SOUTH FLORIDA WATER MANAGEMENT DISTRICT

ADDITIONAL MATERIAL

BEG. PERMIT NUMBER:

50-00421-W

APPLICATION NUMBER:

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Lost tree Club

30-sep-2005

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Gerhardt M.
Witt
& Associates, Inc.

Hydrogeology, Geology, and Water Resources

Lost Tree Club, Inc.
Floridan Aquifer Production Well Completion, Surficial Aquifer Production Well Abandonment, and FDEP Monitor Well Installation Report

Prepared for:

Lost Tree Club, Inc.
11520 Lost Tree Way
North Palm Beach, Florida 33408
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Prepared by:

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February 22, 2007

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Witt
& Associates, Inc.

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INTRODUCTION

Gerhardt M.
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SECTION 1

INTRODUCTION

1.0 INTRODUCTION

Gerhardt M. Witt & Associates, Inc. ("GMW&A"), with the concurrence of the South Florida Water Management District ("SFWMD"), agreed to remove Lost Tree Club, Inc.'s ("LTC") requirement to utilize effluent reuse water, and to apply for a Floridan aquifer water use permit. This eliminates the need for LTC to use effluent reuse water, and removes LTC's role as a portion of a pollution control facility.

GMW&A was contracted by LTC to assist with the installation of one (1) new Floridan aquifer well, the abandonment of eight (8) Surficial aquifer wells, the installation of the Florida Department of Environmental Protection ("FDEP") required monitor wells for concentrate disposal, and the designation of surface water stations and sample points (**Figure 1-1: Well Location Map**). (Additionally, GMW&A provided a technical administrative overview of installing a reverse osmosis ("RO") system, building, and concentration disposal trench.) This report covers the construction of the RO Floridan aquifer production well, the abandonment of eight (8) Surficial aquifer production wells, and the installation of the FDEP monitor wells for monitoring concentrate disposal water quality impacts. LTC applied for and was granted a SFWMD Water Use Permit (Permit No. 50-00421-W) to withdraw 221 million gallons per year from the Floridan aquifer with the assistance of GMW&A under a separate contract. The raw water from the Floridan well is processed through a reverse osmosis plant. Approximately 75% of the raw water becomes product water (permeate), and 25% becomes concentrate (reject). The concentrate is disposed of through an infiltration trench (FDEP Permit No. FLA472913). Water from the Floridan aquifer eliminated the need to utilize lower quality effluent reuse water and/or Surficial aquifer water for irrigation purposes. GMW&A's work included technical well specifications, bidding services, hydrogeologic field services, and preparation of the well completion and abandonment report.

Prior to the installation of the Floridan aquifer well, LTC was being supplied approximately 500,000 gallons of effluent reuse water a day from Seacoast Utility Authority ("SUA"). The amount of water supplied by SUA was insufficient to meet the actual demand for irrigation water, let alone the calculated amount allowed by the SFWMD. In addition, the Florida Department of Transportation ("FDOT") informed LTC that the FDOT was to dig up the effluent transmission line (composed of asbestos), which was owned by LTC, and LTC would have to replace it at a cost of $2,000,000+. During this time, LTC would only be able to irrigate for three (3) weeks with potable water at a rate of 300,000 gallons per day ("gpd"). This quantity of water is insufficient to sustain the golf course

Well Location Map

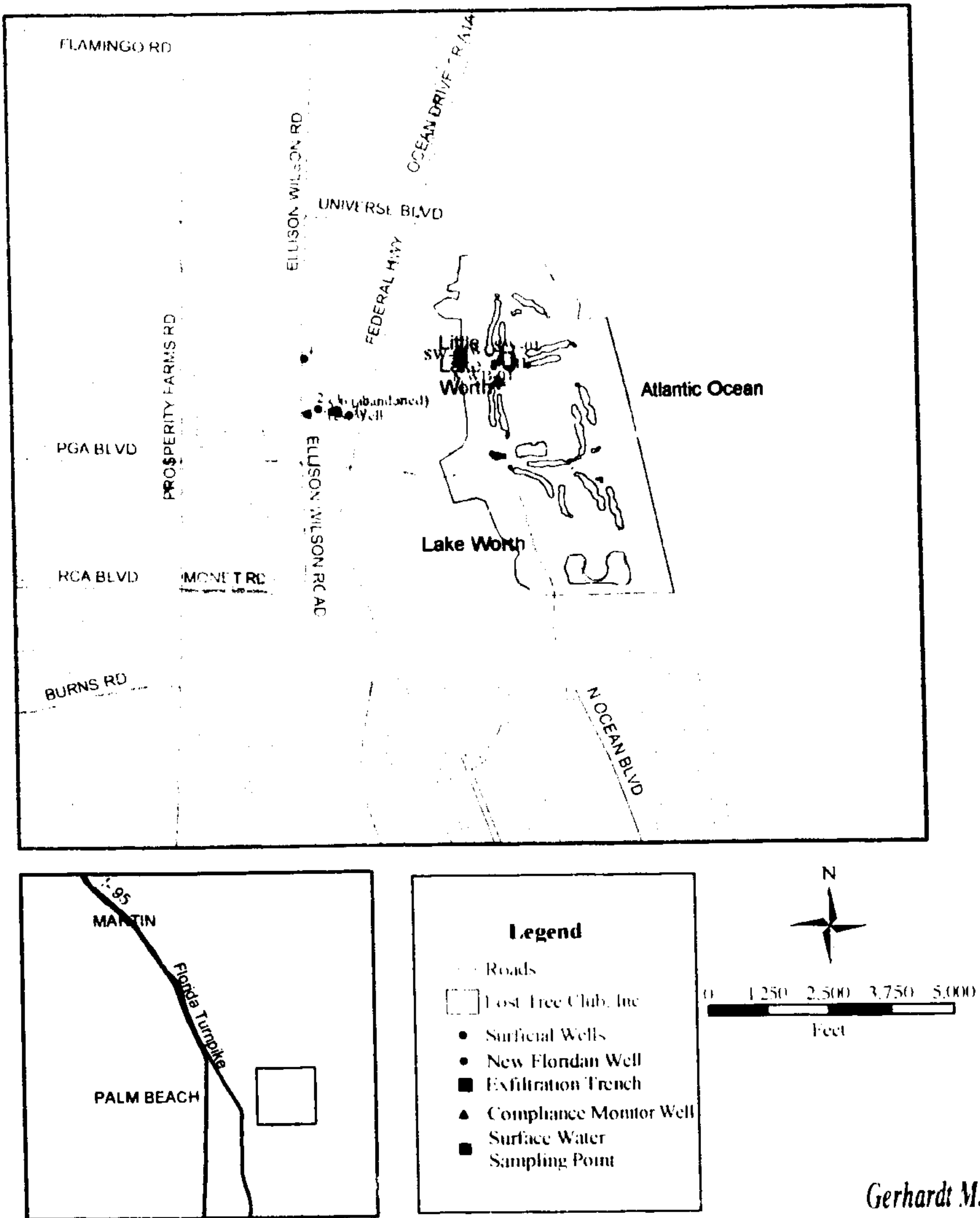

Figure 1-1

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(without augmentation by rainfall, which obviously could not be assumed), which is most critical to LTC.

GMW&A, Jaffer Associates Corporation ("Jaffer"), Alternative H_2O Solutions ("H_2O Solutions"), East Bay Group ("EBG"), and Eckler Engineering ("EE") permitted, designed, and built the well, and designed and built the RO system in eight (8) months to provide water to LTC to meet the FDOT deadline. The project was completed on time and within budget. Legal assistance, when necessary, was provided by Derrevere, Hawkes, & Black.

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SECTION 2

GEOLOGY AND HYDROGEOLOGY

SECTION 2

GEOLOGY AND HYDROGEOLOGY

2.0 REGIONAL GEOLOGY AND HYDROGEOLOGY

The geology of southeast Florida consists of approximately 16,000 vertical feet of sedimentary rocks ranging in age from Holocene (recent to 10,000 years ago) to Cretaceous (65 to 140 million years in age). Underlying the sedimentary rock is a complex sequence of older igneous and metamorphic rock that makes up the base (or basement complex) of the Florida Peninsula. Since the geology occurring within 4,000 feet below land surface ("bls") is the unit of primary interest to the people in southeast Florida, this geologic section is briefly described.

Generally, in northeastern Palm Beach County, the first 350 feet bls consist of a series of Late Pleistocene to Miocene formations composed of limestone, sandstone, sand, and clay. The formations consist (from top to bottom) of the Pamlico Sand, the Anastasia Formation, and the upper portion of the Tamiami Formation. These formations comprise the Surficial (Biscayne) aquifer, which serves as the source of most irrigation and potable water for the people of Palm Beach County.

Underlying the Surficial Aquifer System is a Miocene aquiclude/aquitard consisting of the lower units of the Tamiami and the Hawthorn Formations, referred to as the Hawthorn Group. The aquiclude consists of clay, marl, limestone, and chert from depths of approximately 350 to 850 feet bls. The major significance of this unit is that it is the confining bed sequence that separates the Surficial Aquifer System from the Floridan Aquifer System. Also present is the Suwannee Limestone Formation from depths of approximately 850 to 950 feet bls. The Suwannee Limestone Formation is Oligocene in age, and is described as follows by Reese, 1994:

> *The lower part of the Suwannee Limestone contains beds of marlstone and limestone with as much as 30 percent black phosphate sand (Camp Dresser and McKee* (Witt), *1987, app. I). Most of the phosphate generally occurs within a 20- to 30-ft thick zone as shown by high natural radioactivity on the gamma ray logs (as high as 150 API units). This zone has been locally called the phosphate rubble zone, but is referred to as the phosphatic zone in this report (fig. 3). The top of the phosphatic zone usually coincides with a correlation made in the upper to middle part of the Suwannee Limestone, referred to as the Suwannee Limestone correlation and given in table 1. Some limestone beds in the lower part of the Suwannee Limestone below the phosphatic zone contain quartz sand.*

Reese, 1999 states that the Suwannee Limestone only occurs in western Palm Beach County, and that phosphatic mineral grains are rare to absent in the Suwannee Limestone. However, due to data that has been collected by GMW&A since 1999, GMW&A believes that the Suwannee Limestone Formation may be present where LTC is located.

The upper Floridan Aquifer System is composed of several geologic units of Eocene age, the most prominent being (from top to bottom) the Ocala Group, the Avon Park Limestone, and the Lake City Limestone. Current convention is that the upper aquifer extends from 900 feet bls to a depth of approximately 2,300 feet bls. Underlying the Lake City Limestone is the Eocene Oldsmar Formation, which consists of two (2) units, the upper Oldsmar (2,300 to 3,000 feet bls) and the lower Oldsmar (from 3,000 to 4,000 feet bls). The upper Oldsmar is a confining unit that separates the upper Floridan aquifer from the lower Oldsmar Formation and the lower Floridan aquifer. The lower Oldsmar, commonly called the Boulder Zone, is highly transmissive, contains non-potable water, and has been used for the disposal of waste products such as industrial by-products (including RO concentrate) and treated wastewater. Below the lower Oldsmar is the Paleocene Cedar Keys Limestone that acts as a lower confining unit for the Boulder Zone. **Figure 2-1: General Lithology** shows the lithology of the Palm Beach County area.

2.1 SURFICIAL AQUIFER SYSTEM

The Surficial Aquifer System in the LTC area is considered a water table aquifer exhibiting a delayed yield response. This means that the aquifer is stratified and that water moves faster laterally than vertically (downward and/or upward). Therefore, total drawdown of the aquifer is "delayed" as water moves vertically through the aquifer. Drawdown in a Surficial aquifer well will continue until the cone of depression/impression reaches a recharge boundary such as the Intracoastal Waterway and/or the Atlantic Ocean.

The Surficial aquifer water at the site contains fresh, brackish, and saline water. The aquifer exists from approximately two (2) feet bls to approximately 350 feet bls. Because water levels change in the Surficial aquifer, thereby affecting the saturated thickness of the aquifer, the aquifer's characteristics (transmissivity, specific yield, storage coefficient, and delayed yield) change with time. However, these changes are small and for the most part are considered negligible.

At one (1) time, the Surficial Aquifer System at LTC was used for withdrawal of irrigation water. The water quality underlying the LTC golf course is brackish to saline, and the surface water ponds are brackish to saline, and are tidal. They approximately reflect the depth from land surface to the top of the water table. The wells (with the exception of Well No. 1E) were located west of US1 on the East side of the Intracoastal Waterway. These wells exhibit impacts from saline water intrusion and/or upconing. Well No. 1E existed on the golf course near the maintenance area. This well

Palm Beach County
General Lithology

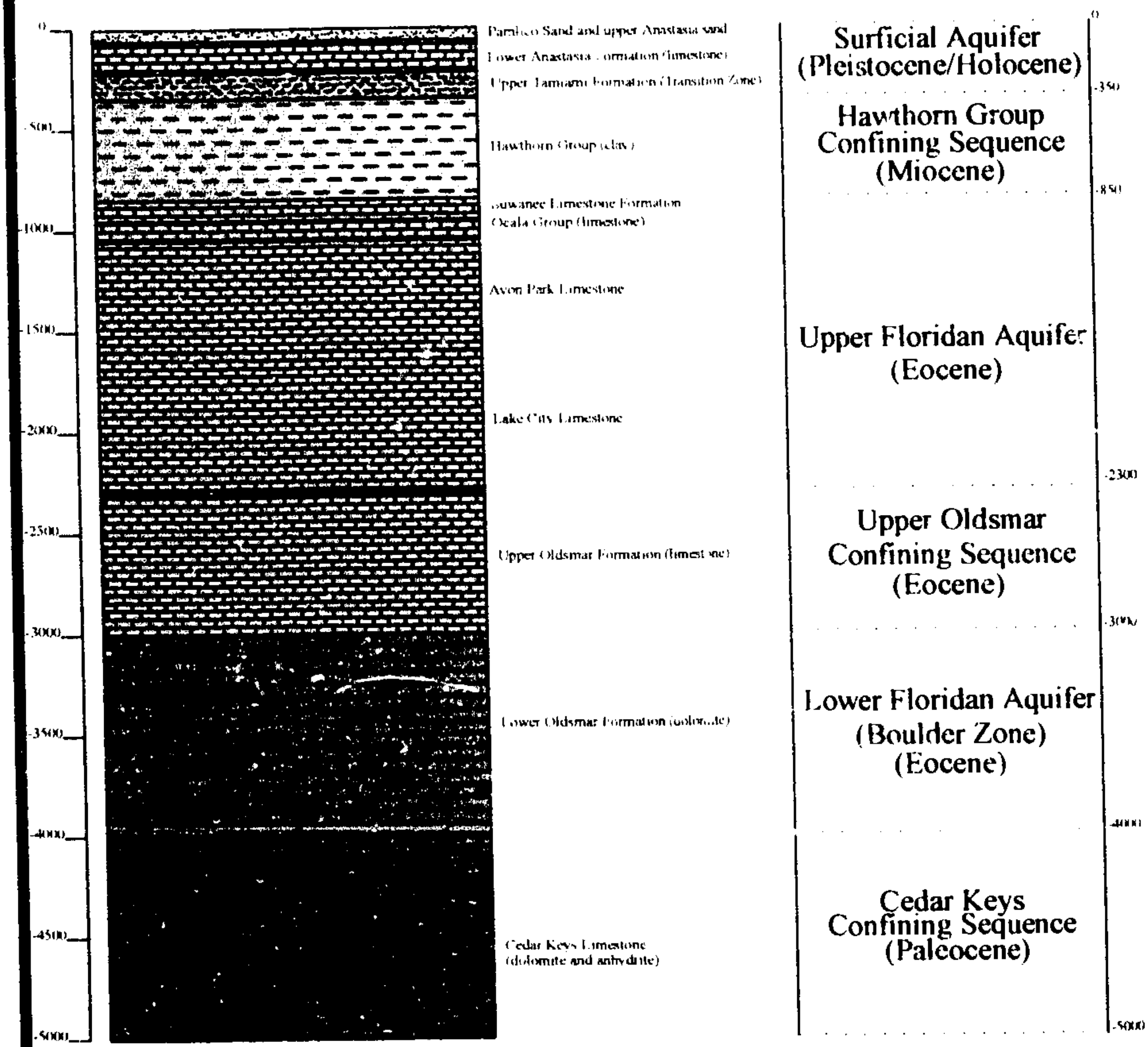

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Figure 2-1

produced saline water, and pumped dry within days. LTC had planned to investigate the use of shallow horizontal well(s) on LTC golf course property, but never proceeded once LTC was provided with effluent reuse water. Due to the state of disrepair of the Surficial aquifer wells, and because of the concern of saline water encroachment and upconing, all of the Surficial aquifer wells were abandoned after installation and operation of the new, Floridan aquifer production well.

2.2 FLORIDAN AQUIFER SYSTEM

The Floridan aquifer is considered a leaky artesian aquifer. In essence, this means that the aquifer is under artesian pressure. In the case of the LTC well, the pressure is significant enough that under non-pumping conditions, the well water level should rise to approximately 35 feet above mean sea level ("msl"). Since the elevation of LTC's Floridan well is approximately 7 feet above msl, this well should flow under non-pumping conditions. Therefore, the flowing conditions in the well <u>must be controlled or suppressed at all times</u>.

In the leaky artesian, Floridan aquifer, the drawdown in a well will continue until flow from the aquifer and the amount of leakance (water leaking in from above and below) is equal to the amount being removed (pumped). The cone of depression, widening and deepening, will continue outward until equilibrium is met.

The water in the upper Floridan Aquifer System is brackish, with a chloride concentration of 1,700 mg/L, sulfates of 390 mg/L, and total dissolved solids ("TDS") of 3,500 mg/L in the new LTC well. These concentrations generally increase with depth, eventually reaching the average TDS concentration of ocean water.

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SECTION 3

WELL CONSTRUCTION AND ABANDONMENT

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SECTION 3

WELL CONSTRUCTION AND ABANDONMENT

3.0 WELL CONSTRUCTION AND ABANDONMENT

LTC obtained bids from two (2), licensed, water well contractors. Jaffer Associates Corporation ("Jaffer") was the low, responsible bidder. The Floridan aquifer well was constructed by Jaffer between February and June 2006. The maximum monthly raw water allocation for LTC is 33.8 million gallons, or approximately 772 gallons per minute ("gpm"). The LTC water treatment plant will run approximately 12 hours each day for average irrigation requirements, and 24 hours each day for maximum irrigation requirements. The well was designed to supply approximately 875 gpm. Jaffer abandoned the Surficial aquifer wells in July 2006. A chronology of well construction and abandonment events is given in **Appendix A: Well Construction and Abandonment Chronology**.

3.1 FLORIDAN AQUIFER WELL CONSTRUCTION

Using mud rotary techniques, Jaffer drilled a 42-inch diameter hole to 22 feet below land surface ("bls") and set the 36-inch outside diameter, 0.375-inch wall thickness, steel surface casing to 20 feet bls. The 36-inch casing was cemented in place using 77 cubic feet of ASTM C-150, Type II, sulfate-resistant cement. A 32-inch diameter hole was drilled from 22 feet bls to 345 feet bls. The 24-inch outside diameter, 0.375-inch wall thickness, steel casing was installed to 339 feet bls. The 24-inch diameter casing was cemented in place using 864 cubic feet of ASTM C-150, Type II, sulfate-resistant cement down to 345 feet bls. A 12¼-inch diameter pilot hole was drilled from 345 to 1,070 feet bls. After geophysical logging, the hole was reamed to 1,032 feet bls with a 22-inch diameter bit. The 12-inch diameter (12.750-inch outside diameter, 11.070-inch minimum inside diameter), SDR 17, PVC casing was installed to a depth of 1,032 feet bls and cemented in place using 1,296 cubic feet of ASTM C-150, Type II, sulfate resistant, 50-50 Pozmix cement. The plan to include a two (2)-inch diameter, monitor tube was eliminated due to the use of a centrifugal pump to operate the well. A monitor tube would have caused a break in the suction of the pump on the well water. The open hole was drilled with a 10⅝-inch diameter bit using mud rotary drilling methods to 1,070 feet bls, and then drilled with a 10⅝-inch diameter bit using reverse air drilling methods to 1,168 feet bls. The well was geophysically logged and television surveyed. **Figure 3-1: Floridan Aquifer Well** shows the construction details for the production well. The well was disinfected prior to installing the well head

The theoretical volume of the annular space between the 24-inch outside diameter casing and the 32-inch diameter borehole to a depth of 345 feet bls was calculated to be approximately 862 cubic feet. Jaffer used 864 cubic feet of cement to grout the 24-inch diameter casing in place.

Lost Tree Club, Inc.
Floridan Well
Construction Details

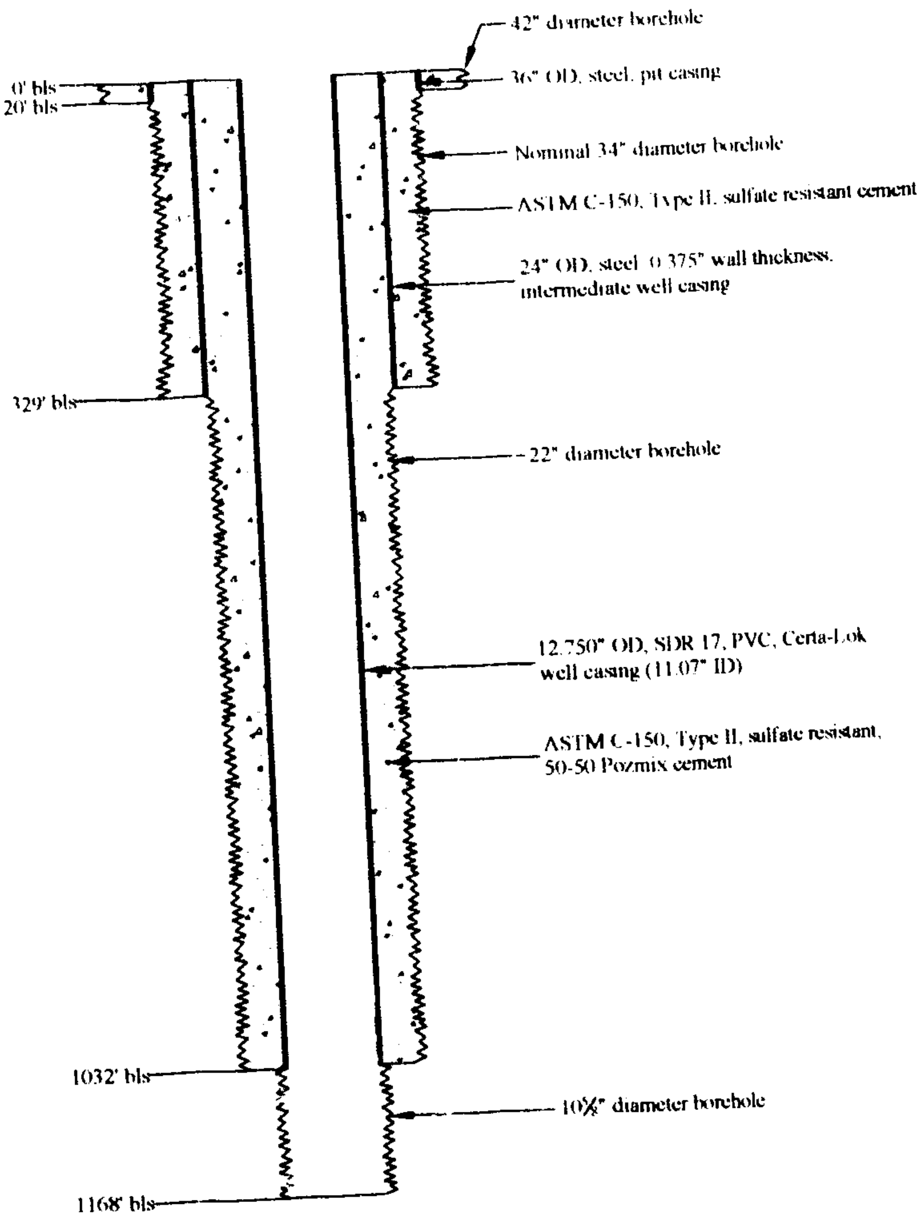

Figure 3-1

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The theoretical volume of the annular space between the 12-inch diameter casing and the 22-inch diameter borehole to a depth of 1,032 feet bls was calculated to be approximately 1,914 cubic feet. Jaffer used 1,296 cubic feet of cement to grout the 12-inch diameter casing in place.

3.2 FLORIDAN AQUIFER WELL DEVELOPMENT

The well was developed during the drilling of the open hole using reverse-air methods, a centrifugal pump, natural artesian flow, and the submersible test pump until the well was free of sand (based on visual observations). The compressed air method consisted of using the drill-rig mounted air compressor. Over pumping the well as a means of development was limited to the submersible pump due to the volume of flow naturally issued from the formation.

The geologist's estimate of needed development time was 80 hours. Thirty-six (36) hours of pump development occurred prior to and during well testing. This development time was 44 hours under the original estimate for the well. The well water cleared of sediment, sand, silt, and colloidal material in less time than anticipated.

3.3 SURFICIAL AQUIFER WELL ABANDONMENT

Due to the dilapidated nature of LTC's existing Surficial aquifer wells, it was decided that all of the Surficial aquifer wells would be abandoned after completion of the Floridan aquifer production well. Each of the Surficial aquifer wells were disinfected with calcium hypochlorite prior to abandonment. With the exception of Well No. 1E, all of the Surficial aquifer wells were disinfected and filled by pumping Type II (ASTM C-150), sulfate resistant, neat, Portland cement (using the tremie pipe method) from the bottom of the well to land surface. Well No. 1E was filled manually by pouring cement into the top of the well. Seven (7) sacks of cement (approximately 8.3 cubic feet) were used to fill Well No. 1E. **Table 3-1: Well Abandonment Data** lists the data for each of the abandoned wells.

3.4 MONITOR WELL CONSTRUCTION

The two monitor wells (Background, MWB-01 and Compliance, MWC-02) were constructed on May 17 2006. They were drilled with a hollow stem/split spoon auger. The two monitor wells were constructed with ten (10) feet of two (2)-inch diameter PVC pipe, and five (5) feet of two (2)-inch diameter mill slot well screen. The annulus was filled with gravel pack to approximately two (2) feet above the top of the screen, and grouted to land surface. The total depth of MWB-01 was approximately 15.07 feet bls, and the total depth of MWC-02 was approximately 14.64 feet bls. According to the field survey performed by Lidberg Land Surveying, Inc. on December 21, 2006, the top of the casing of MWB-01 was 10.69 feet National Geodetic Vertical Datum ("NGVD"), and

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the top of the casing of MWC-02 was 4.17 feet NGVD. **Figure 3-2: Monitor Wells** shows the general construction details for the two (2) monitor wells.

Table 3-1

Well Data

Well No.	Casing Inside Diameter (inches)	Total Depth (feet)	Theoretical Well Volume (cubic feet)	Approximate Grout Used (cubic feet)
1	9.5	156	76.79	81.0
2	9.625	177	89.43	162.0
3	10	155	84.54	81.0
4	10	156	85.08	94.5
5*	7.5	Unknown	Unknown	40.5
7	6	56.2	11.03	54.0
1E	6	25	4.91	8.3
Test Well	6	14	2.75	40.5
			Total	561.80

* Note: The total depth of Well No. 5 could not be determined due to an obstruction in the well.

Lost Tree Club, Inc.
Monitor Wells
Generalized Construction Details

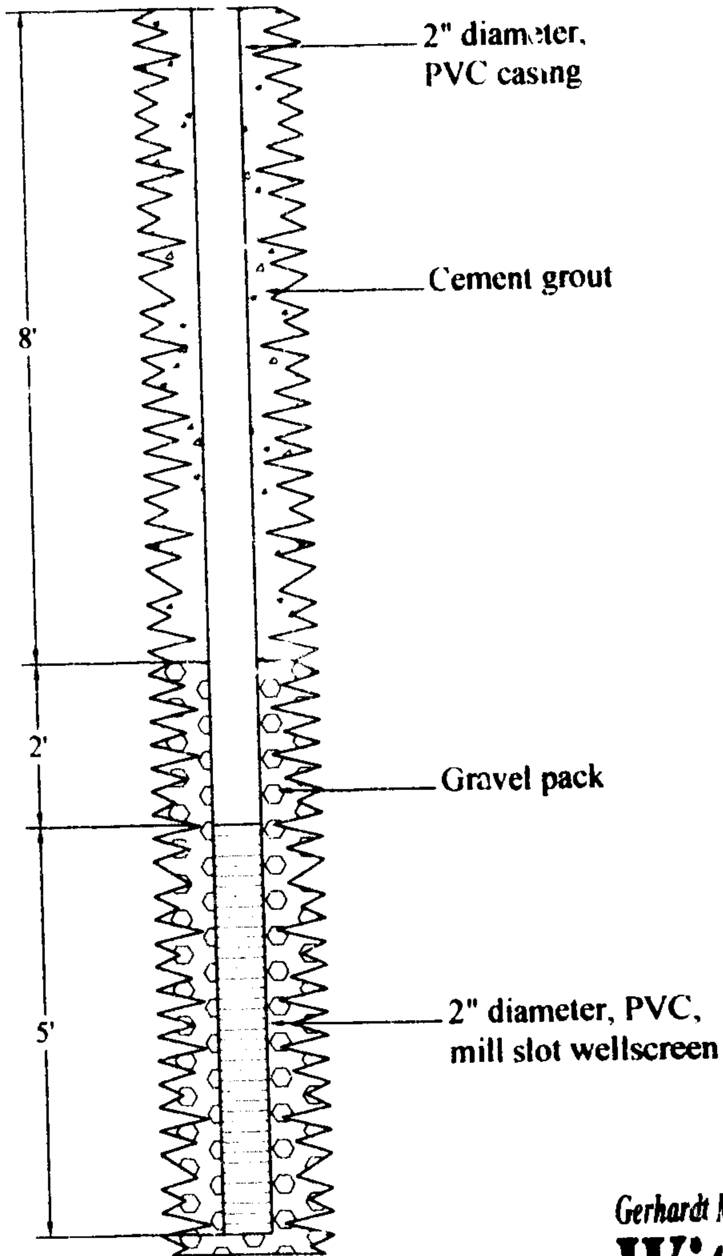

Figure 3-2

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SECTION 4

WELL TESTING

SECTION 4

WELL TESTING

4.0 WELL TESTING

Testing of the pilot hole consisted of collecting geologic samples and performing geophysical logging. Testing of the new production well consisted of step-drawdown, sand concentration, silt density index, water quality, and microbiological testing, as well as geophysical logging and color television surveying.

4.1 GEOLOGIC LOGGING

4.1.1 FLORIDAN AQUIFER WELL

Geologic logging consisted of the collection of lithologic samples at ten (10)-foot intervals, or at formation changes, throughout the drilling of the reamed 44-inch diameter hole from 0 to 24 feet bls, the 32-inch diameter hole to 345 feet bls, the 12 1/4-inch pilot hole to 1,076 feet bls, and the 10 3/4-inch hole to 1,168 feet bls. The samples were described to compile a geologic log and to ascertain the physical characteristics of the rock.

The geology encountered during the drilling of the Floridan aquifer irrigation well at LTC consisted of sand with whole and fragmented shells from zero (0) to approximately seven (7) feet bls. From seven (7) to 30 feet bls, the geology consisted mainly of coquina with shell fragments and sand. The geology from 30 to 130 feet bls consisted of varying percentages of sand, shell fragments, and limestone with shell fragments often the largest constituent. The interval from 130 to 220 feet bls was largely friable to moderately hard limestone with silt to coarse-grained sand and fragmented shells, ostracods, and echinoderm spines. The samples for the 220 to 240-foot bls interval were inadvertently missed. From 240 to 320 feet bls, the geology was comprised of friable to hard limestone, shell fragments, and sand. The transition from the Biscayne aquifer to the Hawthorn Group formation began around the depth of 320 feet bls, with the geology comprised of fossil fragments (shells, echinoderm spines, and tubules), hard limestone, and some sand. By 380 feet bls, the lithology was comprised mainly of clay to coarse-grained sand, soft to moderately hard limestone, and shell fragments. The geology remained consistent until the 441 to 469-foot bls interval, where pelagic and benthic foraminifera commonly contained in the Hawthorn Group matrix began to be present. From 469 to 500 feet bls, the geology consisted of silt to medium grained sand with approximately 3% shell fragments and foraminifera. The lithology of the hole was quartz, calcium carbonate, and phosphate sand with shell fragments and foraminifera from 500 to 755 feet bls. The samples from 755 to 795 feet bls were missing, but a formation change does not appear to have occurred in that interval because from 795 to 835 feet bls, the geology appeared to be the same as the 500 to 755-foot bls interval. During the drilling of the pilot hole, there were problems associated with circulating the cuttings In addition, drill pipe became clogged. Intervals were not sampled if cuttings were known to be contaminated (non-representative samples). At 835 feet bls, a formation change occurred. The geology became soft to moderately hard limestone with sand (quartz, calcium carbonate, and phosphate) and trace amounts of shell fragments and foraminifera from 835 to 867 feet bls. The samples for the 867 to 897-foot bls interval were not present. The formation did not appear to change in this interval because from 897 to 952 feet bls, the geology was the same as the 835 to 867-foot bls interval. From 952 to 1,077 feet bls, the geology consisted mainly of shell fragments, foraminifera, soft to moderately hard limestone, and calcium carbonate sand. The lithology in the 1,070 to 1,140-foot bls interval was comprised of moderately hard limestone with fossil fragments (including *Lepidocyclina sp.* foraminifera up to 1.4 cm in diameter) and calcium carbonate sand. From 1,140 to 1,160 feet bls, the geology was mainly foraminifera, shell, and reef fossil fragments with moderately hard limestone and calcium carbonate sand. The 1,160 to 1,168-foot bls interval showed a formation change with the appearance of phosphatic siltstone, present with moderately hard limestone, calcium carbonate sand, and foraminifera. This depth was where the drilling was terminated, and where the hole reaches its Total Depth (T.D.).

A generalized, geologic cross-section has been drawn from the lithologic information obtained during the drilling of the pilot holes and is presented in **Figure 4-1: Floridan Well Lithology**. Detailed geologic logs are provided in **Appendix B: Geologic Logs**.

4.1.2 MONITOR WELLS

The geology encountered during the drilling of the Background Monitor Well (MWB-01) was largely silt to medium grained quartz sand with a small amount of limestone and a large amount of organics from zero (0) to four (4) feet bls. From four (4) to six (6) feet bls, there was only silt to coarse-grained quartz sand. From six (6) to fifteen (15) feet bls, the geology was largely clay to coarse-grained quartz and calcium carbonate sand with varying percentages of fine to medium grained sandstone with a calcium carbonate matrix.

The geology encountered during the drilling of the Compliance Monitor Well (MWC-02) was largely very fine to medium grained quartz and calcium carbonate sand with a small percentage of shell fragments from zero (0) to two (2) feet bls. From two (2) to four (4) feet bls, the geology was approximately 60 percent shell fragments with 40 percent clay to coarse grained quartz and calcium carbonate sand. From four (4) to six (6) feet bls, there was only

Lost Tree Club, Inc.
Well No. F-1
Lithology

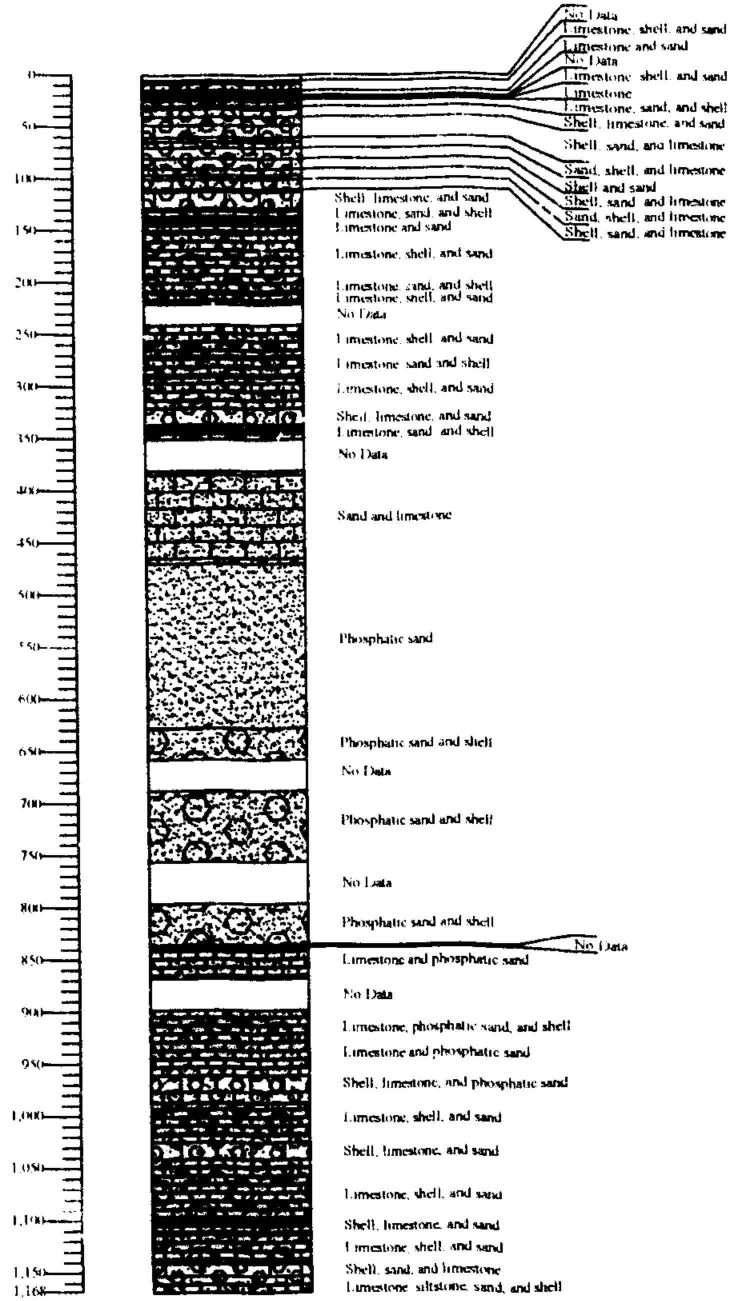

Figure 4-1

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hard coquina rock. From six (6) to sixteen (16) feet bls, the geology was approximately half clay to coarse grained quartz and calcium carbonate sand, and half micritic limestone.

4.2 GEOPHYSICAL LOGGING

After the 12¼-inch diameter pilot hole was drilled, the hole was geophysically logged by MV Geophysical Surveys, Inc. The completed well was never properly logged from 1,036 feet bls to the total depth of the hole (1,168 feet bls) due to an obstruction (pieces of broken cement grout that appear to have come from around the bottom of the casing) in the open bore hole portion of the well at approximately 1,036 feet bls. No attempt to remove the obstruction from the bore hole occurred due to a number of reasons. The first reason was timing (drilling delays from Jaffer, and the need to get the drilling rig out of the way of the RO contractor, Alternative H_2O Solutions, by June 30, 2006). There were also timing delays that occurred in actually getting the geophysical logging truck on-site (August 22, 2006) to discover the concern. After discovering the obstruction, there was not much concern about the condition of the well because it had only been producing negligible amounts of sand, silt, clay, and/or colloidals. In addition, the water chemistry and microbial results were better than anticipated. Based on all of these reasons, GMW&A recommended that nothing be done to remove the obstruction in the well. However, it was decided that Jaffer should extend the warranty for two years. **(Appendix C: Well Warranty)** Geophysical logging of the pilot hole from approximately 340 feet bls to a depth of 1,060 feet bls was performed, and included natural gamma ray, electric (spontaneous potential and dual induction), and caliper logs. The geophysical logs are included as **Appendix D: Geophysical Logs**. Geophysical logging of the pilot hole was completed on April 28, 2006.

4.2.1 GEOPHYSICAL LOGS

Geophysical well logging (testing) uses a sensing device, lowered into a well and/or borehole, to record various physical parameters. The physical parameters/measurements indicate characteristics of the rock, the fluid contained in the rock and borehole, and/or the construction characteristics of the well. The following is a brief technical description of the function of each geophysical log and its purpose in the logging program of this project.

<u>Caliper Log</u> - The caliper log is a tool that determines the average gauge of the borehole, i.e., measures the diameter of the borehole. The caliper tool is used to find cavities, washouts, and fractures in the borehole. The log can be used to determine the proper casing seat for the well and to determine more accurate volumetric calculations for cementing and gravel packing of a well. The log can also be used to assist in finding holes, splits, and separations in well casings. The caliper tool measurement in these logs is in inches.

Gamma Ray Log - The gamma ray log measures the amount of radioactivity naturally present in the formation. Gamma radiation is emitted from formation material such as clays and sands with heavy phosphatic constituents. The gamma ray log is usually effective in determining formation breaks and may be utilized in stratigraphic correlation over relatively areally extensive areas. Gamma ray logs are measured in gamma ray counts, recorded as API-GR (American Petroleum Institute-Gamma Ray) units.

Electric Logs - The electric logs are a suite of logs consisting, in this case, of spontaneous potential, single point resistivity, and long and short normal resistivity.

Spontaneous Potential Log - The spontaneous potential (S.P.) is a small electric voltage generated at the boundaries of permeable rock units, especially between such strata and less permeable units. The contact between drilling mud and formation fluid is another area where S.P. may be generated. Generally, in limestones and sandstones of similar water quality in the Biscayne/Turnpike aquifer, the S.P. log generates little useful or correlatable data. The logging tool can pick up clay units that might otherwise not be noted during the drilling of the formation. Spontaneous potential log readings are in millivolts ("MV").

Dual Induction Log - In induction logging, the rocks surrounding the tool are energized by an induced electromagnetic field. Secondary effects of the electromagnetic field that are related to the resistivity of the strata are measured, producing a log of the formation resistivities. The induction log tool sends electrical energy into the strata horizontally and therefore measures only the resistivity of the strata opposite the instrument. The induction logging systems can provide resistivity measurements regardless of whether or not a conductive medium exists between the instrument and the formation. They can be used to provide resistivity measurements in oil-based drilling muds, air, and fresh mud as well as in conductive fluids like saline water. Three (3) different measures are taken by the dual induction tool:

a. RLL3: This log measures the borehole wall conductivities where the maximum sensitivity of the tool is at a distance of approximately three (3) feet from the tool.

b. RILM: The radial induction log medium measures formation conductivities in a four (4) foot to six (6) foot radius from the tool.

c. RILD: The radial induction log deep measures formation conductivities in a four (4) foot to ten (10) foot radius from the tool.

4.2.2 GEOPHYSICAL LOG INTERPRETATIONS

Pilot Hole Geophysics

Jaffer drilled a 12¼-inch diameter pilot hole from 345 feet bls to 1,070 feet bls. The purpose of the pilot hole was to determine the extent of the Hawthorn Group and the phosphatic Rubble Zone of the Suwannee Limestone Formation. The Hawthorn Group consists of squeezing calcareous clays of the Arcadia Formation and the Hawthorn Formation. The Suwannee Limestone Formation consists of poorly indurated limestone with unconsolidated quartz and phosphatic sand, silts, and clays. All of these materials must be cased off to mitigate the potential of fine-grained material adversely impacting the operation of a reverse osmosis system. In addition, the phosphatic material releases alpha, beta, and gamma radiation, which, in significant concentrations, could adversely impact the disposal of the concentrate. However, it is important for the client, the general public, and the regulatory agencies to know that these concentrations are not significant as a public health concern. The geophysical logs performed on April 28, 2006, were caliper, gamma ray, and electric logs.

Caliper Log: The caliper log for this hole indicated that the 24-inch diameter outer casing extended to approximately 340 feet bls. The pilot hole diameter remained between 12.25 inches (gauged hole) and 14-inches from 340 to 895 feet bls, which was predominantly the Hawthorn Group. The diameter increased to 16 inches from 895 to 925 feet bls. From 925 to 960 feet bls, the diameter of the pilot hole decreased to 13.5 inches. The diameter peaked to a maximum of 16.5 inches from 960 to 1,060 feet bls. This was in the production zone of the well.

Gamma Ray Log: From the bottom of the 24-inch diameter outer casing (approximately 340 feet bls) to 820 feet bls, the gamma ray log remained in the range of 30 to 60 GAPI. The higher readings correlated to the location of the Hawthorn Group. From 820 to 860 feet bls, the gamma ray reading spiked off the scale. This correlated to the presence of phosphatic minerals in the Rubble Zone of the Suwannee Limestone Formation. The gamma ray log decreased to 30 GAPI from 860 to 910 feet bls. A peak to 70 GAPI occurred between 910 and 930 feet bls. The log then decreased to a range of 10 to 30 GAPI from 930 to 1,060 feet bls.

Spontaneous Potential: No significant or correlatable changes were observed in the spontaneous potential log, as is generally the case in limestones of South Florida. This is especially true in the Floridan aquifer, but a spontaneous potential log is run, as a matter of practice, with the dual induction log.

Dual Induction Logs: From below the 24-inch diameter outer casing (approximately 340 feet bls) to 830 feet bls, the dual induction log remained in a range of 13 to 19 Ohm-m. This correlated to the Hawthorn Group. From 830 to 890 feet bls, the dual induction log peaked to 50 ohm-m, correlating to the gamma ray log spike, which was due to phosphatic minerals in the Suwannee Limestone Formation. The Suwannee Limestone Formation is a water bearing formation; however, the formation does not consist of well indurated materials and would likely require a well screen. Obtaining water from this zone requires consideration of the radiation associated with the phosphates; therefore, the Suwannee Limestone Formation in this area is not practical as a production zone. The dual induction log reduced [illegible] ohm-m in the 890 to 930 feet bls interval. From 930 to 1,060 feet bls, the dual [illegible]on log remained at approximately 19 Ohm-m. This is the production zone of the well.

Well Casing Seat Selection

GMW&A's recommended casing seat was 1,032 to 1,040 feet bls. This selection was based on data from the geologic log of the formation, drill cuttings, penetration information, borehole geophysics, and borehole fluid loss. In addition, borehole geophysics from several coastal Floridan aquifer wells located in Palm Beach County were also reviewed. Another concern associated with casing seat selection that was considered was how far into the Floridan aquifer the casing seat was. The casing seat has to be at a sufficient depth below the phosphatic Rubble Zone to avoid the radioactive nuclides and sands, silts, clays, and colloidals of the Hawthorn Formation and Suwannee Limestone Formation. The casing seat must be set in a competent, well indurated, and gauged hole to avoid washouts around the casing.

Production Well Geophysics

Production well geophysics were not completed due to an obstruction encountered at 1,036 feet bls that kept the logging tools from going deeper than 1,039 feet bls.

4.3 STEP-DRAWDOWN TESTING

Step-drawdown testing was performed on the production well. Normally, the step-drawdown testing is performed in conjunction with sand testing. However, the sample pump used during the step-drawdown test did not produce sufficient pressure to perform the test. The sand testing was performed the following day. The purpose of step-drawdown testing is to evaluate the performance of the well. A step-drawdown test is performed on a well in order to determine aquifer characteristics and to quantify the deterioration in well performance over time. Step-drawdown tests yield information regarding well efficiency, well development, and well screen/borehole clogging. The results also help determine possible rehabilitative procedures and optimum pumping rates. The data collected during the step-drawdown tests are used in the evaluation of the performance, efficiency, and specific capacity of the well at the different pumping rates, and for the calculation of the transmissivity of the aquifer.

Step-drawdown testing involves pumping a well for a predetermined amount of time (approximately 60 minutes), until water level stabilization is reached, at each of three (3) increasing pumping rates. Ideally, the three (3) rates should be at 50, 100, and 150 percent of the design pumping rate. For instance, if the design production rate is 1,400 gpm, then the three (3) rates for the step-drawdown test would be 700 gpm, 1,400 gpm, and 2,100 gpm. Before each increase in pumping rate, water levels are allowed to recover to static levels for at least the same amount of time as the well was pumped. The changes in water levels within the well are measured with an electric water level probe ("M-scope") during both the drawdown and recovery periods. The time increments for measurements are as follows: one (1) minute readings for the first ten (10) minutes, two (2) minute readings from 10 to 20 minutes, and five (5) minute readings from 20 to 60 minutes and/or the end of the test. For the LTC well, a pressure transducer/data logger was used to measure the water levels. The time increment for the readings from the data logger was two (2) seconds. **Appendix E: Step-Drawdown Test Results** gives the step-drawdown testing results for the newly installed production well at 30 second intervals. Please note that because the Floridan aquifer is artesian, the static water levels are measured above land surface ("als").

4.3.1 DRAWDOWN

The total drawdown (measured in the field) in a well is a function of the drawdown due to aquifer characteristics and the drawdown due to the loss of efficiency from the well. Total drawdown(s) can be written as the following equation (Dawson and Istok, 1991):

$$s = BQ + CQ^2 \qquad \textbf{(4.1)}$$

where:

s	=	drawdown in the well casing, feet
B	=	$(264/T)\log[(0.3Tt)/(r^2S)]$, gallons per day per foot
Q	=	pumping rate, gallons per minute
C	=	well loss coefficient, second^2 per foot^5
T	=	transmissivity, gallons per day per foot
t	=	time, minutes
r	=	radius of the well, feet
S	=	storage coefficient, dimensionless

Because the transmissivity and storage coefficient of an artesian aquifer and a leaky aquifer are constant, the *BQ* term in the equation does not affect the determination of well loss using the Jacob method discussed in equation 4.4. Assuming that the well is not developing, the total drawdown can be used to determine transmissivity. However, this method gives lower transmissivity values than those calculated without accounting for drawdown due to well loss. The drawdowns observed in the LTC well are shown in **Table 4-1: Step-Drawdown Test Results**.

4.3.2 SPECIFIC CAPACITY

The productivity (quantity of water produced) of a production well can be expressed in terms of specific capacity. The specific capacity of a well is defined as the ratio of the pumping rate to the drawdown at a given time:

$$C_s = \frac{Q}{s} \qquad \textbf{(4.2)}$$

where:

C_s	=	specific capacity of the well, gallons per minute per foot of drawdown at a unit of time
Q	=	pumping rate, gallons per minute
s	=	drawdown, feet

stimating the specific capacity of a well requires determining the drawdown from a static water evel to a pumping water level within the well at a known pumping rate after a known span of time. Specific capacity is measured in gallons per minute per foot of drawdown at a given period of time (gpm/ft at a unit of time) and is used to calculate well efficiency. The higher the specific capacity, the more efficient the well, as long as all other factors are equal. Specific capacity changes in a non-linear fashion with increased pumping rates because a well cannot, in reality, be one-hundred percent (100%) efficient. Slight decreases in the specific capacity with increased pumping rates are to be expected in wells that have been fully stabilized and are no longer developing. Specific capacities increasing at higher pumping rates indicate that the well is developing. The specific capacities for the well are shown in **Table 4-1: Step-Drawdown Test Results**. These data indicate that the well flowing at a rate of 437 gpm has a low friction loss through the well bore with low turbulent flow caused by the obstruction in the bore hole. When the well was pumping at higher rates, significant efficiency losses indicated both in steps two and three were probably caused by turbulent flow in the well from the bore hole obstruction. However, the well can still meet the maximum demand flow (875 gpm) of the RO system with the use of a centrifugal pump.

The unusually high specific capacity seen during Step 1 was due to the natural Artesian flow without significant impacts of turbulent flow.

Table 4-1

Step-Drawdown Test Results

Well Number	Floridan		
Step	1	2	3
Pumping Rate (gpm)	437	875	1,300
Drawdown (ft)	1.50	31.40	51.90
Specific Capacity (gpm/ft at 60 min)	291.33	27.87	25.05
Well Loss 1 and 2 (sec^2/ft^5)	14.924		
Well Loss 2 and 3 (sec^2/ft^5)	-4.675		
Well Loss (1+2) and 3 (sec^2/ft^5)	1.913		
Well Loss 1 and (2+3) (sec^2/ft^5)	8.517		
Average Well Loss Constant (sec^2/ft^5)	5.170		
Well Loss (ft)	4.90	19.65	43.38
Well Efficiency (%)	-226.77	37.42	16.42

4.3.3 WELL LOSS COEFFICIENT

Well loss is defined as head loss attributable to well inefficiency due to the turbulent flow of water through the well screen and/or inside the casing to the pump intake (Jacob, 1946.) Well loss can be expressed as a well loss constant (C) and the well loss in feet (S_w).

The well loss constant is derived from a comparison of the drawdown data at the various pumping rates of the step-drawdown test. This constant is in turn expressed as well loss in feet or as well efficiency. The value of C may be computed from step-drawdown test data using the following equation (Jacob, 1946):

$$C = \frac{(\Delta s^{i}/\Delta Q_i) - (\Delta s^{i-1}/\Delta Q_{i-1})}{\Delta Q_{i-1} + \Delta Q_i} \qquad \textbf{(4.3)}$$

where:	C	=	well loss constant, second^2 per feet^5
	i	=	any given pumping step
	Δs^i	=	incremental drawdown associated with step i, feet
	ΔQ_i	=	incremental pumping that produces incremental drawdown (s^i) associated with step i, feet^3 per second

Changes in C values are affected by changes in discharge rates, shifting of the gravel outside the wells, and/or development of the formation.

Equation 4.3 assumes that the production well was stable and that the value of C did not change during the well production test. New wells, improperly designed and/or constructed wells, and old wells can be unstable, and the calculated value of C can be affected by changes in the discharge rate. The value of C calculated for steps 1 and 2 of the step-drawdown test may be greater or less than that calculated for steps 2 and 3. Sand and gravel often shift outside the production well during discharge periods under the influence of high discharge rates. This may result in either the development or clogging of the pores of the well face. If the value of C for steps 2 and 3 is considerably less than the value of C for steps 1 and 2, it is probable that development has occurred during the well production (step-drawdown) test. A large increase in the value of C with higher discharge rates indicates clogging has occurred during the production well test. Clogging may be a function of a number of items: fine-grained material clogging boreholes, the presence of bacteria, and/or formation collapse. Formation collapse may be an indication of sink hole formation. Negative C values indicate that the well was developing during testing. If the production well is unstable, C may be calculated with Equation 4.3 and data from steps 1+2 and 3, or 2+3 and 1.

Borehole clogging due to incomplete well development or well deterioration by bacteria or other concerns is generally negligible when C is less than 5.0 sec^2/ft^5. Values of C between 5.0 and 10.0 sec^2/ft^5 indicate mild clogging or well deterioration, and clogging or well deterioration is severe when C is greater than 40.0 sec^2/ft^5 (Walton, 1962, p. 27). Deteriorated wells may be returned to near original yields by one (1) of several rehabilitation methods. The success of the rehabilitation can be appraised with the results of well production tests conducted prior to and after rehabilitation.

The average well loss coefficient for LTC's Floridan Well was 5.170 sec^2/ft^5. The values of C for the well are presented in **Table 4-1: Step-Drawdown Test Results**. Results of the well loss calculations indicated mild clogging or turbulent flow, which was probably due to the blockage observed at 1,036 feet bls in the video survey.

4.3.4 WELL LOSS

Well loss in feet is the approximate head loss in feet due to the well's inefficiency. Well loss in feet may be computed using the following equation (Jacob, 1946):

$$s_w = CQ^2 \tag{4.4}$$

where:
s_w = well loss, feet
C = well loss coefficient, second^2 per feet^5
Q = production well discharge, feet^3 per second

Well loss is used to calculate the well efficiency. The well losses for LTC's Floridan well at each tested rate are shown in **Table 4-1: Step-Drawdown Test Results**. The well loss for the Floridan well was 43.38 feet at 1,300 gpm.

4.3.5 WELL EFFICIENCY

Well efficiency is defined as the percentage of total drawdown that is attributable to well loss. This number can be obtained by dividing the theoretical drawdown by the total drawdown, and multiplying by 100 percent.

$$\frac{s_t}{s} \times 100 = Percent\ Efficiency \tag{4.5}$$

where:
s_t = theoretical drawdown, feet
s = actual drawdown, feet

The theoretical drawdown is calculated as the total (measured) drawdown minus the well loss. The name "well efficiency," in this context, can be misleading because it does not confer that the efficiency (productivity) is due to both the well characteristics (well loss) and aquifer characteristics (theoretical drawdown). Therefore, wells with lower well efficiencies should not be thought of as necessarily inferior to wells with higher well efficiencies. Well efficiencies of greater than 100% indicate that the wells are developing. The well efficiencies for LTC's Floridan well are shown in **Table 4-1: Step-Drawdown Test Results**. The well efficiencies for the Floridan well increase from Step 1 to Step 2 and decrease from Step 2 to Step 3. This indicates that turbulent flow due to the higher water velocities decreases the efficiency of the well. The obstruction observed in the video survey could also cause the water to become even more turbulent, decreasing the efficiency at higher pump rates. Therefore, the pump rate used during Step 2 (875 gpm) meets the one (1) MGD of permeate demand of the system using a centrifugal pump, without causing the pump to exceed its lift limitations (approximately 21 feet bls) while supplying maximum day demands of water.

4.3.6 AQUIFER TRANSMISSIVITY

From the data gathered during the step-draw down tests, it was possible to calculate aquifer transmissivity using the Jacob method (also called the Cooper-Jacob method). The criteria for this method are as follows:

1. Flow is entirely horizontal, radial, and laminar.

2. The well fully penetrates the aquifer.

3. There are no vertical components of flow.

4. No water is stored in the well (i.e., drawdown and recovery data are not affected by well storage capacity).

5. The uniformly porous aquifer is overlain and underlain by aquicludes, with negligible vertical hydraulic conductivity (except in a water table aquifer that is of uniform grain size, i.e., no delayed-yield response. Under this condition the Jacob method can apply to water table conditions).

6. The aquifer is homogenous, isotropic, infinite in areal extent, and has a constant thickness throughout.

7. Wells have infinitesimal diameter, and discharge is constant.

8. There are no boundaries and/or discontinuities.

9. Before pumping, the piezometric surface is horizontal.

10. There is no recharge to the aquifer.

11. The groundwater density and viscosity are constant.

12. Groundwater flow can be described by Darcy's Law.

13. Head losses through the well screen and pump intake are negligible.

14. The aquifer is compressible and completely elastic.

These conditions must be met for the duration of the pumpage and in the area of influence of the well(s) during the time of pumpage, and/or corrections must be made to account for conditions not met. The following remarks note for each criterion how the aquifer and/or well(s) meet the conditions and/or how corrections were made:

1. The majority of flow for the duration of pumping was horizontal, radial, and laminar. (Because of the blockage, this was not true in Steps 2 and 3.)

2. The wells fully penetrate the producing unit of the aquifer.

3. The vertical components of flow have a leakance response, and are seen in the production well, but do not affect the semilog calculations of transmissivity.

4. The water stored in the well was negligible compared to the amount withdrawn.

5. This statement was valid.

6. For the area tested, over the duration of the test, this statement was valid, as evidenced by the drawdown data.

7. Discharge was constant. Well diameter does not effect the calculation of the transmissivity in this equation, only the storage coefficient.

8. No boundary conditions are indicated in the drawdown data during the duration of the test.

9. Because the hydraulic gradient was negligible over the area impacted, this statement was valid.

10. Based on the step-drawdown data, recharge leakance occurring at steady state does not effect the semilog transmissivity calculation.

11. Based on chemical analysis, this does not appear to be a concern.

12. This statement was valid.

13. The head losses were constant at a given pumping rate and therefore do not affect the calculation of transmissivity, i.e., head losses do not affect the change in drawdown, Δs, between log cycles. This well loss was accounted for in the calculations.

14. This statement was valid, based on the information available.

The Jacob method uses the equation:

$$T = \frac{264Q}{\Delta s} \qquad \textbf{(4.6)}$$

where:
- T = transmissivity, gallons per day per foot
- Q = pumping rate, gallons per minute
- Δs = the slope of the time-drawdown graph expressed as the change in drawdown between any two values of time on the log scale whose ratio is 10.

Recovery data was used to determine the transmissivity results. The time-drawdown graphs are shown in **Appendix F: Step-Drawdown Graphs.** Transmissivity values are given in **Table 4-2: Transmissivity Results.**

Table 4-2

Transmissivity Results

Well Number	Rate (gpm)	Drawdown Transmissivity (gpd/ft)	Recovery Transmissivity (gpd/ft)	Average Transmissivity (gpd/ft)
Floridan	437	124,051.6	96,140.0	110,095.8
	875	22,318.8	12,157.9	17,238.4
	1,300	45,039.4	14,300.0	29,669.7
Average		63,803.3	40,866.0	52,334.6

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Due to the low well efficiency caused by the obstruction in the bore hole, even attempting to account for head loss was extremely difficult. Therefore, GMW&A believes the transmissivity calculated in the first step to be the more accurate value, and is comparable to other transmissivity data for the Floridan aquifer, including Seminole Golf Club, Inc.'s average transmissivity of 211,318 gpd/ft.

4.4 SAND TESTING

Sand testing was performed on the production well using a Lakos Laval Sand Separator. Although the Rossum Sand Tester is the American Water Works Association ("AWWA") standard to measure sand concentration, GMW&A has found the Lakos Laval Sand Separator to provide a more accurate sand concentration due to the greater volume of water that flows through the separator. GMW&A used a Lakos Laval Sand Separator to obtain sand concentration data discussed in this report.

The purpose of sand testing is to determine the amount of sand being pumped from a well. This is important because sand, especially quartz sand, can adversely affect the longevity of pumps, motors, column pipes, and pipe lines due to its ability to abrade steel. The abrasion then has the ability to create points of potential corrosion by both electrolysis and bacteria. In a membrane plant, sand can also clog pre-filters (if present in the plant, or the membranes themselves if no pre-filters exist), and therefore sand production should be avoided.

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4.4.1 SAND STANDARDS

Under normal operating conditions, the concentration of sand produced by a water supply well should be less than the AWWA Standard for Water Wells A100-97 of 5.0 mg/L. Any recommendations for limiting sediment concentration must take into account the water use, the method of treatment, the type of sediment, and the source of the sediment. The U.S Environmental Protection Agency and the National Water Well Association (1975) have recommended the following limits:

A. 1 mg/L --- water to be used directly in contact with, or in the processing of, food and beverages.

B. 5 mg/L --- water for homes, institutions, municipalities, and industries.

C. 10 mg/L --- water for sprinkler irrigation systems, industrial evaporative cooling systems, and other uses where a moderate amount of sand is not especially harmful.

D. 15 mg/L --- water for flood-type irrigation and where the nature of the water-bearing formations and the overlying strata are such that pumping this amount of sand will not seriously shorten the useful life of the well.

The limits suggest reasonable goals that can be achieved if good well design, construction, and development practices are followed. In older wells or wells in problem aquifers, a well may pump unacceptable amounts of sediment. If the well cannot be redeveloped by conventional techniques, a special sand separator can be installed as a permanent part of the well system. Although sand separators are efficient, they may not remove all sediment and should not be used as a substitute for good well design and construction practices. In addition, removal of sufficient sand could cause catastrophic collapse of the formation.

There is no current standard for sand production for a membrane process well. However, the amount of sand can adversely impact the life expectancy of the pre-filters. Good well design and velocity control (less than 2.5 fps in a membrane plant, and less than 5.0 fps in a non-membrane plant) may limit sand production in a well. GMW&A recommends that the sand concentration be maintained below 1.0 mg/L for production wells.

4.4.2 LAKOS LAVAL SAND SEPARATOR

While the Rossum Sand Tester is the instrument accepted by the AWWA, GMW&A's experience has indicated that the use of a Lakos Laval Sand Separator provides a better method of quantifying sand produced from a well. This is primarily due to the larger volumes of water tested over a greater period of time with the Lakos Laval sand separator. In this procedure, sand testing was performed the day after step-drawdown testing. Approximately ten (10) to fifteen (15) gallons per minute of water were diverted through the sand separator during the test. Upon completion of the test, the sand was removed from the sand separator. These sand samples were dried and analyzed for weight.

It should be noted that the Lakos Laval Sand Separator only removes sand particles in the range of 6.35 mm to 74 microns, with ninety-eight percent (98%) efficiency. This means that particles less than 74 microns will pass through the sand separator and into a pre-filter in a membrane plant, which screens particles that are greater than 5.0 microns in size.

4.4.2.1 CALCULATIONS

The amount of sand produced in milligrams per liter for the pumping rate is determined by the following equation:

$$S = \frac{S_{wt}(1000)}{3.785Qt} \tag{4.7}$$

where:			
	S	=	sand content, milligrams per liter
	S_{wt}	=	weight of sand, grams
	1000	=	equation constant, milligrams per gram
	3.785	=	equation constant, liters per gallon
	Q	=	rate through the sand separator, gallons per minute
	t	=	time, minutes

The well was pumped at its design rate for two (2) hours, and sand samples were collected at 5, 30, 60, and 120 minutes without stopping the pumping. The amount of sand pumped during normal operation is reflected in the fourth (120 minutes) sand sample. This sample is a realistic figure for the quantity of sand which will be produced during normal well operations.

Large discrepancies in the amount of sand collected at the five (5)-minute sample as compared to the amount of the 120-minute sample are of concern and are an indication of water hammer to the formation. Therefore, it is imperative that appropriate engineering is provided in the well pump and valving design to mitigate these concerns.

4.4.3 RESULTS OF SAND TESTING

The sand tests were performed on LTC's Floridan well using a Lakos Level Sand Separator. The sand concentration was less than the standard of 1.0 mg/L after 60 minutes of pumping at the design rate. The only instance of the concentration being higher than 1.0 mg/L occurred in the five (5) minute test, and the concentration was still very low (<1.3 mg/L). The accuracy limitations of the scale used to weigh the samples (accurate to 0.1 g) is the reason all the values are given as less than (<) values.

Table 4-3: Sand Test Results presents the quantities of sand collected during sand testing on the production well.

Table 4-3

Sand Test Results

Test Number	Sand Concentration (mg/L)
5 min	<1.3
30 min	<0.2
60 min	<0.2
120 min	<0.1

LTC must understand that even though virtually no sand was observed at the design pump rate, LTC must follow the "Lost Tree Club, Inc. Wellfield Operations Manual" provided by GMW&A, in addition to making sure the cartridge filters are changed in accordance with the RO system manufacturer's Operations and Maintenance manual requirements.

4.5 SILT DENSITY INDEX TESTING

Silt Density Index ("SDI") testing, ASTM Standard D-4189, is an empirical measurement to test for the potential of silt, colloidals, bacteria, and other substances to foul a membrane. SDI testing is used to predict the tendency of a water supply to foul membranes.

The SDI test simply measures the decay in flow rate through a 47-millimeter ("mm") diameter, 0.45-micron ("µm") pore size membrane. The 0.45-micron membrane was used because it is more susceptible to clogging from colloidal matter than from hard particles such as sand and scale. Furthermore, the 0.45-micron size is smaller than the 5.0-micron size of the pre-filter and therefore measures particles that would pass through the pre-filter and clog the membrane. (The membrane is approximately 0.5 microns in size.) The measured decay in flow rate is converted to a number between 1 and 100.

The SDI number is a function of the rate at which the filter (membrane) clogs with colloidal material. The larger the SDI number, the greater the fouling tendency of the water. "*Generally, RO systems operating on feed water supplies with SDI values less than 1 run for years without problems, and those operating on supplies with SDI values less than 3 run for months without need of membrane cleaning. However, systems operating on supplies with values between 3 and 5 are cleaned regularly and are often considered problem systems. SDI values greater than 5 are not acceptable at this time.*" (Amjad, 1993)

During SDI testing of the production well, a colloidal filter was installed and SDI's were taken before and after the water had passed through the colloidal filter. The filter pore spaces are 5.0 microns in size. This filter size allows the capture of most clay- and silt-sized particles.

4.5.1 CALCULATIONS

In order to calculate the SDI of a given water, the following formula is used:

$$SDI = \left(1 - \frac{T_I}{T_F}\right) \times 100 \div T_T \qquad \textbf{(4.8)}$$

where:

where:	SDI	=	Silt Density Index (an empirical number between 1 and 100)
	T_I	=	the initial time to fill 500 milliliters, seconds
	T_F	=	the final time to fill 500 milliliters, seconds
	T_T	=	the total time test is performed, minutes

4.5.2 RESULTS OF SDI TESTING

SDI's were obtained both before and after water passed through the 5.0 micron colloidal filter. **Table 4-4: SDI Results** presents the results of the SDI testing.

Pre- and post-colloidal filter SDI's were obtained during the two (2)-hour pump test. The SDI value for Test 3 was the only result above the desired 3.00. The SDI's ranged from 1.13 to 3.49. The SDI values of the pre-colloidal filter test compared to the corresponding post-colloidal filter test indicate that the size of a great majority of the particles flowing through the testing apparatus was greater than 5.0 microns.

Based on the SDI test results, membrane fouling due to these silt sized particles may be a significant concern if pre-filters are not used to trap these particles prior to their entering the membrane. Continued development of the well as it is pumped may decrease the SDI values, however this will not be certain until the well has been in production for some time.

Table 4-4

SDI Results

Test Number	Pre / Post Filter	SDI
1	Pre	2.68
2	Post	1.65
3	Pre	3.49
4	Post	1.13

LTC must continue to perform SDI tests in accordance with the "Lost Tree Club, Inc. Wellfield Operations Manual" provided by GMW&A, and the RO system manufacturer's Operations and Maintenance manual.

4.5.3 UPHOLE VELOCITY

One method of controlling the SDI is through the regulation of the uphole velocity of water in the well. Decreasing the velocity decreases the SDI of the water. For membrane processes, an uphole velocity of less than 2.5 feet per second ("fps") is recommended. The following formula is used to calculate the uphole velocity (Heald, 1994):

$$V = \frac{.4085\ Q}{d^2} \quad (4.9)$$

where: V = uphole velocity, feet per second
Q = pumpage rate, gallons per minute
d = inner diameter of the well, inches

Using the design pumping rate of 875 gpm and a pipe minimum inner diameter of 11.070 inches, the calculation yields an uphole velocity of 2.91 fps for the new production well. In order for the velocity not to rise above the recommended 2.5 fps for a membrane plant, the pumpage rate should not be greater than 750 gpm. This reduction of rate should be implemented only if high SDI values become a concern.

4.6 WATER QUALITY TESTING

Field water quality sampling was performed during the drilling of the open hole section of the well. The samples were analyzed for temperature in degrees Centigrade ("°C"), conductivity in micro-Siemens per centimeter ("µS/cm"), salinity in parts per thousand ("ppt"), total dissolved solids ("TDS") in milligrams per liter ("mg/L), and chloride in mg/L. The results of these tests are presented in **Table 4-5: Field Water Quality**.

Additional composite water quality field testing for the Floridan well were obtained on June 6, 2006. The samples were analyzed for temperature (°C), conductivity (µS/cm), salinity (ppt), and iron, chloride, hydrogen sulfide, and sulfate (mg/l). These results are presented in **Table 4-6: Additional Field Water Quality**.

Raw water, permeate, and concentrate water samples were also obtained for RO water quality analysis. The results were compared to the design RO output specifications. These results are presented in **Table 4-7: RO Water Quality**, and also in **Appendix G: RO Water Quality**.

Samples of the two monitor wells (MWB-01 and MWC-02) were taken for background data to be used for permit compliance purposes. These results are presented in **Table 4-8: Monitor Wells Water Quality**, and also in **Appendix H: Monitor Wells Water Quality**.

Samples of the two surface water stations SW1 (Background, Little Lake Worth) and SW2 (Compliance, Lake No. 3) were taken for background data to be used for permit compliance purposes. These results are presented in **Table 4-9: Surface Water Quality**, and also in **Appendix I: Surface Water Quality**.

Table 4-10: SW1 Field Water Quality (December 19, 2005) and **Table 4-11: SW1 Field Water Quality (July 11, 2006)** display the results from field water quality tests performed on water from Little Lake Worth. **Table 4-12: SW2 Field Water Quality (December 19, 2005)** and **Table 4-13: SW2 Field Water Quality (July 11, 2006)** display the results from field water quality tests performed on water from Lake No. 3. **Appendix J: Discharge Monitoring Reports** is the letter sent to Mr. Paul Sze of the FDEP regarding the Discharge Monitoring Reports. This letter also includes field water quality.

Table 4-5

Field Water Quality

Depth (ft)	Temperature (°C)	Conductivity (μS/cm)	Salinity (ppt)	TDS (mg/L)	Chloride (mg/L)
1,070	25.7	2,670	1.8	3,270	2,000
1,080	24.4	4,151	2.7	3,370	2,000
1,091	24.6	4,056	2.2	3,340	2,000
1,100	23.9	4,254	2.3	3,450	2,000
1,110	23.6	TNP	2.2	3,501	2,000
1,120	23.9	4,215	2.2	3,450	2,000
1,130	23.5	4,447	2.4	3,450	2,500
1,140	23.5	4,402	2.4	3,650	2,500
1,151	23.3	4,437	2.4	3,310	2,500
1,160	23.1	4,519	2.4	3,830	2,500

TNP = Test not Performed

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Table 4-6

Additional Field Water Quality

Parameter	June 6, 2006
Temperature (°C)	22.9
Salinity (ppt)	2.4
Conductivity (μS/cm)	4,374
Iron (mg/L)	0.05
Chloride (mg/L)	2,000
Hydrogen Sulfide (mg/L)	5.35
Sulfate (mg/L)	>200

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Table 4-7

RO Water Quality

Parameter	Unit	Limit	Permeate[A]	Raw[B]	Concentrate[A]
Nitrate	ppm	10	U	U	U
Phosphate	ppm	0.4	U	U	U
Potassium	ppm	10	0.33	13	19
Magnesium	ppm	24	2.1	110	100
Calcium	ppm	120	1.4	40	41
Chloride	ppm	140	79	1400	4500
Sodium	ppm	10	8.7	770	440
Sulfate	ppm	180	13	380	1300
Manganese	ppm	0.2	U	0.013	U
Iron	ppm	5	U	0.18	0.029
Alkalinity (CaCO3)	ppm	120	35	160	490
Cation/Anion Ratio	NA	1	TNP	TNP	TNP
Residual Sodium Carbonate	ppm	1.5	0.9	TNP	13
Hydroxide	ppm	0	TNP	TNP	TNP
Boron	ppm	0.5	U	TNP	U
pH	pH units	6.0-6.8	6.9	7.6	7.5
Hardness	ppm	145	U	TNP	3800
Bicarbonate	ppm	120	35	TNP	490
Carbonate	ppm	0	TNP	TNP	TNP
Conductivity	mmhos/cm	0.75	0.39	4.9	19
Total Dissolved Solids	ppm	500	160	2800	11000
Sodium Adsorption Ratio	Meq/L	$3^{(1)}$ $6^{(2)}$	1.1	TNP	8.4

U = Below detection limit of instrument.
TNP = Test Not Performed
NA = Not Applicable
1 = Non-adjusted
2 = Adjusted
A = Sample taken on September 22, 2006.
B = Sample taken on June 29, 2006.

Table 4-8

Monitor Wells Water Quality

Parameter	Unit	MWB-01	MWC-02
Total Dissolved Solids	mg/L	880	5800
Gross Alpha	pCi/L	4.8 +/-2.8	12.5 +/-1
pH	su	6.7	6.8
Fluoride	mg/L	0.50	0.96
Unionized Ammonia	mg/L	0.00029	0.0056
Hydrogen Sulfide	mg/L	0.0010	0.0010

Samples taken on September 22, 2006.

Table 4-9

Surface Water Quality

Parameter	Unit	SW1	SW2
Fluoride	mg/L	4.0	2.1
Unionized Ammonia	mg/L	0.027	0.076
Gross Alpha	pCi/L	1.4 +/-0.4	2.7 +/-0.6

Samples taken on September 22, 2006.

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Table 4-10

SW1 Field Water Quality (December 19, 2005)

Parameter	Units	Value at Surface	Value at Depth
Temperature	Celsius	22.6	21.6
Conductivity	mS/cm	33.88	36.5
Salinity	mg/L	2,170	2,490
Dissolved Oxygen	mg/L	2.78	3.3
Specific Conductance	mS/cm	35.42	39.12
pH	SU	8.2	8.2
TDS	mg/L	7,990	9,900
Chloride	mg/L	12,000	19,000

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Table 4-11

SW1 Field Water Quality (July 11, 2006)

Parameter	Units	Value
Temperature	Celsius	29.66
Specific Conductivity	µS/cm	50.21
Turbidity	NTU	5.17
pH	SU	6.56
TDS	mg/L	29.96
Dissolved Oxygen	mg/L	6.95
Hydrogen Sulfide	mg/L	BD
Sulfate	mg/L	>200
Chloride	mg/L	TNP
Iron	mg/L	0.2
Free Chlorine	mg/L	2.0

TNP = Test Not Performed
BD = Below Detection

Table 4-12

SW2 Field Water Quality (December 19, 2005)

Parameter	Units	Value at Surface	Value at Depth
Temperature	°Celsius	22.3	22.4
Conductivity	mS/cm	7.05	8.13
Salinity	mg/L	4,100	4,800
Dissolved Oxygen	mg/L	0.97	2.07
Specific Conductance	mS/cm	7.43	5.57
pH	SU	7.6	7.8
TDS	mg/L	6,740	[illegible],000
Chloride	mg/L	3,000	7,800

Table 4-13

SW2 Field Water Quality (July 11, 2006)

Parameter	Units	Value
Temperature	Celsius	29.29
Specific Conductivity	µS/cm	6,664
Turbidity	NTU	39.6
pH	SU	7.92
TDS	mg/L	4,005
Dissolved Oxygen	mg/L	5.97
Hydrogen Sulfide	mg/L	BD
Sulfate	mg/L	>200
Chloride	mg/L	1,900
Iron	mg/L	0.35
Free Chlorine	mg/L	1.75

BD = Below Detection

Water samples obtained at depth differ from composite samples. The water samples obtained at depth relate specifically to the water produced at that portion of the water bearing formation. Composite water samples, those obtained once the well was allowed to flow, are a mixture of the water produced from all of the water bearing rock in the open hole.

In general, water quality decreases deeper into the Floridan aquifer. However, with the exception of the most shallow sample (1,070 feet bls), there was very little change in the water quality with depth.

Water chemistry measurements conducted on composite samples obtained on June 6, 2006, showed relatively high concentrations of hydrogen sulfide and sulfates, but this is typical of the Floridan aquifer.

A raw water sample from the production well was obtained and analyzed by Jupiter Environmental Laboratories, Inc., a licensed, Florida Department of Environmental Protection ("FDEP") certified laboratory. Of the parameters tested, the following were above the maximum contaminant level

("MCL") for primary or secondary drinking water standards: chloride, color, iron, odor, sulfate, TDS, and turbidity. All other tested parameters were below the MCL for each parameter. High levels of chloride, sulfate, and total dissolved solids are expected in this aquifer, and shall be managed by membrane treatment. Odor may be due to the presence of hydrogen sulfide. Odor and turbidity will also be reduced by the treatment process. The raw water contains barium, strontium, and radium, although none are above the MCL. However, these radioactive elements are concentrated in the reject and may cause permitting problems with disposal of the concentrate. The water is slightly encrusting (non-corrosive). This water is not for human consumption and therefore does not need to meet drinking water standards. However, for aesthetic concerns and because of the potential for human contact, the water quality should be monitored and maintained.

The results of the raw water quality tests performed by Jupiter Environmental Laboratories, Inc. are presented in **Appendix K: Water Quality Results**.

4.7 MICROBIOLOGICAL TESTING

On June 29, 2006, and August 10, 2006, personnel from GMW&A collected water samples from LTC's Floridan well. The samples were collected aseptically and delivered to Micrim Labs, Inc. ("Micrim") for analysis. Results of the microbiological sampling are included in **Appendix L: Microbiological Sample Results**.

4.7.1 EXPLANATION OF MICROBIOLOGICAL TEST PARAMETERS

HPC: Heterotrophic Plate Count. This is an estimate of the number of heterotrophic bacteria found in the water sample. Heterotrophic bacteria are bacteria that utilize organic substances as principal sources of energy for growth and reproduction. This includes most bacteria encountered in nature. The HPC is reported in colony forming units per milliliter ("CFU/mL") and represents the number of viable organisms per milliliter of water. (*Standard Methods* 9215B)

TCC: Total Coliform Count. This is an estimate of the number of coliform bacteria present in the water sample. Coliform bacteria are defined as bacteria capable of fermenting lactose to acid and gas within 48 hours at 35°C (95°F). The presence of coliform bacteria indicates the presence of contaminating waste in the water sample. The TCC is measured in colony forming units per 100 milliliters of water ("CFU/100mL"). (*Standard Methods* 9222B)

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FCC: Fecal Coliform Count. This is an estimate of the number of fecal coliform bacteria present in the water sample. Fecal coliform bacteria are differentiated from total coliform bacteria by the fermentation of lactose to acid and gas within 24 hours at 44.5°C (112°F). The most widely known and often isolated fecal coliform is *Escherichia coli* ("*E. coli*"). Fecal coliforms are an indication of fecal contamination of the water sample. The FCC is measured in colony forming units per 100 milliliters of water ("CFU/100mL"). (*Standard Methods* 9222D)

Bacterial I.D.: This is a list of all of the bacterial species that were isolated (grown) from the sample.

TFC: Total Fungal Count. This is an estimate of the number of the fungal organisms found in the water sample. The TFC is measured in colony forming units per 100 milliliters of water ("CFU/100mL"). (*Standard Methods* 9215D)

Fungal I.D.: This is a list of all of the fungal species that were isolated from the sample. Certain types of fungi are considered pathogenic organisms.

Algal I.D.: This is a list of the algal morphologies that were identified by direct microscopic examination of the sample. The presence of algae in a water sample from a well usually indicates that there is a direct connection between the well and a surface water source. In addition to algae, bacterial species that are difficult to grow in the laboratory environment but are distinguishable by microscopic examination (such as the iron bacteria *Gallionella ferruginea* and *Sphaerotilus natans*) will also be identified in this section, if noted in the sample.

4.7.2 MICROBIOLOGICAL SAMPLE RESULTS

Seven bacterial species were isolated from the two (2) samples. *Chryseomonas luteola*, *Enterobacter cloacae*, *Klebsiella pneumoniae*, *Pantoea agglomerans*, *Pseudomonas aeruginosa*, and *Pseudomonas stutzeri* were isolated from the June 29, 2006, sample. *Chryseomonas luteola*, *Pseudomonas alcaligenes*, and *Pseudomonas stutzeri* were isolated from the August 10, 2006, sample. *Chryseomonas luteola* is an environmental contaminant and should be of little or no concern. Four (4) of the bacterial species isolated, *Enterobacter cloacae*, *Klebsiella pneumoniae*, *Pantoea agglomerans*, and *Pseudomonas aeruginosa* are considered opportunistic pathogens capable of causing disease in debilitated or susceptible people. Six (6) of the bacterial species isolated, *Enterobacter cloacae*, *Klebsiella pneumoniae*, *Pseudomonas aeruginosa*, *Pseudomonas alcaligenes*, *Pseudomonas stutzeri*, and *Pantoea agglomerans* are considered biofouling organisms capable of producing biofilms by the production of extracellular polymeric substances such as alginate and capsules.

The June 29, 2006, sample had an HPC of 400 CFU/mL, a TCC of 63 CFU/mL, and an FCC and TFC of less than one (<1) CFU/100mL. These counts are normally considered unacceptable for an RO membrane supply well. However, the August 10, 2006, sample had an HPC of 8 CFU/mL, and a TCC, FCC, and TFC of less than one (<1) CFU/100mL. The bacterial counts in the second sample are acceptable for an RO membrane supply well. Furthermore, the latter sample did not indicate the presence of any coliform or opportunistically pathogenic bacterial species, and only two (2) potentially biofouling species were isolated (as opposed to five (5) biofouling isolates in the initial sample). However, routine bacterial sampling should be performed as outlined in Section 5 of this report.

4.8 TELEVISION SURVEYING

On August 22, 2006, a downhole, color, television video of the well was performed by MV Geophysical Surveys, Inc. using a downhole and side view camera. The survey was performed under static conditions. The video logged from land surface to 1,039 feet, 10 inches bls. The total depth of the well is 1,165 feet, however, an obstruction observed at 1,036 feet bls kept the camera from going deeper than 1,039 feet, 10 inches bls. Casing joints occurred at approximately twenty (20)-foot intervals. All joints appeared to be sound. The bottom of the casing was encountered at 1,035 feet bls. The obstruction encountered at approximately 1,036 feet bls appeared to be pieces of grout that had broken from the casing seat seal. At the time of the video survey, the obstruction did not appear to be causing any sanding problems, or seriously affecting the flow of water in the well.

This television survey presents the condition of the well at the time of installment and should be used for comparison when future video surveys are performed. A copy of the video survey is presented in **Appendix M: Television Video Survey**.

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SECTION 5

WELLFIELD MAINTENANCE AND OPERATION

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5.0 WELLFIELD MAINTENANCE AND OPERATION

In order to maintain well performance and increase well life, LTC should monitor and evaluate the performance of its new well through specific testing procedures and regular maintenance. It is important that LTC staff recognize changes in the well and notify the appropriate personnel of these changes. GMW&A has provided an operations and maintenance manual to LTC for the new Floridan aquifer well entitled, Lost Tree Club, Inc. Wellfield Operations Manual submitted to LTC in July, 2006. This is a summary of the procedures required to maintain the Floridan aquifer well.

5.1 RECOMMENDED TESTING AND MAINTENANCE PROCEDURES

GMW&A strongly recommends that LTC's regular maintenance program include the following testing and preventative maintenance procedures to enhance well life and well efficiency:

5.1.1 MONTHLY

Each month LTC staff should:

A. Maintain records such as static water level, drawdown, and water quality (as per Hach field test kits).

B. Physically inspect the well to determine the following:

1. Flow meters are functioning properly.
2. All valves are operating under design parameters.
3. No leaks and/or damage to the well has occurred.
4. All pressure gauges are operating as designed.
5. Any and all repairs are noted and reported to supervisors.

C. Take SDI's on the well.

D. Run a bacterial scan for coliform and fecal coliform bacteria in the production well.

E. Record static water levels in the well. (LTC should obtain a proper measuring device [pressure transducer].)

F. Record the drawdowns from the static water levels after 60 minutes of continuous pumping at the design pumping rate of the production well.

G. Record the pumping rate of the well (gpm).

H. Calculate the specific capacity using the following formula:

$$\text{Specific Capacity (gpm/ft)} = \text{Pumping Rate (gpm)} \div \text{drawdown (feet)} \qquad \textbf{(5.1)}$$

The original specific capacity of LTC's Floridan well was 27.87 gpm per foot of drawdown after 60 minutes of pumping at 875 gpm. If the specific capacity drops by 20% or more of the original specific capacity, then LTC staff should:

1. Contact a hydrogeologist.
2. Take water samples as described in this report to be analyzed for total bacterial (including total coliform), algal, and fungal, as performed by Micrim Labs, Inc. of Fort Lauderdale, Florida.
3. Perform a step-drawdown test as described in this report.
4. Perform a sand test as described in this report.
5. Perform Silt Density Index testing as described in this report.
6. Send all data to a qualified hydrogeologist for analysis.

5.1.2 YEARLY

Each year LTC staff should:

A. Take water samples from the well to be analyzed for total bacterial (including total coliform), algal, and fungal, as performed by Micrim Labs, Inc. of Fort Lauderdale, Florida.

B. Take water samples from the well to be analyzed for Priority Pollutants.

C. Perform a step-drawdown test on the well.

D. Perform a sand test on the well.

E. Shock chlorinate the well with a 6,000 mg/L solution of calcium hypochlorite and dispose to waste. <u>Chlorine **must not** come in contact with the membranes.</u>

5.1.3 EVERY FIVE YEARS

Every five (5) years LTC staff should:

A. Pull and visually inspect the well pump for wear/corrosion.

B. Television survey the well.

It should be noted that this procedure should be considered minimal. Operational data on the well will further determine how frequently disinfection and certain tests are performed. It is imperative that LTC staff maintain records as scheduled testing is done.

5.2 RECORD KEEPING

It is extremely important for LTC staff to maintain records on step-drawdown testing and specific capacity, sand concentration, silt density index, microbiological, and water quality testing.

[illegible] maintain an individual file on the well. This file should contain all records of [illegible]nance performed on the well.

5.2.1 PERMIT REQUIREMENTS

GMW&A has provided a letter to Mr. Stephen Ehrbar, C.G.C.S., Golf Course Superintendent of Lost Tree Club, Inc., dated December 22, 2006. **(Appendix N: Permit Requirements)** This letter lists the requirements of both the SFWMD and the FDEP. LTC should keep all files containing information sent to and received from the FDEP and the SFWMD, and have them readily available.

5.2.2 PERMIT COMPLIANCE

Appendix O: Permit Compliance Letter, dated December 21, 2006, is the official submission of the previously overlooked permit compliance requirements to Mr. Bill Rasperger. All requirements have now been submitted.

SECTION 6

CONCLUSIONS, RECOMMENDATIONS, AND SUMMARY

Gerhardt M. Witt & Associates

SECTION 6

CONCLUSIONS, RECOMMENDATIONS, AND SUMMARY

6.0 CONCLUSIONS, RECOMMENDATIONS, AND SUMMARY

Based on the findings submitted in this report, GMW&A has made conclusions and recommendations regarding the LTC's new, Floridan aquifer production well.

6.1 CONCLUSIONS

The following is the summary of relevant findings of this project.

1. The drilling of the production well proceeded as expected. The well was constructed in accordance with AWWA and FDEP standards.

2. Television and geophysical logging indicated that there was an obstruction in the well at 1,036 feet bls. However, the well appeared to be functioning to an acceptable degree, even with the obstruction.

3. Step-drawdown testing indicated that the well was relatively stable and should function as expected at the needed pumping rate. The average transmissivity calculated from the step drawdown testing was 52,334.6 gpd/ft, however, this value was probably lower than the actual transmissivity of the aquifer due to the obstruction in the well.

4. The sand concentration results meet the standard of less than 1.0 mg/L after 60 minutes of pumping at the design rate.

5. Based on the SDI test results, membrane fouling due to silt sized particles may be a concern. However, the amount of silt-sized particles should decrease with well use.

6. An uphole velocity of 5.0 fps was calculated for the new production well. In order for the velocity not to rise above the required 2.5 fps for a membrane plant, the pumpage rate should not be greater than 750 gpm.

7. The following constituents are above the maximum contaminant level ("MCL") for primary or secondary drinking water standards: total dissolved solids, chlorides,

sulfates, odor, and turbidity. However, these parameters should diminish with treatment.

8. The finished water was appropriate for irrigation purposes, provided proper agronomic practices are carried out for the water quality, soil type(s), and turfgrass type(s).

9. There was no significant population of bacteria present in the well.

10. The well should be able to function within its design parameters, however, it should be monitored to ensure the obstruction does not cause any concerns.

6.2 RECOMMENDATIONS

GMW&A recommends LTC take the following actions:

1. The pumping rate should be lowered if high SDI values become a concern.

2. As a minimum, LTC should perform the recommended testing and maintenance procedures outlined in Section 5 of this report. Routine maintenance and testing will most likely detect a possible problem before it causes failure of the well, the wellfield, and/or the water production system.

6.3 SUMMARY

The well, as constructed by Jaffer, should function within the final design parameters of the well, provided LTC maintains, operates, and tests the well as recommended.

This report is respectfully submitted to the Lost Tree Club, Inc. GMW&A wants to express our thanks to the Lost Tree Club, Inc. for the opportunity to provide our knowledge and expertise to this project.

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APPENDIX A

WELL CONSTRUCTION AND ABANDONMENT CHRONOLOGY

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February 3, 2006	Jaffer begins mobilization.
February 17, 2006	Drill 42-inch diameter borehole to 19 feet bls.
February 20, 2006	Drill 42-inch borehole from 19 to 22 feet bls.
February 21-22, 2006	Install and cement 36-inch diameter steel surface casing to 22 feet bls with 162 cubic feet of ASTM C-150, Type II, sulfate-resistant cement.
March 1, 2006	Drill 32-inch diameter borehole from 22 to 46 feet bls.
March 3, 2006	Drill 32-inch diameter borehole from 46 to 77 feet bls.
March 6, 2006	Drill 32-inch diameter borehole from 77 to 109 feet bls.
March 7, 2006	Drill 32-inch diameter borehole from 109 to 180 feet bls.
March 8, 2006	Drill 32-inch diameter borehole from 180 to 226 feet bls.
March 9, 2006	Drill 32-inch diameter borehole from 226 to 251 feet bls.
March 10, 2006	Drill 32-inch diameter borehole from 251 to 320 feet bls.
March 11, 2006	Drill 32-inch diameter borehole from 320 to 345 feet bls.
March 15, 2006	Install 24-inch diameter steel casing to 339 feet bls.
March 16-26, 2006	24-inch diameter steel casing cemented into place with 864 cubic feet of ASTM C-150, Type II, sulfate-resistant cement.
March 28, 2006	Drill 9⅞-inch diameter pilot hole from 348 to 380 feet bls.
March 29, 2006	Drill 9⅞-inch diameter pilot hole from 380 to 532 feet bls.
April 15, 2006	Drill 12¼-inch diameter pilot hole from 345 to 411 feet bls.
April 17, 2006	Drill 12¼-inch diameter pilot hole from 411 to 627 feet bls.
April 18, 2006	Drill 12¼-inch diameter pilot hole from 627 to 713 feet bls.

April 19, 2006	Drill 12¼-inch diameter pilot hole from 713 to 785 feet bls.
April 20, 2006	Drill 12¼-inch diameter pilot hole from 785 to 837 feet bls.
April 21, 2006	Drill 12¼-inch diameter pilot hole from 837 to 897 feet bls.
April 24 2006	Drill 12¼-inch diameter pilot hole from 897 to 987 feet bls.
April 25, 2006	Drill 12¼-inch diameter pilot hole from 987 to 1,047 feet bls.
April 26, 2006	Drill 12¼-inch diameter pilot hole from 1,047 to 1,076 feet bls.
April 28, 2006	MV Geophysical Surveys, Inc. performs geophysical logging of pilot hole.
April 29- May 17, 2006	Ream 12¼-inch diameter pilot hole with 22-inch bit to 1,052 feet bls.
May 21, 2006	Install 12-inch diameter, CertainTeed, Certa-Lok casing to 1,032 feet bls.
May 22, 2006	Begin cementing 12-inch diameter casing to 780 feet bls (Stage I) with 324 cubic feet of 50/50 Pozmix cement.
May 23-30, 2006	12-inch diameter PVC casing cemented into place with 1,296 cubic feet of ASTM C-150, Type II, sulfate-resistant, 50-50 Pozmix cement.
June 2, 2006	Drill 10⅝-inch diameter borehole from 1,063 to 1,020 feet bls.
June 5, 2006	Drill 10⅝-inch diameter borehole from 1,020 to 1,070 feet bls.
June 6-8, 2006	Switched from mud rotary drilling to reverse air drilling.
June 9, 2006	Drill 10⅝-inch diameter borehole from 1,070 to 1,120 feet bls.
June 10, 2006	Drill 10⅝-inch diameter borehole from 1,120 to 1,168 feet bls.
June 27- 29, 2006	Develop well for 36 hours.

Gerhardt M.
Witt
& Associates, Inc.

June 28-29, 2006	Conduct step-drawdown, sand concentration, SDI, and constant rate testing. Jupiter Environmental Laboratory, Inc. collects samples for laboratory water quality analyses. Collect water sample for microbiological analysis.
July 11, 2006	Abandoned Well No. 1E by pouring 8.3 cubic feet (seven (7) sacks) of concrete into the top of the well.
July 14, 2006	Chlorinated Wells Nos. 1, 2, 3, 4, 5, 7, and the test well.
July 21, 2006	Abandoned Well No. 4 with 94.5 cubic feet of Type II (ASTM C-150), sulfate resistant, neat, Portland cement. Pumped 148.5 cubic feet of Type II (A[illegible]-150), sulfate resistant, neat, Portland cement into We[illegible] 154 cubic feet of Type II (ASTM C-150), sulfate [illegible]rtland cement into Well No. 1. Pumped 13.5 [illegible] ASTM C-150), sulfate resistant, neat, Portland [illegible] well.
July 25, 2006	Abandoned Wel[illegible] cubic feet of Type II (ASTM C-150), sulfate resistant, nea[illegible]and cement. Abandoned Well No. 3 with 81 cubic feet of Type II (ASTM C-150), sulfate resistant, neat, Portland cement. Abandoned Well No. 5 with 40.5 cubic feet of Type II (ASTM C-150), sulfate resistant, neat, Portland cement. Finished abandoning test well with 27 cubic feet of Type II (ASTM C-150), sulfate resistant, neat, Portland cement. Finished abandoning Well No. 2 with 13.5 cubic feet of Type II (ASTM C-150), sulfate resistant, neat, Portland cement. Finished abandoning Well No. 1 with 27 cubic feet of Type II (ASTM C-150), sulfate resistant, neat, Portland cement.
August 22, 2006	MV Geophysical Surveys, Inc. performed television logging of the completed well.

Gerhardt M. Witt & Associates, Inc.

APPENDIX B

GEOLOGIC LOGS

Geologic Log

LTC

Well No. E1

0 To 5 Feet **Drilling Method:** Mud Rotary **Bit Type:** Button **Date Collected:** 2/17/2006

55 % SAND	**Color:**	10YR 6/2 Pale yellowish brown to 10YR 4/2 Dk y. brown	**Roundness:**	Round -- Subangular
	Mineral:	Quartz, calcium carbonate	**Sphericity:**	Moderate
	Size:	Fine -- Coarse	**Frosting:**	Frosted
25 % FOSSILS (Fragments)	**Type:**	Shell	**Weathering:**	Extreme
20 % FOSSILS (Whole)	**Type:**	Shell	**Weathering:**	Moderate

Comments: Moderate HCl reaction w[illegible]
Organics present. Some or[illegible] staining present on shells. Some woody debris

5 To 10 Feet **Drilling Method:** Mud Rotary **Bit Type:** Button **Date Collected:** 2/17/2006

10 % SAND	**Color:**	10YR 8/2 Very pale orange to 10YR 6/2 Pale yellowish brown	**Roundness:**	Subround -- Subangular
	Mineral:	Calcium carbonate, quartz	**Sphericity:**	Moderate
	Size:	Silt -- Coarse	**Frosting:**	Mixed
20 % FOSSILS (Fragments)	**Type:**	Shell	**Weathering:**	Extreme
70 % LIMESTONE	**Color:**	10YR 6/2 Pale yellowish brown	**Porosity:**	Poor
	Matrix:	Sparite	**Cementation**	Not Discernible
	Clasts:	Biological	**Hardness:**	Hard
	Texture:	Cryptocrystalline		

Comments: Strong HCl reaction.
Shell fragments are from limestone

10 To 15 Feet **Drilling Method:** Mud Rotary **Bit Type:** Button **Date Collected:** 2/17/2006

10 % SAND	**Color:**	10 YR 8/2 Very pale orange to 10YR 6/2 Pale yellowish brown	**Roundness:**	Subround -- Subangular
	Mineral:	Calcium carbonate, quartz	**Sphericity:**	Moderate
	Size:	Silt -- Coarse	**Frosting:**	Mixed
20 % FOSSILS (Fragments)	**Type:**	Shell	**Weathering:**	Extreme
70 % LIMESTONE	**Color:**	10YR 8/2 Very pale orange	**Porosity:**	Poor
	Matrix:	Sparite	**Cementation**	Not Discernible
	Clasts:	Biological	**Hardness:**	Hard
	Texture:	Cryptocrystalline		

Comments: Strong HCl reaction.
Shell fragments are from limestone

Geologic Log

UTC

Well No. F1

15 To 20 Feet **Drilling Method:** Mud Rotary **Bit Type:** Button **Date Collected:** 2/20/2006

15 % SAND	**Color:**	10YR 8/2 Very pale orange	**Roundness:**	Subangular
	Mineral:	Calcium carbonate, quartz	**Sphericity:**	Moderate
	Size:	Silt -- Coarse	**Frosting:**	Frosted
5 % FOSSILS (Fragments)	**Type:**	Shell	**Weathering:**	Extreme
80 % LIMESTONE	**Color:**	10YR 8/2 Very pale orange	**Porosity:**	Poor
	Matrix:	Sparite	**Cementation**	Good
	Clasts:	Intraclasts -- Biological	**Hardness:**	Hard
	Texture:	Cryptocrystalline		

Comments: Strong HCl reaction

21 To 22 Feet **Drilling Method:** Mud Rotary **Bit Type:** Button **Date Collected:** 2/20/2006

10 % SAND	**Color:**	10YR 8/2 Very pale orange	**Roundness:**	Subround -- Subangular
	Mineral:	Calcium carbonate, quartz	**Sphericity:**	Low -- High
	Size:	Silt -- Coarse	**Frosting:**	Mixed
25 % FOSSILS (Fragments)	**Type:**	Shell	**Weathering:**	Extreme
65 % LIMESTONE	**Color:**	10YR 8/2 Very pale orange	**Porosity:**	Poor
	Matrix:	Sparite	**Cementation**	Good
	Clasts:	Intraclasts -- Biological	**Hardness:**	Hard
	Texture:	Cryptocrystalline		

Comments: Strong HCl reaction.

22 To 23 Feet **Drilling Method:** Mud Rotary **Bit Type:** Button **Date Collected:** 2/20/2006

5 % SAND	**Color:**	5Y 8/1 Yellowish gray	**Roundness:**	Subround -- Angular
	Mineral:	Calcium carbonate, quartz	**Sphericity:**	Low -- Moderate
	Size:	Silt -- Coarse	**Frosting:**	Mixed
5 % FOSSILS (Fragments)	**Type:**	Shell	**Weathering:**	Extreme
90 % LIMESTONE	**Color:**	10YR 8/2 Very pale orange	**Porosity:**	Poor -- Fair
	Matrix:	Sparite -- Micrite	**Cementation**	Fair -- Good
	Clasts:	Intraclasts -- Biological	**Hardness:**	Hard
	Texture:	Cryptocrystalline -- Sandy		

Comments: Strong HCl reaction.

Geologic Log

LIC

Well no. E1

23 To 30 Feet | **Drilling Method:** Mud Rotary | **Bit Type:** Button | **Date Collected:** 3/1/2006

20 % **SAND**	**Color:**	10YR 8/2 Very pale orange to 5Y 8/1 Yellowish gray	**Roundness:**	Subround -- Subangular
	Mineral:	Calcium carbonate, quartz	**Sphericity:**	Moderate
	Size:	Clay -- Coarse	**Frosting:**	Mixed
10 % **FOSSILS (Fragments)**	**Type:**	Shell	**Weathering:**	Extreme
70 % **LIMESTONE**	**Color:**	10YR 8/2 Very pale orange to N8 Very light gray	**Porosity:**	Poor
	Matrix:	Sparite -- Micrite	**Cementation**	Good
	Clasts:	Intraclasts -- Biological	**Hardness:**	Hard
	Texture:	Cryptocrystalline -- Sandy		

Comments: Strong HCl reaction
10YR 8/2 limestone is more crystalline with sparite matrix. N8 limestone has a micritic matrix

30 To 40 Feet | **Drilling Method:** Mud Rotary | **Bit Type:** Button | **Date Collected:** 3/1/2006

30 % **SAND**	**Color:**	10YR 8/2 Very pale orange	**Roundness:**	Round -- Subangular
	Mineral:	Calcium carbonate, quartz	**Sphericity:**	Low -- Moderate
	Size:	Clay -- Coarse	**Frosting:**	Mixed
35 % **FOSSILS (Fragments)**	**Type:**	Shell	**Weathering:**	Extreme
35 % **LIMESTONE**	**Color:**	5Y 8/1 Yellowish gray	**Porosity:**	Poor
	Matrix:	Micrite	**Cementation**	Fair -- Good
	Clasts:	Intraclasts -- Biological	**Hardness:**	Moderately Hard -- Hard
	Texture:	Silty -- Sandy		

Comments: Strong HCl reaction.

40 To 50 Feet | **Drilling Method:** Mud Rotary | **Bit Type:** Button | **Date Collected:** 3/3/2006

25 % **SAND**	**Color:**	10YR 8/2 Very pale orange	**Roundness:**	Subround -- Subangular
	Mineral:	Calcium carbonate, quartz	**Sphericity:**	Low -- Moderate
	Size:	Silt -- Coarse	**Frosting:**	Mixed
50 % **FOSSILS (Fragments)**	**Type:**	Shell	**Weathering:**	Extreme
25 % **LIMESTONE**	**Color:**	5Y 6/1 Light olive gray	**Porosity:**	Poor
	Matrix:	Micrite	**Cementation**	Good
	Clasts:	Intraclasts	**Hardness:**	Soft -- Moderately Hard
	Texture:	Cryptocrystalline -- Silty		

Comments: Strong HCl reaction with sand and shell
Moderate reaction with limestone.
Limestone could be scratched by knife and fingernail
Smaller pieces were friable. Very fine grained

Geologic Log

LLC

Well No. I-1

50 To 60 Feet **Drilling Method:** Mud Rotary **Bit Type:** Button **Date Collected:** 3/3/2006

25 % **SAND**	**Color:** 10YR 8/2 Very pale orange **Mineral:** Calcium carbonate, quartz **Size:** Clay -- Coarse	**Roundness:** Subround -- Subangular **Sphericity:** Low -- Moderate **Frosting:** Mixed	
55 % **FOSSILS (Fragments)**	**Type:** Shell	**Weathering:** Extreme	
10 % **FOSSILS (Whole)**	**Type:** Shell	**Weathering:** Extreme	
10 % **LIMESTONE**	**Color:** 5Y 8/1 Yellowish gray **Matrix:** Micrite **Clasts:** Intraclasts -- Biological **Texture:** Sandy	**Porosity:** Poor **Cementation** Good **Hardness:** Moderately Hard	

Comments: Strong HCl reaction
Limestone is friable.

60 To 70 Feet **Drilling Method:** Mud Rotary **Bit Type:** Button **Date Collected:** 3/3/2006

35 % **SAND**	**Color:** 5Y 8/1 Yellowish gray **Mineral:** Calcium carbonate, quartz **Size:** Silt -- Coarse	**Roundness:** Subround -- Subangular **Sphericity:** Low -- Moderate **Frosting:** Mixed
35 % **FOSSILS (Fragments)**	**Type:** Shell	**Weathering:** Extreme
30 % **LIMESTONE**	**Color:** 5Y 8/1 Yellowish gray **Matrix:** Micrite **Clasts:** Intraclasts -- Biological **Texture:** Sandy -- Chalky	**Porosity:** Fair **Cementation** Fair **Hardness:** Soft -- Moderately Hard

Comments: Strong HCl reaction.
Limestone is friable.

70 To 80 Feet **Drilling Method:** Mud Rotary **Bit Type:** Button **Date Collected:** 3/6/2006

30 % **SAND**	**Color:** 5Y 8/1 Yellowish gray **Mineral:** Quartz, calcium carbonate **Size:** Silt -- Coarse	**Roundness:** Round -- Subangular **Sphericity:** Low -- High **Frosting:** Mixed
65 % **FOSSILS (Fragments)**	**Type:** Shell	**Weathering:** Extreme
5 % **LIMESTONE**	**Color:** 5Y 8/1 Yellowish gray **Matrix:** Micrite **Clasts:** Intraclasts -- Biological **Texture:** Cryptocrystalline	**Porosity:** Poor **Cementation** Good **Hardness:** Hard

Comments: Strong HCl reaction.
Limestone is present in very small fragments

Geologic Log

UTC

Well No F1

80 To 90 Feet | **Drilling Method:** Mud Rotary | **Bit Type:** Button | **Date Collected:** 3/6/2006

25 % SAND	**Color:**	10YR 8/2 Very pale orange to 5Y 8/1 Yellowish gray	**Roundness:**	Round -- Subangular
	Mineral:	Calcium carbonate, quartz	**Sphericity:**	Low -- High
	Size:	Clay -- Coarse	**Frosting:**	Mixed
65 % FOSSILS (Fragments)	**Type:**	Shell	**Weathering:**	Extreme
10 % LIMESTONE	**Color:**	5Y 8/1 Yellowish gray	**Porosity:**	Poor -- Fair
	Matrix:	Micrite	**Cementation**	Fair -- Good
	Clasts:	Intraclasts -- Biological	**Hardness:**	Moderately Hard
	Texture:	Sandy -- Chalky		

Comments: Strong HCl reaction.
A few larger fragments of shell are extremely rounded and polished
A few fragments of limestone are extremely rounded and polished

90 To 100 Feet | **Drilling Method:** Mud Rotary | **Bit Type:** Button | **Date Collected:** 3/6/2006

35 % SAND	**Color:**	10YR 8/2 Very pale orange	**Roundness:**	Subround -- Subangular
	Mineral:	Quartz, calcium carbonate	**Sphericity:**	Low -- Moderate
	Size:	Silt -- Coarse	**Frosting:**	Mixed
35 % FOSSILS (Fragments)	**Type:**	Shell	**Weathering:**	Extreme
30 % LIMESTONE	**Color:**	5Y 8/1 Yellowish gray to 5Y 6/1 Light olive gray	**Porosity:**	Poor -- Fair
	Matrix:	Micrite	**Cementation**	Fair -- Good
	Clasts:	Intraclasts -- Biological	**Hardness:**	Moderately Hard -- Hard
	Texture:	Sandy -- Chalky		

Comments: Strong HCl reaction.
Some limestone is friable.
A few fragments of limestone are very rounded and polished (pebble shaped).

100 To 110 Feet | **Drilling Method:** Mud Rotary | **Bit Type:** Button | **Date Collected:** 3/6/2006

30 % SAND	**Color:**	5Y 8/1 Yellowish gray	**Roundness:**	Round -- Subangular
	Mineral:	Calcium carbonate, quartz	**Sphericity:**	Low -- Moderate
	Size:	Clay -- Coarse	**Frosting:**	Mixed
40 % FOSSILS (Fragments)	**Type:**	Shells, echinoderm spines	**Weathering:**	Extreme
30 % LIMESTONE	**Color:**	5Y 8/1 Yellowish gray	**Porosity:**	Poor -- Fair
	Matrix:	Micrite	**Cementation**	Fair
	Clasts:	Intraclasts -- Biological	**Hardness:**	Moderately Hard
	Texture:	Sandy -- Chalky		

Comments: Strong HCl reaction.
Limestone is friable.

Geologic Log

LTC

Well No. F1

110 To 120 Feet **Drilling Method:** Mud Rotary **Bit Type:** Button **Date Collected:** 3/6/2006

25 % **SAND**	**Color:**	5Y 8/1 Yellowish gray	**Roundness:**	Round -- Subangular
	Mineral:	Calcium carbonate, quartz	**Sphericity:**	Low -- High
	Size:	Silt -- Coarse	**Frosting:**	Mixed
45 % **FOSSILS (Fragments)**	**Type:**	Shells, coral	**Weathering:**	Moderate -- Extreme
30 % **LIMESTONE**	**Color:**	5Y 8/1 Yellowish gray	**Porosity:**	Poor -- Fair
	Matrix:	Micrite	**Cementation**	Fair
	Clasts:	Intraclasts -- Biological	**Hardness:**	Moderately Hard
	Texture:	Sandy -- Chalky		

Comments: Strong HCl reaction
Limestone is friable.

120 To 130 Feet **Drilling Method:** Mud Rotary **Bit Type:** Button **Date Collected:** 3/7/2006

30 % **SAND**	**Color:**	5Y 8/1 Yellowish gray	**Roundness:**	Subround -- Subangular
	Mineral:	Calcium carbonate, quartz	**Sphericity:**	Low -- Moderate
	Size:	Silt -- Coarse	**Frosting:**	Mixed
35 % **FOSSILS (Fragments)**	**Type:**	Shell	**Weathering:**	Extreme
35 % **LIMESTONE**	**Color:**	5Y 8/1 Yellowish gray	**Porosity:**	Poor -- Fair
	Matrix:	Micrite	**Cementation**	Fair
	Clasts:	Intraclasts -- Biological	**Hardness:**	Moderately Hard
	Texture:	Sandy -- Chalky		

Comments: Strong HCl reaction.

130 To 140 Feet **Drilling Method:** Mud Rotary **Bit Type:** Button **Date Collected:** 3/7/2006

35 % **SAND**	**Color:**	5Y 8/1 Yellowish gray	**Roundness:**	Round -- Subangular
	Mineral:	Calcium carbonate, quartz	**Sphericity:**	Low -- High
	Size:	Silt -- Coarse	**Frosting:**	Mixed
15 % **FOSSILS (Fragments)**	**Type:**	Shells, Ostracods	**Weathering:**	Extreme
50 % **LIMESTONE**	**Color:**	5Y 8/1 Yellowish gray	**Porosity:**	Poor
	Matrix:	Micrite	**Cementation**	Fair
	Clasts:	Intraclasts -- Biological	**Hardness:**	Moder[illegible] Hard
	Texture:	Sandy -- Chalky		

Comments: Strong HCl reaction.
Limestone is friable.

Geologic Log

LTC

Well No. F1

140 To 150 Feet **Drilling Method:** Mud Rotary **Bit Type:** Button **Date Collected:** 3/7/2006

35 % **SAND**	**Color:**	10YR 8/2 Very pale orange to 10YR 6/2 Pale yellowish brown	**Roundness:**	Round -- Subangular
	Mineral:	Calcium carbonate, quartz	**Sphericity:**	Low -- High
	Size:	Silt -- Coarse	**Frosting:**	Mixed
5 % **FOSSILS (Fragments)**	**Type:**	Shell	**Weathering:**	Extreme
60 % **LIMESTONE**	**Color:**	5Y 8/1 Yellowish gray	**Porosity:**	Poor -- Fair
	Matrix:	Micrite	**Cementation**	Fair
	Clasts:	Intraclasts -- Biological	**Hardness:**	Soft -- Moderately Hard
	Texture:	Sandy -- Chalky		

Comments: Strong HCl reaction.
Limestone is friable.
Sand contains large amounts of ostracods and round foraminifera.

150 To 160 Feet **Drilling Method:** Mud Rotary **Bit Type:** Button **Date Collected:** 3/7/2006

20 % **SAND**	**Color:**	5Y 7/2 Yellowish gray	**Roundness:**	Round -- Subangular
	Mineral:	Calcium carbonate, quartz	**Sphericity:**	Low -- High
	Size:	Silt -- Coarse	**Frosting:**	Mixed
20 % **FOSSILS (Fragments)**	**Type:**	Shells, echinoderm spines	**Weathering:**	Extreme
60 % **LIMESTONE**	**Color:**	5Y 8/1 Yellowish gray	**Porosity:**	Poor
	Matrix:	Micrite	**Cementation**	Fair
	Clasts:	Intraclasts -- Biological	**Hardness:**	Soft -- Moderately Hard
	Texture:	Sandy -- Chalky		

Comments: Strong HCl reaction.
Sand contains large amount of ostracods and foram nifera.
Limestone is friable.

160 To 170 Feet **Drilling Method:** Mud Rotary **Bit Type:** Button **Date Collected:** 3/7/2006

20 % **SAND**	**Color:**	5Y 7/2 Yellowish gray	**Roundness:**	Round -- Subangular
	Mineral:	Calcium carbonate, quartz	**Sphericity:**	Low -- High
	Size:	Silt -- Coarse	**Frosting:**	Mixed
35 % **FOSSILS (Fragments)**	**Type:**	Shell	**Weathering:**	Extreme
45 % **LIMESTONE**	**Color:**	5Y 8/1 Yellowish gray	**Porosity:**	Poor
	Matrix:	Micrite	**Cementation**	Fair -- Good
	Clasts:	Intraclasts -- Biological	**Hardness:**	Soft -- Hard
	Texture:	Sandy -- Chalky		

Comments: Strong HCl reaction.
Sand contains ostracods and foraminifera.
Some limestone has been smoothed
Some limestone is friable

Geologic Log

LTC

Well No. F1

170 To 180 Feet **Drilling Method:** Mud Rotary **Bit Type:** Button **Date Collected:** 3/7/2006

15 % **SAND**	**Color:**	5Y 8/1 Yellowish gray	**Roundness:**	Round -- Subangular
	Mineral:	Calcium carbonate, quartz	**Sphericity:**	Low -- High
	Size:	Silt -- Coarse	**Frosting:**	Mixed
20 % **FOSSILS (Fragments)**	**Type:**	Shells, ostracods	**Weathering:**	Extreme
65 % **LIMESTONE**	**Color:**	5Y 8/1 Yellowish gray	**Porosity:**	Poor -- Fair
	Matrix:	Micrite	**Cementation**	Fair
	Clasts:	Intraclasts -- Biological	**Hardness:**	Moderately Hard
	Texture:	Sandy -- Chalky		

Comments: Strong HCl reaction
Sand contains ostracods and foraminifera.

180 To 190 Feet **Drilling Method:** Mud Rotary **Bit Type:** Button **Date Collected:** 3/8/2006

25 % **SAND**	**Color:**	5Y 8/1 Yellowish gray	**Roundness:**	Round -- Subangular
	Mineral:	Calcium carbonate, quartz	**Sphericity:**	Low -- High
	Size:	Silt -- Coarse	**Frosting:**	Mixed
35 % **FOSSILS (Fragments)**	**Type:**	Shell, ostracods	**Weathering:**	Moderate -- Extreme
40 % **LIMESTONE**	**Color:**	5Y 8/1 Yellowish gray	**Porosity:**	Fair
	Matrix:	Micrite	**Cementation**	Fair
	Clasts:	Intraclasts -- Biological	**Hardness:**	Moderately Hard
	Texture:	Sandy -- Chalky		

Comments: Strong HCl reaction.
Sand contains ostracods and foraminifera.

190 To 200 Feet **Drilling Method:** Mud Rotary **Bit Type:** Button **Date Collected:** 3/8/2006

10 % **SAND**	**Color:**	5Y 8/1 Yellowish gray	**Roundness:**	Round -- Subangular
	Mineral:	Calcium carbonate, quartz	**Sphericity:**	Low -- High
	Size:	Silt -- Coarse	**Frosting:**	Mixed
15 % **FOSSILS (Fragments)**	**Type:**	Shell	**Weathering:**	Extreme
75 % **LIMESTONE**	**Color:**	5Y 8/1 Yellowish gray	**Porosity:**	Poor
	Matrix:	Micrite	**Cementation**	Good
	Clasts:	Intraclasts -- Biological	**Hardness:**	Moderately Hard
	Texture:	Sandy -- Chalky		

Comments: Strong HCl reaction.
Ostracods and foraminifera present in sample.

Geologic Log

FTC

Well No. F1

200 To 210 Feet **Drilling Method:** Mud Rotary **Bit Type:** Button **Date Collected:** 3/8/2006

15 % **SAND**	**Color:**	5Y 8/1 Yellowish gray	**Roundness:**	Round -- Subangular
	Mineral:	Calcium carbonate, quartz	**Sphericity:**	Low -- High
	Size:	Silt -- Coarse	**Frosting:**	Mixed
10 % **FOSSILS (Fragments)**	**Type:**	Shell	**Weathering:**	Extreme
75 % **LIMESTONE**	**Color:**	5Y 8/1 Yellowish gray to 5Y 6/1 Light olive gray	**Porosity:**	Poor -- Fair
	Matrix:	Micrite	**Cementation**	Fair -- Good
	Clasts:	Intraclasts -- Biological	**Hardness:**	Moderately Hard
	Texture:	Sandy -- Chalky		

Comments: Strong HCl reaction.
Sands contain a small amount of fossilized organisms such as ostracods
Limestone is somewhat friable.

210 To 220 Feet **Drilling Method:** Mud Rotary **Bit Type:** Button **Date Collected:** 3/8/2006

20 % **SAND**	**Color:**	5Y 8/1 Yellowish gray to 5Y 6/1 Light olive gray	**Roundness:**	Round -- Angular
	Mineral:	Calcium carbonate, quartz	**Sphericity:**	Low -- High
	Size:	Fine -- Coarse	**Frosting:**	Mixed
20 % **FOSSILS (Fragments)**	**Type:**	Shell	**Weathering:**	Extreme
60 % **LIMESTONE**	**Color:**	5Y 8/1 Yellowish gray to N8 Very light gray	**Porosity:**	Fair
	Matrix:	Micrite	**Cementation**	Fair -- Good
	Clasts:	Intraclasts -- Biological	**Hardness:**	Moderately Hard -- Hard
	Texture:	Cryptocrystalline -- Chalky		

Comments: Strong HCl reaction.
Sand contains many fossilized organisms such as ostracods and foraminifera. Many fossils appear to have been recrystallized
Some of the limestone is very friable.

240 To 250 Feet **Drilling Method:** Mud Rotary **Bit Type:** Button **Date Collected:** 3/9/2006

20 % **SAND**	**Color:**	5Y 8/1 Yellowish gray	**Roundness:**	Round -- Subangular
	Mineral:	Calcium carbonate, quartz	**Sphericity:**	Low -- High
	Size:	Silt -- Coarse	**Frosting:**	Mixed
20 % **FOSSILS (Fragments)**	**Type:**	Shell	**Weathering:**	Extreme
60 % **LIMESTONE**	**Color:**	5Y 8/1 Yellowish gray	**Porosity:**	Poor
	Matrix:	Micrite	**Cementation**	Fair -- Good
	Clasts:	Intraclasts -- Biological	**Hardness:**	Moderately Hard
	Texture:	Cryptocrystalline -- Chalky		

Comments: Strong HCl reaction.

Geologic Log

LTC

Well No. F1

250 To 260 Feet **Drilling Method:** Mud Rotary **Bit Type:** Button **Date Collected:** 3/10/2006

20 % **SAND**	**Color:** 5Y 8/1 Yellowish gray **Mineral:** Calcium carbonate, quartz **Size:** Silt -- Coarse	**Roundness:** Subround -- Subangular **Sphericity:** Moderate **Frosting:** Mixed
25 % **FOSSILS (Fragments)**	**Type:** Shell	**Weathering:** Extreme
55 % **LIMESTONE**	**Color:** 5Y 8/1 Yellowish gray **Matrix:** Micrite **Clasts:** Intraclasts -- Biological **Texture:** Cryptocrystalline -- Chalky	**Porosity:** Poor **Cementation** Fair **Hardness:** Moderately Hard

Comments: Strong HCl reaction
Some limestone is very friable.

260 To 270 Feet **Drilling Method:** Mud Rotary **Bit Type:** Button **Date Collected:** 3/10/2006

20 % **SAND**	**Color:** 5Y 8/1 Yellowish gray **Mineral:** Calcium carbonate, quartz **Size:** Very Fine -- Coarse	**Roundness:** Subround -- Subangular **Sphericity:** Moderate **Frosting:** Mixed
30 % **FOSSILS (Fragments)**	**Type:** Shell	**Weathering:** Extreme
50 % **LIMESTONE**	**Color:** 5Y 8/1 Yellowish gray **Matrix:** Micrite **Clasts:** Intraclasts -- Biological **Texture:** Cryptocrystalline -- Chalky	**Porosity:** Poor **Cementation** Fair -- Good **Hardness:** Moderately Hard

Comments: Strong HCl reaction.
Some limestone is friable.

270 To 280 Feet **Drilling Method:** Mud Rotary **Bit Type:** Button **Date Collected:** 3/10/2006

25 % **SAND**	**Color:** 5Y 8/1 Yellowish gray **Mineral:** Calcium carbonate, quartz **Size:** Silt -- Coarse	**Roundness:** Subround -- Subangular **Sphericity:** Low -- Moderate **Frosting:** Mixed
20 % **FOSSILS (Fragments)**	**Type:** Shell	**Weathering:** Extreme
55 % **LIMESTONE**	**Color:** 5Y 8/1 Yellowish gray **Matrix:** Micrite **Clasts:** Intraclasts -- Biological **Texture:** Chalky	**Porosity:** Poor **Cementation** Good **Hardness:** Moderately Hard -- Hard

Comments: Strong HCl reaction.

Geologic Log

LTC

Well No. F1

280 To 290 Feet **Drilling Method:** Mud Rotary **Bit Type:** Button **Date Collected:** 3/10/2006

30 % **SAND**	**Color:** 5Y 8/1 Yellowish gray **Mineral:** Calcium carbonate, quartz **Size:** Silt -- Coarse	**Roundness:** Subround -- Subangular **Sphericity:** Low -- Moderate **Frosting:** Mixed
15 % **FOSSILS (Fragments)**	**Type:** Shell	**Weathering:** Extreme
55 % **LIMESTONE**	**Color:** 5Y 8/1 Yellowish gray **Matrix:** Micrite **Clasts:** Intraclasts -- Biological **Texture:** Chalky	**Porosity:** Poor -- Fair **Cementation** Fair **Hardness:** Moderately Hard

Comments: Strong HCl reaction.

290 To 300 Feet **Drilling Method:** Mud Rotary **Bit Type:** Button **Date Collected:** 3/10/2006

20 % **SAND**	**Color:** 5Y 8/1 Yellowish gray **Mineral:** Calcium carbonate, quartz **Size:** Silt -- Coarse	**Roundness:** Subround -- Subangular **Sphericity:** Low -- Moderate **Frosting:** Mixed
20 % **FOSSILS (Fragments)**	**Type:** Shell	**Weathering:** Extreme
60 % **LIMESTONE**	**Color:** 5Y 8/1 Yellowish gray **Matrix:** Micrite **Clasts:** Intraclasts -- Biological **Texture:** Sandy -- Chalky	**Porosity:** Poor **Cementation** Fair **Hardness:** Moderately Hard

Comments: Strong HCl reaction.
Sand contains foraminifera and other organism fossils.

300 To 310 Feet **Drilling Method:** Mud Rotary **Bit Type:** Button **Date Collected:** 3/10/2006

20 % **SAND**	**Color:** 5Y 8/1 Yellowish gray **Mineral:** Calcium carbonate, quartz **Size:** Silt -- Coarse	**Roundness:** Subround -- Subangular **Sphericity:** Low -- Moderate **Frosting:** Mixed
20 % **FOSSILS (Fragments)**	**Type:** Shell	**Weathering:** Extreme
60 % **LIMESTONE**	**Color:** 5Y 8/1 Yellowish gray **Matrix:** Micrite **Clasts:** Intraclasts -- Biological **Texture:** Chalky	**Porosity:** Poor -- Fair **Cementation** Fair **Hardness:** Soft -- Moderately Hard

Comments: Strong HCl reaction

Geologic Log

LTC

Well No. F1

310 To 320 Feet **Drilling Method:** Mud Rotary **Bit Type:** Button **Date Collected:** 3/10/2006

15 % **SAND**
Color: 5Y 8/1 Yellowish gra.
Mineral: Calcium carbonate, quartz
Size: Silt -- Coarse
Roundness: Subround -- Subangular
Sphericity: Low -- Moderate
Frosting: Mixed

15 % **FOSSILS (Fragments)**
Type: Shell
Weathering: Extreme

70 % **LIMESTONE**
Color: 5Y 8/1 Yellowish gray
Matrix: Micrite
Clasts: Intraclasts -- Biological
Texture: Sandy -- Chalky
Porosity: Poor -- Fair
Cementation Fair -- Good
Hardness: Moderately Hard -- Hard

Comments: Strong HCl reaction.

320 To 330 Feet **Drilling Method:** Mud Rotary **Bit Type:** Button **Date Collected:** 3/10/2006

20 % **SAND**
Color: 5Y 8/1 Yellowish gray
Mineral: Calcium carbonate, quartz
Size: Silt -- Coarse
Roundness: Subround -- Subangular
Sphericity: Low -- Moderate
Frosting: Mixed

40 % **FOSSILS (Fragments)**
Type: Shells, spines, tubules
Weathering: Extreme

40 % **LIMESTONE**
Color: 5Y 8/1 Yellowish gray
Matrix: Micrite
Clasts: Intraclasts -- Biological
Texture: Silty -- Sandy
Porosity: Poor
Cementation Poor -- Good
Hardness: Hard

Comments: Strong HCl reaction.

330 To 340 Feet **Drilling Method:** Mud Rotary **Bit Type:** Button **Date Collected:** 3/11/2006

20 % **SAND**
Color: 5Y 8/1 Yellowish gray to 5Y 6/1 Light olive gray
Mineral: Calcium carbonate, quartz
Size: Silt -- Coarse
Roundness: Round -- Subangular
Sphericity: Moderate
Frosting: Mixed

50 % **FOSSILS (Fragments)**
Type: Shell
Weathering: Extreme

30 % **LIMESTONE**
Color: 5Y 8/1 Yellowish gray to 5Y 6/1 Light olive gray
Matrix: Micrite
Clasts: Intraclasts -- Biological
Texture: Silty -- Sandy
Porosity: Poor
Cementation Good
Hardness: Hard

Comments: Strong HCl reaction.

Geologic Log

LTC

Well No. F1

340 To 350 Feet **Drilling Method:** Mud Rotary **Bit Type:** Button **Date Collected:** 3/11/2006

25 % **SAND**	**Color:**	5Y 7/2 Yellowish gray	**Roundness:**	Round -- Subangular
	Mineral:	Calcium carbonate, quartz	**Sphericity:**	Moderate
	Size:	Silt -- Coarse	**Frosting:**	Mixed
15 % **FOSSILS (Fragments)**	**Type:**	Shell	**Weathering:**	Extreme
60 % **LIMESTONE**	**Color:**	5Y 8/1 Yellowish gray	**Porosity:**	Poor
	Matrix:	Micrite	**Cementation**	Good
	Clasts:	Intraclasts -- Biological	**Hardness:**	Hard
	Texture:	Sandy -- Chalky		

Comments: Strong HCl reaction.

380 To 411 Feet **Drilling Method:** Mud Rotary **Bit Type:** Button **Date Collected:** 3/29/2006

80 % **SAND**	**Color:**	5Y 8/1 Yellowish gray	**Roundness:**	Round -- Subangular
	Mineral:	Quartz, calcium carbonate	**Sphericity:**	Moderate
	Size:	Clay -- Coarse	**Frosting:**	Mixed
5 % **FOSSILS (Fragments)**	**Type:**	Shells, spines	**Weathering:**	Extreme
15 % **LIMESTONE**	**Color:**	N8 Very light gray to 5Y 8/1 Yellowish gray	**Porosity:**	Poor
	Matrix:	Micrite	**Cementation**	Good
	Clasts:	Intraclasts -- Biological	**Hardness:**	Soft -- Moderately Hard
	Texture:	Chalky		

Comments: Strong HCl reaction.
Small shark tooth present.
Limestone is very easily scratched.

411 To 441 Feet **Drilling Method:** Mud Rotary **Bit Type:** Button **Date Collected:** 3/29/2006

80 % **SAND**	**Color:**	5Y 8/1 Yellowish gray	**Roundness:**	Round -- Subangular
	Mineral:	Calcium carbonate, quartz	**Sphericity:**	Moderate
	Size:	Silt -- Coarse	**Frosting:**	Mixed
5 % **FOSSILS (Fragments)**	**Type:**	Shell, spines	**Weathering:**	Extreme
15 % **LIMESTONE**	**Color:**	N8 Very light gray to 5Y 8/1 Yellowish gray	**Porosity:**	Poor
	Matrix:	Micrite	**Cementation**	Good
	Clasts:	Intraclasts -- Biological	**Hardness:**	Soft -- Moderately Hard
	Texture:	Sandy -- Chalky		

Comments: Strong HCl reaction.
Small shark tooth present.
Limestone is very easily scratched

Geologic Log

UIC

Well No. F1

441 To 469 Feet | **Drilling Method:** Mud Rotary | **Bit Type:** Button | **Date Collected:** 3/22/2006

80 % **SAND**	**Color:**	5Y 8/1 Yellowish gray	**Roundness:**	Subround -- Subangular
	Mineral:	Calcium carbonate, quartz	**Sphericity:**	Low -- Moderate
	Size:	Clay -- Medium	**Frosting:**	Mixed
3 % **FOSSILS (Fragments)**	**Type:**	Shells, foraminifera	**Weathering:**	Moderate -- Extreme
17 % **LIMESTONE**	**Color:**	5Y 8/1 Yellowish gray	**Porosity:**	Poor
	Matrix:	Micrite	**Cementation**	Poor -- Fair
	Clasts:	Intraclasts -- Biological	**Hardness:**	Soft
	Texture:	Sandy -- Chalky		

Comments: Strong HCl reaction.

469 To 500 Feet | **Drilling Method:** Mud Rotary | **Bit Type:** Button | **Date Collected:** 3/29/2006

97 % **SAND**	**Color:**	5Y 7/2 Yellowish gray to 5Y 5/2 Light olive gray	**Roundness:**	Subround -- Subangular
	Mineral:	Quartz, calcium carbonate	**Sphericity:**	Moderate
	Size:	Silt -- Medium	**Frosting:**	Mixed
3 % **FOSSILS (Fragments)**	**Type:**	Shells, foraminifera	**Weathering:**	Extreme

Comments: Strong HCl reaction.

500 To 532 Feet | **Drilling Method:** Mud Rotary | **Bit Type:** Button | **Date Collected:** 3/29/2006

95 % **SAND**	**Color:**	5Y 7/2 Yellowish gray	**Roundness:**	Round -- Subangular
	Mineral:	Calcium carbonate, quartz, phosphate	**Sphericity:**	Moderate
	Size:	Silt -- Medium	**Frosting:**	Mixed
5 % **FOSSILS (Fragments)**	**Type:**	Shells, foraminifera	**Weathering:**	Extreme

Comments: Strong HCl reaction.
Some of the sediment is "cemented" from drying.

532 To 565 Feet | **Drilling Method:** Mud Rotary | **Bit Type:** Button | **Date Collected:** 4/17/2006

100 % **SAND**	**Color:**	5Y 5/2 Light olive gray	**Roundness:**	Subround -- Subangular
	Mineral:	Calcium carbonate, quartz, phosphate	**Sphericity:**	Moderate
	Size:	Silt -- Medium	**Frosting:**	Mixed

Comments: Strong HCl reaction
Foraminifera present in sediment
Some sediment is "cemented" from drying

Geologic Log

[illegible]

Well No. [illegible]

565 To 596 Feet **Drilling Method:** Mud Rotary **Bit Type:** Button **Date Collected:** 4/17/2006

95 % **SAND**

Color: 5Y 5/2 Light olive gray
Mineral: Calcium carbonate, quartz, phosphate
Size: Silt -- Medium
Roundness: Subround -- Subangular
Sphericity: Moderate
Frosting: Mixed

5 % **FOSSILS (Fragments)**

Type: Shells, foraminifera
Weathering: Extreme

Comments: Strong HCl reaction
Some sediment is "cemented" from drying

596 To 627 Feet **Drilling Method:** Mud Rotary **Bit Type:** Button **Date Collected:** 4/17/2006

97 % **SAND**

Color: 5Y 5/2 Light olive gray
Mineral: Calcium carbonate, quartz, phosphate
Size: Silt -- Medium
Roundness: Round -- Subangular
Sphericity: Low -- High
Frosting: Mixed

3 % **FOSSILS (Fragments)**

Type: Foraminifera, shells
Weathering: Moderate -- Extreme

Comments: Strong HCl reaction
Some sediment is "cemented" from drying

627 To 657 Feet **Drilling Method:** Mud Rotary **Bit Type:** Button **Date Collected:** 4/18/2006

50 % **SAND**

Color: 5Y 7/2 Yellowish gray
Mineral: Calcium carbonate, quartz, phosphate
Size: Silt -- Coarse
Roundness: Round -- Subangular
Sphericity: Low -- Moderate
Frosting: Mixed

50 % **FOSSILS (Fragments)**

Type: Shells, foraminifera
Weathering: Extreme

Comments: Strong HCl reaction.

687 To 715 Feet **Drilling Method:** Mud Rotary **Bit Type:** Button **Date Collected:** 4/18/2006

80 % **SAND**

Color: 5Y 7/2 Yellowish gray to 5Y 5/2 Light olive gray
Mineral: Calcium carbonate, quartz, phosphate
Size Silt -- Medium
Roundness: Round -- Subangular
Sphericity: Moderate -- High
Frosting: Mixed

20 % **FOSSILS (Fragments)**

Type: Shell, foraminifera
Weathering: Extreme

Comments: Strong HCl reaction
Some sediment is "cemented" from drying.

715 To 755 Feet **Drilling Method:** Mud Rotary **Bit Type:** Button **Date Collected:** 4/19/2006

80 % **SAND**

Color: 5Y 7/2 Yellowish gray
Mineral: Calcium carbonate, quartz, phosphate
Size: Silt -- Coarse
Roundness: Subround -- Subangular
Sphericity: Low -- Moderate
Frosting: Mixed

20 % **FOSSILS (Fragments)**

Type: Shell, foraminifera
Weathering: Extreme

Comments: Strong HCl reaction
Some sediment is "cemented" due to drying

Geologic Log

LTC

Well No. F1

795 To 835 Feet | **Drilling Method:** Mud Rotary | **Bit Type:** Button | **Date Collected:** 4/19/2006

90 % SAND

- **Color:** 5Y 7/2 Yellowish gray to 5Y 5/2 Light olive gray
- **Mineral:** Calcium carbonate, quartz, phosphate
- **Size:** Silt -- Coarse
- **Roundness:** Subround -- Subangular
- **Sphericity:** Moderate
- **Frosting:** Mixed

10 % FOSSILS (Fragments)

- **Type:** Shell, foraminifera
- **Weathering:** Extreme

Comments: Strong HCl reaction.
Some sediment is "cemented" from drying

837 To 867 Feet | **Drilling Method:** Mud Rotary | **Bit Type:** Button | **Date Collected:** 4/21/2006

25 % SAND

- **Color:** 5Y 7/2 Yellowish gray
- **Mineral:** Calcium carbonate, quartz, phosphate
- **Size:** Silt -- Medium
- **Roundness:** Round -- Subangular
- **Sphericity:** Moderate
- **Frosting:** Mixed

2 % FOSSILS (Fragments)

- **Type:** Shell, foraminifera
- **Weathering:** Extreme

73 % LIMESTONE

- **Color:** 5Y 7/2 Yellowish gray
- **Matrix:** Micrite
- **Clasts:** Intraclasts -- Biological
- **Texture:** Cryptocrystalline -- Silty
- **Porosity:** Poor
- **Cementation** Poor
- **Hardness:** Soft -- Moderately Hard

Comments: Strong HCl reaction.
Tiny crystals present in limestone and sand

897 To 928 Feet | **Drilling Method:** Mud Rotary | **Bit Type:** Button | **Date Collected:** 4/21/2006

20 % SAND

- **Color:** 5Y 7/2 Yellowish gray
- **Mineral:** Calcium carbonate, quartz, phosphate
- **Size:** Silt -- Coarse
- **Roundness:** Round -- Subangular
- **Sphericity:** Moderate
- **Frosting:** Mixed

10 % FOSSILS (Fragments)

- **Type:** Shells, spines, foraminifera
- **Weathering:** Extreme

70 % LIMESTONE

- **Color:** 5Y 7/2 Yellowish gray
- **Matrix:** Micrite
- **Clasts:** Intraclasts -- Biological
- **Texture:** Cryptocrystalline -- Silty
- **Porosity:** Poor -- Fair
- **Cementation** Fair
- **Hardness:** Moderately Hard

Comments: Strong HCl reaction.

Geologic Log

LTC

Well No. F1

928 To 952 Feet **Drilling Method:** Mud Rotary **Bit Type:** Button **Date Collected:** 4/24/2006

15 % SAND
- **Color:** 5Y 7/2 Yellowish gray
- **Mineral:** Calcium carbonate, quartz, phosphate
- **Size:** Silt -- Coarse
- **Roundness:** Subangular
- **Sphericity:** Moderate
- **Frosting:** Mixed

5 % FOSSILS (Fragments)
- **Type:** Shell
- **Weathering:** Extreme

80 % LIMESTONE
- **Color:** 5Y 8/1 Yellowish gray
- **Matrix:** Micrite
- **Clasts:** Intraclasts -- Biological
- **Texture:** Cryptocrystalline -- Silty
- **Porosity:** Poor
- **Cementation** Fair
- **Hardness:** Moderately Hard

Comments: Strong HCl reaction.

952 To 986 Feet **Drilling Method:** Mud Rotary **Bit Type:** Button **Date Collected:** 4/24/2006

20 % SAND
- **Color:** 5Y 7/2 Yellowish gray
- **Mineral:** Calcium carbonate, trace quartz, trace phosphate
- **Size:** Silt -- Coarse
- **Roundness:** Round -- Subangular
- **Sphericity:** Low -- High
- **Frosting:** Mixed

40 % FOSSILS (Fragments)
- **Type:** foraminifera, shells
- **Weathering:** Extreme

40 % LIMESTONE
- **Color:** 5Y 7/2 Yellowish gray
- **Matrix:** Micrite
- **Clasts:** Intraclasts -- Biological
- **Texture:** Cryptocrystalline -- Sandy
- **Porosity:** Poor -- Fair
- **Cementation** Fair
- **Hardness:** Moderately Hard

Comments: Strong HCl reaction.

986 To E+03 Feet **Drilling Method:** Mud Rotary **Bit Type:** Button **Date Collected:** 4/24/2006

10 % SAND
- **Color:** 5Y 7/2 Yellowish gray
- **Mineral:** Calcium carbonate, quartz
- **Size:** Silt -- Medium
- **Roundness:** Round -- Subangular
- **Sphericity:** Moderate
- **Frosting:** Mixed

30 % FOSSILS (Fragments)
- **Type:** Foraminifera, shells, spines
- **Weathering:** Extreme

60 % LIMESTONE
- **Color:** 5Y 7/2 Yellowish gray
- **Matrix:** Micrite
- **Clasts:** Biological
- **Texture:** Sandy -- Chalky
- **Porosity:** Poor -- Fair
- **Cementation** Poor
- **Hardness:** Soft -- Moderately Hard

Comments: Strong HCl reaction.

Geologic Log

LTC

Well No. 11

E+03 To E+03 Feet **Drilling Method:** Mud Rotary **Bit Type:** Button **Date Collected:** 4/25/2006

10 % SAND	**Color:**	5Y 7/2 Yellowish gray	**Roundness:**	Round -- Subangular
	Mineral:	Calcium carbonate, quartz	**Sphericity:**	Low -- High
	Size:	Silt -- Coarse	**Frosting:**	Mixed
45 % FOSSILS (Fragments)	**Type:**	Foraminifera, shells	**Weathering:**	Extreme
45 % LIMESTONE	**Color:**	5Y 7/2 Yellowish gray	**Porosity:**	Poor -- Fair
	Matrix:	Micrite	**Cementation**	Poor
	Clasts:	Intraclasts -- Biological	**Hardness:**	Soft -- Moderately Hard
	Texture:	Sandy -- Chalky		

Comments: Strong HCl reaction.
A few round grains of a magnetic mineral present

E+03 To E+03 Feet **Drilling Method:** Mud Rotary **Bit Type:** Button **Date Collected:** 4/25/2006

10 % SAND	**Color:**	5Y 7/2 Yellowish gray	**Roundness:**	Round -- Subangular
	Mineral:	Calcium carbonate, quartz	**Sphericity:**	Low -- High
	Size:	Silt -- Coarse	**Frosting:**	Mixed
45 % FOSSILS (Fragments)	**Type:**	Foraminifera, shells, spines	**Weathering:**	Extreme
45 % LIMESTONE	**Color:**	5Y 7/2 Yellowish gray	**Porosity:**	Poor -- Fair
	Matrix:	Micrite	**Cementation**	Poor
	Clasts:	Intraclasts -- Biological	**Hardness:**	Soft -- Moderately Hard
	Texture:	Sandy -- Chalky		

Comments: Strong HCl reaction.

E+03 To E+03 Feet **Drilling Method:** Mud Rotary **Bit Type:** Button **Date Collected:** 4/25/2006

10 % SAND	**Color:**	5Y 7/2 Yellowish gray	**Roundness:**	Round -- Subangular
	Mineral:	Calcium carbonate	**Sphericity:**	Low -- Moderate
	Size:	Silt -- Coarse	**Frosting:**	Mixed
45 % FOSSILS (Fragments)	**Type:**	Foraminifera, spines	**Weathering:**	Extreme
45 % LIMESTONE	**Color:**	5Y 7/2 Yellowish gray	**Porosity:**	Poor -- Fair
	Matrix:	Micrite	**Cementation**	Poor
	Clasts:	Intraclasts -- Biological	**Hardness:**	Soft -- Moderately Hard
	Texture:	Sandy -- Chalky		

Comments: Strong HCl reaction.

Geologic Log
LLC
Well No. F1

E+03 **To** E+03 **Feet** **Drilling Method:** Mud Rotary **Bit Type:** Button **Date Collected:** 4/25/2006

10 % **SAND**	**Color:**	5Y 7/2 Yellowish gray	**Roundness:**	Round -- Subangular
	Mineral:	Calcium carbonate, quartz	**Sphericity:**	Low -- High
	Size:	Silt -- Coarse	**Frosting:**	Mixed
35 % **FOSSILS (Fragments)**	**Type:**	Foraminifera, shells	**Weathering:**	Extreme
55 % **LIMESTONE**	**Color:**	5Y 7/2 Yellowish gray	**Porosity:**	Poor -- Fair
	Matrix:	Micrite	**Cementation**	Fair
	Clasts:	Intraclasts -- Biological	**Hardness:**	Moderately Hard
	Texture:	Sandy -- Chalky		

Comments: Strong HCl reaction.
Metal flecks present in sample. Possibly from drill bit

E+03 **To** E+03 **Feet** **Drilling Method:** Mud Rotary **Bit Type:** Button **Date Collected:** 4/25/2006

15 % **SAND**	**Color:**	5Y 8/1 Yellowish gray	**Roundness:**	Round -- Subangular
	Mineral:	Calcium carbonate, quartz	**Sphericity:**	Low -- Moderate
	Size:	Silt -- Coarse	**Frosting:**	Mixed
40 % **FOSSILS (Fragments)**	**Type:**	Foraminifera, shells	**Weathering:**	Extreme
45 % **LIMESTONE**	**Color:**	5Y 8/1 Yellowish gray	**Porosity:**	Poor -- Fair
	Matrix:	Micrite	**Cementation**	Poor
	Clasts:	Intraclasts -- Biological	**Hardness:**	Soft
	Texture:	Sandy -- Chalky		

Comments: Strong HCl reaction

E+03 **To** E+03 **Feet** **Drilling Method:** Mud Rotary **Bit Type:** Button **Date Collected:** 4/25/2006

20 % **SAND**	**Color:**	5Y 8/1 Yellowish gray	**Roundness:**	Round -- Subangular
	Mineral:	Calcium carbonate, quartz	**Sphericity:**	Low -- Moderate
	Size:	Silt -- Coarse	**Frosting:**	Mixed
35 % **FOSSILS (Fragments)**	**Type:**	Foraminifera, shells	**Weathering:**	Extreme
45 % **LIMESTONE**	**Color:**	5Y 8/1 Yellowish gray	**Porosity:**	Poor -- Fair
	Matrix:	Micrite	**Cementation**	Poor -- Fair
	Clasts:	Intraclasts -- Biological	**Hardness:**	Soft -- Moderately Hard
	Texture:	Sandy -- Chalky		

Comments: Strong HCl reaction.

Geologic Log

UIC

Well No. I-1

E+03 To E+03 Feet **Drilling Method:** Reverse Air **Bit Type:** Button **Date Collected:** 6/9/2006

10 % **SAND**	**Color:**	10YR 8/2 Very pale orange to 10YR 6/2 Pale yellowish brown	**Roundness:**	Round -- Subangular
	Mineral:	Calcium carbonate, trace quartz	**Sphericity:**	Low -- Moderate
	Size:	Silt -- Coarse	**Frosting:**	Mixed
15 % **FOSSILS (Fragments)**	**Type:**	Shells, spines, foraminifera	**Weathering:**	Extreme
75 % **LIMESTONE**	**Color:**	10YR 8/2 Very pale orange to 5Y 8/1 Yellowish gray	**Porosity:**	Poor -- Fair
	Matrix:	Sparite -- Micrite	**Cementation**	Fair
	Clasts:	Intraclasts -- Biological	**Hardness:**	Moderately Hard
	Texture:	Cryptocrystalline -- Silty		

Comments: Strong HCl reaction.
Fossils have been recrystallized
Limestone has been broken into sand-sized grains.

E+03 To E+03 Feet **Drilling Method:** Reverse Air **Bit Type:** Button **Date Collected:** 6/9/2006

10 % **SAND**	**Color:**	10YR 8/2 Very pale orange to 10YR 6/2 Pale yellowish brown	**Roundness:**	Round -- Subangular
	Mineral:	Calcium carbonate, trace quartz	**Sphericity:**	Low -- Moderate
	Size:	Silt -- Coarse	**Frosting:**	Mixed
20 % **FOSSILS (Fragments)**	**Type:**	Foraminifera, spines, shells, coral	**Weathering:**	Extreme
70 % **LIMESTONE**	**Color:**	10YR 8/2 Very pale orange to 5Y 8/1 Yellowish gray	**Porosity:**	Poor
	Matrix:	Sparite -- Micrite	**Cementation**	Fair -- Good
	Clasts:	Intraclasts -- Biological	**Hardness:**	Moderately Hard
	Texture:	Cryptocrystalline		

Comments: Strong HCl reaction
Fossils have been recrystallized
Limestone has been broken into sand-sized grains.

E+03 To E+03 Feet **Drilling Method:** Reverse Air **Bit Type:** Button **Date Collected:** 6/9/2006

20 % **SAND**	**Color:**	10YR 8/2 Very pale orange	**Roundness:**	Round -- Angular
	Mineral:	Calcium carbonate, trace quartz	**Sphericity:**	Low -- Moderate
	Size:	Silt -- Coarse	**Frosting:**	Mixed
20 % **FOSSILS (Fragments)**	**Type:**	Foraminifera, spines, shells	**Weathering:**	Extreme
60 % **LIMESTONE**	**Color:**	10YR 8/2 Very pale orange to 5Y 8/1 Yellowish gray	**Porosity:**	Poor -- Fair
	Matrix:	Sparite -- Micrite	**Cementation**	Fair
	Clasts:	Intraclasts -- Biological	**Hardness:**	Moderately Hard
	Texture:	Cryptocrystalline -- Silty		

Comments: Strong HCl reaction.
A lot of recrystallization present.
Limestone is broken into sand-sized grains

Geologic Log

ETC

Well No. F1

E+03 To E+03 Feet **Drilling Method:** Reverse Air **Bit Type:** Button **Date Collected:** 6/9/2006

20 % **SAND**	**Color:**	10YR 8/2 Very pale orange	**Roundness:**	Round -- Subangular
	Mineral:	Calcium carbonate	**Sphericity:**	Low -- High
	Size:	Silt -- Coarse	**Frosting:**	Mixed
40 % **FOSSILS (Fragments)**	**Type:**	Large and small foraminifera, shells	**Weathering:**	Extreme
40 % **LIMESTONE**	**Color:**	5Y 8/1 Yellowish gray	**Porosity:**	Poor -- Fair
	Matrix:	Micrite	**Cementation**	Poor -- Fair
	Clasts:	Intraclasts -- Biological	**Hardness:**	Soft -- Moderately Hard
	Texture:	Cryptocrystalline -- Silty		

Comments: Strong HCl reaction.
Foraminifera as large as 1.4 cm.
Recrystallization is evident in sample
Some limestone has been broken down to sand-sized grains

E+03 To E+03 Feet **Drilling Method:** Reverse Air **Bit Type:** Button **Date Collected:** 6/9/2006

25 % **SAND**	**Color:**	10YR 8/2 Very pale orange	**Roundness:**	Round -- Subangular
	Mineral:	Calcium carbonate, trace quartz	**Sphericity:**	Low -- High
	Size:	Silt -- Coarse	**Frosting:**	Mixed
30 % **FOSSILS (Fragments)**	**Type:**	Foraminifera, trace shells	**Weathering:**	Extreme
45 % **LIMESTONE**	**Color:**	5Y 8/1 Yellowish gray	**Porosity:**	Poor -- Fair
	Matrix:	Micrite	**Cementation**	Fair -- Good
	Clasts:	Intraclasts -- Biological	**Hardness:**	Moderately Hard -- Hard
	Texture:	Cryptocrystalline -- Silty		

Comments: Strong HCl reaction.
Some limestone broken down to sand-sized grains.

E+03 To E+03 Feet **Drilling Method:** Reverse Air **Bit Type:** Button **Date Collected:** 6/9/2006

10 % **SAND**	**Color:**	10YR 8/2 Very pale orange	**Roundness:**	Round -- Subangular
	Mineral:	Calcium carbonate	**Sphericity:**	Low -- Moderate
	Size:	Silt -- Coarse	**Frosting:**	Mixed
25 % **FOSSILS (Fragments)**	**Type:**	Foraminifera, reef	**Weathering:**	Extreme
65 % **LIMESTONE**	**Color:**	10YR 8/2 Very pale orange	**Porosity:**	Poor -- Fair
	Matrix:	Sparite -- Micrite	**Cementation**	Fair -- Good
	Clasts:	Intraclasts -- Biological	**Hardness:**	Moderately Hard
	Texture:	Cryptocrystalline -- Silty		

Comments: Strong HCl reaction
Recrystallization is present.
Some limestone is fragmented to sand-sized grains

Geologic Log

LTC

Well No. F1

E+03 To E+03 Feet	Drilling Method: Reverse Air	Bit Type: Button	Date Collected: 6/9/2006
20 % SAND	Color: 10YR 8/2 Very pale orange Mineral: Calcium carbonate Size: Silt -- Coars		Roundness: Subround -- Subangular Sphericity: Moderate Frosting: Mixed
20 % FOSSILS (Fragments)	Type: Foraminifera, reefs		Weathering: Extreme
60 % LIMESTONE	Color: 10YR 8/2 Very pale orange Matrix: Sparite -- Micrite Clasts: Intraclasts -- Biological Texture: Cryptocrystalline -- Silty		Porosity: Poor -- Fair Cementation: Frir -- Good Hardness: Moderately Hard

Comments: Strong HCl reaction.
Recrystallization is evident.

E+03 To E+03 Feet	Drilling Method: Reverse Air	Bit Type: Button	Date Collected: 6/10/2006
15 % SAND	Color: 10YR 8/2 Very pale orange Mineral: Calcium carbonate Size: Silt -- Coarse		Roundness: Subround -- Subangular Sphericity: Low -- High Frosting: Mixed
60 % FOSSILS (Fragments)	Type: Fo minifera, reefs		Weathering: Extreme
25 % LIMESTONE	Color: 10YR 2 Very pale orange Matrix: Sparite -- Micrite Clasts: Intraclasts -- Biological Texture: Cryptocrystalline -- Silty		Porosity: Poor -- Fair Cementation: Fair -- Good Hardness: Moderately Hard

Comments: Strong HCl r ction.
Some recryst lization present.

E+03 To E+03 Feet	Drilling Method: Reverse Air	Bit Type: Button	Date Collected: 6/10/2006
10 % SAND	Color: 10YR 8/2 Very pale orange Mineral: Calcium carbonate Size: Silt -- Coarse		Roundness: Round -- Subangular Sphericity: Low -- Moderate Frosting: Mixed
80 % FOSSILS (Fragments)	Type: Foraminifera, shells, reef		Weathering: Extreme
10 % LIMESTONE	Color: 10YR 8/2 Very pale orange Matrix: Sparite -- Micrite Clasts: Intraclasts -- Biological Texture: Cryptocrystalline -- Silty		Porosity: Poor -- Fair Cementation: Fair -- Good Hardness: Moderately Hard

Comments: Strong HCl reaction.
Some recrystallization is evident.

Geologic Log

LTC

Well No. F1

E+03 To E+03 Feet	**Drilling Method:** Reverse Air	**Bit Type:** Button	**Date Collected:**	6/10/2006

20 % **SAND**	**Color:**	10YR 8/2 Very pale orange	**Roundness:**	R und -- Subangular
	Mineral:	Calcium carbonate, trace quartz	**Sphericity:**	ow -- Moderate
	Size:	Silt -- Coarse	**Frosting:**	Mixed
15 % **FOSSILS (Fragments)**	**Type:**	Foraminifera, spines	**Weathering:**	Extreme
40 % **LIMESTONE**	**Color:**	5Y 8/1 Yellowish gray	**Porosity:**	Poor -- Fair
	Matrix:	Sparite -- Micrite	**Cementation**	Fair -- Good
	Clasts:	Intraclasts -- Biological	**Hardness:**	Moderately Hard
	Texture:	Cryptocrystalline -- Silty		
25 % **SILTSTONE**	**Color:**	5Y 6/1 Light olive gray	**Cementation**	Good
	Matrix:	Calcium Carbonate	**Hardness:**	Moderately Hard
	Porosity:	Poor		

Comments: Strong HCl reaction
Recrystallization is evident.
Siltstone is phosphatic.

Gerhardt M.
Witt
& Associates, Inc.

APPENDIX C

WELL WARRANTY

Jaffer Associates Corp
2801 N.W. 6th Ave
Miami, FL 33127-3937
P.O. Box 370277
Dade: (305) 576-7363
Fax: (305) 573-8711

September 6, 2006

Mr. Stephen Ehrbar, C.G.C.S.
Lost Tree Club
11520 Lost Tree Way
North Palm Beach, FL 33048

Reference: Well Completion Video

Dear Mr. Ehrbar,

Thank you for the opportunity of working for the Lost Tree Club developing the R.O. Floridan Water Supply Well. During the video logging of the well, we observed an area below the casing where a portion of the grout has fallen into the borehole "Picture No. 1 Grout material and No. 2" open borehole below obstruction.

No. 1

No. 2

After discussions with Mr. Witt of Gerhardt M. Witt & Associates, he does not feel the lose grout will cause any problems with the performance of the well. We will offer an additional one-year warranty to repair the well should the above cause any flow restrictions.

Please do not hesitate to contact us if you require any additional information.

Sincerely,

Gary Bielak
Rotary Division Administrator
enclosure; video log of well
Cc/Mr. Gerhardt M. Witt, P.G. Gerhardt M. Witt & Associates

Gerhardt M.
Witt
& Associates, Inc.

APPENDIX D

GEOPHYSICAL LOGS

South Florida Water Management District

MAP OVERLAPS

LEAHY

Leahy Incorporated
5307 N.W. 35th Terrace
Fort Lauderdale, FL 33309
Phone 954-485-7788
Fax 954-485-6968

MV Geophysical

DUAL INDUCTION
LL3 / SP
LOG

Company Jaffer Associates Corp.
Well Lost Tree Club F-1
Field Palm Beach Gardens
County Palm Beach
State/Prv Florida

Company **Jaffer Associates Corporation**

Well **Lost Tree Club F-1**

Field **Palm Beach Gardens**

County **Palm Beach** State/Prv **Florida**

Location

Village of Lost Tree
Gerhardt M. Witt & Associates

Other Services
XY/GR

Elevation

Permanent Datum	G L.	Elevation	K B	
Log Measured From	G.L.		D F	
Drilling Measured From	G.L.		G L	

Date	28-APR-2006		
Run Number	ONE		
Depth Driller	1076		
Depth Logger	1066'		
Bottom Logged Interval	1060		
Top Log Interval	SURFACE		
Open Hole Size	12 25"		
Type Fluid	MUD		
Density / Viscosity	NA/NA		
Max Recorded Temp	na		
Estimated Cement Top	NA		
Time Well Ready	09 30 4/28/2006		
Time Logger on Bottom	11.00 4/28/2006		
Equipment Number	MVGS-1		
Location	Ft. Myers		
Recorded By	S Miller		
Witnessed By	S Nieratka (GMWA)	G Witt (GMWA)	Terry/Adnan (JAC)

Borehole Record				Tubing Record			
Run Number	Bit	From	To	Size	Weight	From	To
ONE	12 25"	339'	1076' 1060' Logger				

Casing Record	Size	Wgt/Ft	Top	Bottom
Surface String	24"	375" WT	SURFACE	339' 321' Logger
Prot String				
Production String				
Liner				

Invoice No 2006123

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All interpretations are opinions based on inferences from electrical or other measurements and we cannot and do not guarantee the accuracy or correctness of any interpretation, and we shall not, except in the case of gross or willful negligence on our part, be liable or responsible for any loss, costs, damages or expenses incurred or sustained by anyone resulting from any interpretation made by any of our officers, agents or employees. These interpretations are also subject to our general terms and conditions set out in our current Price Schedule

Comments

Rm=5.375 ohm-m @ 81.2 degF

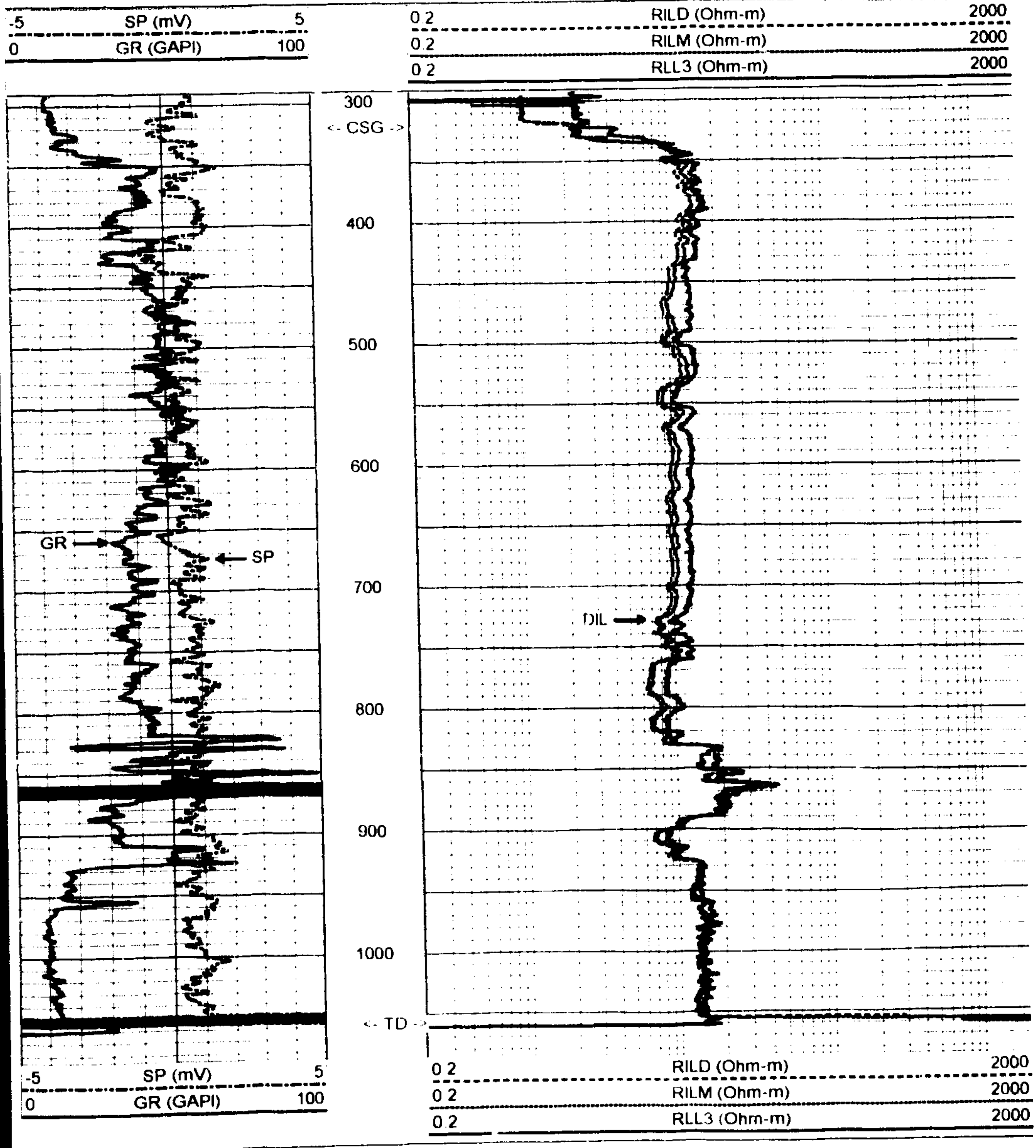
Comments

Rm=5 375 ohm-m @ 81 2 degF

MV Geophysical

MAIN PASS

Database File: jaf-lt1.db
Dataset Pathname: MAIN
Presentation Format: dil-1.prs
Dataset Creation: Fri Apr 28 11 10 19 2006
Charted by: Depth in Feet scaled 1 1200



MV

MAIN PASS

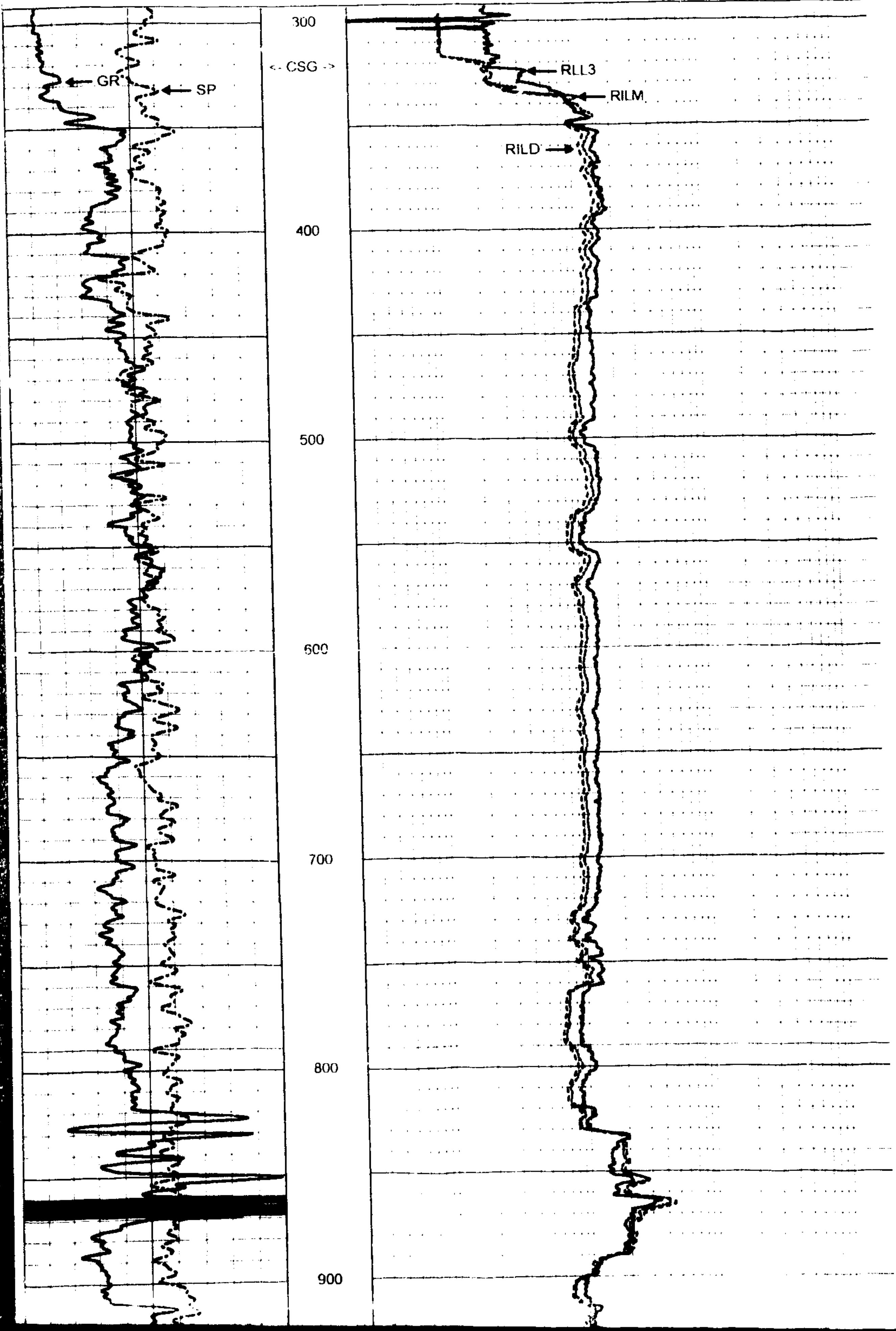
-5	SP (mV)	5	0.2	RILD (Ohm-m)	2000
10	GR (GAPI)	100	0.2	RILM (Ohm-m)	2000
			0.2	RLL3 (Ohm-m)	2000

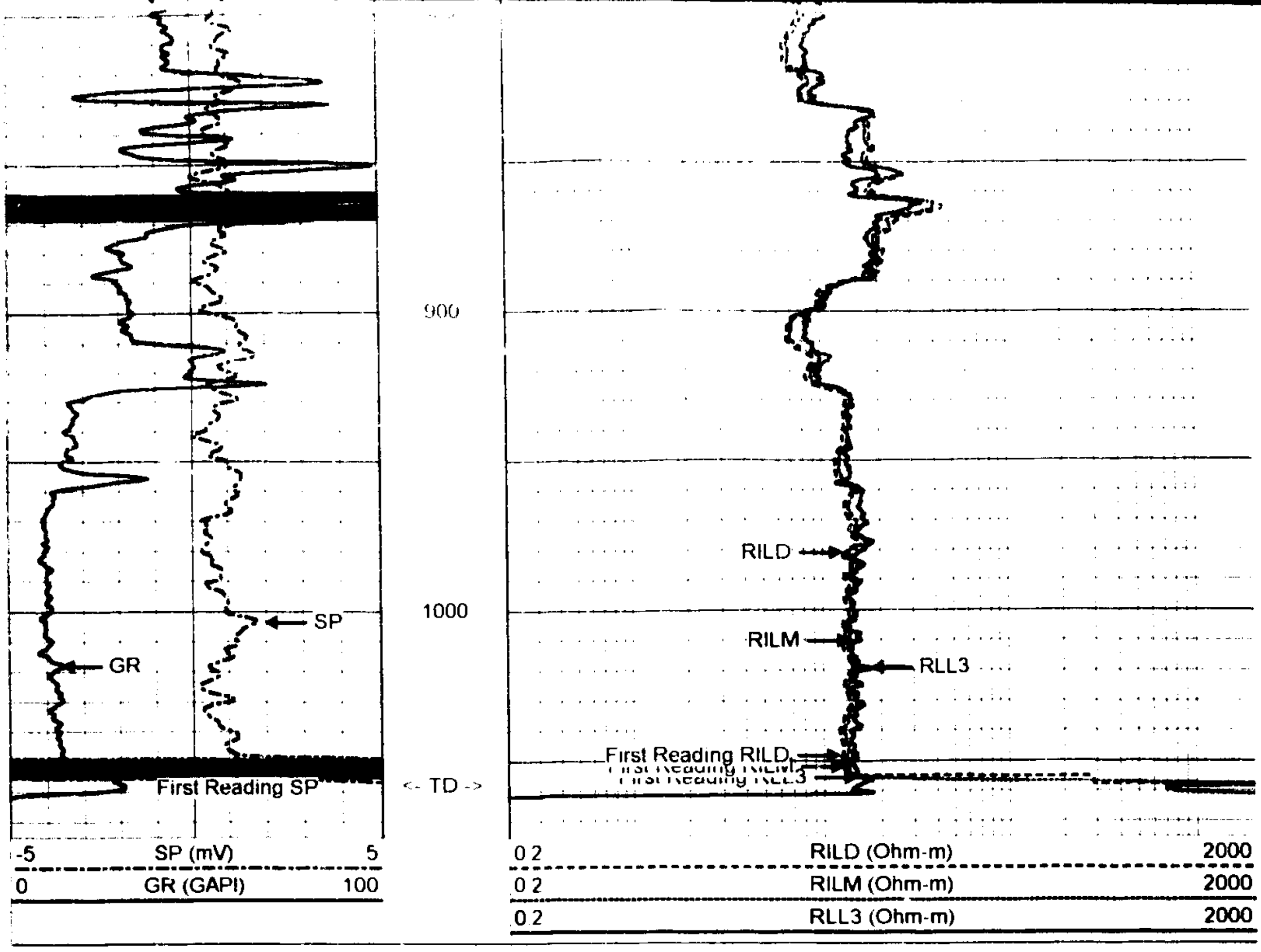
MV Geophysical

MAIN PASS

Database File: jaf-it1 db
Dataset Pathname: MAIN
Presentation Format: dil.prs
Dataset Creation: Fri Apr 28 11 10 19 2006
Charted by: Depth in Feet scaled 1 600

-5	SP (mV)	5	0.2	RILD (Ohm-m)	2000
0	GR (GAPI)	100	0.2	RILM (Ohm-m)	2000
			0.2	RLL3 (Ohm-m)	2000

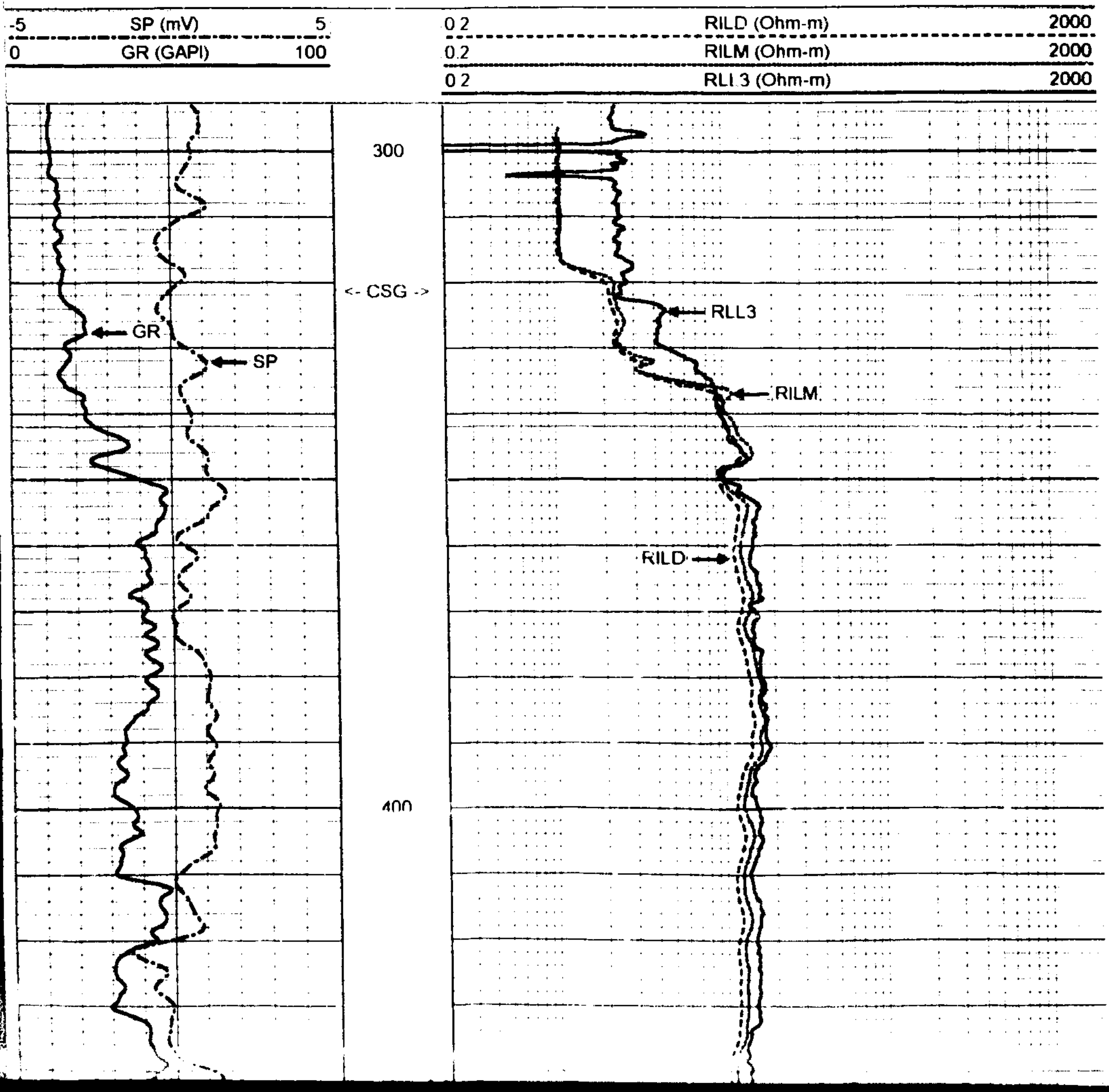


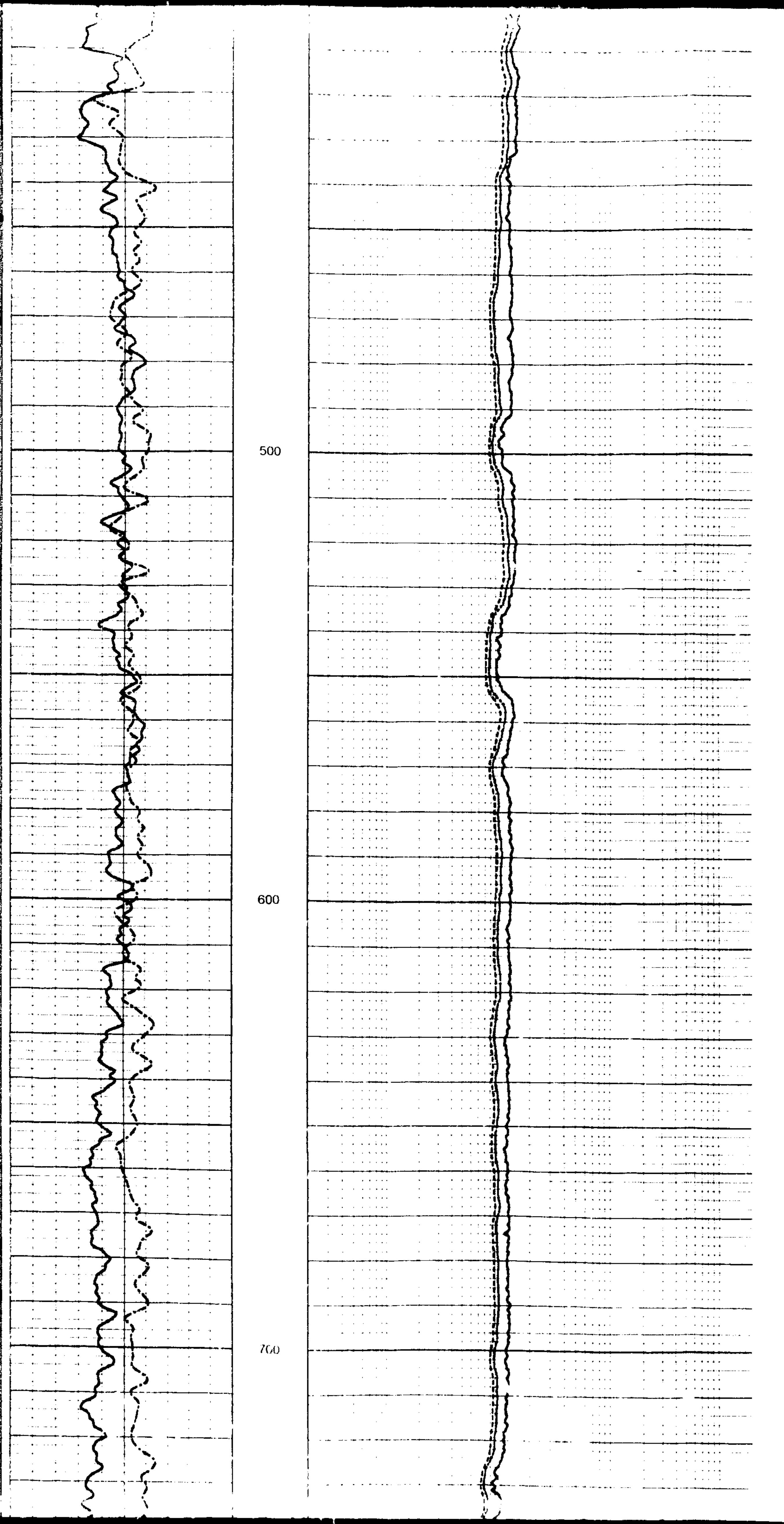


MV Geophysical

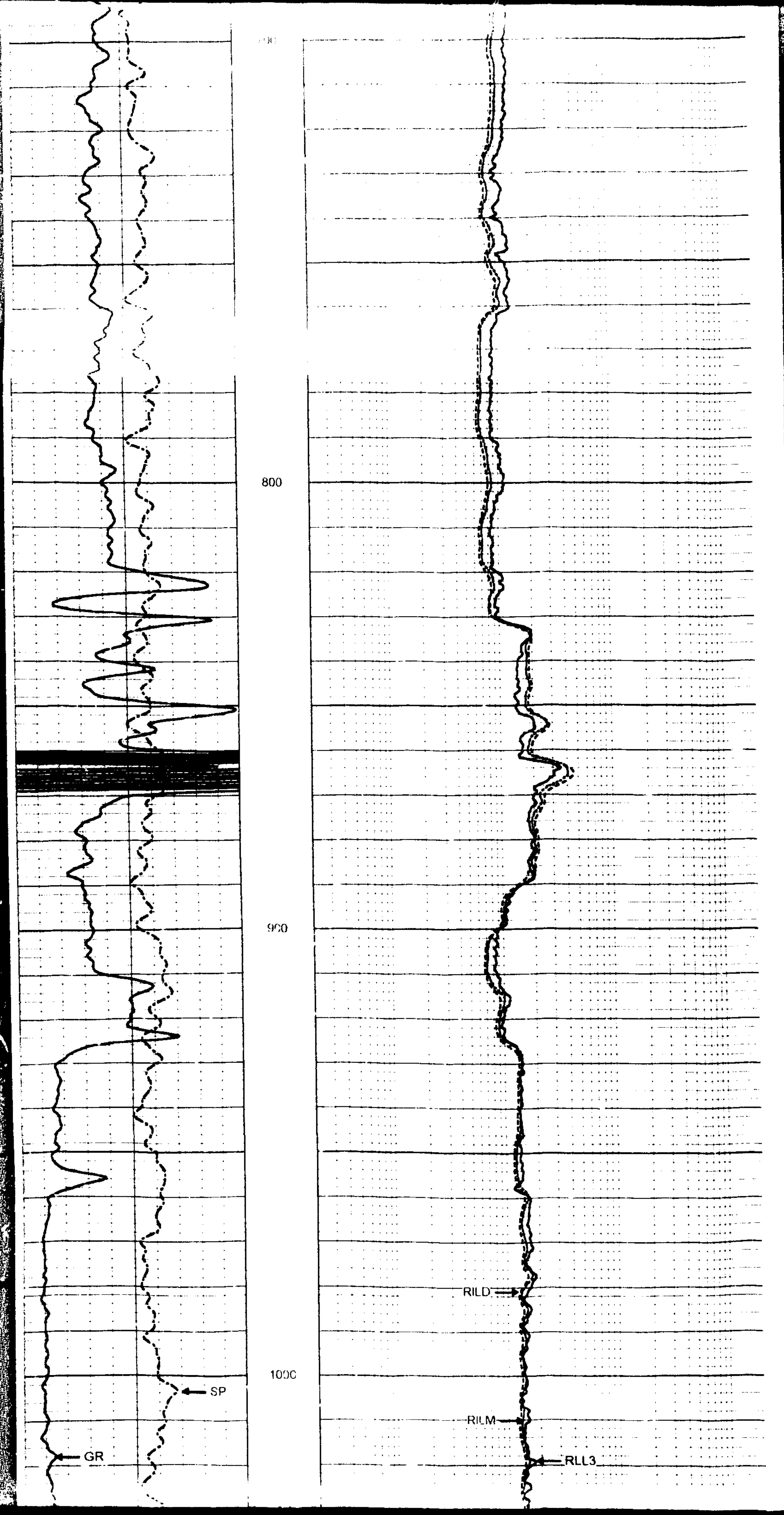
MAIN PASS

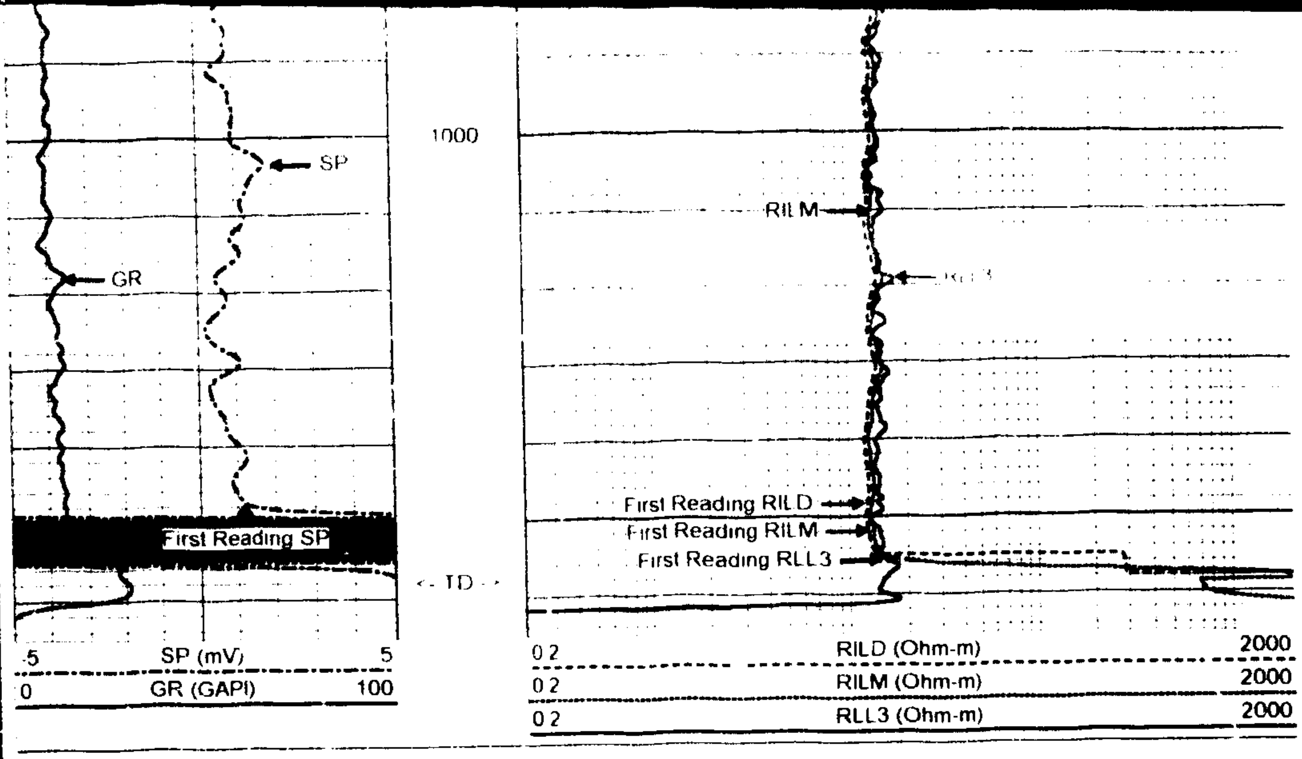
Database File: jaf-lt1 db
Dataset Pathname: MAIN
Presentation Format: dil prs
Dataset Creation: Fri Apr 28 11 10 19 2006
Charted by: Depth in Feet scaled 1 240





500
600
700


800
900
1000
SP
GR
RILD
RILM
RLL3

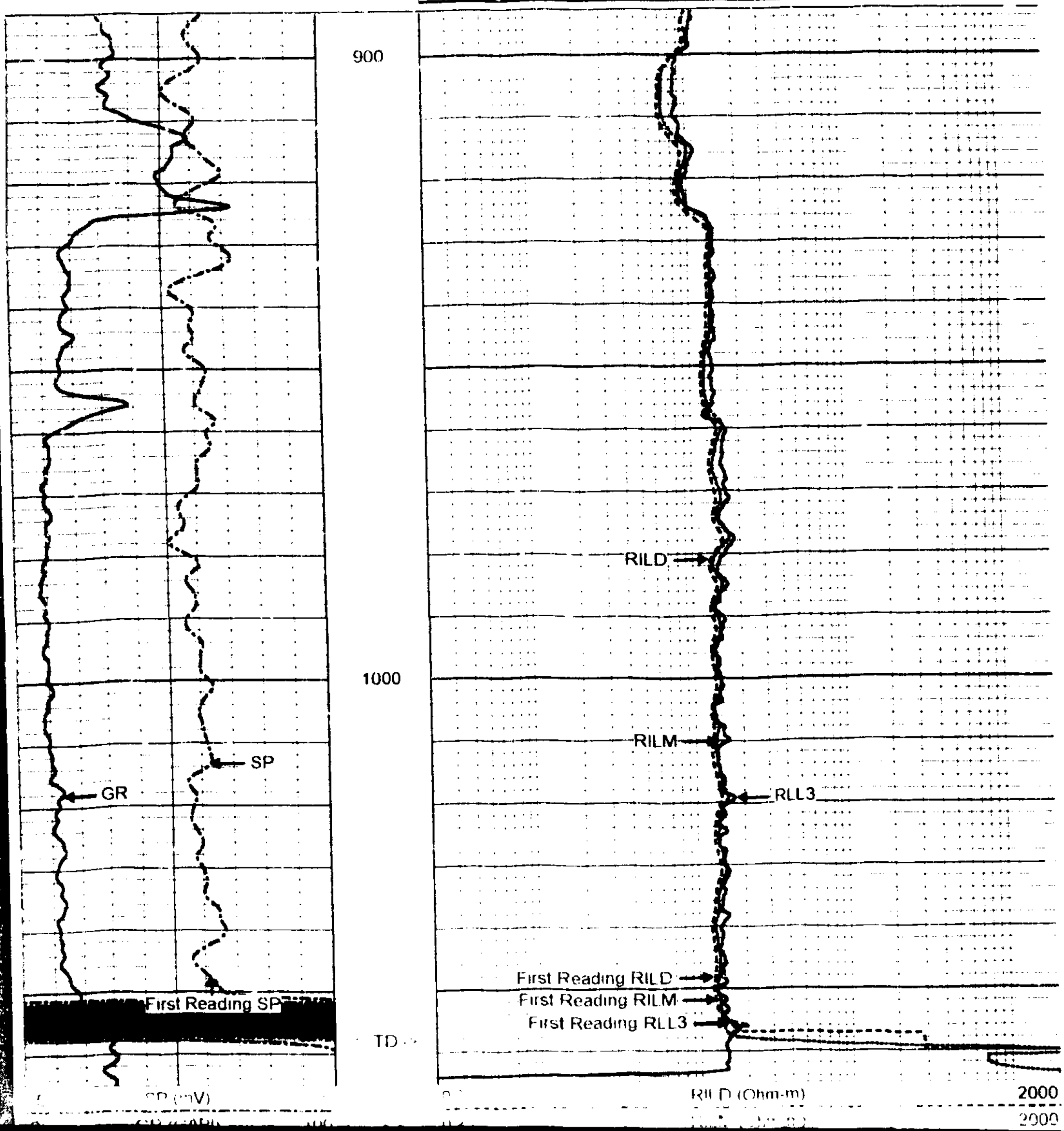


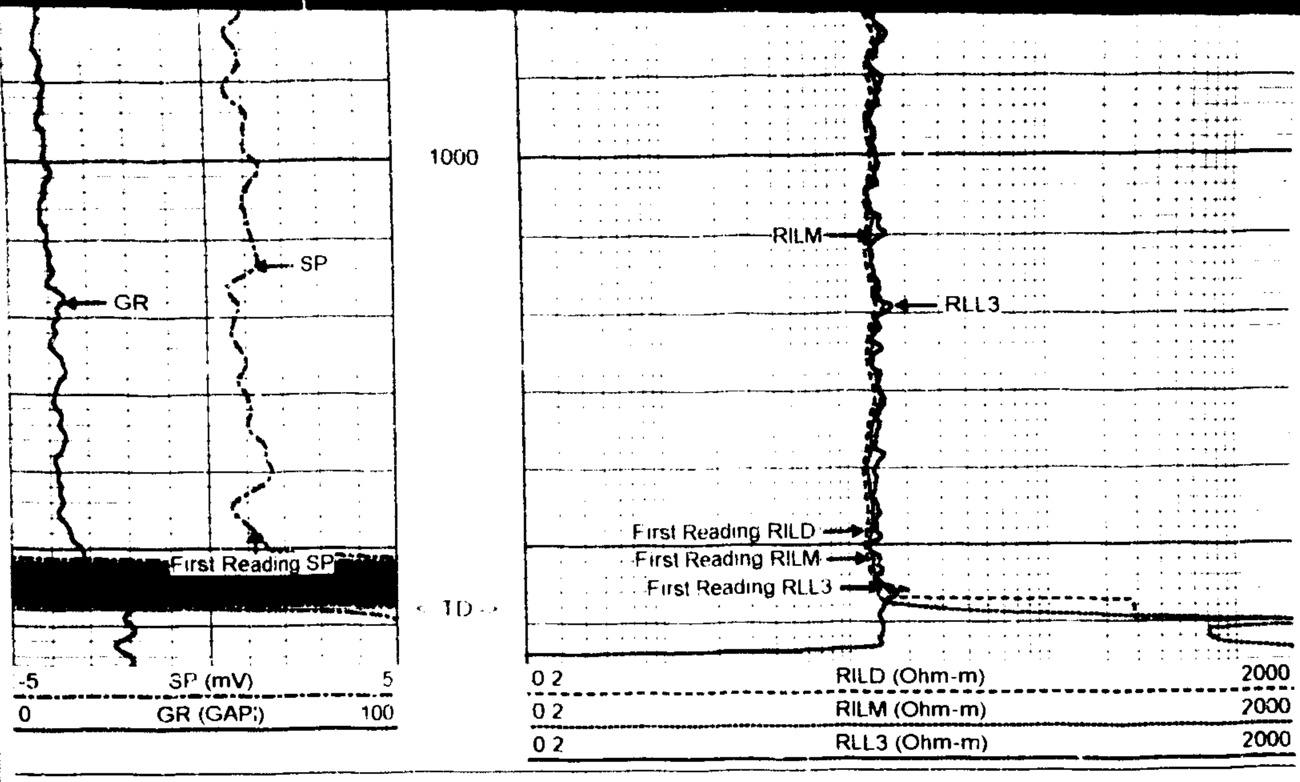
MV Geophysical

REPEAT SECTION

Database File: jaf-lt1.db
Dataset Pathname: REPEAT
Presentation Format: dil.prs
Dataset Creation: Fri Apr 28 09:58:00 2006
Charted by: Depth in Feet scaled 1:240

-5	SP (mV)	5	0.2	RILD (Ohm-m)	2000
0	GR (GAPI)	100	0.2	RILM (Ohm-m)	2000
			0.2	RLL3 (Ohm-m)	2000





Dual Induction Calibration Report

Serial-Model	5390-R
Surface Cal Performed	Sun Jan 16 21:49:43 2005
Downhole Cal Performed	Thu Mar 02 08:33:17 2006
After Survey Verification Performed	Thu Mar 02 09:07:55 2006

Surface Calibration

	Readings			References			Results	
Loop	Air	Loop		Air	Loop		m	b
Deep	0.050	0.646	V	0.000	400.000	mmho-m	671.771	-33.646
Medium	0.001	0.732	V	0.000	464.000	mmho-m	634.710	-0.492
Internal	Zero	Cal		Zero	Cal		m	b
Deep	0.011	0.641	V	0.000	400.000	mmho-m	634.996	-7.104
Medium	-0.009	0.738	V	0.000	464.000	mmho-m	620.900	5.734

Downhole Calibration

	Readings			References			Results	
Internal	Zero	Cal		Zero	Cal		m	b
Deep	-26.171	398.056	mmho-m	-26.130	397.036	mmho-m	0.997	-0.024
Medium	-6.919	468.912	mmho-m	-6.353	467.967	mmho-m	0.997	0.544
Shallow	0.010	0.005	V	494.500	2.000	Ohm-m	86951.773	-398.156

After Survey Verification

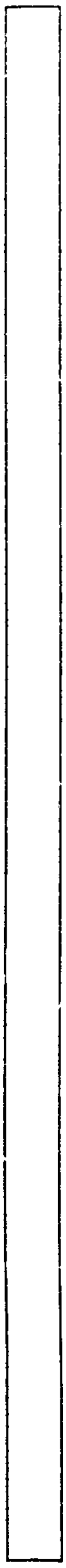
	Readings			Targets			Results	
Internal	Zero	Cal		Zero	Cal		m'	b'
Deep	-26.106	396.761	mmho-m	-26.171	398.056	mmho-m	0.997	-0.024
Medium	-5.784	469.505	mmho-m	-6.919	468.912	mmho-m	0.997	0.544
Shallow	554.471	-7.022	Ohm-m	494.500	2.000	Ohm-m	0.877	8.159

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	mho m	0 997	0 544
Shallow	554 471	[illegible] 022	Ohm m	494 50[illegible]	[illegible]	Ohm-m	0 877	8 159

CILD 10 60 ft
SP 10 60 ft

CILM 6 80 ft

RLL3 1 70 ft



DIL-R (5390) 345 00 lb 4 00 in OD 20 90 ft

Dataset	run1/pass5
Total Length	20 90 ft
Total Weight	345 00 lb
O D	4 00 in

MV Geophysical

X-Y CALIPER GAMMA RAY LOG

Company Jaffer Associates Corp.
Well Lost Tree Club F-1
Field Palm Beach Gardens
County Palm Beach
State/Prv Florida

Company	Jaffer Associates Corporation
Well	Lost Tree Club F-1
Field	Palm Beach Gardens
County	Palm Beach — State/Prv Florida
Location	Village of Lost Tree Gerhardt M. Witt & Associates

Other Services: DIL/SP

			Elevation
Permanent Datum	G.L.	Elevation	K.B.
Log Measured From	G.L.		D.F.
Drilling Measured From	G.L.		G.L.

Date	28-APR-2006	
Run Number	ONE	
Depth Driller	1076'	
Depth Logger	1060'	
Bottom Logged Interval	1060'	
Top Log Interval	SURFACE	
Open Hole Size	12.25"	
Type Fluid	MUD	
Density / Viscosity	NA/NA	
Max. Recorded Temp	na	
Estimated Cement Top	NA	
Time Well Ready	09:30 4/28/2006	
Time Logger on Bottom	09:30 4/28/2006	
Equipment Number	MVGS-1	
Location	Ft. Myers	
Recorded By	S Miller	
Witnessed By	S Nieratka (GMWA)	Terry/Adnan (JAC)

Borehole Record				Tubing Record			
Run Number	Bit	From	To	Size	Weight	From	To
ONE	12.25"	339'	1076' 1060' Logger				

Casing Record	Size	Wgt/Ft	Top	Bottom
Surface String	24"	.375" WT	SURFACE	339' 321' Logger
Prot. String				
Production String				
Liner				

Invoice No 2006123

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Comments

X-Y Caliper Arm Extensions: 33"

Lost 2' in between "MAIN PASS" and "REPEAT SECTION".

• FINAL PRINT •
Bottom 339'
321 Logger
To
KB
Elevation
DIL/SP
Other Services

Comments

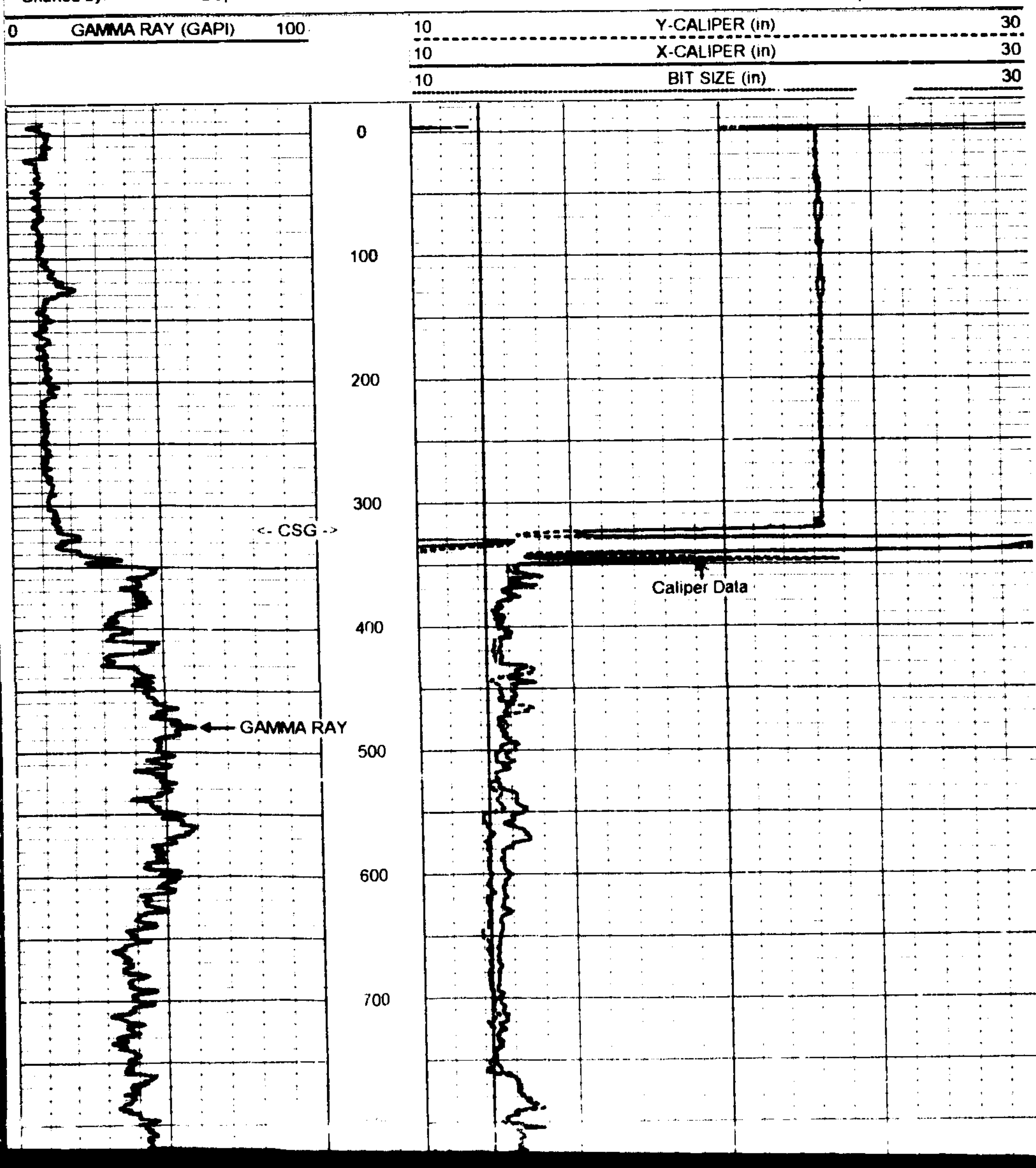
X-Y Caliper Arm Extensions: 33"

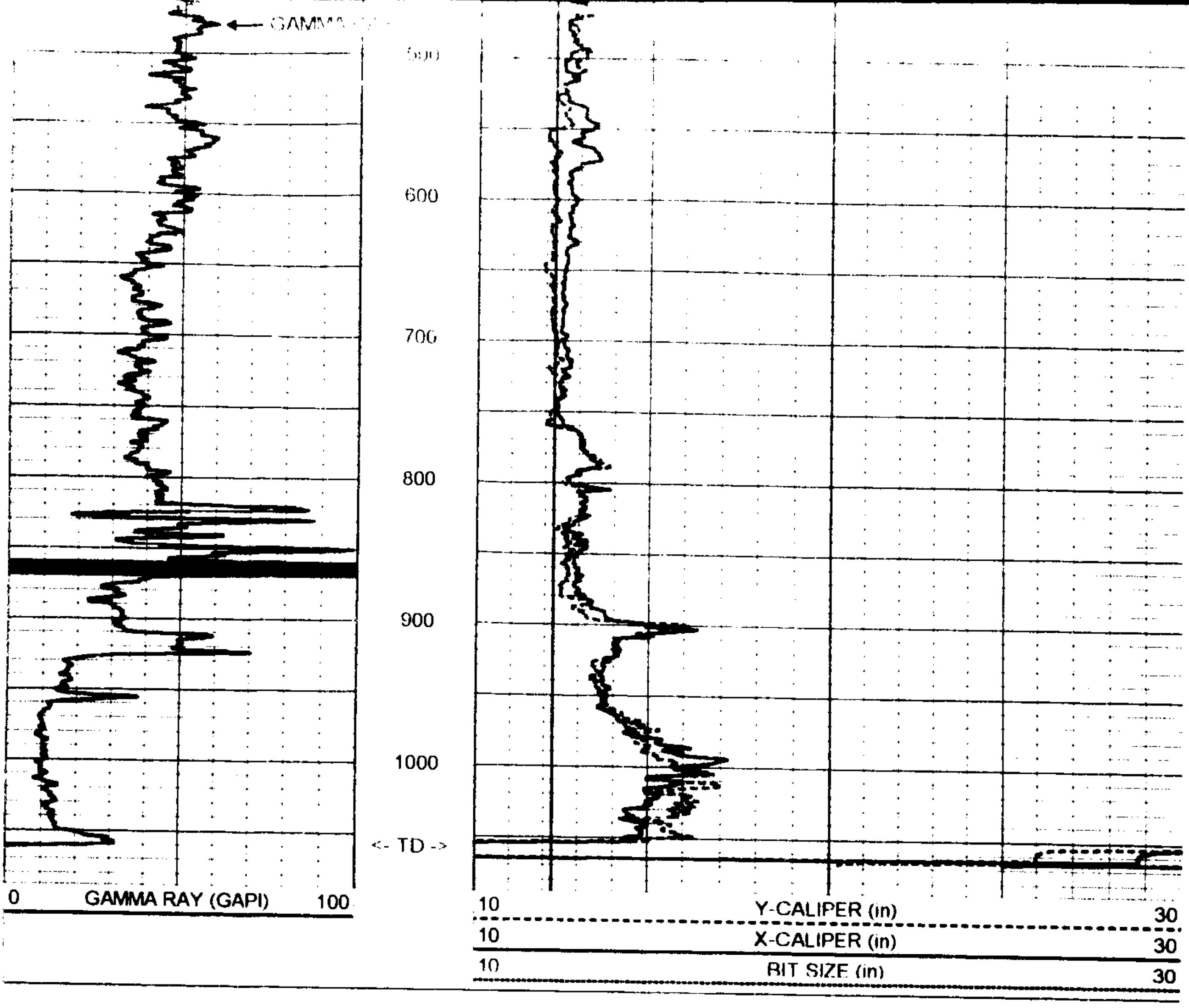
Lost 2' to between "MAIN PASS" and "REPEAT SECTION".

MV Geophysical

MAIN PASS

Database File: jaf-lt1.db
Dataset Pathname: MAIN
Presentation Format: xy1030-1.prs
Dataset Creation: Fri Apr 28 11:10:19 2006
Charted by: Depth in Feet scaled 1:1200

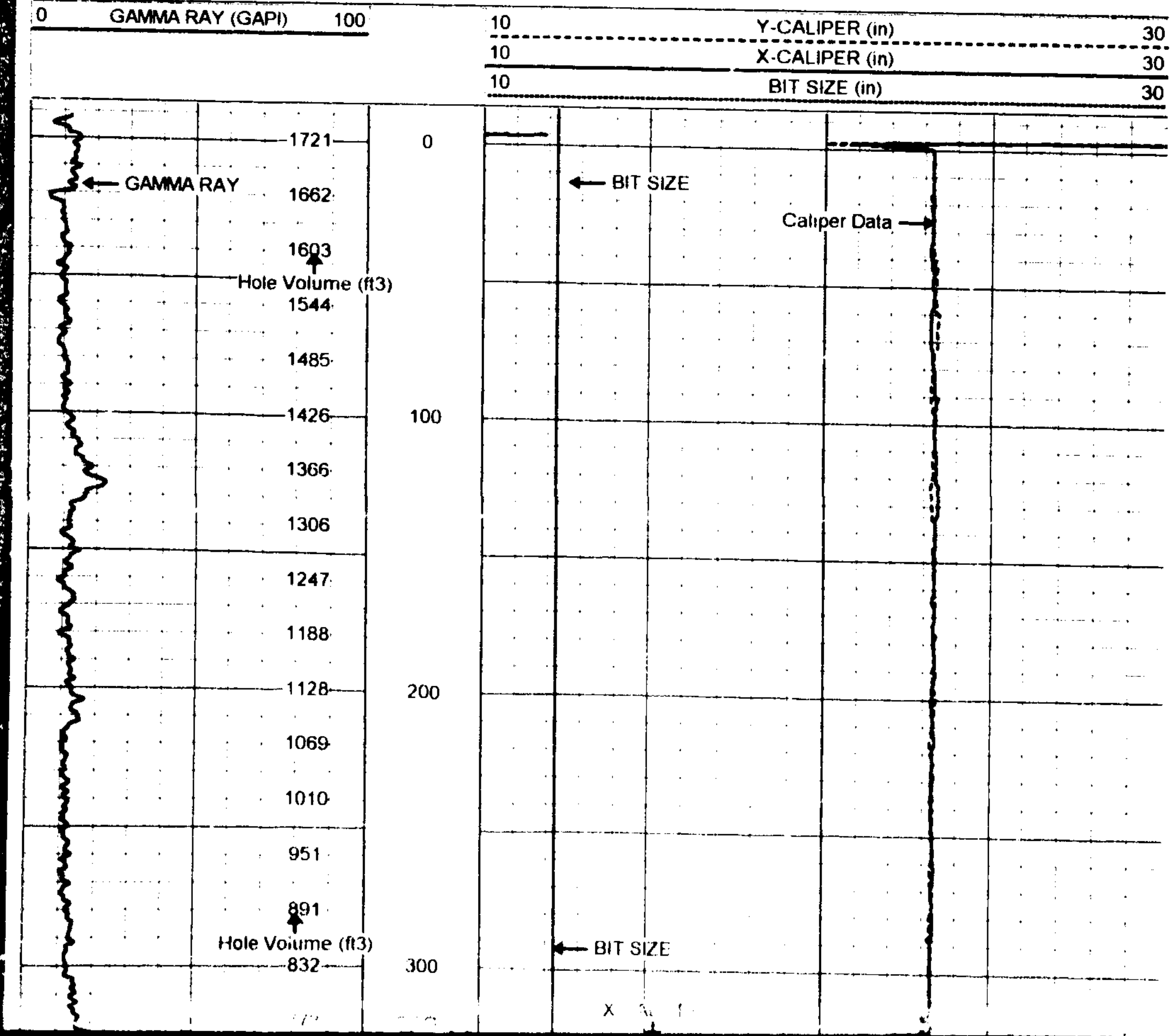


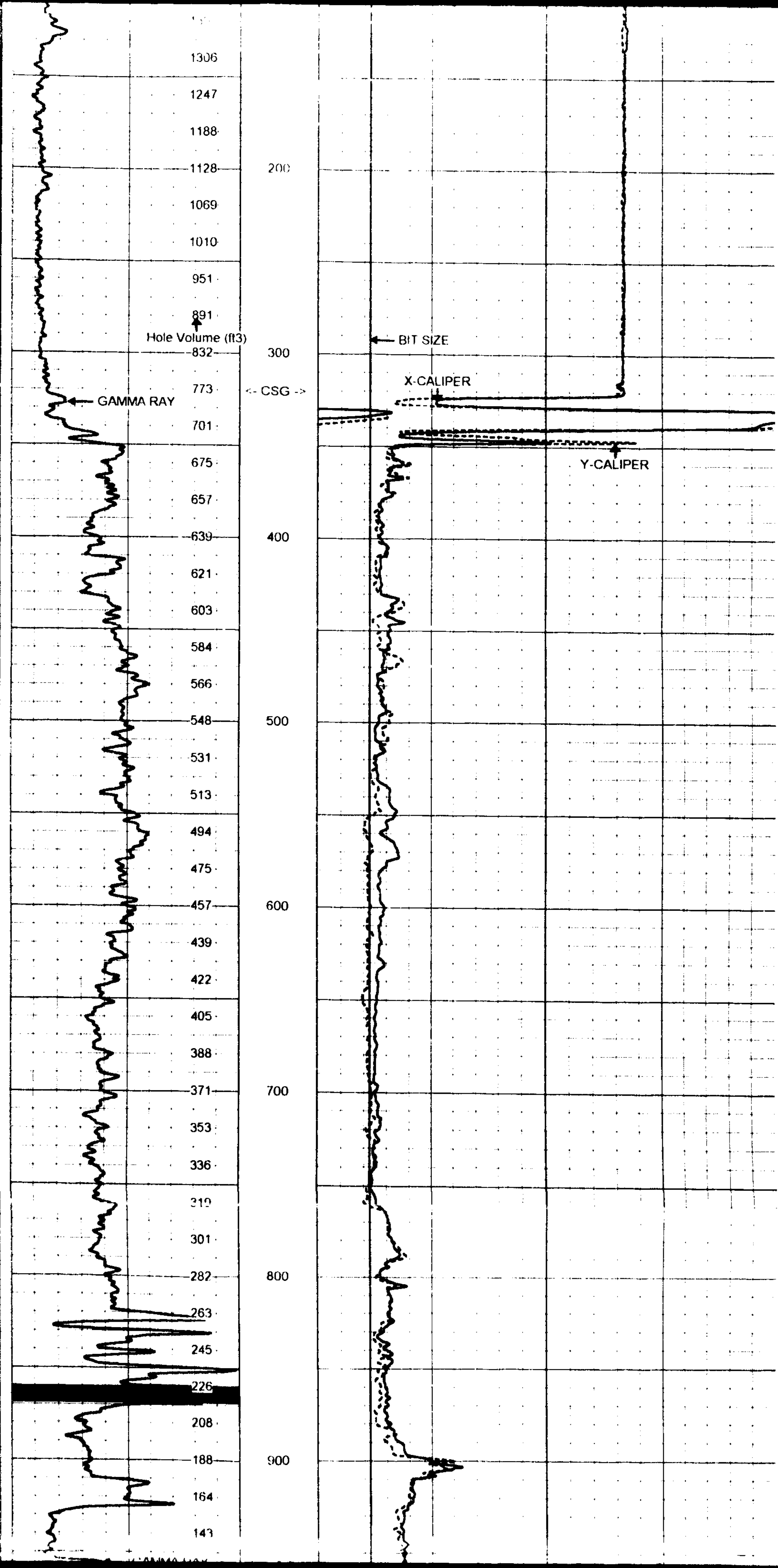


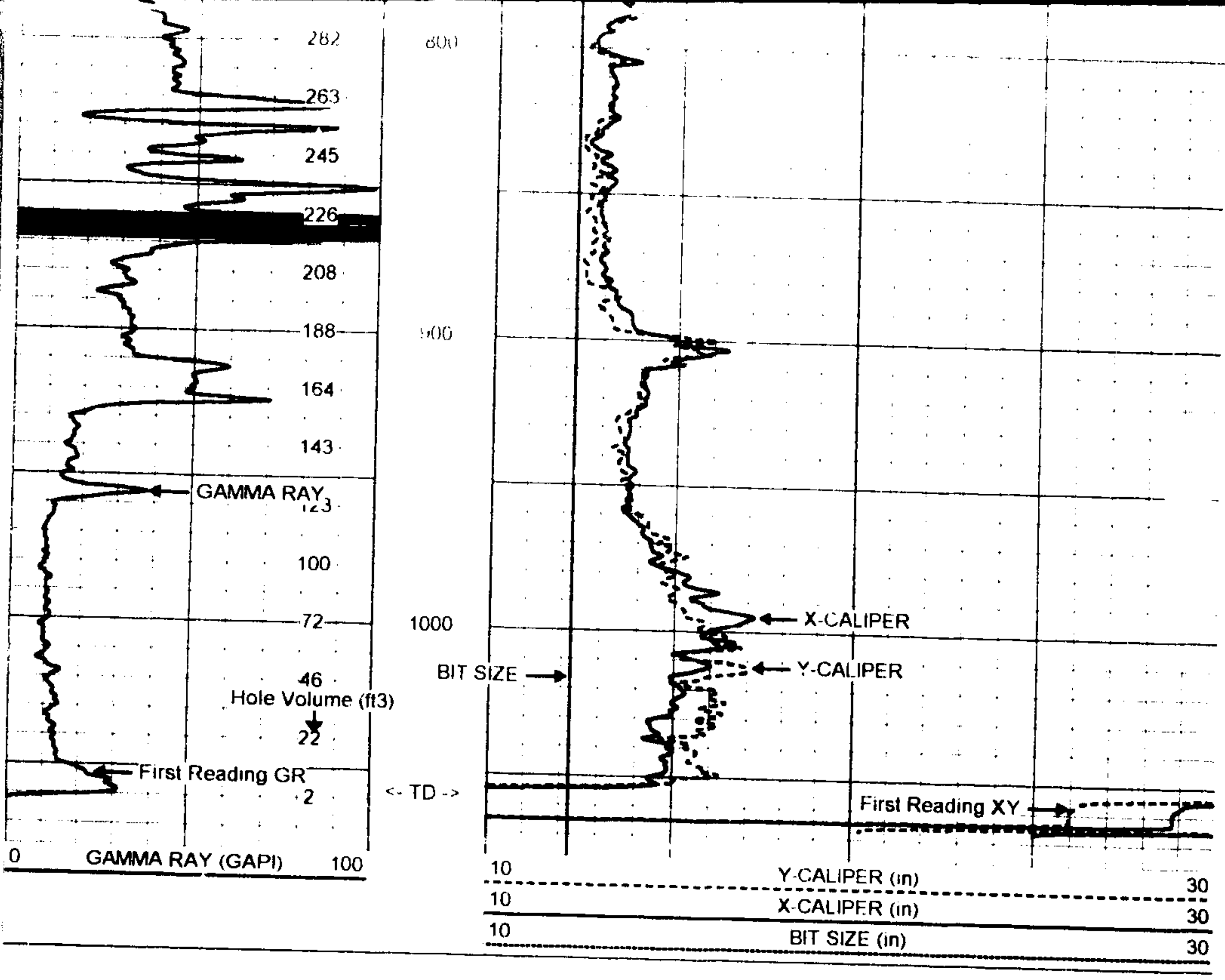
MV Geophysical

MAIN PASS

Database File: jaf-lt1.db
Dataset Pathname: MAIN
Presentation Format: xy1030-5.prs
Dataset Creation: Fri Apr 28 11:10:19 2006
Charted by: Depth in Feet scaled 1:600



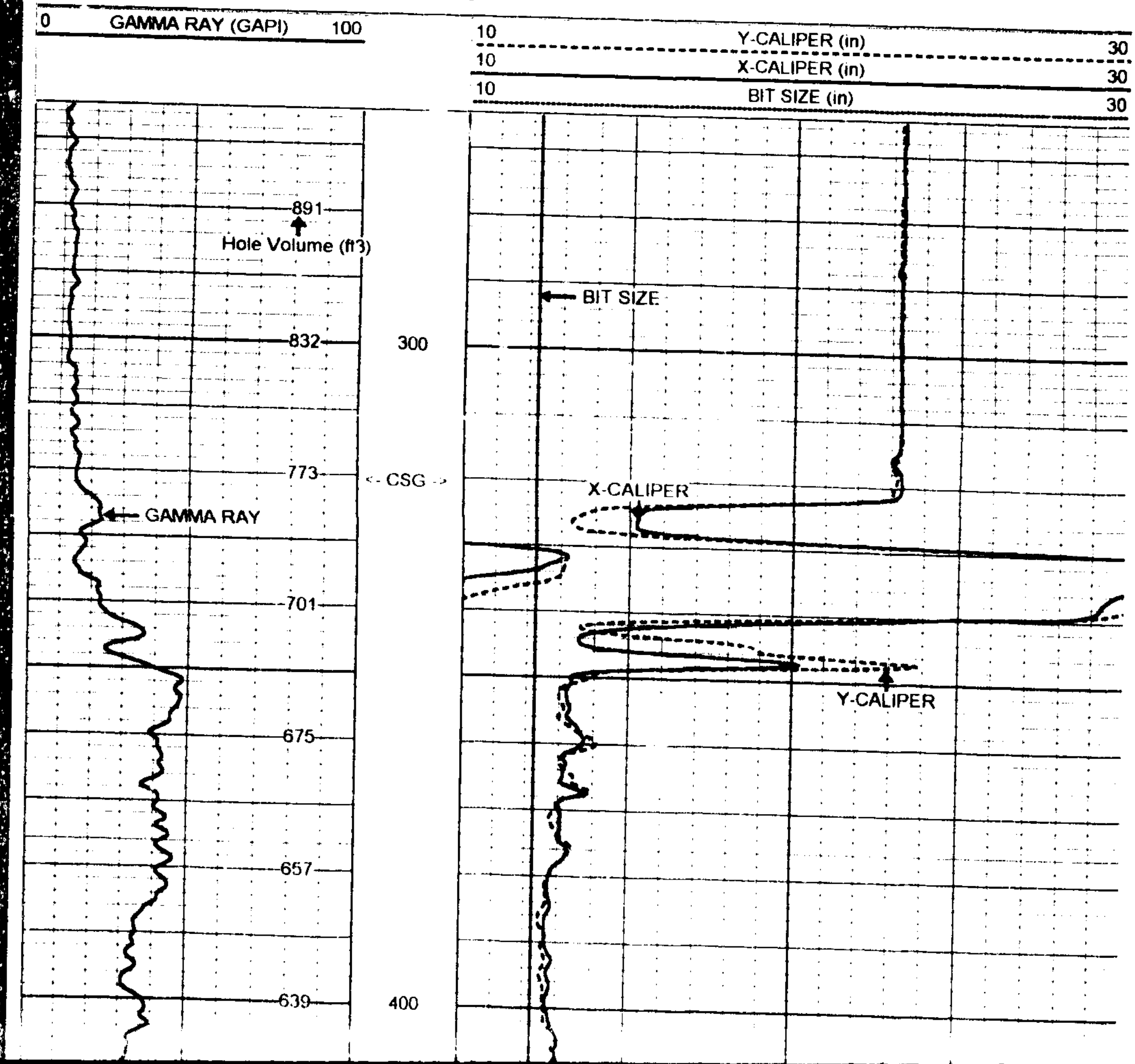

1306
1247
1188
1128
1069
1010
951
891
Hole Volume (ft3)
832
773
701
675
657
639
621
603
584
566
548
531
513
494
475
457
439
422
405
388
371
353
336
319
301
282
263
245
226
208
188
164
143
GAMMA RAY
200
300
<- CSG ->
400
500
600
700
800
900
BIT SIZE
X-CALIPER
Y-CALIPER

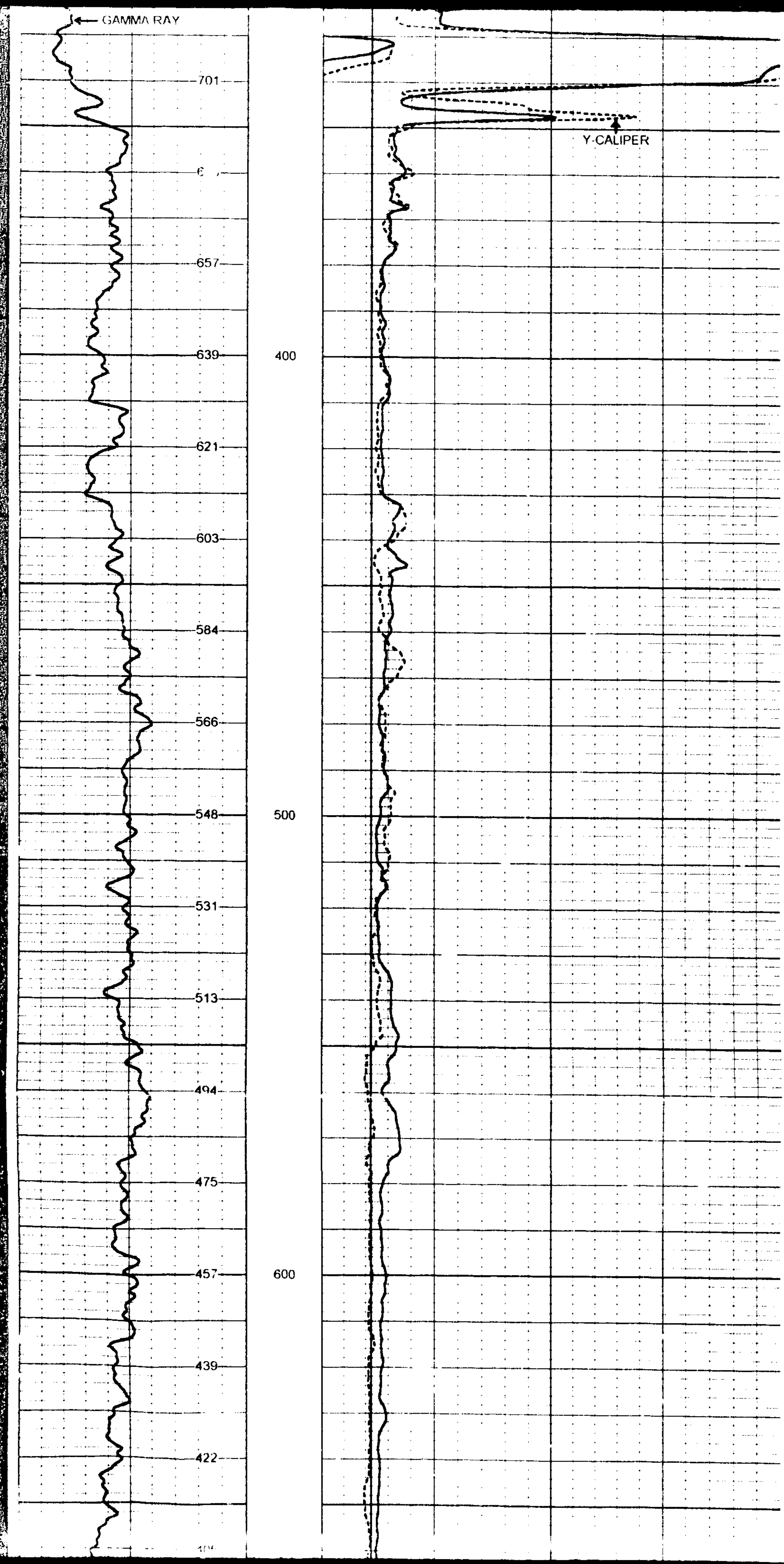


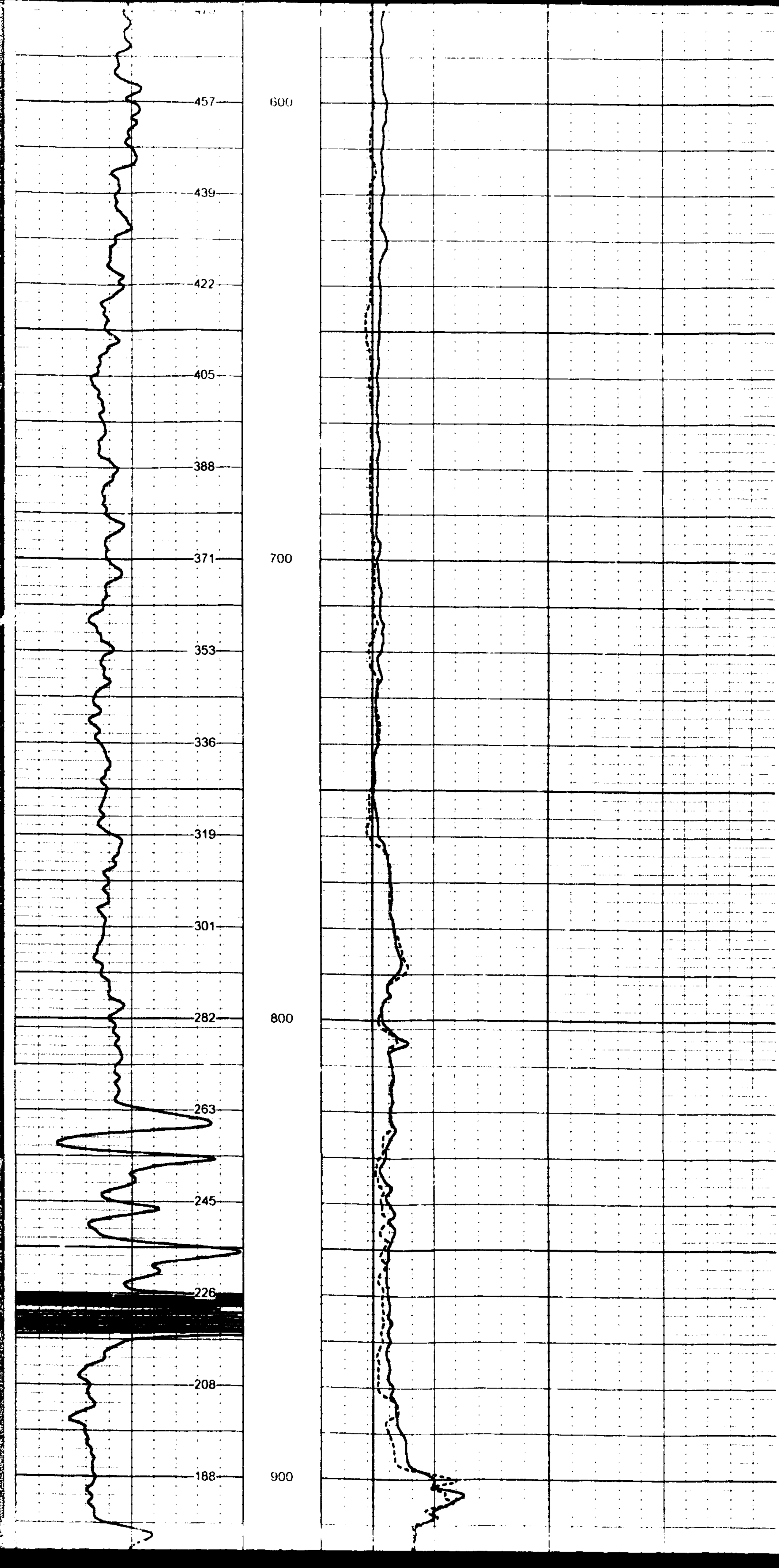
MV Geophysical

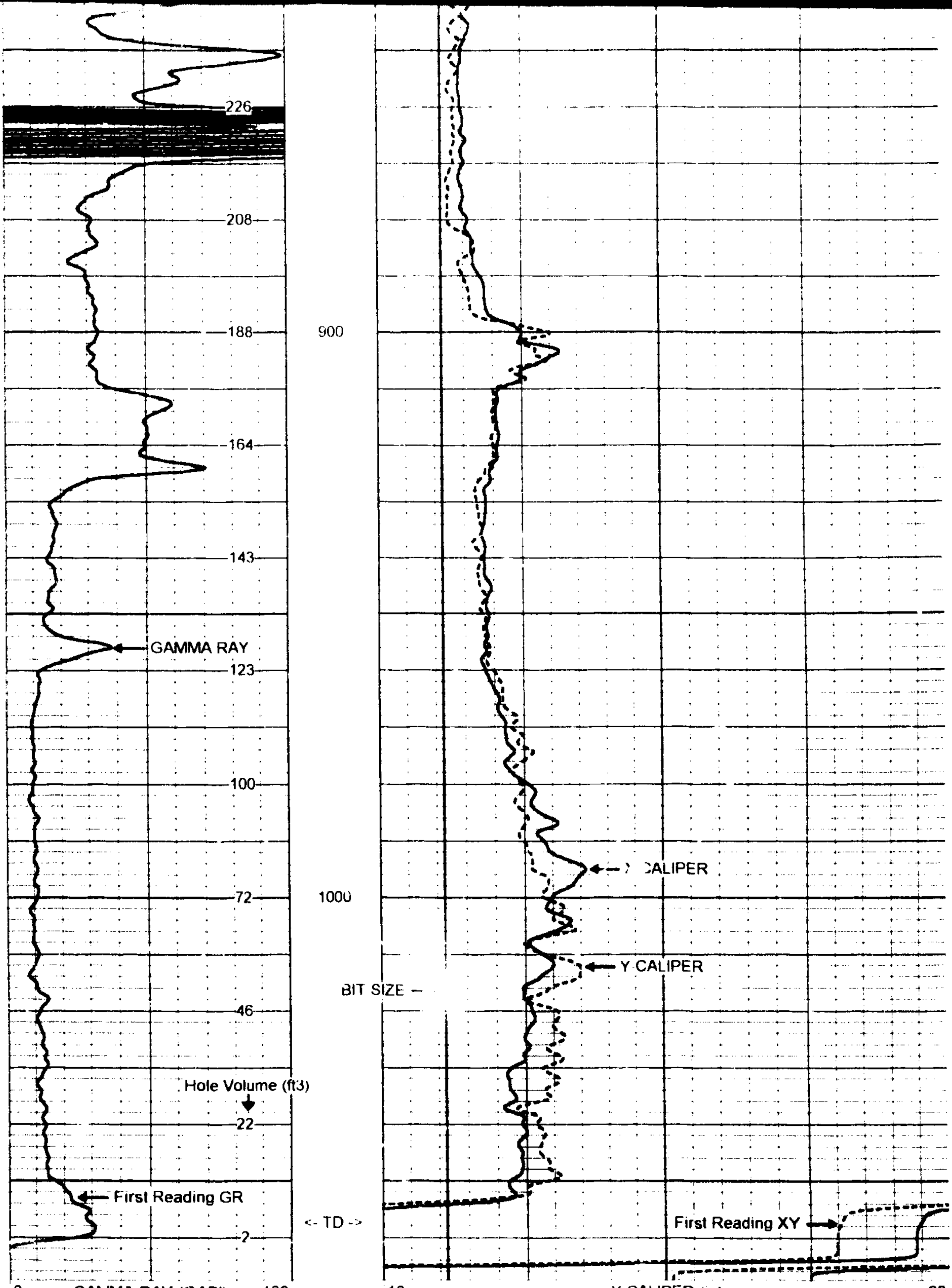
MAIN PASS

Database File: jaf-lt1 db
Dataset Pathname: MAIN
Presentation Format: xy1030-5 prs
Dataset Creation: Fri Apr 28 11 10 19 2006
Charted by: Depth in Feet scaled 1 240




GAMMA RAY
701
657
639
621
603
584
566
548
531
513
494
475
457
439
422
400
500
600
Y-CALIPER


457
600
439
422
405
388
371
700
353
336
319
301
282
800
263
245
226
208
188
900



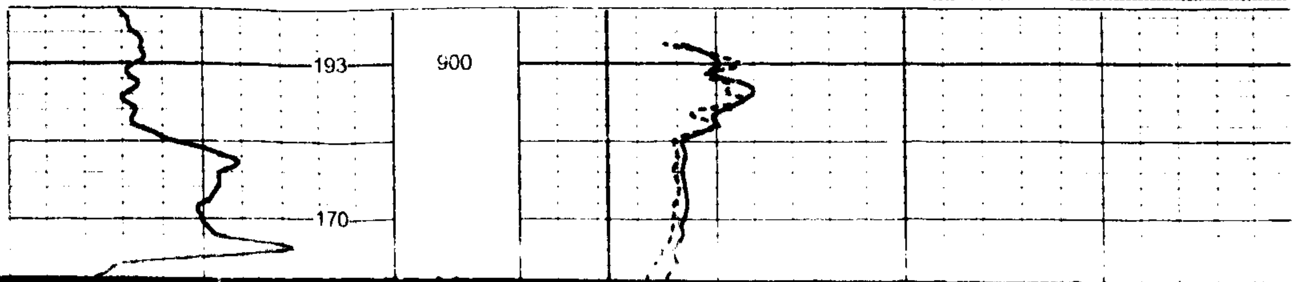
0 GAMMA RAY (GAPI) 100	10 Y-CALIPER (in) 30
	10 X-CALIPER (in) 30
	10 BIT SIZE (in) 30

MV Geophysical

REPEAT SECTION

Database File: jaf-lt1 db
Dataset Pathname: REPEAT
Presentation Format: xy1030-5 prs
Dataset Creation: Fri Apr 28 09 58 00 2006
Charted by: Depth in Feet scaled 1 240

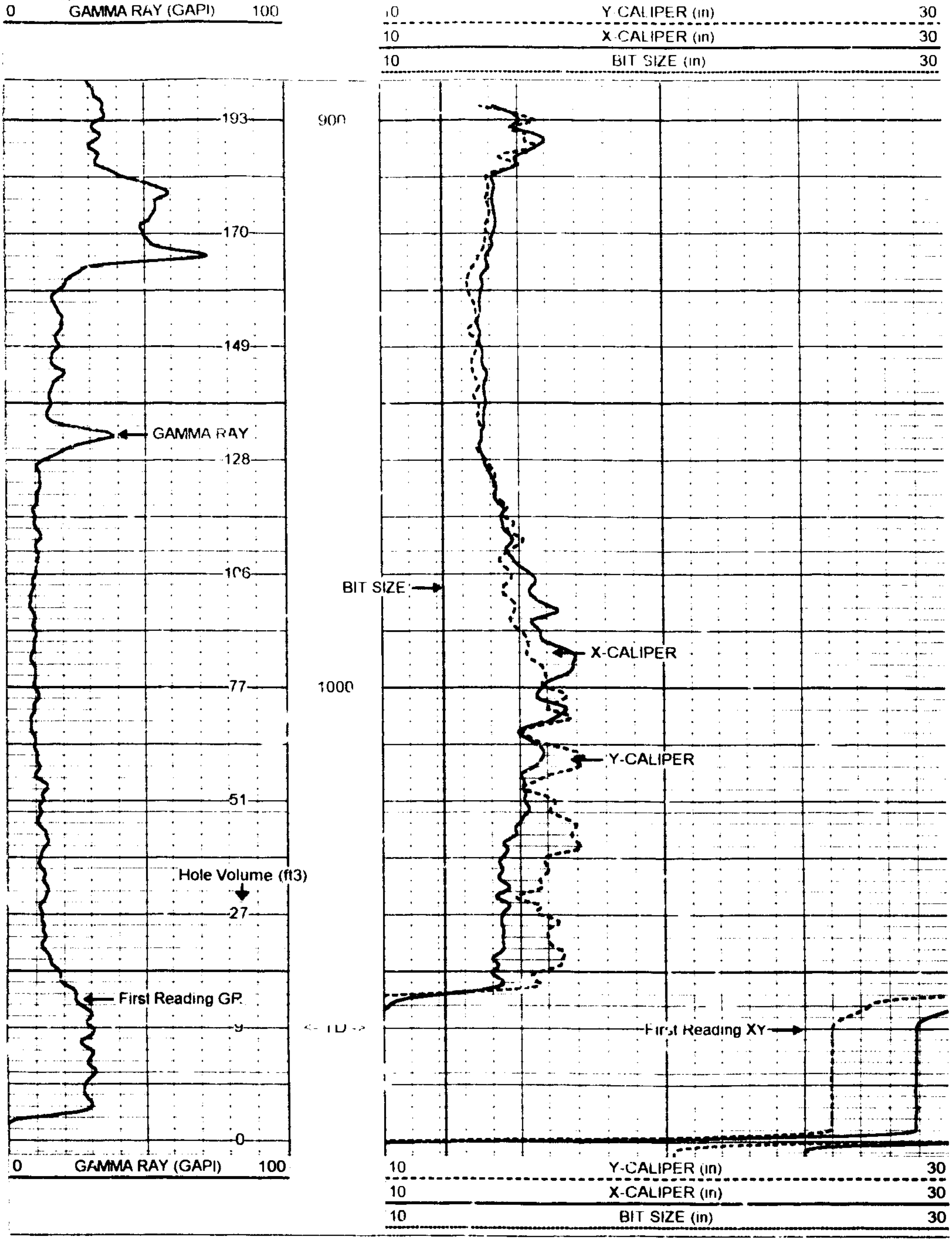
0 GAMMA RAY (GAPI) 100	10 Y-CALIPER (in) 30
	10 X-CALIPER (in) 30
	10 BIT SIZE (in) 30



MV Geophysical

REPEAT SECTION

Database File	jaf-lt1 db
Dataset Pathname	REPEAT
Presentation Format	xy 1030-5 prs
Dataset Creation	Fri Apr 28 09 58 00 2006
Charted by	Depth in Feet scaled 1 240



XY Caliper Calibration Report

Serial Number	01S		
Tool Model	XYCS		
Performed	Fri Apr 28 09 54 33 2006		
Small Ring	12 25	in	
Large Ring	33	in	
	X Caliper	Y Caliper	
Reading with Small Ring	658 3	681 5	cps
Reading with Large Ring	1108 5	1098 9	cps
Gain	0 0460906	0 0497125	
Offset	-18 0915	-21 6291	

Gamma Ray Calibration Report

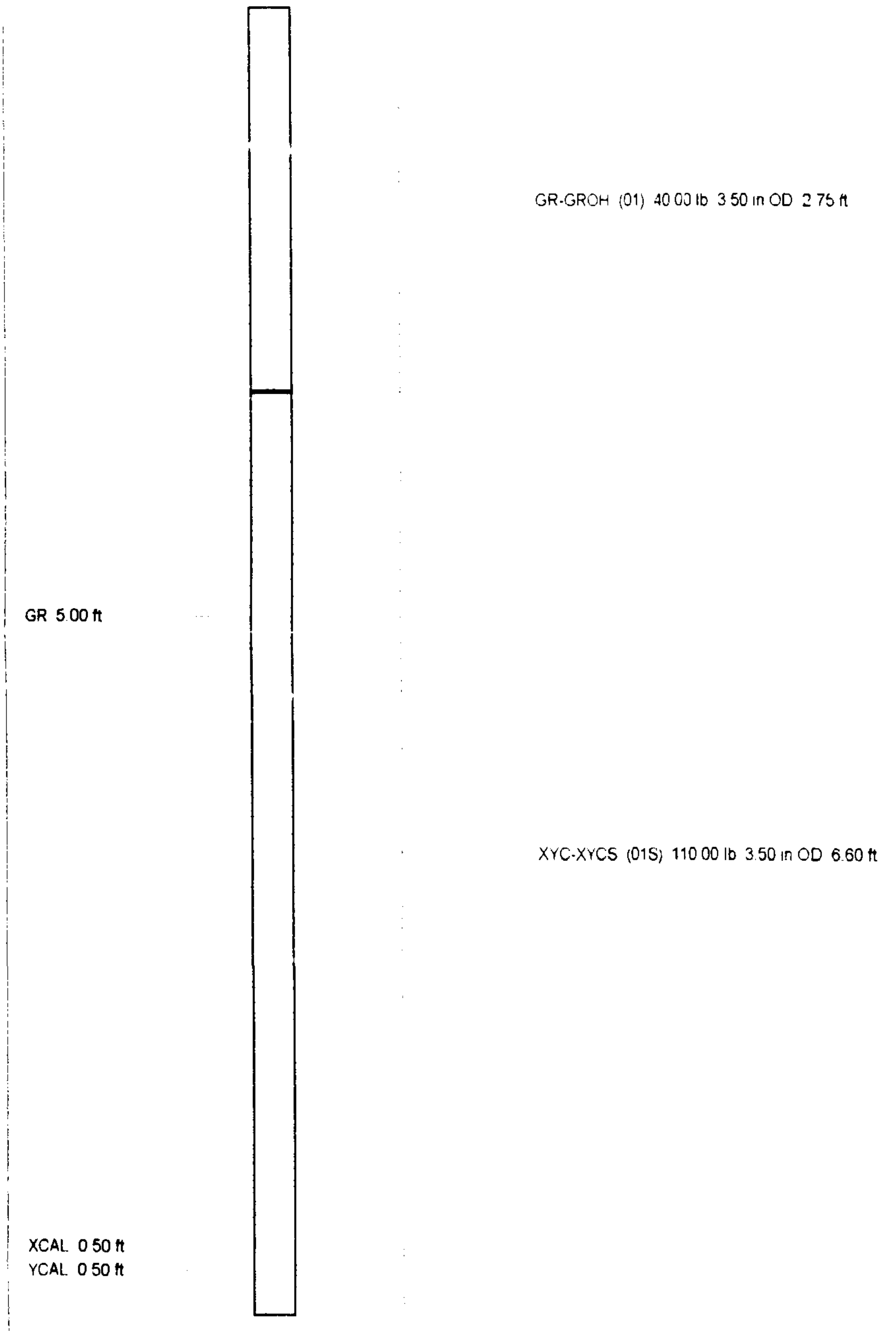
Serial Number	01	
Tool Model	GROH	
Performed	Fri Apr 28 09 42 29 2006	
Calibrator Value	[illegible]	GAPI

XY Caliper Calibration Report

Serial Number	01S		
Tool Model	XYCS		
Performed	Fri Apr 28 09 54 33 2006		
Small Ring	12 25	in	
Large Ring	33	in	
	X Caliper	Y Caliper	
Reading with Small Ring	658 3	681 5	cps
Reading with Large Ring	1108 5	1098 9	cps
Gain	0 0460906	0 04[illegible]125	
Offset	-18 0915	-21 [illegible]291	

Gamma Ray Calibration Report

Serial Number	01	
Tool Model	GROH	
Performed	Fri Apr 28 09 42 29 2006	
Calibrator Value	120	GAPI
Background Reading	3 5691	cps
Calibrator Reading	123 117	cps
Sensitivity	1 00378	GAPI/cps



Dataset	run1/pass3
Total Length	9 35 ft
Total Weight	150 00 lb
O D	3 50 in

Gerhardt M.
Witt
& Associates, Inc.

APPENDIX E

STEP-DRAWDOWN TEST RESULTS

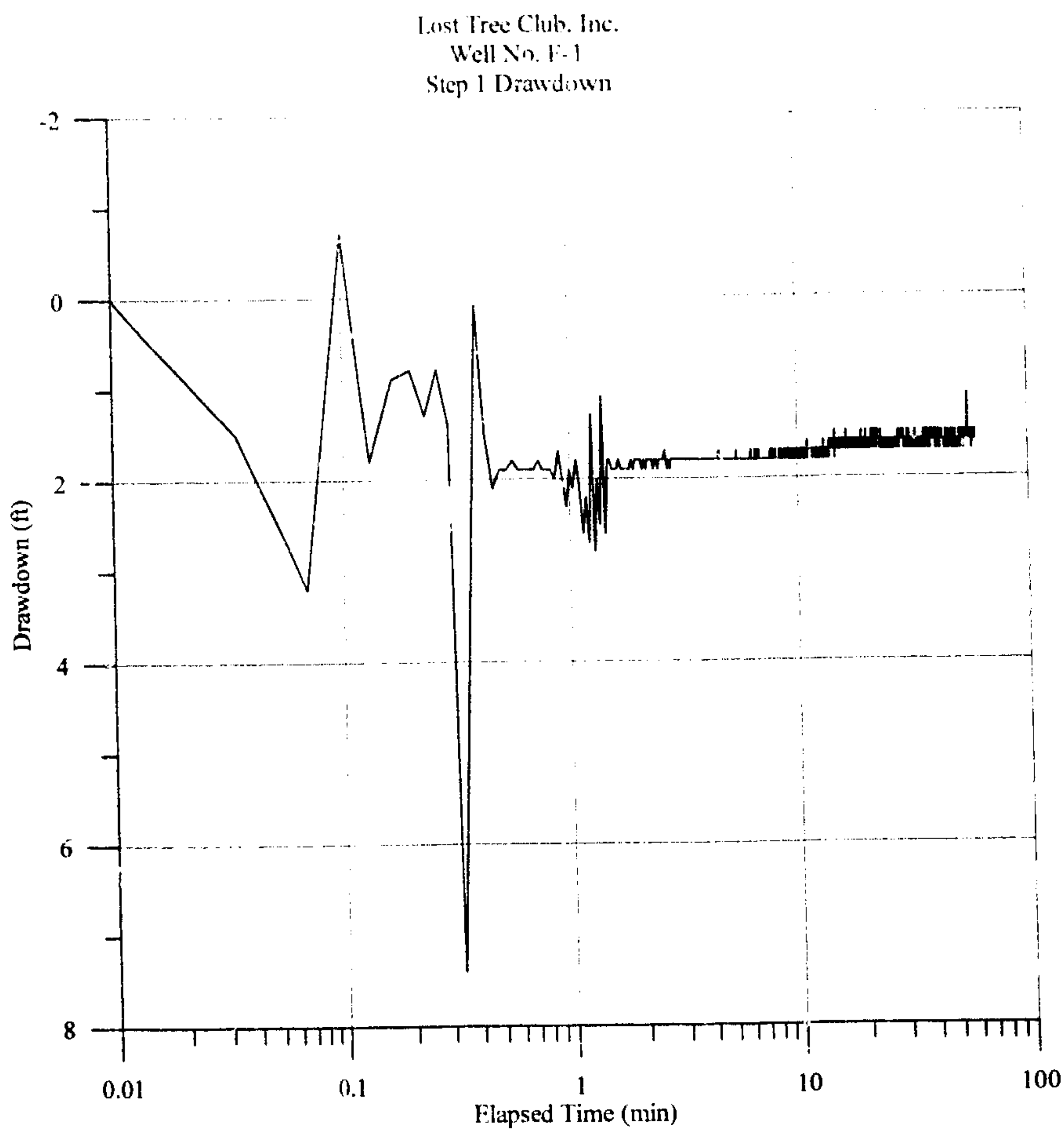
Lost Tree Club, Inc.
Well No. F-1
Step Drawdown Test Results

ET (min)	Step 1		Step 2		Step 3	
	Drawdown (ft)	Recovery (ft)	Drawdown (ft)	Recovery (ft)	Drawdown (ft)	Recovery (ft)
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1	1.9	1.8	18.4	30.0	50.2	44.6
2	1.9	1.9	31.3	30.3	50.9	50.7
3	1.8	1.7	31.8	[illegible]	51.4	51.1
4	1.8	1.8	31.8	30.6	51.7	51.1
5	1.8	1.8	31.2	30.7	51.6	51.2
6	1.8	1.9	31.4	30.8	51.5	51.3
7	1.8	1.8	31.5	30.8	51.6	51.4
8	1.7	1.8	31.1	30.8	51.8	51.4
9	1.7	1.9	31.5	30.8	51.7	51.5
10	[illegible]	1.8	31.4	30.8	51.9	51.5
11	1.7	1.8	31.4	30.9	51.8	51.5
12	1.8	1.9	31.5	30.9	51.9	51.6
13	1.7	1.9	31.6	30.8	52.1	51.6
14	1.7	1.9	31.4	30.9	52.0	51.6
15	1.6	1.9	31.5	31.0	51.8	51.6
16	1.6	1.9	31.5	31.0	52.1	51.7
17	1.6	1.9	31.3	30.9	51.9	51.7
18	1.7	1.9	31.1	31.0	52.1	51.7
19	1.7	1.9	31.2	31.0	52.0	51.7
20	1.6	1.9	31.1	30.9	51.8	51.7
21	1.6	1.9	31.4	31.0	51.8	51.7
22	1.5	1.9	31.1	31.0	52.1	51.8
23	1.6	1.9	31.4	31.0	52.0	51.8
24	1.6	1.9	31.4	31.0	52.0	51.8
25	1.6	1.9	31.8	31.0	51.9	51.8
26	1.7	1.9	31.4	31.0	52.0	51.8
27	1.6	1.9	31.2	31.0	51.9	51.8
28	1.6	1.9	31.7	31.0	52.0	51.8
29	1.6	2.0	31.4	31.0	52.2	51.8
30	1.6	1.9	31.3	31.0	51.9	51.8
31	1.6	1.9	31.5	31.0	51.9	51.8
32	1.6	1.9	[illegible]	[illegible]	51.9	51.8
33	1.6	2.0	31.6	31.0	52.0	51.9
34	1.6	1.9	31.4	31.0	52.0	51.8
35	1.6	1.9	31.4	31.0	52.0	51.8
36	1.6	1.9	31.6	31.1	52.2	51.8
37	1.6	2.0	31.4	31.1	51.9	51.9
38	1.6	1.9	31.2	31.1	51.8	51.8
39	1.5	1.9	31.5	31.1	51.9	51.8
40	1.6	1.9	31.3	31.1	51.7	51.8
41	1.6	1.9	31.4	31.1	51.9	51.8
42	1.6	1.9	31.3	31.1	51.9	51.8
43	1.6	1.9	31.3	31.1	51.9	51.9
44	1.6	2.0	31.5	31.1	51.9	51.9
45	1.6	1.9	31.1	31.1	51.9	51.9
46	1.6	2.0	31.1	31.1	52.0	51.9
47	1.6	1.9	31.1	31.1	51.9	51.9
48	1.6	1.9	31.1	31.1	52.0	51.9
49	1.6	2.0	31.0	31.1	51.6	51.9
50	1.7	2.0	31.4	31.1	52.0	51.9
51	1.6	1.9	30.8	31.1	52.0	51.9
52	1.6	1.9	31.1	31.1	51.9	51.9
53	1.5	2.0	31.1	31.1	52.0	51.9
54	1.6	2.0	31.1	31.1	51.8	51.9
55	1.6	2.0	31.1	31.1	52.0	51.9
56	1.6	2.0	31.3	31.1	51.9	51.9
57	1.6	2.0	31.3	31.1	51.9	52.0
58	1.6	2.0	31.2	31.1	52.0	52.0
59	1.6	2.0	31.2	31.1	52.0	51.9
60	1.5	2.0	31.4	31.1	51.9	51.9
61		1.9		31.1		51.9

Gerhardt M. Witt & Associates, Inc.

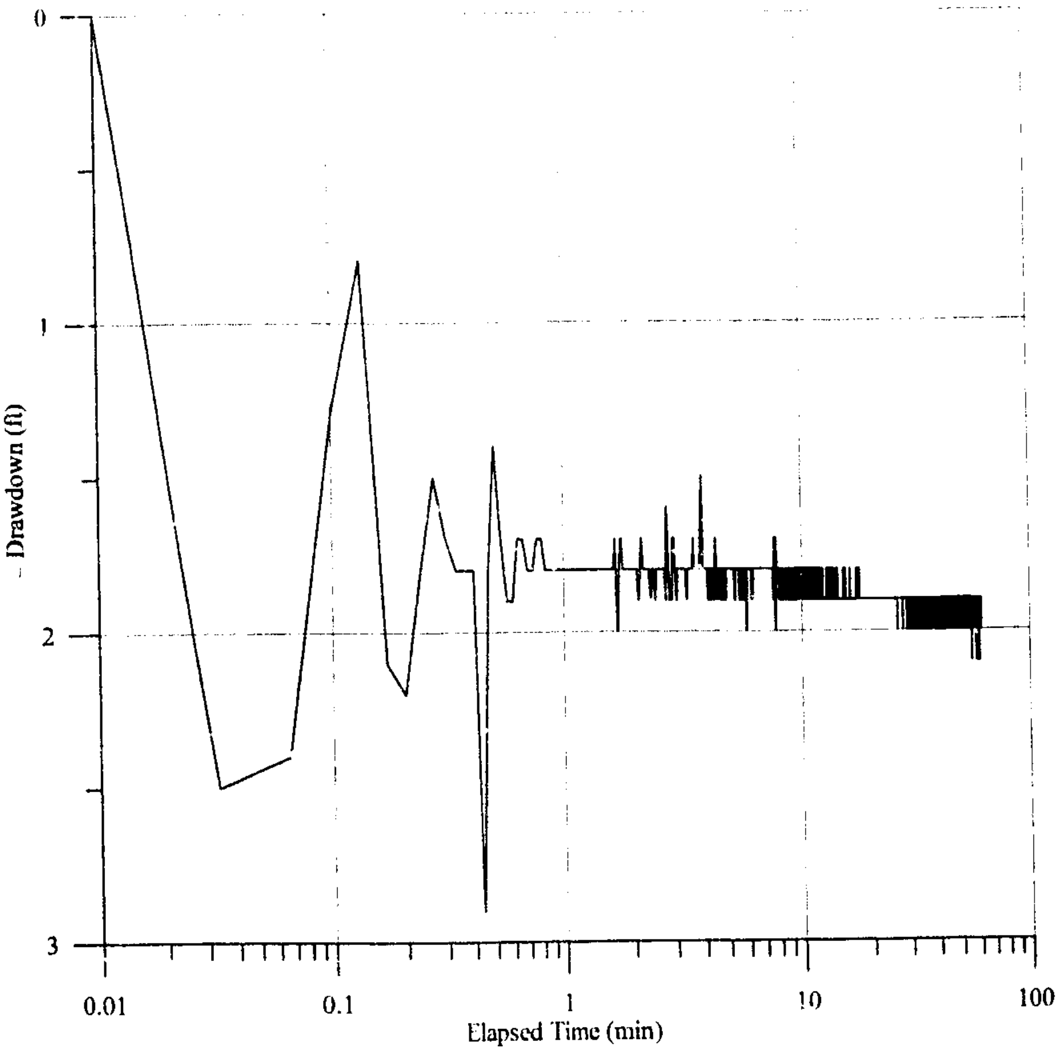
APPENDIX F

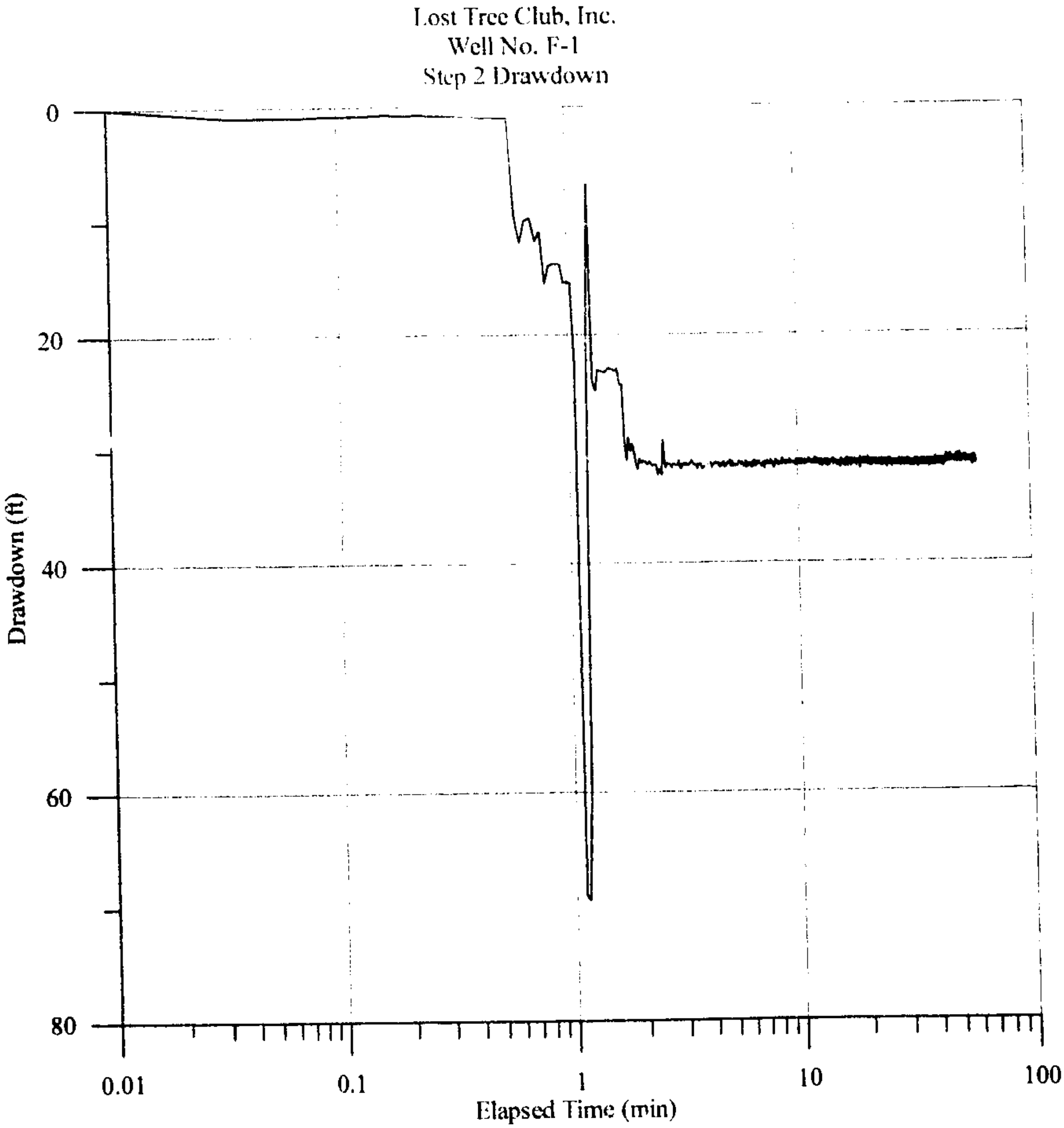
STEP-DRAWDOWN GRAPHS



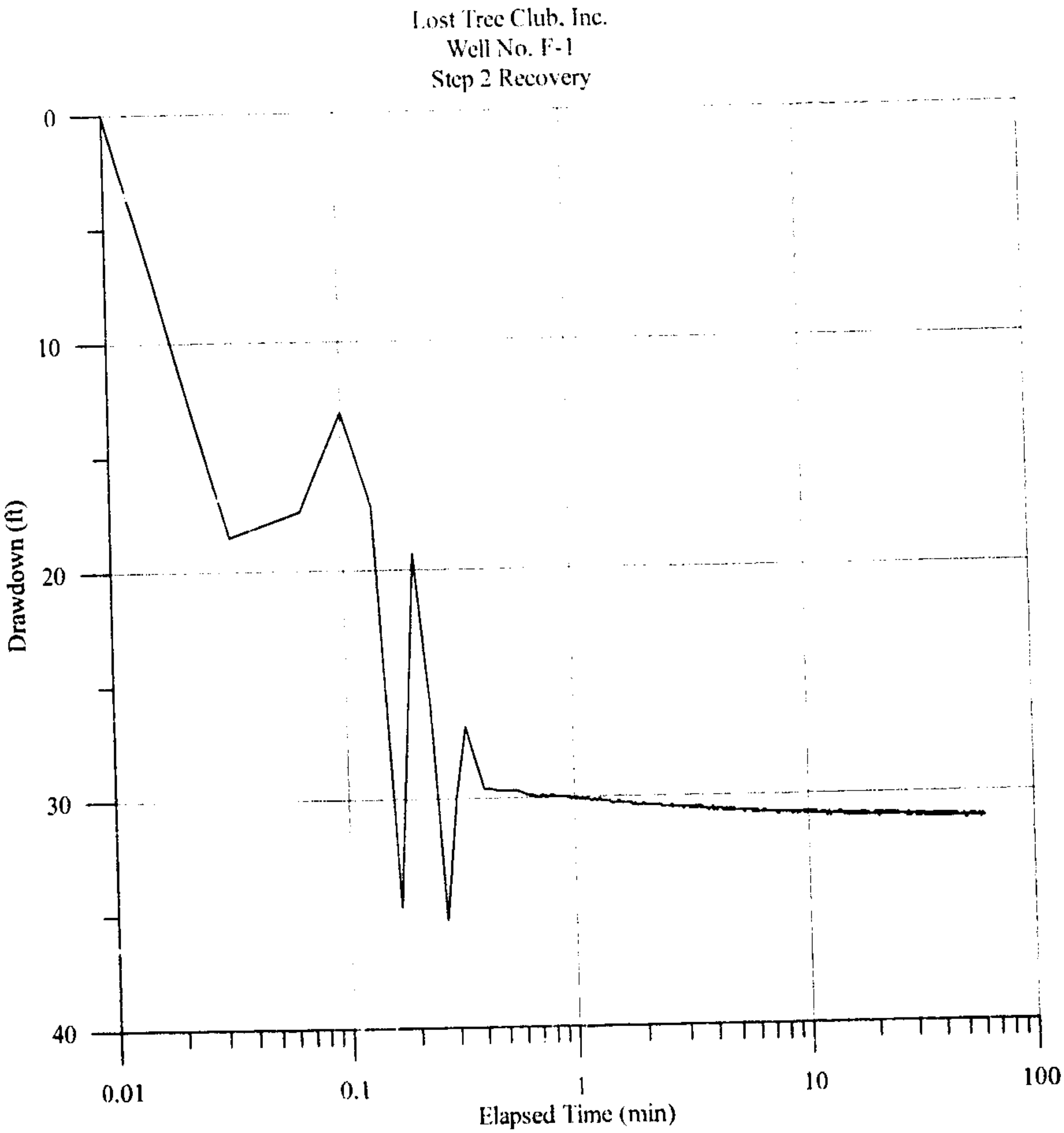
Lost Tree Club, Inc.
Well No. F-1
Step 1 Drawdown
-2
0
2
4
6
8
Drawdown (ft)
0.01
0.1
1
10
100
Elapsed Time (min)

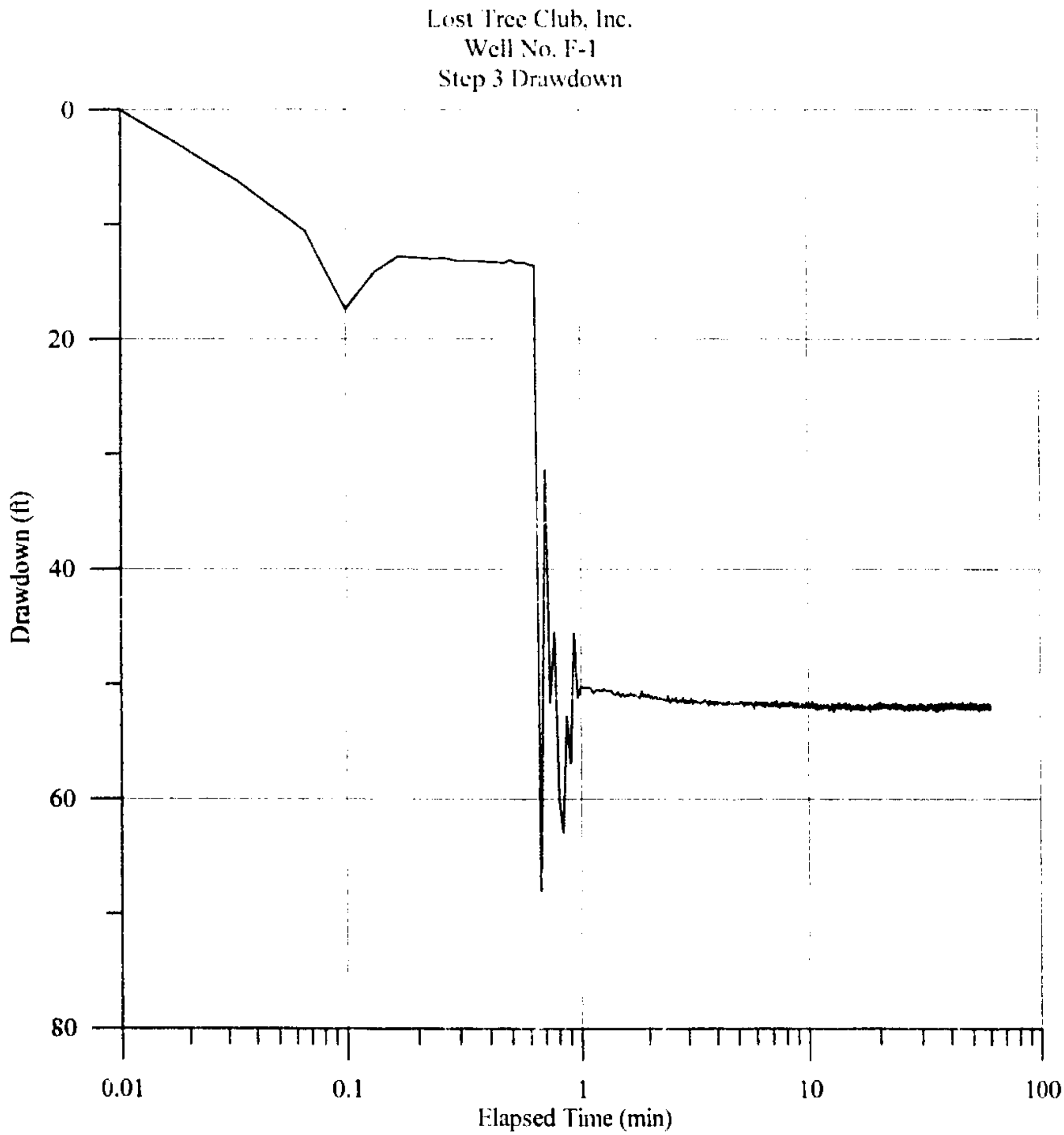
Lost Tree Club, Inc.
Well No. F-1
Step 1 Recovery

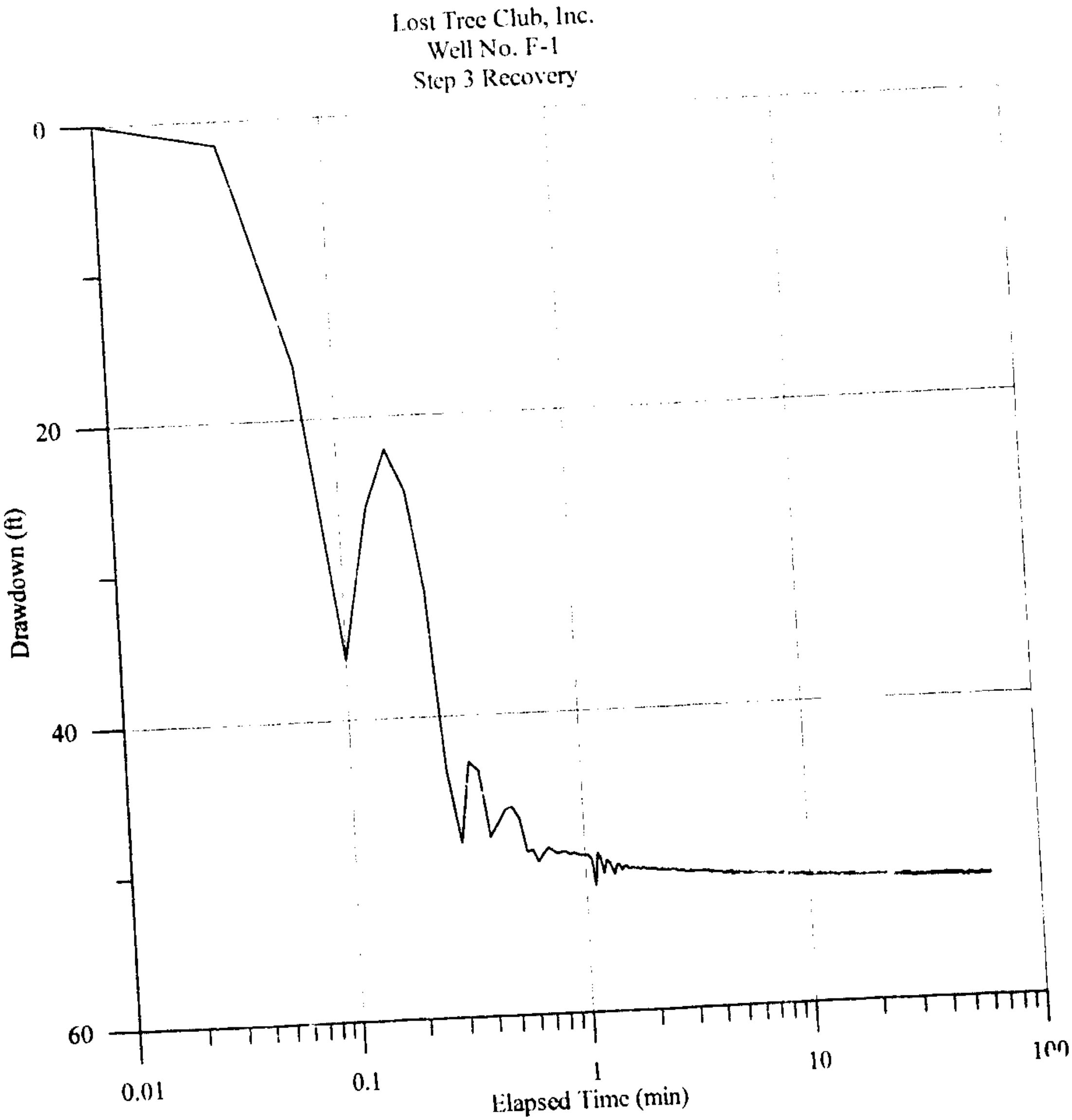




Lost Tree Club, Inc.
Well No. F-1
Step 2 Drawdown
Drawdown (ft)
0
20
40
60
80
0.01
0.1
1
10
100
Elapsed Time (min)


Lost Tree Club, Inc.
Well No. F-1
Step 2 Recovery
Drawdown (ft)
0
10
20
30
40
0.01
0.1
1
10
100
Elapsed Time (min)


Lost Tree Club, Inc.
Well No. F-1
Step 3 Drawdown
Drawdown (ft)
0
20
40
60
80
0.01
0.1
1
10
100
Elapsed Time (min)



Lost Tree Club, Inc.
Well No. F-1
Step 3 Recovery
0
20
40
60
Drawdown (ft)
0.01
0.1
1
10
100
Elapsed Time (min)

Gerhardt M. Witt & Associates, Inc.

APPENDIX G

RO WATER QUALITY

Jupiter
Environmental Laboratories, Inc.

Jupiter Environmental Laboratories, Inc.
150 S. Old Dixie Highway
Jupiter, FL 33458
Phone: (561)575-0030
Fax: (561)575-4118
www.jupiterlabs.com
clientservices@jupiterlabs.com

October 9, 2006

Gerhardt M Witt
Gerhardt M. Witt & Associates
1495 Forest Hill Boulevard #F
West Palm Beach, FL 33406

RE: LOG# 616891
Project ID: Lost Tree Concentrate
COC# 16891

Dear Gerhardt Witt:

Enclosed are the analytical results for sample(s) received by the laboratory on Friday, September 22, 2006. Results reported herein conform to the most current NELAC standards, where applicable, unless indicated by * in the body of the report.

The enclosed Chain of Custody is a component of this package and should be retained with the package and incorporated therein.

Results for all solid matrices are reported in dry weight unless otherwise noted. Results for all liquid matrices are reported as received in the laboratory unless otherwise noted.

Samples are disposed of after 30 days of their receipt by the laboratory unless archiving is requested in writing. The laboratory maintains the right to charge storage fees for archived samples.

Certain analyses are subcontracted to outside NELAC certified laboratories, please see the Footnotes section of this report for NELAC certification numbers of laboratories used.

A Statement of Qualifiers is available upon request.

If you have any questions concerning this report, please feel free to contact me.

Sincerely,

Pooram Kalkat for
Kacia Baldwin
kbaldwin@jupiterlabs.com

Enclosures

FDOH# E86546

CERTIFICATE OF ANALYSIS

Jupiter
Environmental Laboratories, Inc.

Jupiter Environmental Laboratories, Inc.
150 S. Old Dixie Highway
Jupiter, FL 33458
Phone: (561)575-0...
Fax: (561)575-41..

SAMPLE ANALYTE COUNT

LOG# 616891
Project ID: Lost Tree Concentrate

Lab ID	Sample ID	Method	Analytes Reported
616891001	RO Concentrate	Calc.	2
		EPA 120.1	1
		EPA 130.1	1
		EPA 150.1	1
		EPA 160.1	1
		EPA 200.8 (Total)	6
		EPA 310.2	2
		EPA 325.2	1
		EPA 353.1	1
		EPA 365.1	1
		EPA 375.4	1
		EPA 6020	1
616891002	RO Permeate	Calc.	2
		EPA 120.1	1
		EPA 130.1	1
		EPA 150.1	1
		EPA 160.1	1
		EPA 200.8 (Total)	6
		EPA 310.2	2
		EPA 325.2	1
		EPA 353.1	1
		EPA 365.1	1
		EPA 375.4	1
		EPA 6020	1
616891003	RO Tank	Calc.	2
		EPA 120.1	1
		EPA 130.1	1
		EPA 150.1	1
		EPA 160.1	1
		EPA 200.8 (Total)	6
		EPA 310.2	2
		EPA 325.2	1
		EPA 353.1	1
		EPA 365.1	1

Report ID: 616891 - 227122
10/9/2006

FDOH# E86546

CERTIFICATE OF ANALYSIS

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Environmental Laboratories, Inc.

Jupiter Environmental Laboratories, Inc.
150 S. Old Dixie Highway
Jupiter, FL 33458
Phone: (561)575-0030
Fax: (561)575-4118

SAMPLE ANALYTE COUNT

LOG# 616891
Project ID: Lost Tree Concentrate

Lab ID	Sample ID	Method	Analytes Reported
616891003	RO Tank	EPA 375.4	1
		EPA 6020	1

Report ID: 616891 - 227122
10/9/2006

FDOH# E86546

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Fax: (561)575-4118

SAMPLE SUMMARY

LOG# 616891
Project ID: Lost Tree Concentrate

Lab ID	Sample ID	Matrix	Date Collected	Date Received
616891001	RO Concentrate	Aqueous Liquid	9/22/2006 10:41	9/22/2006 16:20
616891002	RO Permeate	Aqueous Liquid	9/22/2006 10:57	9/22/2006 16:20
616891003	RO Tank	Aqueous Liquid	9/22/2006 14:14	9/22/2006 16:20

FDOH# E86546

CERTIFICATE OF ANALYSIS

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Jupiter
Environmental Laboratories, Inc.

ANALYTICAL RESULTS

LOG# 616891
Project ID: Lost Tree Concentrate

Lab ID: 616891001
Sample ID: RO Concentrate

Date Received: 9/22/2006
Date Collected: 9/22/2006
Matrix: Aqueous Liquid

Parameters	Results	Units	Report Limit	MDL	DF	Prepared	By	Analyzed	By	Qual	CAS
Analysis Desc: Conductivity by EPA 120.1 [Field] (W) — Analytical Method: EPA 120.1											
Conductivity	13000	umhos/cm			1			09/22/06	BFM		
Analysis Desc: Hardness by EPA 130.1 [REF] (W) — Analytical Method: EPA 130.1											
Hardness as CaCO3	3800	mg/L	750		.5			10/03/06	ESC		
Analysis Desc: TDS by EPA 160.1 [REF] (W) — Analytical Method: EPA 160.1											
Total Dissolved Solids	[illegible]	mg/L	1.0		1			09/29/06	ESC		
Analysis Desc: Nitrate by EPA 353.1 (W) — Analytical Method: EPA 353.1											
Nitrate	U	mg/L	0.10		1			09/23/06	ESC		
Analysis Desc: Phosphorus by EPA 365.1 [REF] (W) — Analytical Method: EPA 365.1											
Phosphorus	U	mg/L	0.10		1			09/26/06	ESC		7723-14-0
Analysis Desc: pH by EPA 150.1 (Field) — Analytical Method: EPA 150.1											
pH	7.5	su			1			09/22/06	BFM		
Analysis Desc: Chloride by EPA 325.2 (W) — Analytical Method: EPA 325.2											
Chloride	4500	mg/L	50		100			09/27/06	SS		16887-00-6
Analysis Desc: Sulfate by 375.4 (W) — Analytical Method: EPA 375.4											
Sulfate	1300	mg/L	100		100			09/28/06	TG	J4	14808-79-8
Analysis Desc: Alkalinity, EPA 310.2 (W) — Analytical Method: EPA 310.2											
Alkalinity	450	mg/L	50		10			09/27/06	SS	J4	
Alkalinity-Bicarbonate	490	mg/L	10		1			10/06/06	ESC		
Analysis Desc: SAR by Calculation [REF] — Analytical Method: Calc.											
Sodium Absorption Ratio (SAR)	8.4				1			10/09/06	PK		
Residual Sodium Carbonate*	13				1			10/09/06	PK		
Analysis Desc: EPA 6020 Boron by ICP/MS (W) — Preparation Method: EPA 3010; Analytical Method: EPA 6020											

Report ID: 616891 - 227122
10/9/2006

FDOH# E86546

CERTIFICATE OF ANALYSIS

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Jupiter
Environmental Laboratories, Inc.

ANALYTICAL RESULTS

LOG# 616891
Project ID: Lost Tree Concentrate

Lab ID: 616891001
Sample ID: RO Concentrate
Date Received: 9/22/2006
Date Collected: 9/22/2006
Matrix: Aqueous Liquid

Parameters	Results	Units	Report Limit	MDL	DF	Prepared	By	Analyzed	By	Qual	CAS
Boron	U	mg/L	0.0050	0.0014	1	09/25/06	ZS	09/27/06	ZS		7440-42-8
Analysis Desc: EPA 200.8 Metals (W)			Analytical Method: EPA 200.8 (Total)								
Manganese	U	mg/L	0.00017	0.000085	1	09/25/06	ZS	09/25/06	ZS		7439-96-5
Magnesium	100	mg/L	0.00082	0.00041	1	09/25/06	ZS	09/25/06	ZS		7439-95-4
Potassium	19	mg/L	0.0068	0.0034	1	09/25/06	ZS	09/25/06	ZS		7440-09-7
Calcium	41	mg/L	0.048	0.024	1	09/25/06	ZS	09/25/06	ZS		7440-70-2
Iron	0.029	mg/L	0.020	0.010	1	09/25/06	ZS	09/25/06	ZS		7439-89-6
Sodium	440	mg/L	0.0070	0.0035	1	09/27/06	ZS	09/27/06	ZS		7440-23-5

Report ID: 616891 - 227122
10/5/2006

FDOH# E86546

CERTIFICATE OF ANALYSIS

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Jupiter
Environmental Laboratories, Inc.

ANALYTICAL RESULTS

LOG# 616891
Project ID: Lost Tree Concentrate

Lab ID: 616891002 Date Received 9/22/2006 Matrix: Aqueous Liquid
Sample ID: RO Permeate Date Collected 9/22/2006

Parameters	Results	Units	Report Limit	MDL	DF	Prepared	By	Analyzed	By	Qual	CAS
Analysis Desc: Conductivity by EPA 120.1 [Field] (W)	Analytical Method: EPA 120.1										
Conductivity	390	umhos/cm			1			09/22/06	BFM		
Analysis Desc: Hardness by EPA 130.1 [REF] (W)	Analytical Method: EPA 130.1										
Hardness as CaCO3	U	mg/L	30		1			10/03/06	ESC		
Analysis Desc: TDS by EPA 160.1 [REF] (W)	Analytical Method: EPA 160.1										
Total Dissolved Solids	160	mg/L	10		1			09/29/06	ESC		
Analysis Desc: Nitrate by EPA 353.1 (W)	Analytical Method: EPA 353.1										
Nitrate	U	mg/L	0.10		1			09/23/06	ESC		
Analysis Desc: Phosphorus by EPA 365.1 [REF] (W)	Analytical Method: EPA 365.1										
Phosphorus	U	mg/L	0.10		1			09/26/06	ESC		7723-14-0
Analysis Desc: pH by EPA 150.1 (Field)	Analytical Method: EPA 150.1										
pH	6.9	su			1			09/22/06	BFM		
Analysis Desc: Chloride by EPA 325.2 (W)	Analytical Method: EPA 325.2										
Chloride	79	mg/L	5.0		10			09/27/06	SS		16887-00-6
Analysis Desc: Sulfate by 375.4 (W)	Analytical Method: EPA 375.4										
Sulfate	13	mg/L	1.0		1			09/28/06	TG	J4	14808-79-8
Analysis Desc: Alkalinity, EPA 310.2 (W)	Analytical Method: EPA 310.2										
Alkalinity	17	mg/L	5.0		1			09/27/06	SS	J4	
Alkalinity-Bicarbonate	35	mg/L	10		1			10/06/06	ESC		
Analysis Desc: SAR by Calculation [REF]	Analytical Method: Calc.										
Sodium Absorption Ratio (SAR)	1.1				1			10/09/06	PK		
Residual Sodium Carbonate*	0.90				1			10/09/06	PK		
Analysis Desc: EPA 6020 Boron by ICP/MS (W)	Preparation Method: EPA 3010 Analytical Method: EPA 6020										

Report ID: 616891 - 227122
10/3/2006

FDOH# E86546

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ANALYTICAL RESULTS

LOG# 616891
Project ID: Lost Tree Concentrate

Lab ID. **616891002**
Sample ID: **RO Permeate**

Date Received: 9/22/2006
Date Collected: 9/22/2006
Matrix: Aqueous Liquid

Parameters	Results	Units	Report Limit	MDL	DF	Prepared	By	Analyzed	By	Qual	CAS
Boron	U	mg/L	0.0050	0.0014	1	09/25/06	ZS	09/27/06	ZS		7440-42-8
Analysis Desc: EPA 200.8 Metals (W)			Analytical Method: EPA 200.8 (Total)								
Manganese	U	mg/L	0.00017	0.000085	1	09/25/06	ZS	09/25/06	ZS		7439-96-5
Magnesium	2.1	mg/L	0.00082	0.00041	1	09/25/06	ZS	09/25/06	ZS		7439-95-4
Potassium	0.33	mg/L	0.0068	0.0034	1	09/25/06	ZS	09/25/06	ZS		7440-09-7
Calcium	1.4	mg/L	0.048	0.024	1	09/25/06	ZS	09/25/06	ZS		7440-70-2
Iron	U	mg/L	0.020	0.010	1	09/25/06	ZS	09/25/06	ZS		7439-89-6
Sodium	8.7	mg/L	0.0070	0.0035	1	09/27/06	ZS	09/27/06	ZS		7440-23-5

Report ID: 616891 - 227122
10/9/2006

FDOH# E86546

CERTIFICATE OF ANALYSIS

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ANALYTICAL RESULTS

LOG# 616891
Project ID: Lost Tree Concentrate

Lab ID: 616891003
Sample ID: RO Tank
Date Received: 9/22/2006
Date Collected: 9/22/2006
Matrix: Aqueous Liquid

Parameters	Results	Units	Report Limit	MDL	DF	Prepared	By	Analyzed	By	Qual	CAS
Analysis Desc: Conductivity by EPA 120.1 [Field] (W) — Analytical Method: EPA 120.1											
Conductivity	400	umhos/cm			1			09/22/06	BFM		
Analysis Desc: Hardness by EPA 130.1 [REF] (W) — Analytical Method: EPA 130.1											
Hardness as CaCO3	32	mg/L	30		1			10/03/06	ESC		
Analysis Desc: TDS by EPA 160.1 [REF] (W) — Analytical Method: EPA 160.1											
Total Dissolved Solids	190	mg/L	1.0		1			09/29/06	ESC		
Analysis Desc: Nitrate by EPA 353.1 (W) — Analytical Method: EPA 353.1											
Nitrate	U	mg/L	0.10		1			09/23/06	ESC		
Analysis Desc: Phosphorus by EPA 365.1 [REF] (W) — Analytical Method: EPA 365.1											
Phosphorus	U	mg/L	0.10		1			09/26/06	ESC		7723-14-0
Analysis Desc: pH by EPA 150.1 (Field) — Analytical Method: EPA 150.1											
pH	7.1	su			1			09/22/06	BFM		
Analysis Desc: Chloride by EPA 325.2 (W) — Analytical Method: EPA 325.2											
Chloride	92	mg/L	5.0		10			09/27/06	SS		16887-00-6
Analysis Desc: Sulfate by 375.4 (W) — Analytical Method: EPA 375.4											
Sulfate	23	mg/L	1.0		1			09/28/06	TG	J4	14808-79-8
Analysis Desc: Alkalinity, EPA 310.2 (W) — Analytical Method: EPA 310.2											
Alkalinity	5.3	mg/L	5.0		1			09/27/06	SS	J4	
Alkalinity-Bicarbonate	18	mg/L	10		1			10/06/06	ESC		
Analysis Desc: SAR by Calculation [REF] — Analytical Method: Calc.											
Sodium Absorption Ratio (SAR)	1.0				1			10/09/06	PK		
Residual Sodium Carbonate*	0.092				1			10/09/06	PK		
Analysis Desc: EPA 6020 Boron by ICP/MS (W) — Preparation Method: EPA 3010; Analytical Method: EPA 6020											

Report ID: 616891 - 227122
10/9/2006

FDOH# E86546
CERTIFICATE OF ANALYSIS

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Jupiter
Environmental Laboratories, Inc.

Jupiter Environmental Laboratories, Inc.
150 S. Old Dixie Highway
Jupiter, FL 33458
Phone: (561)575-0030
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ANALYTICAL RESULTS

LOG# 616891
Project ID: Lost Tree Concentrate

Lab ID:	616891003	Date Received:	9/22/2006
Sample ID:	RO Tank	Date Collected:	9/22/2006
Matrix:	Aqueous Liquid		

Parameters	Results	Units	Report Limit	MDL	DF	Prepared	By	Analyzed	By	Qual	CAS
Boron	U	mg/L	0.0050	0.0014	1	09/25/06	ZS	09/27/06	ZS		7440-42-8
Analysis Desc: EPA 200.8 Metals (W)	Analytical Method: EPA 200.8 (Total)										
Manganese	U	mg/L	0.00017	0.000085	1	09/25/06	ZS	09/25/06	ZS		7439-96-5
Magnesium	3.1	mg/L	0.00082	0.00041	1	09/25/06	ZS	09/25/06	ZS		7439-95-4
Potassium	0.40	mg/L	0.0068	0.0034	1	09/25/06	ZS	09/25/06	ZS		7440-09-7
Calcium	2.5	mg/L	0.048	0.024	1	09/25/06	ZS	09/25/06	ZS		7440-70-2
Iron	0.014I	mg/L	0.020	0.010	1	09/25/06	ZS	09/25/06	ZS		7439-89-6
Sodium	10	mg/L	0.0070	0.0035	1	09/27/06	ZS	09/27/06	ZS		7440-23-5

Report ID: 616891 - 227122
10/9/2[illegible]

FDOH# E86546

CERTIFICATE OF ANALYSIS

Jupiter
Environmental Laboratories, Inc.

Jupiter Environmental Laboratories, Inc.
150 S. Old Dixie Highway
Jupiter, FL 33458
Phone: (561)575-0030
Fax: (561)575-4118

ANALYTICAL RESULTS QUALIFIERS

LOG# 616891
Project ID: Lost Tree Concentrate

PARAMETER QUALIFIERS

J4 MS/MSD recovery exceeded control limits due to matrix interference. LCS/LCSD recovery was within acceptable range.

PROJECT COMMENTS

616891 "i" Flag indicates that the reported value is between the laboratory method detection limit and the practical quantitation limit.

SUBCONTRACTOR NELAC CERTIFICATION

616891 ESC = E87487

FDOH# E86546
CERTIFICATE OF ANALYSIS

nelac

Gerhardt M. Witt & Associates, Inc.

APPENDIX H

MONITOR WELLS WATER QUALITY

Jupiter

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Jupiter Environmental Laboratories, Inc.
150 S. Old Dixie Highway
Jupiter, FL 33458

Phone (561)575-0030
Fax (561)575-4118
www.jupiterlabs.com
clientservices@jupiterlabs.com

October 11 [illegible]006

Gerhardt M Witt
Gerhardt M. Witt & Associates,
1495 Forest Hill Boulevard #F
West Palm Beach, FL 33406

RE: LOG# 616890
Project ID: Lost Tree Quarterly MW's
COC# 16890

Dear Gerhardt Witt:

Enclosed are the analytical results for sample(s) received by the laboratory on Friday, September 2[illegible] [illegible] ported herein conform to the most current NELAC standards, where applicable, unless indicated by * in the bo[illegible]

The enclosed Chain of Custody is a component of this package and should be retained with the [illegible] herein.

Results for all solid matrices are reported in dry weight unless otherwise noted. Results for all [illegible] received in the laboratory unless otherwise noted.

Samples are disposed of after 30 days of their receipt by the laboratory unless archiving is reque[illegible] [illegible]atory maintains the right to charge storage fees for archived samples.

Certain analyses are subcontracted to outside NELAC certified laboratories, please see the Footnotes [illegible] this report for NELAC certification numbers of laboratories used.

A Statement of Qualifiers is available upon request.

If you have any questions concerning this report, please feel free to contact me.

Sincerely,

Poonam Kalkat for
Kacia Baldwin
kbaldwin@jupiterlabs.com

Enclosures

FDOH# E86546

CERTIFICATE OF ANALYSIS

nelac

Jupiter
Environmental Laboratories, Inc.

Jupiter Environmental Laboratories, Inc.
150 S. Old Dixie Highway
Jupiter, FL 33458
Phone: (561)575-0030
Fax: (561)575-4118

SAMPLE ANALYTE COUNT

LOG# 616890
Project ID: Lost Tree Quarterly MW's

Lab ID	Sample ID	Method	Analytes Reported
616890001	MWB-01	DEP SOP 10/03/83	1
		EPA 150.1	1
		EPA 160.1	1
		EPA 340.1	1
		EPA 376.1	1
		EPA 900.0	1
616890002	MWC-01	DEP SOP 10/03/83	1
		EPA 00-02	1
		EPA 150.1	1
		EPA 160.1	1
		EPA 340.1	1
		EPA 376.1	1

Report ID: 616890 - 227913
10/11/2006

FDOH# E86546
CERTIFICATE OF ANALYSIS

Jupiter Environmental Laboratories, Inc.
150 S. Old Dixie Highway
Jupiter, FL 33458
Phone: (561)575-0030
Fax: (561)575-4118

Jupiter
Environmental Laboratories, Inc.

SAMPLE SUMMARY

LOG# 616890
Project ID: Lost Tree Quarterly MW's

Lab ID	Sample ID	Matrix	Date Collected	Date Received
616890001	MWB-01	Aqueous Liquid	9/22/2006 11:40	9/22/2006 16:20
616890002	MWC-01	Aqueous Liquid	9/22/2006 13:04	9/22/2006 16:20

Report ID: 616890 - 227913
10/11/2006

FDOH# E86546
CERTIFICATE OF ANALYSIS

nelac

Jupiter Environmental Laboratories, Inc
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Jupiter, FL 33458
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Fax (561)575-4118

Jupiter
Environmental Laboratories, Inc

ANALYTICAL RESULTS

LOG# 616890
Project ID: Lost Tree Quarterly MW's

Lab ID: 616890001
Sample ID: MWB-01

Date Received: 9/22/2006
Date Collected: 9/22/2006 11:40
Matrix: Aquenus Liquid

Parameters	Results	Units	Report Limit	MDL	DF	Prepared	By	Analyzed	By	Qual	CAS
Analysis Desc: TDS by EPA 160.1 [REF] (W) — Analytical Method: EPA 160.1											
Total Dissolved Solids	880	mg/L	1.0		1			09/29/06	ESC		
Analysis Desc: Gross Alpha by EPA 900.0 [REF] — Analytical Method: EPA 900.0											
Gross Alpha	4.8+/-2.8	pCi/L	3.9		1			10/06/06	KNL		
Analysis Desc: pH by EPA 150.1 (Field) — Analytical Method: EPA 150.1											
pH	6.7	su			1			09/22/06	BFM		
Analysis Desc: Fluoride by EPA 340.1 (W) — Analytical Method: EPA 340.1											
Fluoride	0.50	mg/L	0.10		1			09/26/06	TG	J4	16984-48-8
Analysis Desc: Un-Ionized Ammonia by Calculation — Analytical Method: DEP SOP 10/03/83											
Un-Ionized Ammonia	0.00029	mg/L			1			10/09/06	PK		7664-41-7UN
Analysis Desc: Hydrogen Sulfide by EPA 376.1 [REF](W) — Analytical Method: EPA 376.1											
Hydrogen Sulfide	0.0010	mg/L	0.0010		1			09/25/06	FL		

Report ID: 616890 - 227913
10/11/2006

FDOH# E86546

CERTIFICATE OF ANALYSIS

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Jupiter
Environmental Laboratories, Inc.

ANALYTICAL RESULTS

LOG#: 616890
Project ID: Lost Tree Quarterly MW's

Lab ID: 616890002
Sample ID: MWC-01

Date Received: 9/22/2006
Date Collected: 9/22/2006
Matrix: Aqueous Liquid

Parameters	Results	Units	Report Limit	MDL	DF	Prepared	By	Analyzed	By	Qual	CAS
Analysis Desc: TDS by EPA 160.1 [REF] (W)	Analytical Method: EPA 160.1										
Total Dissolved Solids	580.0	mg/L	1.0		1			09/29/06	ESC		
Analysis Desc: pH by EPA 150.1 (Field	Analytical Method: EPA 150.1										
pH	6.8	su			1			09/22/06	BFM		
Analysis Desc: Fluoride by EPA 340.1 (W)	Analytical Method: EPA 340.1										
Fluoride	0.96	mg/L	0.10		1			09/26/06	TG	J4	16984-48-8
Analysis Desc: Un-Ionized Ammonia by Calculation	Analytical Method: DEP SOP 10/03/83										
Un-Ionized Ammonia	0.0056	mg/L			1			10/09/06	PK		7664-41-7UN
Analysis Desc: Hydrogen Sulfide by EPA 376.1 [REF](W)	Analytical Method: EPA 376.1										
Hydrogen Sulfide	0.0010	mg/L	0.0010		1			09/25/06	FL		
Analysis Desc: Gross Alpha by EPA 00-02 [REF]	Analytical Method: EPA 00-02										
Gross Alpha	12.5+/-1	pCi/L	0.50		1			10/09/06	KNL		

Report ID: 616890 - 227913
10/11/2006

FDOH# E86546

CERTIFICATE OF ANALYSIS

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Phone: (561)575-0030
Fax: (561)575-4118

ANALYTICAL RESULTS QUALIFIERS

LOG# 616890
Project ID: Lost Tree Quarterly MW's

PARAMETER QUALIFIERS

J4 MS/MSD recovery exceeded control limits due to matrix interference. LCS/LCSD recovery was within acceptable range.

SUBCONTRACTOR NELAC CERTIFICATION

616890	ESC = E87487
616890	FL = E83015
616890	KNL = E84025

FDOH# E86546
CERTIFICATE OF ANALYSIS

Gerhardt M.
Witt
& Associates, Inc.

APPENDIX I

SURFACE WATER QUALITY

Jupiter Environmental Laboratories, Inc.
150 S. Old Dixie Highway
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www.jupiterlabs.com
clientservices@jupiterlabs.com

Jupiter
Environmental Laboratories, Inc

October 11, 2006

Gerhardt M Witt
Gerhardt M. Witt & Associates,
1495 Forest Hill Boulevard #F
West Palm Beach, FL 33406

RE: LOG# 616888
Project ID: Lost Tree Quarterly SW's
COC# 16838

Dear Gerhardt Witt:

Enclosed are the analytical results for sample(s) received by the laboratory on Friday, September 22, 2006. Results reported herein conform to the most current NELAC standards, where applicable, unless indicated by * in the body of the report.

The enclosed Chain of Custody is a component of this package and should be retained with the package and incorporated therein.

Results for all solid matrices are reported in dry weight unless otherwise noted. Results for all liquid matrices are reported as received in the laboratory unless otherwise noted.

Samples are disposed of after 30 days of their receipt by the laboratory unless archiving is requested in writing. The laboratory maintains the right to charge storage fees for archived samples.

Certain analyses are subcontracted to outside NELAC certified laboratories, please see the Footnotes section of this report for NELAC certification numbers of laboratories used.

A Statement of Qualifiers is available upon request.

If you have any questions concerning this report, please feel free to contact me.

Sincerely,

Poonam Kalkat for
Kacia Baldwin
kbaldwin@jupiterlabs.com

Enclosures

FDOH# E86546
CERTIFICATE OF ANALYSIS

nelac

Jupiter Environmental Laboratories, Inc.
150 S. Old Dixie Highway
Jupiter, FL 33458
Phone: (561)575-0030
Fax: (561)575-4118

Jupiter
Environmental Laboratories, Inc.

SAMPLE ANALYTE COUNT

LOG# 616888
Project ID: Lost Tree Quarterly SW's

Lab ID	Sample ID	Method	Analytes Reported
616888001	Surface Water 1	DEP SOP 10/03/83	1
		EPA 00-02	1
		EPA 340.1	1
616888002	Surface Water 2	DEP SOP 10/03/83	1
		EPA 00-02	1
		EPA 340.1	1

Report ID: 616888 - 227906
10/11/2006

FDOH# E86546

CERTIFICATE OF ANALYSIS

nelac

Jupiter
Environmental Laboratories, Inc.

Jupiter Environmental Laboratories, Inc.
150 S. Old Dixie Highway
Jupiter, FL 33458
Phone: (561)575-0030
Fax: (561)575-4118

SAMPLE SUMMARY

LOG# 616888
Project ID: Lost Tree Quarterly SW's

Lab ID	Sample ID	Matrix	Date Collected	Date Received
616888001	Surface Water 1	Aqueous Liquid	9/22/2006 13:49	9/22/2006 16:20
616888002	Surface Water 2	Aqueous Liquid	9/22/2006 13:25	9/22/2006 16:20

FDOH# E86546

CERTIFICATE OF ANALYSIS

Jupiter
Environmental Laboratories, Inc.

Jupiter Environmental Laboratories, Inc
150 S. Old Dixie Highway
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Fax (561)575-4118

ANALYTICAL RESULTS

LOG# 616888
Project ID: Lost Tree Quarterly SW's

Lab ID: **616888001** Date Received: 9/22/2006 Matrix: Aqueous Liquid
Sample ID: **Surface Water 1** Date Collected: 9/22/2006

Parameters	Results	Units	Report Limit	MDL	DF	Prepared	By	Analyzed	By	Qual	CAS
Analysis Desc: Fluoride by EPA 340.1 (W)			Analytical Method: EPA 340.1								
Fluoride	4.0	mg/L	0.50		5			09/26/06	TG	J4	16984-48-8
Analysis Desc: Un-Ionized Ammonia by Calculation			Analytical Method: DEP SOP 10/03/83								
Un-Ionized Ammonia	0.027	mg/L			1			10/09/06	PK		7664-41-7UN
Analysis Desc: Gross Alpha by EPA 00-02 [REF]			Analytical Method: EPA 00-02								
Gross Alpha	1.4+/-0.4	pCi/L	0.50		1			10/09/06	KNL		

Report ID: 616888 - 227906
10/11/2006

FDOH# E86546

CERTIFICATE OF ANALYSIS

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ANALYTICAL RESULTS

LOG# 616888
Project ID: Lost Tree Quarterly SW's

Lab ID: **616888002**	Date Received: 9/22/2006	Matrix:	Aqueous Liquid
Sample ID: **Surface Water 2**	Date Collected: 9/22/2006		

Parameters	Results	Units	Report Limit	MDL	DF	Prepared	By	Analyzed	By	Qual	CAS
Analysis Desc: Fluoride by EPA 340.1 (W)	Analytical Method: EPA 340.1										
Fluoride	2.1	mg/L	0.50		5			09/26/06	TG	J4	16984-48-8
Analysis Desc: Un-Ionized Ammonia by Calculation	Analytical Method: DEP SOP 10/03/83										
Un-Ionized Ammonia	0.076	mg/L			1			10/09/06	PK		7664-41-7UN
Analysis Desc: Gross Alpha by EPA 00-02 [REF]	Analytical Method: EPA 00-02										
Gross Alpha	2.7+/-0.6	pCi/L	0.40		1			10/09/06	KNL		

FDOH# E86546

CERTIFICATE OF ANALYSIS

nelac

Jupiter Environmental Laboratories, Inc.
150 S. Old Dixie Highway
Jupiter, FL 33458
Phone: (561)575-0030
Fax: (561)575-4118

Jupiter
Environmental Laboratories, Inc.

ANALYTICAL RESULTS QUALIFIERS

LOG# 616888
Project ID: Lost Tree Quarterly SW's

PARAMETER QUALIFIERS

J4 MS/MSD recovery exceeded control limits due to matrix interference. LCS/LCSD recovery was within acceptable range.

SUBCONTRACTOR NELAC CERTIFICATION

616888 KNL = E84025

Report ID: 616888 - 227906
10/11/2006

FDOH# E86546

CERTIFICATE OF ANALYSIS

nelac