granular to sucrosic.	2870 - 2880	10
Dolomite lt Brown, soft - mod soft, sucrosic. good to fair poorsity, vuggular, friable. ~~g~~ crystaline w/ traces of micro crystaline surfaces. 20% of sample Limestone ~~of~~ off White consitiwe mostly of foram test	2880 - 2890	10

GERAGHTY & MILLER, INC.

WELL LOG

PROJECT: WPB Sewage Disposal DATE: ________ SHEET: 30 OF ________

LOCATION: WPB DRILLING CONTRACTOR: Progress Supply

WELL NUMBER: 5 DRILLING METHOD: Reverse Air

SAMPLE DESCRIBED BY: GMWitt / Patrice SAMPLING METHOD: Strained washed

SAMPLE DESCRIPTION	DEPTH INTERVAL (FEET)	THICKNESS (FEET)
Dolomite, Light to Medium brown, hard. Light Brown pieces are dolomite mixed with white calcareous material (shell fragments) Subcrystalline, poor porosity Medium brown pieces are very porous dolomite, light (weight), subcrystalline with many surfaces of Rhombic crystals Trace, soft white Limestone.	2390 2900	10
Dolomite, medium brown, hard, sub-crystalline, poor to no porosity, some have traces of white calcareous material. 10% soft, white or Beige Limestone Biomicrite, sucrosic, friable.	2900 2910	10
As Above	2910 2920	10
Dolomite, medium brown, sample is very uniform in colour, hard, sub-crystalline, poor to no porosity, Dolomite shows no evidence of calcareous material.	2920 2930	10
As Above - Denser / Harder. some Dolomitic Dolomite Dolomitic matrix w/ calcite fossils and skeletal Remains Dense Hard. non porous	2930 2940	10
As Above	2940 - 2950	10
Dolomite, Denser, Harder less Porous and Darker Brown.	2950 - 2960	10

GERAGHTY & MILLER, INC.

WELL LOG

PROJECT: WPB Sewage Disposal DATE: 5/13/78 SHEET: 31 OF ____

LOCATION: WPB, Fl DRILLING CONTRACTOR: Progress

WELL NUMBER: 5 DRILLING METHOD: Reverse Air

SAMPLE DESCRIBED BY: Pearce SAMPLING METHOD: Strained/Washed

SAMPLE DESCRIPTION	DEPTH INTERVAL (FEET)	THICKNESS (FEET)
Dolomite - Medium to Dark Brown - Hard, dense, subcrystalline, little to no porosity.	2960 - 2970	10
As Above - Increase in Darker Dolomite	2970 - 2980	10
As Above - with Trace soft, white, Biomicritic Limestone	2980 - 2990	10
Dolomite - Light, medium + dark brown mixed, Light brown is, soft, sucrosic, friable Calcitic Dolomite, grainy, with remnants of calcareous shell material. Medium + Dark Brown are, hard, dense subcrystalline with little to no porosity	2990 - 3000	10
As Above - Decrease in soft, Light Brown content.	3000 - 3010	10
Dolomite, Lt brown - Dark Brown - Lt Brown is soft - mod hard sucrosic friable, Fair porosity. Dark Brown - hard Dense w/some porosity calcite inclussions. 3010 - 3014 was not recovered ~~[illegible]~~ soft, hard	3010 3020 (3010 3014) Void	10
Dolomite ~~Lt~~ brown As above - ~~90~~% of sample. 10% of sample Gypsum. White to off white Soft. H 1.5 - 2 ~~[illegible]~~ MASSIVE Earth - No reaction to 10% or 100% solution of HCL however becomes soluble in HCL. Some peices Show reaction rings with dolomite.	3020 - 3030	10

GERAGHTY & MILLER, INC.

WELL LOG

PROJECT: WPB Sewage Disposal DATE: 5/13/78 SHEET: 32 OF ____

LOCATION: WPB DRILLING CONTRACTOR: Progress Supply

WELL NUMBER: 5 DRILLING METHOD: Reverse Air.

SAMPLE DESCRIBED BY: GMWitt. SAMPLING METHOD: Stained Washed

SAMPLE DESCRIPTION	DEPTH INTERVAL (FEET)	THICKNESS (FEET)
Dolomite Light, medium & Dark brown, hard. Light brown is grainy, poor porosity slightly sucrosic, Darker Dolomite is subcrystalline, no porosity. Trace - Gypsum, earthy white, mod. hard	3030 - 3040	10
Dolomite - As Above	3040 - 3050	10
Dolomite - mostly Dark brown, hard subcrystalline to grainy, slightly sucrosic, friable, fair to poor porosity	3050 3060	10
Dolomite - Light to Dark brown, hard. Light brown is grainy, poor porosity slightly sucrosic, Darker Dolomite is subcrystalline, no porosity.	3060 - 3070	10
AS Above w/ trace of Gypsum?	3070 - 3080	10
AS Above w/out Gypsum [Gary, what happened to 3090 - 3100?] Wayne, it might with the rest of them. SR 5/17 SEE PAGE BOTTOM.	3080 3090	10
AS Above w/ trace of DARK Brown Dolomite Trace of Gypsum	~~3090~~ 3100 3110	10
~~As Above~~ Note: ~~w/ trace~~ ~~is as follow~~ 3090-3100 as follows. is the same as 3080-3090. M M Witt!	~~3110~~ ~~3120~~ 3090 - 3100	~~10~~ 10

GERAGHTY & MILLER, INC.

WELL LOG

PROJECT: WPB Sewage Disposal DATE: 5/15/78 SHEET: 33 OF ______

LOCATION: WPB, Fl DRILLING CONTRACTOR: Progress

WELL NUMBER: 5 DRILLING METHOD: Reverse Air

SAMPLE DESCRIBED BY: Pearce / Roland SAMPLING METHOD: Strained / Washed.

SAMPLE DESCRIPTION	DEPTH INTERVAL (FEET)	THICKNESS (FEET)
Dolomite - Medium Brown - moderately hard, grainy to subcrystalline, sucrosic, friable, good porosity, good permeability. A few cuttings are hard, subcrystalline with poor to no porosity.	3110 - 3120	10
As above	3120 3130	10
As above	3130 3140	10
Dolomite - Light, medium + Dark Brown Light Brown dolomite is actually calcitic Dolomite, soft, grainy, slightly friable poor porosity. Medium dolomite contains a little calcareous material, is moderately hard friable, fair porosity Dark Dolomite is hard, dense, subcrystalline to almost resinous, no porosity	3140 - 3150	10
DOLOMITE - MEDIUM TO DARK BROWN, MODERATLY HARD, COARSE XTALINE, MEDIUM TO LOW INDURATION, SLIGHTLY FRIABLE, GOOD POROSITY. DOLOMITE, WHITE TO LIGHT GRAY, VERY, FINE GRAIN, HARD, TO MODERATLY HARD, DENSE, LOW POROSITY (≈ 40% OF SAMPLE)	3150 - 3160	10
DOLOMITE - MEDIUM BROWN, MODERATLY HARD, COARSE XTALINE, CALCITIC DOLOMITE, GOOD POROSITY. (60%) DOLOMITE - DARK BROWN, HARD, VERY FINE GRAIN, XTALINE, DENSE, LOW POROSITY. (30%) DOLOMITE, - OFF WHITE - LIGHT GRAY, HARD, VERY FINE GRAIN, LOW POROSITY. (10%)	3160 - 3170	10
+ TRACE - GRAY CHERT.		

GERAGHTY & MILLER, INC.

WELL LOG

PROJECT: W.P.B. Sewage Disposal DATE: 5/15/78 SHEET: 34 OF

LOCATION: W. P. B. DRILLING CONTRACTOR: Progress Supply

WELL NUMBER: 5 DRILLING METHOD: Reverse/Air

SAMPLE DESCRIBED BY: J Roland SAMPLING METHOD: Strained/Washed

SAMPLE DESCRIPTION	DEPTH INTERVAL (FEET)	THICKNESS (FEET)
DOLOMITE - LIGHT BROWN, MODERATLY HARD, COARSE XTALINE, MEDIUM TO LOW INDURATION, SLIGHTLY FRIABLE, GOOD POROSITY. DOLOMITE - DARK BROWN, HARD, FINE GRAIN, XTALINE, GOOD INDURATION, LOW POROSITY TRACE - CHERT - GRAY, MICRO XTALINE, HARD, CONCOIDAL FRACTURE.	3170 - 3180	10
SAME AS ABOVE WITH TRACES SOFT WHITE FINE GRAIN LIMESTONE.	3180 - 3190	10
SAME AS ABOVE. LESS SOFT WHITE LIMESTONE.	3190 - 3200	10
DOLOMITE, CLEAR TO AMBER, XTALS, UNCONSOLIDATED, GOOD RHOMB HABIT, CALCITIC.	3200 - 3210	10
SAME AS ABOVE WITH OCCASIONAL ~~LOOSELY~~ POORLY CONSOLIDATED CUTTINGS.	3210 - 3220	10
SAME AS ABOVE WITH SOME CONSOLIDATED CUTTINGS.	3220 - 3230	10
NO SAMPLES JR	3230 - 3304 TD	

GERAGHTY & MILLER, INC.

WELL LOG

PROJECT: WPB Sewage Disposal DATE: Oct 4, 78 SHEET: 35 OF ______

LOCATION: WPB DRILLING CONTRACTOR: Progress supply

WELL NUMBER: 5 DRILLING METHOD: Reverse Air

SAMPLE DESCRIBED BY: B. ADAMS SAMPLING METHOD: STRAINED + WASHED

SAMPLE DESCRIPTION	DEPTH INTERVAL (FEET)	THICKNESS (FEET)
Note from 3200 - 3387 KB NO samples were TAKEN. Dirred circulation method of drilling therefore samples Discriptions begin @ 3370 ft Pad level. GMW		
BIT PLUGGED, LOST CIRCULATION, LOST SAMPLE.	3370 - 3380	10.
Void!	3380-3387	7
Dolomite. grey - lt Brown good porosity, in light Brown ~~mic~~ micro crystalline, grey Dolomite (Glauconite?) Hard Dense little or no porosity, lost reaction remis in recrystallize foram test reaction matrix. on foram test. the dolomite matrix. Limestone in sample propably contamination from up hole.	3387-3390	3
DOLOSTONE, CALCITIC, MICROCRYSTALLINE, POROSITY GOOD, ~~[illegible]~~ SOFT, LT. - BROWN; GRAY - GREEN, HARD, DENSE, SLT. POROUS DOLOSTONE; SOME WHITE LIMESTONE (POSS. UPHOLE CONTAMINATION).	3390 - 3400	10
DOLOSTONE, CALCITIC, MICROCRYSTALLINE, GOOD POROSITY, SOFT, LT - BROWN; SOME WHITE LIMESTONE (POSS UPHOLE CONTAMINATION).	3400-3410	10

GERAGHTY & MILLER, INC.

WELL LOG

PROJECT: W.P.B Sewage Disposal DATE: 10-6-78 SHEET: 36 OF

LOCATION: W.P.B. DRILLING CONTRACTOR: PROGRESS

WELL NUMBER: #05 DRILLING METHOD: REVERSE AIR

SAMPLE DESCRIBED BY: LAWRENCE SAMPLING METHOD: STRAINED & WASHED

SAMPLE DESCRIPTION 10-6-78	DEPTH INTERVAL (FEET)	THICKNESS (FEET)
DOLOSTONE, CALCITIC W/FAIR TO GOOD POROSITY MICROCRYSTALLINE W/SOME LIMESTONE DOLOSTONE DRK. GREY TO BROWN, NOTE, PRESENTS GREY TABULAR MICROCRYSTALINE SHALY MATERIAL!	3410 - 20	10'
DOLOSTONE, CALCITIC, CHERTY (BANDED GREY) CHUNKS DOLOSTONE MICROCRYSTALLINE LT. GREY TO BROWNS; INCREASE IN "SHALY" GREY TABLETS W/PARALLEL PLANAR SURFACES. CHERT; LT. CHALK COLOR NON-POROUS W/GREY BANDS V. HARD. NOTE, GREY FINE GRAINED ~~MICROCRYSTA~~ SOFT SAMPLE V. PORIOUS NOTE; W/TRIANGULAR CEMENT GRAPHITE?, MACROSCOPIC CEMENT BLACK CRYSTALS IN TABLETS	3420 - 30	10'
SLIGHTLY CALCITIC DOLOMITE CHUNKS W/CHERTY SURFACES; AND CHERT GREY BANDED AND LT. TAN, HARD LOW POROSITY; WHITE SUBROUNDED LIMESTONE FRAGMENTS HIGHLY CALCITIC, IN FINE MATRIX, GOOD POSOSITY.	3430 - 40	10'

GERAGHTY & MILLER, INC.

WELL LOG

PROJECT: W.P.B. SEWAGE DISPOSAL DATE: 10-7-78 SHEET: 37 OF ____

LOCATION: W.P.B DRILLING CONTRACTOR: PROGRESS

WELL NUMBER: #05 DRILLING METHOD: REVERSE AIR

SAMPLE DESCRIBED BY: LAWRENCE SAMPLING METHOD: STRAIN & WASH

SAMPLE DESCRIPTION	DEPTH INTERVAL (FEET)	THICKNESS (FEET)
NOTE; FIRST SAMPLE CONTAMINATED 80% LIME ROCK - TOOK 2ND SAMPLE; DOLOSTONE CHIPS GOOD POROSITY TAN COLOR, MILDLY SOFT V. FINE GRAINED, W/SMALL AMOUNT CHERT, MICROCRYSTALLINE HARDNESS 6.0 LT. TAN W/GRAY ~~[illegible]~~ BANDS; ALSO SOME LIME ROCK PROBABLY FM. UP HOLE "CONTAMINATION	3440-50' FM PAD TAKEN @ 3446	10'
SAMPLE ALMOST ENTIRELY DOLOSTONE (SEE ABOVE.) SMALL CHIPS DOLOSTONE, V. FINE GRAINED TO MICRO X-TAL, SLIGHTLY CALCITIC	3450-60' @ 3456	10'

GERAGHTY & MILLER, INC.

WELL LOG

PROJECT: W.P.B. Sewage Disposal DATE: 10-9-78 SHEET: ~~30~~ 38 OF 1

LOCATION: West Palm Bch. Fla. DRILLING CONTRACTOR: Progress

WELL NUMBER: #05 DRILLING METHOD: Reverse Air

SAMPLE DESCRIBED BY: Laurence / G With SAMPLING METHOD: Wash & Shake

SAMPLE DESCRIPTION	DEPTH INTERVAL (FEET)	THICKNESS (FEET)
SAMPLE CONTAINS; ABOUT 70% DOLOMITE which is SLIGHTLY CALCITIC and exhibits GOOD POROSITY, HARDNESS ≤6; COLOR RANGES FROM BUFF TAN TO DRK BROWN. WHITE CHALKY LIMESTONE COMPOSES ABOUT 15% OF SAMPLE, PROBABLY FROM "UP-HOLE". THE REMAINING 15% IS CEMENT CHIPS/TABLETS, AND CHERT LT GREY & USUALLY BANDED, AND PIPE SCALE.	3460-70	10
Dolomite 100% sample Lt TAN HARD, Dense, micro crystalline, poor porosity, TRACE OF Re-crystalised (calcitic) Foram test. reaction between Dolomite. (matrix) and test of forams forams unrecognizable.	3470 - 3480	10
AS Above some what lighter in color -	3480 - 3490	10
SAMPLE CONSISTS MOSTLY OF CALCARIOUS (SLIGHT EFFERVENCE) DOLOSTONE, GOOD POROSITY, micro-x-tal GRAINS, Lt BUFF TAN, TO DRK, BROWN, TRACE OF LIMESTONE.	3490-~~35~~00' @ 3495'	10'
Dolomite. 100% of sample, Two-Types. Cream-off White 50% sample. ≈ 3495-3505 ft HARD, Dense MASSIVE, NON-POROUS, some crystal filled Pores mostly replacement of test. • Lt. BROWN - TAN 50%. micro crystaline - Dolomite rooms saccrosic fair - good poorsity.	3500 - 3510 ft sample @ 3505	10'
SAMPLE CONTAINS ABOUT 85% DOLOMITE w/NO EFFERVESCENCE indicating Low CALCITE, DOLOMITE EXHIBITS FAIR to GOOD POROSITY, HARDNESS <6; About 5% of SAMPLE IS CHERT GREY & BANDED CHIPS, HARDNESS, >6, PROBABLY DETRITAL CHIPS, AND 5% IS white Lime rock, contamination as well AS CHERT, LAST 5% is Miscel ie Cement, Paint chips, metal	3510 - 20 @ 3515	10'

GERAGHTY & MILLER, INC.

WELL LOG

PROJECT: W.P.B. SEWAGE DISPOSAL DATE: 10-11-78 SHEET: 39 OF

LOCATION: W.P.B. FLA DRILLING CONTRACTOR: PROGRESS

WELL NUMBER: #05 DRILLING METHOD: REVERSE AIR

SAMPLE DESCRIBED BY: G WITT / LAWRENCE SAMPLING METHOD: STRAINED & WASHED

SAMPLE DESCRIPTION	DEPTH INTERVAL (FEET)	THICKNESS (FEET)
ABOUT 70% OF SAMPLE IS NON-CALCARIOUS, WELL-CONSOLIDATED DOLOMITE MOSTLY ~~MICRO~~ CRYPTO CRYSTALINE W/ POOR POROSITY. ABOUT 20% OF SAMPLE IS MICRO-XTAL VERY PORIOUS ~~OF~~ CALCARIOUS DOLOMITE VARING IN SHADE OF LT. BROWN & DRK. GREY, NOTE ALSO SOME CHERT FOUND AS WELL AS CHALKY WHITE GRANULAR LIMESTONE.	3520-30 @ 3525	10'
AS ABOVE	3530-3540	10'
AS ABOVE, W/ 40% OF SAMPLE OF POROUS DOLOMITE NOT DRILLING RATE INCREASE FORMATION IS SOMEWHAT SOFTER ZONE SEEMS TO BE VUGULAR BY DRILLING RATES, WOB. & SAMPLE.	3540-3550	10'
Dolomite, soft, to mod Hard, micro-crystaline surface, vugular. good porosity Void from 3553-3554 ft.	3550-3560	10
85% SAMPLE CALCITIC DOLOMITE W/GOOD POROSITY, MICRO XTAL GRAINY ALMOST SUCROSIC PITTED TEXTURE, RELITIVELY SOFT, VUGULAR POROSITY IN LT, TAN TO BROWN MATRIX: 15% SAMPLE IS CONSOLIDATED GREY DOLOMITE SLIGHTLY CALCITIC, BUT VERY HARD, SMALL CAVITIES CRYPTOCRYSTALLINE GRAINS, COLOR RANGE, DULL OFF-WHITE TO GREY/BROWN ~~VITREOUS~~ SHINY, POROSITY POOR-FAIR	3560'-70' @ 3565'	10'
SAMPLE SAME AS 3565' SAMPLE★ (SEE ABOVE)	3570-3580	10'
SAMPLE SAME AS ABOVE! NOTE; NO CHERT OR LIMESTONE IN SAMPLES AND VERY LITTLE OTHER CONTAMINANTS.	3580-3590' @ 3585	10'

GERAGHTY & MILLER, INC.

WELL LOG

PROJECT: WPB DATE: Oct 12 SHEET: 40 OF

LOCATION: WPB DRILLING CONTRACTOR: Progress

WELL NUMBER: 5 DRILLING METHOD: Reverse

SAMPLE DESCRIBED BY: G MWTT / T.A LAWRENCE SAMPLING METHOD: STRAINED WASHED

SAMPLE DESCRIPTION	DEPTH INTERVAL (FEET)	THICKNESS (FEET)
~~As~~ SAME AS 3580-3590 ~~As~~ on preceeding page.	3590-3600	10
Dolomite 70% sample TAN - lt BROW DOLOMITE Dense, HARD, cryptocrystalline w/ grey coloned "Veins", grey dolomite Has calcitic inclussions propably the remains of Test. 30% sample ~~gr~~ crystaline dolomite indicative of good porosity sample taken @ Bottom of Void from 3604-3605 ft. sample show metalic mineral. in dolomite Rhoms (most propably Pyrite)	3600-3610 Void 3604-3605	10
Dolomite; 70% of SAMPLE is DENSE, V.HARD CALCIUM CARB. "Coated" GREY to Lt. TAN DOLOMITE, exhibiting Poor POROSITY, CRYPTO xtal. 30% of SAMPLE is ~~Pu~~ious microcrystaline CALCITIC DOLOMITE Lt. TAN to ~~DRK.~~ BRWN, SOFT, NON-CONNECTED vesicales indicate GOOD POROSITY, LIMESTONE TRACES.	3610-3620' Taken @ 3613' pad	10' ft.
Dolomite; ~~SAME~~ AS ABOVE; NOTE CALCITE VEINS VERY common	3620-3630 @ 3625'	10'
Dolomite HARD DENSE, NON-porous. crypto crstalline- lt brown - Brown- 75% sample- 20% Dolomite grey, as described above 5% Dolomite microcrystaline w/ Dolomite Rhoms good porosity	3630-3640	10
As Above w/ recrystalized foram test. in ~~AH~~ abundance in domite matrix.	3640 3650	10
DOLOMITE; 50% of SAMPLE is FRACTURED DOLOMITE, CALCITE COATED Poor Cleavage WELL FRACTURED, CRYPTO XTAL, DRK GREY, HARD, NON POROUS 40% SACCARIOUS DOLOMITE, NON-FRACTURED, CRYPTO-XTAL LT. TAN, GRADES INTO DARKER DOLO. HARD GOOD CLEVAGE 8% SUCROSIC GOOD POROSITY LT. BRWN DOLOMITIC LIMESTONE 2% CEMENT AND LIME CONTAMINATION.	3650-60' Taken @ 3657'	10'

GERAGHTY & MILLER, INC.

WELL LOG

PROJECT: W.P.B. Sewage Disposal DATE: 10-14-78 SHEET: 41 OF ______

LOCATION: West Palm Bch. FLA DRILLING CONTRACTOR: Progress

WELL NUMBER: #05 DRILLING METHOD: Reverse Air

SAMPLE DESCRIBED BY: G. M. Witt w/ T. A. Lawrence SAMPLING METHOD: Strained/Washed

SAMPLE DESCRIPTION	DEPTH INTERVAL (FEET)	THICKNESS (FEET)
Dolomitic Limestone; 95% Dolomitic Limestone w/Good Porosity, Poor cleavage HCL emits steady stream CO_2, Lt. Tan/Buff color med. soft, sucrosic texture; Non-Fractured 5% white chalky limestone (Probable contamin).	3660-70' @ 3665'	10'
Dolomite; 80% Calcitic Coated Dolomite; a) Drk Brwn to Grey/Well Fractured, Hard, ~~crypto~~ micro-xtal b) Lt. Tan to Buff, Non Frac., Hard, micro-xtal ~~Good~~ cleavage a&b often grade into each other 15% Dolomitic Limestone w/Good Porosity Lt. Tan to Buff, sucrosic, rhombs calcite, Good interstices 5% cement and chalky limestone	3670-80' @ 3675	10'
As above w/out Porous Dolomite	3680 3690	
As above w/porous Dolomite	3690 3700	10
Dolomite; 80% Lt. Tan. Dolomite w/recrystalized forams. Fair cleavage, realatively hard, Dull texture w/ mosaic foram pattern, Non fractured, crypto-xtal. 20% slightly calcitic Dolomite Lt. Brown w/ fair porosity Good cleavage, micro-xtal, fine sucrosic text.	3700-10' @ 3707	10'
Dolomite; 50% Lt. Tan Dolomite, Fair cleavage, Hard, crypto. some w/ recrystalized calcite (forams) Non-Frac. 30% slightly fractured calcitic Dolomite, Lt Brwn Good cleve, microxtal grains, sucrosic texture. 10% chalky white limestone soft, granular 10% paint chips & cement w/Lrg. Gilsonite x-tals	3710-20' @ 3715'	10'

GERAGHTY & MILLER, INC.

WELL LOG

PROJECT: WPB Sewage Disposal DATE: 10/15/78 SHEET: 42 OF ______

LOCATION: West Palm Beach DRILLING CONTRACTOR: Progress Supply

WELL NUMBER: 5 DRILLING METHOD: Reverse Air

SAMPLE DESCRIBED BY: G Witt/B Adams SAMPLING METHOD: Stained/washed

SAMPLE DESCRIPTION	DEPTH INTERVAL (FEET)	THICKNESS (FEET)
Dolomite - HARD, DENSE, crypto crystalline, NON porous, lt Brown - lt TAN.	3720 3730	10
Dolomite as above 30% of sample. Dolomite soft, porous, micro crystalline with Dolomite rohms. lt tan 30% Dolomite cream-colored, hard Dense, crypto-crystalline, with trace of 40% clear crystaline surface. VOID 3742 - 3743	3730 3740 3	10
Dolomite lt-TAN - CREAM, HARD, Dense, rock (cuttings) indicate non-porous - However numerous crystalline surface - (microcrystalline some vugs evident formation also appears to be fractured (from drilling records	3740 3750	10
As Above	3750 3760	10
AS ABOVE	3760 3770	10
As Above	3770 3780	10

GERAGHTY & MILLER, INC.

WELL LOG

PROJECT: W.P.B. Sewage Disposal DATE: 10/16/78 SHEET: 43 OF

LOCATION: W.P.B., FLA. DRILLING CONTRACTOR: PROGRESS

WELL NUMBER: #5 DRILLING METHOD: REVERSE AIR

SAMPLE DESCRIBED BY: J. ROLAND SAMPLING METHOD: SIEVE / WASHED

SAMPLE DESCRIPTION	DEPTH INTERVAL (FEET)	THICKNESS (FEET)
DOLOMITE - DK. TAN TO BROWN, HARD, DENSE, V. FINE CRYSTALLINE, VERY LOW POROSITY, FINE CUTTINGS (MOST ≈ 3/8" DIA.). * DARKER CUTTINGS PREDOMINANT ≈ 3787-90'. VERY SLIGHTLY CORRSER CRYSTALLINE	3780 - 3790	10
DOLOMITE - BROWN-GRAY, HARD, DENSE, V. FINE CRYSTALLINE, VERY LOW POROSITY, ANGULAR CUTTINGS. ~60% OF SAMPLE. DOLOMITE - BROWN, HARD, FINE TO MEDIUM FINE CRYSTALLINE, LIGHTER BROWN TO CLEAR XTALS ON SURFACES, PIN POINT VUGS, (BUT ONLY IN A SMALL NUMBER OF CUTTINGS).	3790 - 3800	10