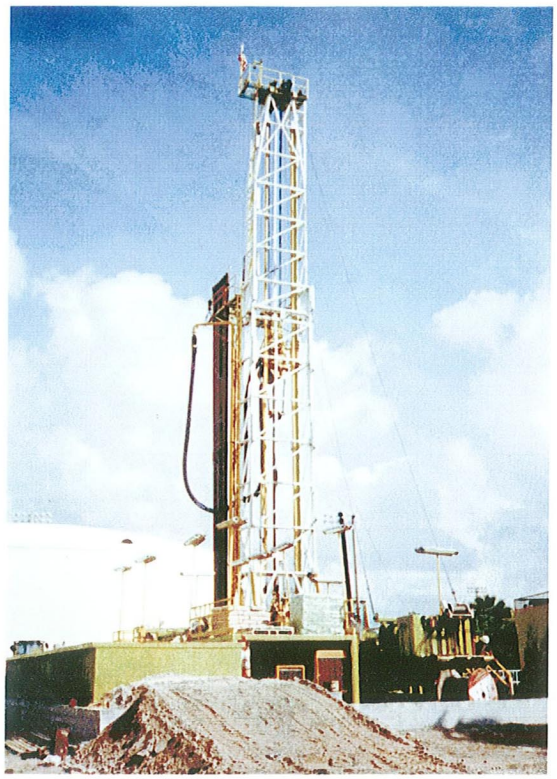

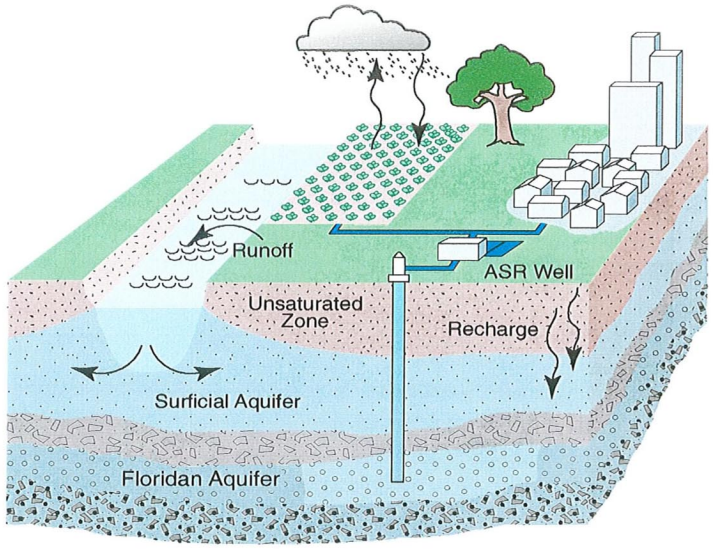

City of Sunrise

Springtree Water Treatment Plant
Aquifer Storage and Recovery System

Sunrise Project No. 403-6136

Well Construction Report

March 1998

with funding by the

MONTGOMERY WATSON

G-2919

MONTGOMERY WATSON

March 26, 1998

William Cocke, P.G.
UIC Program Manager
Florida Department of Environmental Protection
P.O. Box 15425
West Palm Beach, Florida 33416

SUBJECT: Springtree WTP Aquifer Storage and Recovery System
Construction Report and Request for Operational Approval
FDEP Permit No. UC-06-284951
Sunrise Project No. 403-6136
(Montgomery Watson Project No. 1324024.03093045/6.7.1)

Dear Mr. Cocke:

On behalf of the City of Sunrise, Montgomery Watson is pleased to submit four (4) copies of the subject Report detailing the construction and testing of the new Class V Aquifer Storage and Recovery (ASR) well system at the Springtree Water Treatment Plant. This report is submitted along with the associated Operation and Maintenance Manual, in support of a request to proceed with operational (cycle) testing of the system.

We trust that the information contained within these documents meets the requirements for operational testing approval as set forth in Permit No. UC-06-284951. Should you have any questions or comments regarding this submittal, please do not hesitate to contact us.

Very truly yours,

MONTGOMERY WATSON

Anne M. Murray, P.G.
Project Manager

cc: TAC Members
Don Bayler, City of Sunrise
Chris Helfrich, City of Sunrise
Wayne Welch, Montgomery Watson
Robert T. Verrastro, Montgomery Watson
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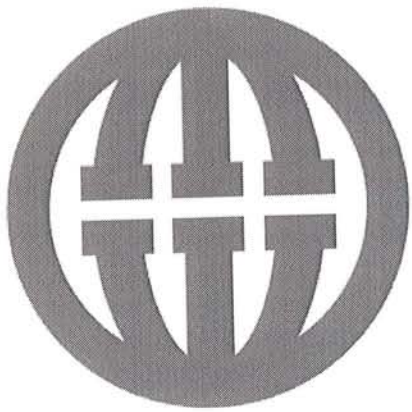
City of Sunrise

Springtree Water Treatment Plant
Aquifer Storage and Recovery System
Sunrise Project No. 403-6136

Well Construction Report

Submitted by
Montgomery Watson Americas, Inc.
490 Sawgrass Corporate Parkway, Suite 300
Sunrise, Florida 33325



March 1998

Acknowledgments

The successful completion of this project was the result of the hard work and cooperation between many individuals and organizations involved in the design, permitting and construction of the system. Those who played significant roles in this achievement were:

The City of Sunrise
Don Bayler
Chris Helfrich
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Department of Public Health
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Wayne Welch

South Florida Water Management District
Steven Anderson
Lou Devillon
Jeff Rosenfeld

Youngquist Brothers, Inc.
Jimmy Brantley
Ed McCullers
Bill Musselwhite

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Executive Summary

MONTGOMERY WATSON

Executive Summary

This report documents the results from the drilling and testing of ASR-1 , a new Class V Treated Water Aquifer Storage and Recovery Well (WTP) for the City of Sunrise. The well is located at the Springtree Water Treatment Plant, on Springtree Drive. This report documents the results of the construction and testing of the well system, which took place between March and July in 1997. The purpose of the ASR system is to store treated water from the Springtree WTP during times of excess and recover this water during peak, seasonal or emergency demands.

The information collected in this report includes lithologic logs, well construction details, geophysical logs, core data, pumping test analyses and water quality data. These data provide reasonable assurance that the system will perform as designed, and that the well has mechanical integrity.

REPORT CONCLUSIONS

The following conclusions are derived from the information presented and interpreted in this report:

- A 16-inch diameter ASR well was constructed with steel casing to a depth of 1,110 feet below land surface (bls).
- The open hole of the ASR well extends from 1,110 feet bls to 1,270 feet bls.
- The well casing has mechanical integrity, as determined from a hydrostatic pressure test and a video survey.
- The data demonstrate the existence of a storage zone with a transmissivity of approximately 43,000 gallons per day per foot.
- The ASR well yields water at a rate of 2,115 gallons per minute with a pumping water level of approximately 60 feet bls.
- The storage zone contains ambient water with a chloride concentration of 2,200 milligrams per liter (mg/L) and a total dissolved solids concentration of 4,520 mg/L.

- Water samples collected from the storage zone did not contain concentrations of constituents exceeding any federal primary drinking water standards.

- The storage zone is overlain by low permeability confining materials comprising the Hawthorn Formation and is underlain by the clay-rich limestone of the Ocala Formation.

Surface facilities include piping, a recharge pump, electrically-actuated control valves, a bi-directional flowmeter, electric submersible pump, electrical systems, and instrumentation and control. Treated water is conveyed both to and from the ASR system via an onsite 12-inch water main. Stored water is pumped from the ASR well and conveyed to the head of the Springtree WTP for additional treatment and distribution. Recharge and recovery rates are approximately 2 million gallons of water per day (mgd).

Construction of the ASR system is now complete. An operations and maintenance (O&M) manual has been prepared as a companion document to the engineering report. It outlines suggested operational, monitoring, and maintenance of the ASR system. The engineering report, O&M manual, and record drawings of the facility are documents presented to FDEP in support of a request for operational testing.

Montgomery Watson recommends that the City of Sunrise proceed with cycle testing of the new ASR well system after obtaining regulatory approval. Cycle testing should consist of a minimum of 5 cycles of injection, storage and recovery of treated water. Injection and recovery can take place at rates of 1,400 gallons per minute, equivalent to 2 million gallons of water per day.

Section 1

Section 1
Introduction

PURPOSE

The purpose of this report is to provide documentation of the design, construction and testing of a new Class V Group 7 Aquifer Storage and Recovery (ASR) well system at the City of Sunrise Springtree Water Treatment Plant (WTP). The Springtree WTP is located in the northwest corner of Section 21 of Township 49 South and Range 41 East, in Broward County, Florida. A project location map is presented on **Figures 1-1** and a vicinity map is presented on **Figure 1-2.**

This report provides support for a request to proceed with operational (cycle) testing of the new ASR well system. The subject well (ASR-1) was constructed in accordance with Construction Permit UC-50-284951 issued by the Florida Department of Environmental Protection (FDEP) and Permit Number WC-06-302016 issued by the Broward County Health Department. Copies of the construction permits obtained for this project are included in **Appendix A.** The ASR well system has been designed to recharge (inject) and recover up to 2 million gallons per day (mgd) of treated drinking water from the Springtree WTP.

PROJECT DESCRIPTION

The Springtree WTP is located between N.W. 44th Street and Springtree Drive, in the City of Sunrise. A site plan is presented on **Figure 1-3.** The Springtree WTP was purchased from Central Broward County Utilities Corporation in 1969 and expanded during 1974 and 1990 to its present capacity of 28 mgd. The water treatment method for the Springtree WTP is lime softening. Raw water is supplied to the WTP from 19 production wells which have a total withdrawal capacity of 30.9 mgd from the surficial aquifer.

The Springtree WTP is presently used in combination with the Park City WTP to supply potable water for the City of Sunrise. The Park City WTP also obtains raw water from a wellfield completed in the surficial aquifer. A Water Use Permit (06-00120-W) issued in April 1996 by the South Florida Water Management District (SFWMD) currently allows the City to withdraw water at an average day rate of 24.27 mgd and a maximum day rate of 31.58 mgd from both of the Springtree and Park City wellfields. By the year 1999, a new membrane softening treatment plant (referred to as the Sawgrass WTP) will be constructed; raw water for the new plant will be supplied by a new surficial aquifer wellfield. The new wellfield is currently under construction, and will be called the Sawgrass wellfield. At that time, groundwater withdrawals will be shifted from the Springtree and Park City wellfields to the Sawgrass wellfield and two other wellfields

PROJECT LOCATION MAP

MONTGOMERY WATSON

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Figure 1-1

CITY OF SUNRISE SPRINGTREE ASR SYSTEM

VICINITY MAP

Figure 1-2

MONTGOMERY WATSON

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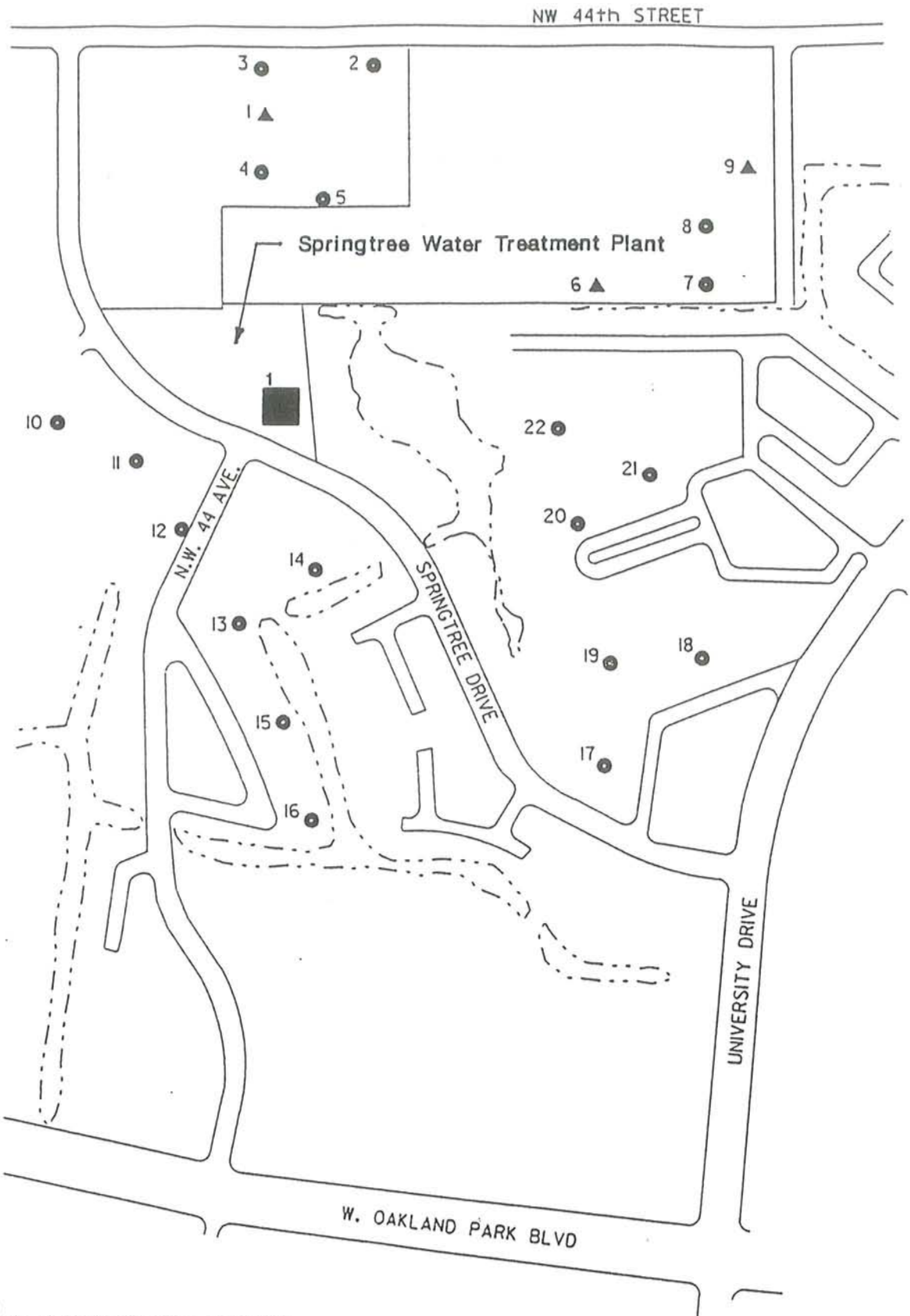

LEGEND

- ● EXISTING PRODUCTION WELL LOCATION
- ▲ INACTIVE PRODUCTION WELL LOCATION
- ■ ASR WELL LOCATION

CITY OF SUNRISE
SPRINGTREE WATER TREATMENT PLANT

Site Plan

Figure 1-3

MONTGOMERY WATSON
/USR7/PROJ/SUN92/WPLAN/ITEM2-1A

known as the Melaleuca Wellfield (currently on standby status) and Flamingo Park Wellfield (not yet constructed).

The future transfer of allocation to the Sawgrass Wellfield will result in a decrease in the amount of treated water that will need to be delivered from the Springtree WTP. The City would like to take advantage of the surplus treated water that will be available from the Springtree WTP to use for the new ASR well system. It is anticipated that the new ASR well system will be used for daily or seasonal peaking and as an emergency supply for the system.

On November 13, 1996, the FDEP issued a construction permit to the City of Sunrise for the construction of a Class V Group 7 ASR Well. The permit allowed for the construction of one 16-inch (outer) diameter ASR well and ancillary appurtenances, equipment and systems for the injection and recovery of treated water at a rate of 1,400 gallons per minute (gpm), or 2 mgd.

Sealed bids from contractors had previously been received by the City on June 12, 1996. Youngquist Brothers, Inc. of Fort Myers, Florida was the low bidder and awarded the contract to construct the ASR well system with a bid of $974,000. A Notice to Proceed was issued on November 10, 1996 and site mobilization began on November 11, 1996. Well drilling commenced on March 10, 1997 and construction was completed by July 1997. Final testing of the well was completed by October 1997 and the surface equipment was installed by January 1998.

Subsequent sections of this report present the ASR well system construction and testing program. Information on the site hydrogeology and the results of the testing are also presented. A plan for cycle testing the new ASR well system is then presented; this plan will be implemented upon regulatory acceptance.

Section 2

Section 2
Construction and Testing Program

The ASR well construction and testing program was developed to ascertain the hydrogeologic conditions at the site, for the proper construction of the well and optimal performance of the system. In addition, testing was performed to fulfill criteria established in the construction permits. Essentially, the construction and testing was performed to demonstrate the following:

- There is an aquifer zone that will accept injection and withdrawal of water at the design rate of 2 mgd.
- There is sufficient confinement above the injection zone, to prevent upward movement (loss) of the stored water.
- The constructed well has mechanical integrity.

SITE DEVELOPMENT

Construction at the site proceeded with installation of a 100-foot by 60-foot steel reinforced concrete containment pad. A plant schematic and location of the project staging area is shown on the Key Plan presented as **Figure 2-1**. The purpose of this pad was to provide support for the drilling equipment. A concrete block retaining wall (approximately three feet high) surrounded the pad perimeter, and was designed to contain fluids spills from the well, principally saline water, thereby protecting the surficial aquifer system.

Four water-table monitoring wells were constructed at each corner of the containment pad, prior to the initiation of drilling the ASR well. The pad monitor wells were all constructed of Schedule 40 PVC casing and screen to 24 feet below land surface (bls), with 5 feet of 0.020-inch slot gravel-packed screen at the base of the well. The wells were cemented from the top of the screen to land surface. Water quality samples and water-level measurements were collected from each well upon completion. The water samples were analyzed for chlorides, conductivity and total dissolved solids (TDS). This information was collected to provide baseline water quality data.

During April 1997, the water table was observed to be approximately 10 feet bls at the site. Results from the background sampling indicated that chloride concentrations in water collected from the wells averaged approximately 50 to 100 milligrams per liter (mg/L), conductivity concentrations ranged from approximately 700 to 1,100 micromhos per centimeter (mmhos/cm) and TDS concentrations of approximately 500 to 900 mg/L. Results from the baseline analyses were used for comparison with water

PIPER HIGH SCHOOL STADIUM

GOLF COURSE

ASR WELL LOCATION No. 1

15' UTILITIES EASEMENT

10' UTILITIES EASEMENT

CONTRACTOR WORK AND STAGING AREA

NW 84TH AVE.

NW 44TH STREET

SPRINGTREE DRIVE

TRAINS A AND C WATER TREATMENT FACILITIES

1. ADMINISTRATION AND CONTROL BUILDING
2. ELECTRICAL AND GENERATOR BUILDING
3. FUEL STORAGE TANKS AND CONTAINMENT AREAS
4. HIGH SERVICE PUMP STATION
5. FINISHED WATER METER VAULT
6. LIME SILO AND CHEMICAL BUILDING
7. CLEARWELL
8. 2.0 MGD UPFLOW SOFTENING UNIT
9. 2.0 MGD FILTER
10. BACKWASH AND SLUDGE DISPOSAL POND
11. 2.0 MG GROUND STORAGE TANK
12. 1.0 MG GROUND STORAGE TANK
13. 0.3 MG GROUND STORAGE TANK
14. CONTROL AND ELECTRICAL BUILDING
15. LIME SILO AND CHEMICAL BUILDING
16. 2.0 MGD SPIRACTOR SOFTENING UNIT
17. 1.0 MGD FILTER
18. RAW WATER WELL
19. PLANT MAINTENANCE BUILDING

TRAIN B WATER

31. AERATORS
32. 6.0 MGD UPFLOW SOFTENING UNIT
33. 12.0 MGD FILTER
34. CLEARWELL
35. 5.0 MG GROUND STORAGE TANK
36. HIGH SERVICE PUMPS
37. FINISHED WATER METER
38. LIME SILO
39. CHEMICAL AND CHLORINATION BUILDING
40. BACKWASH HOLDING POND
41. LIME SLUDGE THICKENER
42. LIME SLUDGE DEWATERING BUILDING
43. ELECTRICAL AND EMERGENCY GENERATOR BUILDING
44. FUEL STORAGE TANK AND CONTAINMENT AREA
45. F.P. & L. VAULT
46. AUXILIARY SLUDGE DISPOSAL POND
47. WASTE SLUDGE SUMP - PROP UNITS
48. WASTE SLUDGE SUMP - EXIST. UNITS
49. 5.0 MG STORAGE TANK (UNDER CONSTRUCTION)

EXISTING WASTEWATER TREATMENT FACILITIES

21. 1.5 MGD TREATMENT UNIT
22. SURGE TANK AND PUMPS
23. BLOWERS
24. PLANT LIFT STATION
25. 1.0 MGD TREATMENT UNIT
26. EFFLUENT PUMP STATION
27. SLUDGE DRYING BEDS

FUTURE WATER TREATMENT FACILITIES

50. 5.0 MG STORAGE TANK (FUTURE)

RECORD DRAWING

These record drawings have been prepared based on information provided by others. The Engineer has not verified the accuracy of such information and shall not be responsible for any errors or ommisions which may be incorporated herein as a result. See original contract drawings for seal and signature.

PROJECT ENGINEER P. E. NO. DATE

REV	DATE	BY	DESCRIPTION
1	1/98	J.O.	RECORD DRAWING

SCALE: 1" = 50'

WARNING 0 1/2 1 IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE.

DESIGNED D. GRACE
DRAWN J. OROZCO
CHECKED G. HART

SUBMITTED
PROJECT MANAGER P. E. NO. DATE
MONTGOMERY WATSON P. E. NO. DATE

MONTGOMERY WATSON
Plantation, Florida

CITY OF sunrise FLORIDA

CITY OF SUNRISE
SUNRISE ASR SYSTEM - SUNRISE PROJECT No.403-6136
KEY PLAN

Figure 2-1

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samples collected weekly during the ASR well drilling and testing activities. Concentrations of the constituents did not change substantially in any of the wells over the course of the project, as a result of successful management of fluids on the containment pad. The water-table monitoring wells were left in place after construction completion, for future monitoring.

Drilling Program

A generalized drilling and testing sequence for the ASR well consisted of drilling a pilot hole to the base of the surficial aquifer system. The pilot hole then was geophysically logged with a variety of tools, and subsequently reamed. Casings were installed in the pre-drilled borehole and cemented in place using sulfate-resistant Type II Portland neat cement (with bentonite gel added when necessary). This sequence was repeated for each consecutive casing of smaller diameter set concentrically within the previous casing. After setting and cementing the final casing, the open-hole was drilled out to a nominal 16-inches in diameter, followed by development and stimulation. Once completed, the well was then pump tested and a final water sample was collected.

Lithologic Determination

Lithologic samples were collected at intervals of every 10 feet during the drilling operation. The lithologic samples were analyzed and described (using a microscope) for composition, color, texture, porosity, cementation, and secondary diagenetic fabrics. A set of samples also was sent to Tallahassee, to the Florida State Geological Survey. A geolograph was used on the drilling rig throughout the drilling operation, so the weight on bit and penetration rate were tracked continually.

Geophysical Logs

At various stages during the construction, geophysical logs were performed. The uses and interpretations of each of the logs is described below:

XY Caliper Log: measures the diameter of the borehole. This log is useful in identifying wash-outs, fractures and competency (mechanical strength) of the strata.

Gamma Ray Log: measures the natural gamma radiation produced by the rock, which is normally a function of the clay or phosphate content (in south Florida).

Dual Induction/Electric/SP: measures the electrical properties of the formation. The resistivity of the formation is affected by lithology, porosity, and water quality. These logs are comprised of "shallow", "medium" and "deep"-penetrating sondes, that investigate at various distances from the borehole into the formation.

Temperature Log: measures the temperature of the fluid filling the borehole or casing. It is also used to determine the elevation of emplaced cement during casing installation and provides information about the movement of fluids within drilled boreholes.

Compensated Sonic Log: measures the acoustic properties of the formation, which is a function of lithology and porosity.

Borehole Television (Video) Log: provides a visual image of the borehole and casing.

Flowmeter Log: measures the contribution of water from various sections of the drilled borehole. Useful in determining flow zones and confining units within the penetrated strata.

Cement Bond Log: measures the acoustic properties of the cemented casing, to evaluate the strength and continuity of the cement bond to the outside of the casing, and to detect potential voids in the grout sheath around the casing.

Upon completion of the pilot hole stages between 0 feet bls to 352 feet bls , and between 352 feet bls and 1,000 feet bls, the following geophysical logs were conducted:

- XY Caliper
- Gamma ray
- Spontaneous Potential (SP)
- Shallow and Deep Electric Logs

The following geophysical logs were conducted in the open-hole, below the final casing:

- XY Caliper
- Gamma ray
- SP
- Dual induction
- Compensated Sonic
- Temperature
- Borehole Television (Video)
- Flowmeter (under pumping and non-pumping conditions)

Drilling Methods

The ASR well was initially drilled using the mud rotary method to a depth above the top of the Floridan aquifer. The drilling rig then was configured for reverse air drilling, for the remainder of the drilling operation within the Floridan aquifer.

Casings

The two casings in the ASR well were centralized in the borehole using strap-type centralizers welded at intervals along the pipe, at 0, 90, 180, and 270 degrees around the casing at each position. The 26-inch outer diameter surface casing was constructed from 0.375-inch wall thickness spiral-wound steel pipe, conforming to the standards of ASTM A139, Grade B. Casing joints were welded. The 16-inch outer diameter casing final casing was constructed of 0.500-inch wall thickness seamless steel pipe, conforming to the standards of ASTM A53, Grade B. Casing joints were welded.

The factory-beveled ends of the casings were arc welded by certified pipeline welders to standard pipeline certifications. Each weld consisted of 3 to 5 layers, with a primary "hot pass" layer and subsequent filler passes. Each welded pass was wire-brushed cleaned and inspected, prior to the next pass. The finished weld was allowed to cool for a period of approximately one hour before being immersed in the wellbore fluids. This procedure minimized the crystallization of the weld material, maximizing the strength and durability of the weld.

Cementing

The annulus between each successive casing was cemented using sulfate-resistant cement. The cement used in the ASR well was ASTM C 150, Type II, with additives where necessary. Additives consisted only of bentonite, up to 4%, for cementing casings. Neat cement was emplaced in the lowermost 174 feet of the final casing.

Cement was emplaced in stages. The first stage was pressure-grouted through a tremie pipe located inside the fluid-filled casing, near the bottom of the open hole. Subsequent stages were emplaced using one tremie pipe placed inside the annulus between the casing and the borehole. After each stage of cementing, the top of the cement was verified by a physical tag with the tremie pipe and by performance of a temperature log/gamma ray log inside the casing. The logs were conducted approximately 5 hours after completion of each stage.

Construction Sequence

Drilling of the ASR well commenced on the afternoon of March 10, 1997. A 12-inch diameter pilot hole was drilled by the mud rotary method to a depth of 352 feet bls.

The determination for the pilot hole depth was primarily based on lithologic sample examination and analysis. Copies of the lithologic descriptions are contained in **Appendix B**.

The pilot hole then was geophysically logged using caliper, dual-induction, and gamma ray tools. Copies of the geophysical logs are contained in **Appendix C.** Following geophysical logging, the pilot hole was reamed to a nominal 36-inch diameter to a depth of 175 feet bls. Deviation surveys of the pilot boreholes and reamed holes were measured approximately every 60 feet to track hole straightness. Copies of the deviation surveys are contained in **Appendix D.** A caliper log then was performed on the reamed hole, followed by setting of the 26-inch diameter surface casing to a depth of 170 feet bls. The casing mill certificates are contained in **Appendix E.** The annular space between the borehole and the casing was pressure grouted with neat cement to pad level in one stage. Cementing records are contained in **Appendix F.**

Twenty four hours after the completion of cementing, drilling of the 12-inch diameter pilot hole resumed. The pilot hole was drilled by the mud rotary method to a depth of 1,133 feet bls. Caliper, dual induction, spontaneous potential and gamma ray geophysical logs then were performed. A final casing setting depth of 1,110 feet bls was selected, based on analysis of the lithologic samples and the geophysical logs. The final casing setting depth selection was approved by the FDEP on March 18, 1997. The pilot hole was then reamed to a nominal 26-inch diameter to a depth of 1,115 feet bls. The installation of the 16-inch diameter final casing took place on March 21, 1997; cementing was accomplished in one stage.

Hydrostatic Pressure Test

A hydrostatic pressure test was performed on the final casing on March 25, 1997, to test for internal mechanical integrity. For the test, the cement plug at the bottom of the casing was utilized as the lower seal. The initial test pressure was 160 pounds per square inch (psi). After a one-hour period, a pressure loss of 4 psi (representing a 2.5% decline) was observed, which was within the 5% decline tolerance required by the FDEP. The hydrostatic pressure test results, along with the pressure gauge certification are presented in **Appendix G.**

Open Hole Drilling

Upon completion of the hydrostatic pressure test, the drilling rig was reconfigured from the mud rotary to the reverse-air method. A 12-inch diameter pilot hole was drilled to a total depth of 1,345 feet bls. During drilling of this interval, four conventional cores were collected at intervals between 1,140 feet bls and 1,309 feet bls. The core barrel was ten feet long and four inches in diameter. The cores were described in the field for color, matrix, cement content, porosity, hardness, and fossil content. The cores were then delivered to Ardaman & Associates, Inc. in Orlando, for analysis of moisture

content, dry density, porosity, average isotropic confining stress, and coefficient of permeability. Copies of the core descriptions and laboratory analyses sheets are contained in **Appendix H.** Results of the core analysis will be discussed in a subsequent section.

Upon reaching the total drilled depth, geophysical logs (including gamma ray, borehole compensated sonic, dual induction, spontaneous potential, temperature, fluid resistivity, caliper and flowmeter) were performed on the pilot hole. In addition to the geophysical logs, flowing water levels and artesian wellhead flowing rates were recorded as "specific capacity tests" in the intervals between 1,191 feet bls and 1,300 feet bls during drilling. Water samples were collected and analyzed for chlorides and conductivity in the field at each 30-foot pipe connection between 1,160 feet bls and 1,340 feet bls. Static and flowing water levels were also recorded during these tests, to ascertain the water yield and specific capacity of the drilled interval.

A video survey then was performed in the pilot hole, the results of which were forwarded to the FDEP under a separate report. A copy of the video survey tape and the survey description is contained in **Appendix I.**

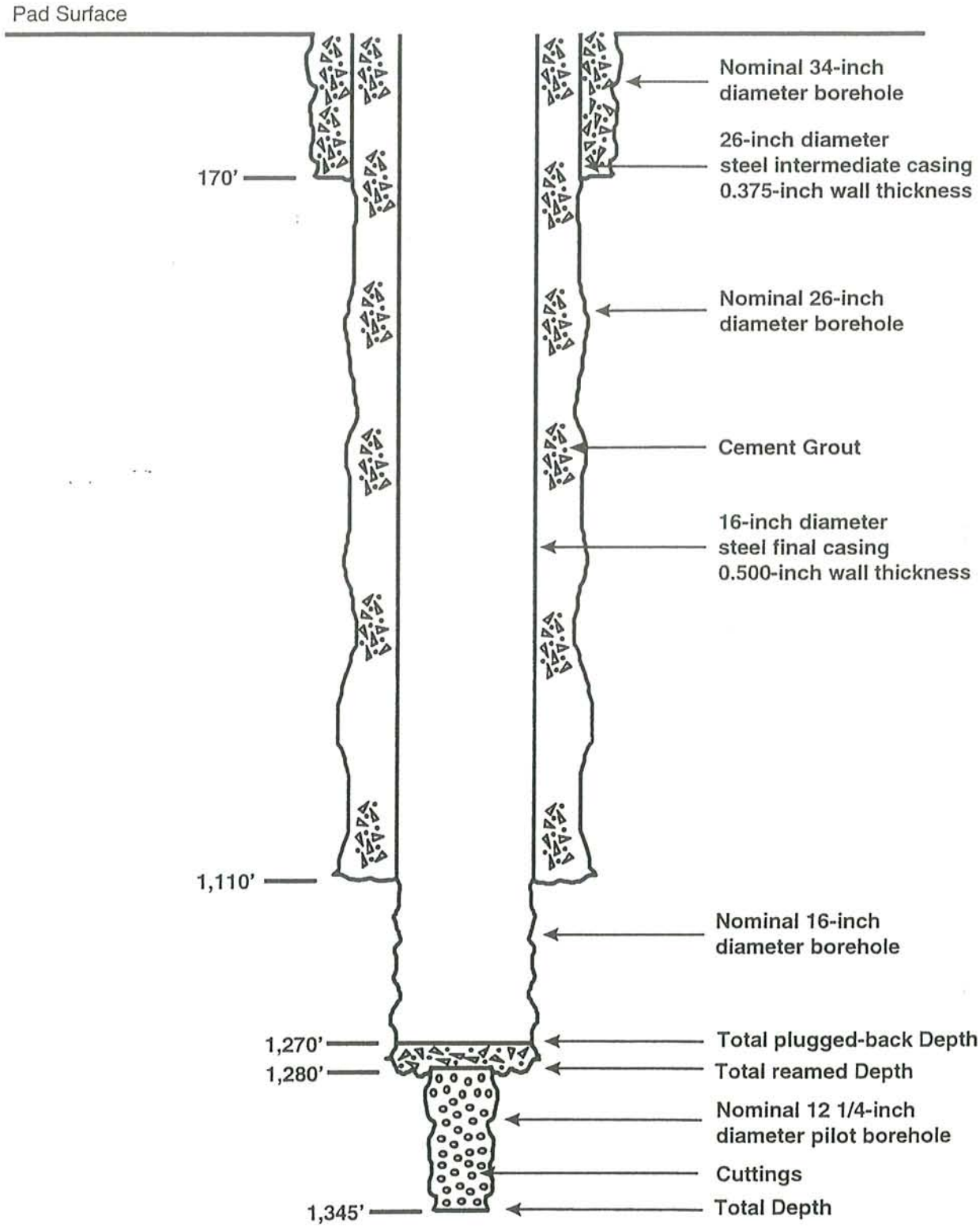
Pilot Hole Plug-Back

The lithologic, hydrologic, and geophysical data collected from the pilot borehole drilled to 1,345 feet bls indicated that highly porous limestone existed to a depth of approximately 1,280 feet bls. Below this depth, the limestone contained higher quantities of clay and silt. In addition, a flowmeter log conducted through this interval indicated that the portion of the hole from below 1,290 feet bls did not contribute significant quantities of water to the well. Based on these interpretations, it was decided that the open hole would be completed to a maximum depth of 1,270 feet bls. The pilot hole was subsequently reamed to a nominal 16-inch diameter to a depth of 1,280 feet bls and the portion of the reamed hole below 1,270 feet bls was filled with a neat cement plug installed through a tremie pipe. A well completion diagram is presented on **Figure 2-2.** The well was then allowed to flow freely, and developed through air-lift pumping. Geophysical logs (including gamma ray, caliper, temperature, and fluid resistivity) then were performed. Copies of the geophysical logs are contained in Appendix C.

Video Survey

Upon completion of the geophysical logs, the borehole was flushed with fresh water and a final video survey was performed on April 15, 1997. There were no internal flaws in the well casing or joints observed during the test, further confirming the internal mechanical integrity of the well.

Springtree ASR Well



MONTGOMERY WATSON	As-Built Construction Diagram	Figure 2-2

Turbine Pump Development

Following completion of the video survey, the ASR well was developed by installing a submersible turbine pump into the well, to pump and surge. Pumping rates of approximately 570 gallons per minute (gpm) to 900 gpm were achieved during pump development. An in-line flowmeter (with totalizer) manufactured by Rockwell International was utilized to measure pumped flow rates. This development resulted in the removal of significant quantities of fine-grained carbonate sand. Specific capacity (as measured in gallons per minute per foot of induced drawdown [gpm/ft]) within the well was approximately 18 gpm/ft at a pumping rate of approximately 1,400 gpm, after approximately 10 days of development.

Step-Rate Pumping Test

On June 6, 1997, a step-rate pumping test was performed on the well at incremental pumping rates of 700 gpm, 1,110 gpm, 1,540 gpm and 1,900 gpm for periods of 8 hours. Water levels were recorded with a calibrated pressure transducer and an Instrumentation Northwest multi-channel datalogger system during the test. The desired flow rate for the ASR well was 2 mgd, which equates to a pumping rate of approximately 1,400 gpm. Drawdown in the well was in excess of 60 feet while pumping near this rate during the step-rate pumping test. As a result of the relatively large drawdown observed during the step-rate pumping test, a request to stimulate (acidize) the open-hole portion of the ASR well was presented to the FDEP. Approval was granted on July 14, 1997.

Acidization

The ASR well was acidized with 2,000 gallons of 23 Baume Hydrochloric acid emplaced through a tremie pipe set within the open hole. After the acid was allowed to react for a period of 17 hours, pumping development resumed for a period of 23 additional hours. The spent acid was neutralized and routed to the City's wastewater treatment system. Post-acidization specific capacity increased to 25 gpm/ft at a pumping rate of 1,500 gpm, (an increase of approximately 40% over the original specific capacity) at which time development was terminated.

Constant-Rate Pumping Test

During the period between July 28 and July 30, 1997, a constant-rate pumping test was performed on the ASR well, at a rate of 2,115 gpm. Water levels during the pumping test were recorded with a calibrated pressure transducer and an Instrumentation Northwest multi-channel datalogger system. During the test, a maximum drawdown of approximately 95 feet was recorded in the well, equating to a specific capacity of approximately 22 gpm/ft. Drawdown and recovery water-levels were plotted on graph

paper and an analysis was performed to estimate the formation transmissivity using the Jacob (1944) "straight-line" method.

Final Water Sample

Prior to completion of the pumping portion of the constant-rate pumping test, a water sample was collected and delivered to Sanders Laboratories for analysis of primary and secondary drinking water standard constituents, as specified in the FDEP construction permit. The laboratory results for this sampling event are contained in **Appendix J.** The pump testing equipment was subsequently removed, and the well pad was cleaned in preparation for completion of the surface facilities and operational use.

Surface Completion

After pump testing was completed, the test pump and temporary discharge piping were removed from the well. New yard piping, pumps, and instrumentation were installed, which connected the ASR wellhead to the existing potable water mains at the Springtree WTP. A wellhead schematic is presented on **Figure 2-3**. As-built diagrams of the surface piping, instrumentation and valves are contained in **Appendix K** along with a Certification of Completion signed and sealed by the Project Engineer and Hydrogeologist. The new yard piping consisted primarily of 12-inch diameter ductile iron pipe. A 60-horsepower, 1,200 revolution per minute horizontal split-case recharge pump was installed on the well pad, to pump potable water into the ASR well. A 60-horsepower, 14-inch diameter stainless steel recovery pump was installed to a depth of 100 feet bls inside the ASR well, to withdraw water from the well. Injection into the ASR well will occur within the annular space between the recovery pump and the 16-inch diameter well casing.

MONITOR WELL TOP EL. 10.25

12'-0"

32'-6"

36'-0"

1" REDUCED PRESSURE BACKFLOW PREVENTOR

1" CL (16) FOR CONTINUATION SEE SHEET C-1

1" AM (10) FOR CONTINUATION SEE SHEET C-1

1" PW (16) FOR CONTINUATION SEE SHEET C-1.

1" PW (16)

1" CL (16)

8" BLIND FLANGE

4'-8"

19'-4"

MONITOR WELL TOP EL. 10.22'

4'-9"

3'-3"

LOCAL CONTROL PANEL SEE SHEET E-6

LCP

8" PLUG

8" ELBOW

I-V-009 8" BFV

8" TEE

12"X8" RED.

AMMONIA INJECTOR DETAIL A G-5

UNISTRUT FABRICATED CHLORINE INJECTION PANEL

12" FW (11)

12" ELBOW

C G-5 CHLORINE INJECTOR DETAIL

12" MECHANICAL COUPLING

B G-5 HOSE BIBB

8" ELBOW

M

8" BUTTERFLY VALVE I-V-010

8" CHECK VALVE I-V-008

8" SPECTACLE FLANGE

AIR RELEASE VALVE

8" ELBOW

M-912 WARNING SIGN

1'-6"

12" X 10" ECCENTRIC REDUCER

8" MECHANICAL COUPLING

18'-0"

6'-8"

6'-6"

5'-0" MIN.

5'-0" MIN.

FOR CONTINUATION SEE FIGURE 2-3

12" SPECTACLE BLIND

12" X 8" REDUCER

I-V-011 8" BUTTERFLY VALVE

2-8" DUAL DISK CHECK VALVE I-V-014 I-V-012

RECHARGE PUMP IASR-ME-002

12" TEE

12" BUTTERFLY VALVE I-V-013

12" MECHANICAL COUPLING

12" FW (11)

BIDIRECTIONAL VENTURIMETER IASR-FE-003

24'-5"

15'-3"

MONITOR WELL TOP EL. 10.29'

PLAN

SCALE: 1/2" = 1'-0"

8" CHECK VALVE

8" SPECTACLE FLANGE

3/4" AIR RELEASE VALVE

8" BUTTERFLY VALVE

8" TEE

M

8" ELBOW

8" ELBOW

8" BLIND FLANGE

8" ELBOW

PIPE SUPPORT M-129

6"

SECTION 2 -

MONITOR WELL TOP EL. 10.36

2'-10"

15'-3"

AIR RELEASE VALVE M-805

PRESSURE GAUGE (TYP) M-606

ASR WELL CASING DETAIL A G-8

1/2" ED (16)

PROVIDE 3 CUBIC FEET OF GRAVEL FOR DRAINAGE

CONCRETE PROTECTION FOR REINFORCEMENT S-199 G-7

8" ELBOW

12" SPECTACLE BLIND

12" X 8" REDUCER

RECHARGE PUMP

8" BUTTERFLY VALVE

2-8" DUAL DISK CHECK VALVE

12" X 10" ECCENTRIC REDUCER

12" MECHANICAL COUPLING

M-610 PRESSURE GAUGE/SWITCH (TYP)

12" BUTTERFLY VALVE

12" TEE

BIDIRECTIONAL VENTURIMETER

12" 45° BEND

EL. 11.71'

15'

3/4" TAPPING SADDLE W/ BALL VALVE

M-142 PIPE CLAMP

S-191 EQUIPMENT PAD G-7

PIPE SUPPORT M-129 G-5

6"

#4 @12" EW (TYP)

SLAB ON GRADE S-190 G-7

FOR CONTINUATION SEE SHEET C-1

12" 45° BEND

SECTION 1 -

SCALE: 1/2" = 1'-0"

RECORD DRAWING

These record drawings have been prepared based on information provided by others. The Engineer has not verified the accuracy of such information and shall not be responsible for any errors or omissions which may be incorporated herein as a result. See original contract drawings for seal and signature.

PROJECT ENGINEER P. E. NO. DATE

REV	DATE	BY	DESCRIPTION
2	1/98	J.O.	RECORD DRAWING

SCALE: AS NOTED

WARNING 0 1/2 1 IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE.

DESIGNED D. GRACE
DRAWN J. OROZCO
CHECKED C. HART

SUBMITTED
PROJECT MANAGER P. E. NO. DATE
MONTGOMERY WATSON P. E. NO. DATE

MONTGOMERY WATSON
Plantation, Florida

CITY OF sunrise FLORIDA

CITY OF SUNRISE
SPRINGTREE ASR SYSTEM - SUNRISE PROJECT No.403-6136
ASR WELL PLAN AND SECTION

Figure 2-3

E No. 0:\proj94\sunrise\dgn\fig2-2.dgn Plot Date: 20 MAR 1998 10:01

Section 3

Section 3
Site Hydrogeology

The information collected during the construction and testing phase of the project was used to build a detailed stratigraphic and hydraulic profile of the site. A summary of the testing interval depths is presented on **Figure 3-1.** This section presents the construction testing results and analyses in the context of a site hydrogeologic interpretation.

REGIONAL GEOLOGIC SETTING

South Florida is underlain by Cenozoic age rocks to a depth of approximately 5,000 feet bls, comprised primarily of sand, limestone, clay and dolomite (Meyer, 1989). Within this province, Broward County lies in a relatively stable structural area, represented by generally flat-lying sediments that accumulated in a quiet marginal-marine setting, similar to the modern-day Bahamas.

The ASR well penetrated sediments from land surface to a depth of 1,345 feet bls. Within these sediments are the surficial aquifer and the Floridan aquifer systems. These two aquifer systems are separated by a confining unit.

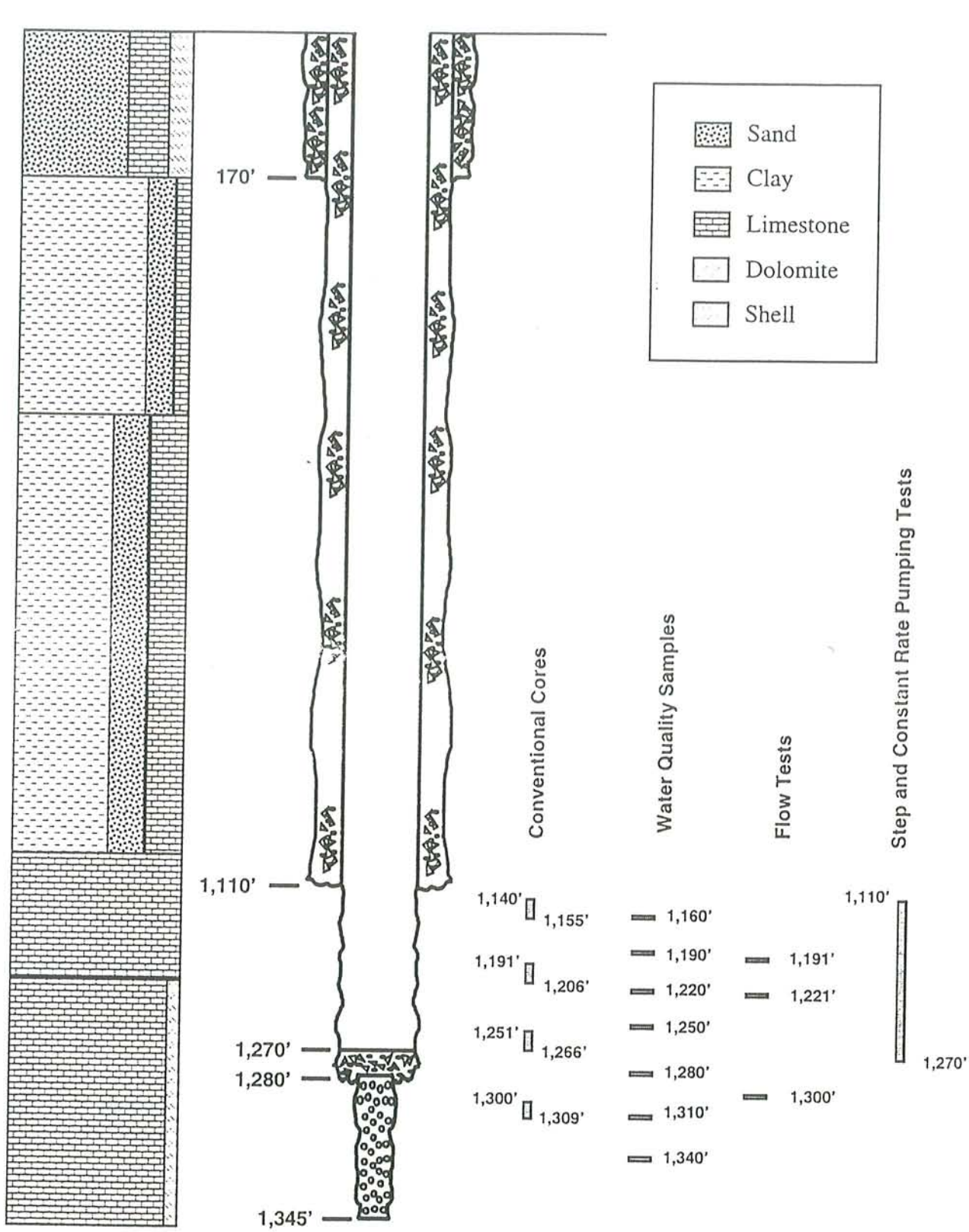
LOCAL GEOLOGY

Plio-Pleistocene Series

During the drilling and testing of the ASR-1, Plio-Pleistocene aged limestone, sand, sandstone, clay and shells were observed from land surface to a depth of approximately 190 feet bls. These sediments are representative of the Pamlico Sand, Anastasia Formation and the Fort Thompson Formation, and were deposited from between one to five million years ago. These sediments were light-gray colored, loosely cemented and contained abundant fossil shells. Porosity within these sediments was relatively high.

Miocene Series

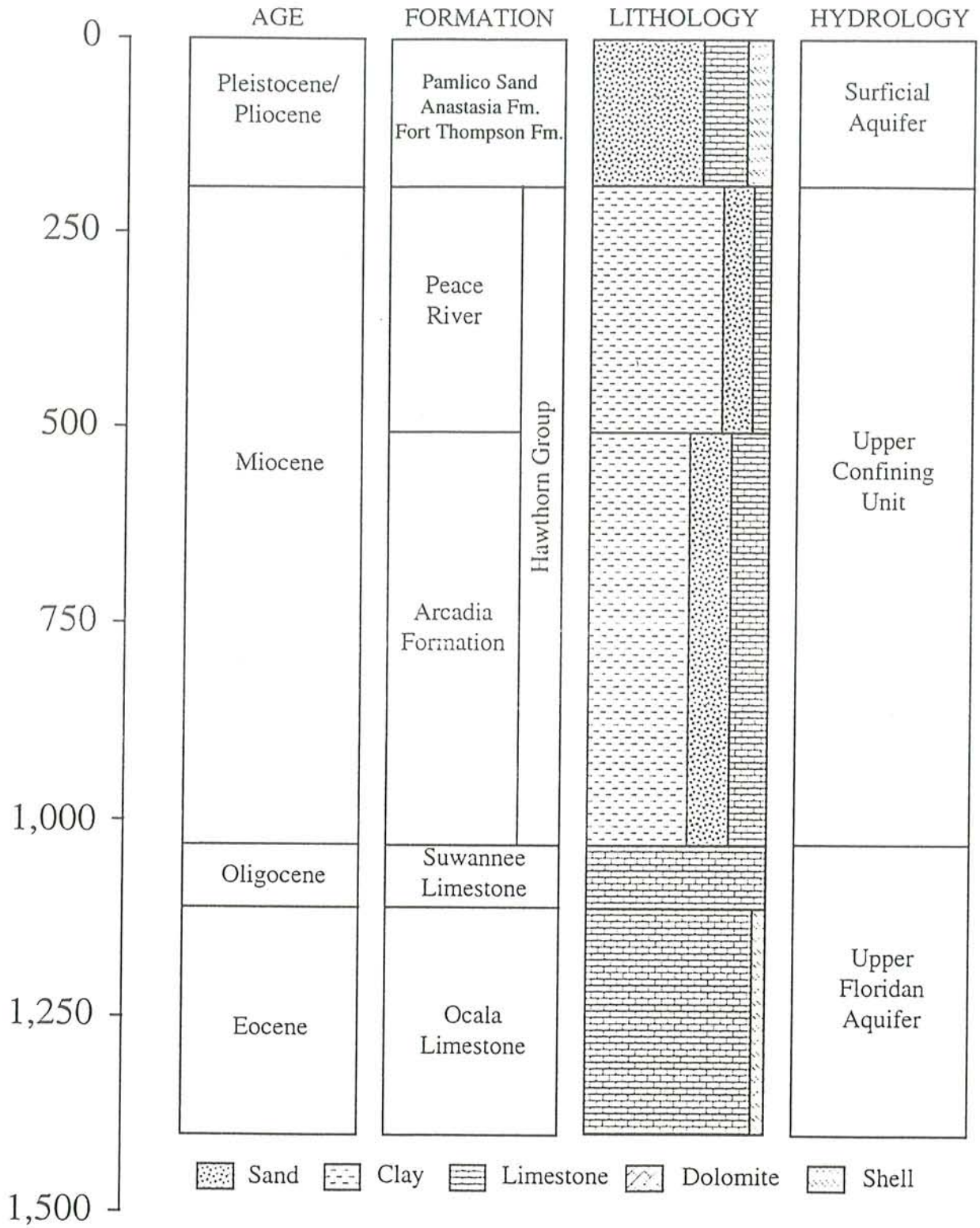
The Plio-Pleistocene sediments unconformably overly dense phosphatic clays and limey silts of the Hawthorn Group. The Hawthorn Group sediments extend from 190 feet bls to 1,035, equating to a total thickness of 845 feet. **Figure 3-2** presents a summary of the lithology penetrated at the wellsite. From 190 feet bls to 510 feet bls, clay-rich sediments representing the Peace River Formation are present. From 510 feet bls to 845 feet bls, the limestone content increases, and is representative of the Arcadia Formation. The phosphate content of these sediments causes the gamma ray log to record high counts through this interval, as displayed on the geophysical log summary, presented on **Figure 3-3.**



MONTGOMERY WATSON

Springtree ASR Well Construction Testing Details

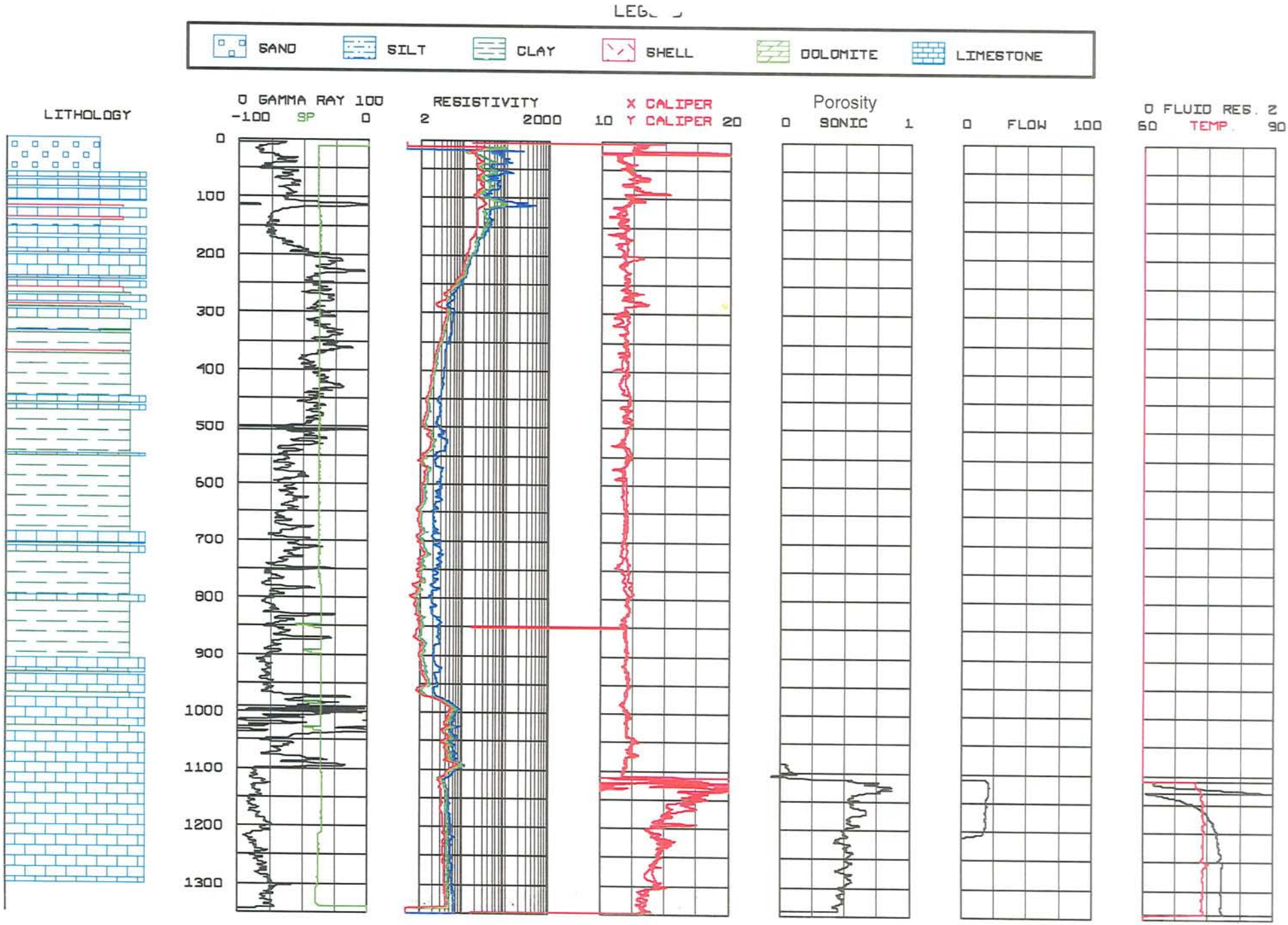
Figure 3-1



MONTGOMERY WATSON

Springtree ASR Well
Site Hydrology and Geology

Figure 3-2



Summary Display of Geophysical Logs

Figure 3-3

Oligocene Series

Lying below the Hawthorn Group sediments is the Oligocene-aged Suwannee Limestone, at a depth of 1,035 feet bls. The Suwannee Limestone is comprised of white, pale orange and gray-colored fossiliferous packstones and wackestones. Numerous gastropod, pelecypod and foraminifera fossils are present within this interval. Secondary porosity in the form of solution vugs is present throughout the penetrated interval. The Suwannee Limestone was present to a depth of 1,115 feet bls.

Eocene Series

At a depth of 1,115 feet bls, the top of the Ocala Formation was encountered. This formation was characterized by pale orange to brown-colored, poorly-cemented lime grainstones. The fossil content in this formation was not high, although fossil hash and red algae debris was commonly observed. The Ocala Formation was present to the total drilled depth of the pilot borehole, which was 1,345 feet bls.

Core Analyses

A total of four conventional cores were collected within the Suwannee and Ocala formations penetrated by ASR-1. **Table 3-1** presents a summary of the cored intervals and the corresponding laboratory analyses. The uppermost three cores contained relatively "clean" limestones. The lowermost core (Number 4) contained a higher concentration of clay. This interval was subsequently plugged back, and the final borehole was completed above that formation. Detailed core descriptions and the geotechnical analyses of the cores are contained in Appendix H.

Table 3-1
Core Analysis Summary

Core Number	Depth Interval (feet bls)	Lithology	Porosity	Permeability (cm/sec)
1	1,140-1,155	Limestone	0.47	0.0013
2	1,191-1,206	Limestone	0.47	0.00019
3	1,251-1,266	Limestone	0.41	0.000010
4	1,300-1,309	Clayey Limestone	0.42	0.00014

HYDROGEOLOGY

Surficial Aquifer System

The surficial aquifer system is present to a depth of 190 feet bls at the wellsite. Within the surficial aquifer system of Broward County is the Biscayne aquifer, which is the

source of most of the drinking water in south Florida. The City's Springtree Wellfield is completed within this aquifer. Supply wells completed within this aquifer are typically pumped at rates of 1,000 to 1,500 gpm in this area. Water within the surficial aquifer is fresh, with chloride concentrations of between 10 mg/L and 100 mg/L. The surficial aquifer system is an unconfined aquifer, recharged by rainfall and surface water canals.

Hawthorn Confining Unit

From 190 feet bls to 1,035 feet bls are low-permeability formations that comprise the Hawthorn Group. Fish (1988) estimated that the green clays contained within these formations exhibit a hydraulic conductivity of approximately 0.001 feet per day (equivalent to approximately 0.00000035 centimeters per second). This confining unit separates the surficial aquifer system from the Upper Floridan aquifer.

Upper Floridan Aquifer

From 1,035 feet bls to the total depth penetrated by the well (1,345 feet bls) is the upper Floridan aquifer. Within the upper Floridan aquifer are high permeability inter-aquifer "flow zones" separated by lower permeability units. Water within this portion of the aquifer is brackish, with chloride concentrations of approximately 2,200 mg/L.

Upper Floridan Aquifer Water Quality

Flowing water samples were collected while pipe connections were made during reverse air drilling through the upper Floridan aquifer. These water samples were analyzed for chlorides and conductivity in the field. **Table 3-2** presents a summary of the information collected from these analyses. Water quality remained fairly consistent throughout the entire drilled interval of the pilot hole.

Table 3-2
Water Quality During Drilling

Depth (feet bls)	Conductivity (umhos/cm)	Chlorides (mg/L)
1,160	4,000	2,200
1,190	4,000	2,200
1,220	4,200	2,200
1,250	4,200	2,200
1,280	4,200	2,200
1,310	4,250	2,200
1,340	4,300	2,200

Flow Tests During Drilling

At selected intervals during reverse-air drilling through the upper Floridan aquifer, static water-levels in the drill pipe were recorded. Water then was allowed to discharge (flow) from the drill pipe, providing for analysis of the flowing specific capacity of the well. **Table 3-3** presents a summary of the data collected during these flow tests.

Table 3-3
Flow Test Summary

Depth (feet bls)	Static Water Level (fapl)	Flowing Water Level (fapl)	Flow Rate (gpm)	Specific Capacity (gpm/ft)
1,191	8.42	1.5	60	8.67
1,221	36.38	22.54	89	6.43
1,300	41.70	30.96	85	7.91

note: "fapl" signifies "feet above pad level"

Examination of the table reveals that the 1,300 foot interval did not contribute significant additional water flow to the well. This was reflective of the clayey, low permeability materials found below the depth of 1,270 feet. As a result of these analyses, this interval was plugged back.

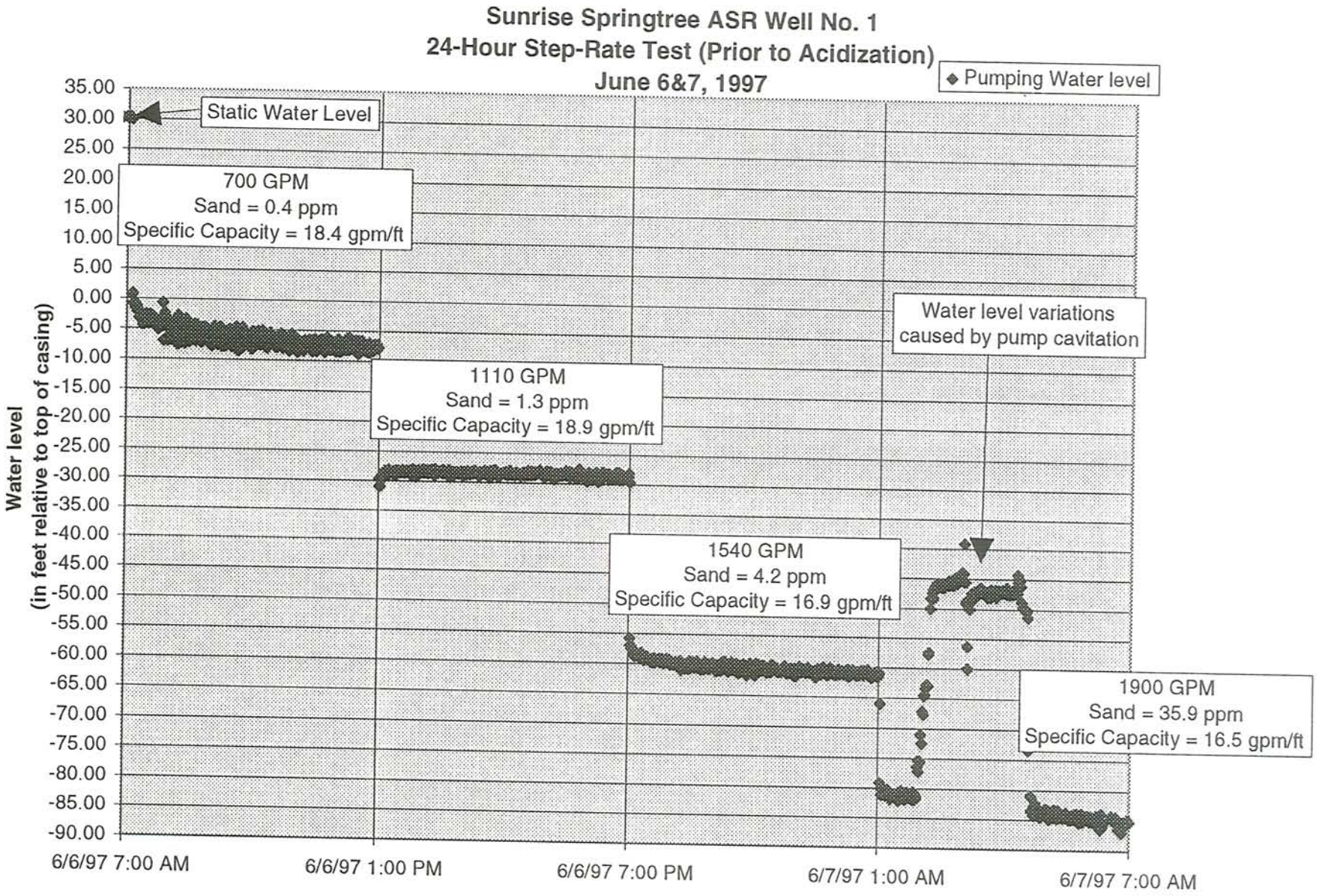
Well Development

Upon completion of the plug-back, the open hole of the well was developed by air-lift surging and turbine pumping. During development, sand content was recorded by use of a Rossum sand meter. A 5 parts per million (ppm) sand content criteria was established for water withdrawn from the well at the desired flow rate (2 mgd). After approximately 140 hours of turbine pumping development, the sand content decreased from initial concentrations of approximately 1,500 ppm to approximately 5 ppm at the desired flow rate.

Step-Rate Pumping Test

During June 6 and 7, 1997 a step-rate pumping test was performed on the well. Results of the step-rate pumping test are presented on **Table 3-4.** Water levels recorded during the step-rate pumping test are presented on **Figure 3-4.** During the step-rate pumping test, flowmeter and temperature geophysical logs were performed and are contained in Appendix F.

Based on the excessive depths of water-levels recorded during the step-rate pumping test, the open hole was stimulated with 2,000 gallons of 28 Baume Hydrochloric acid.



MONTGOMERY WATSON

Step-Rate Pumping Test Data

Figure 3-4

Following the acidization, turbine pumping development took place at rates of between 1,400 gpm and 2,500 gpm for an additional 30 hours.

Table 3-4
Step-rate Pumping Test Summary

Pumping Rate (gpm)	Drawdown (ft)	Specific Capacity (gpm/ft)	Sand Content (ppm)
700	38	18.4	0.4
1,110	59	18.9	1.3
1,540	91	16.9	4.2
1,900	115	16.5	35.9

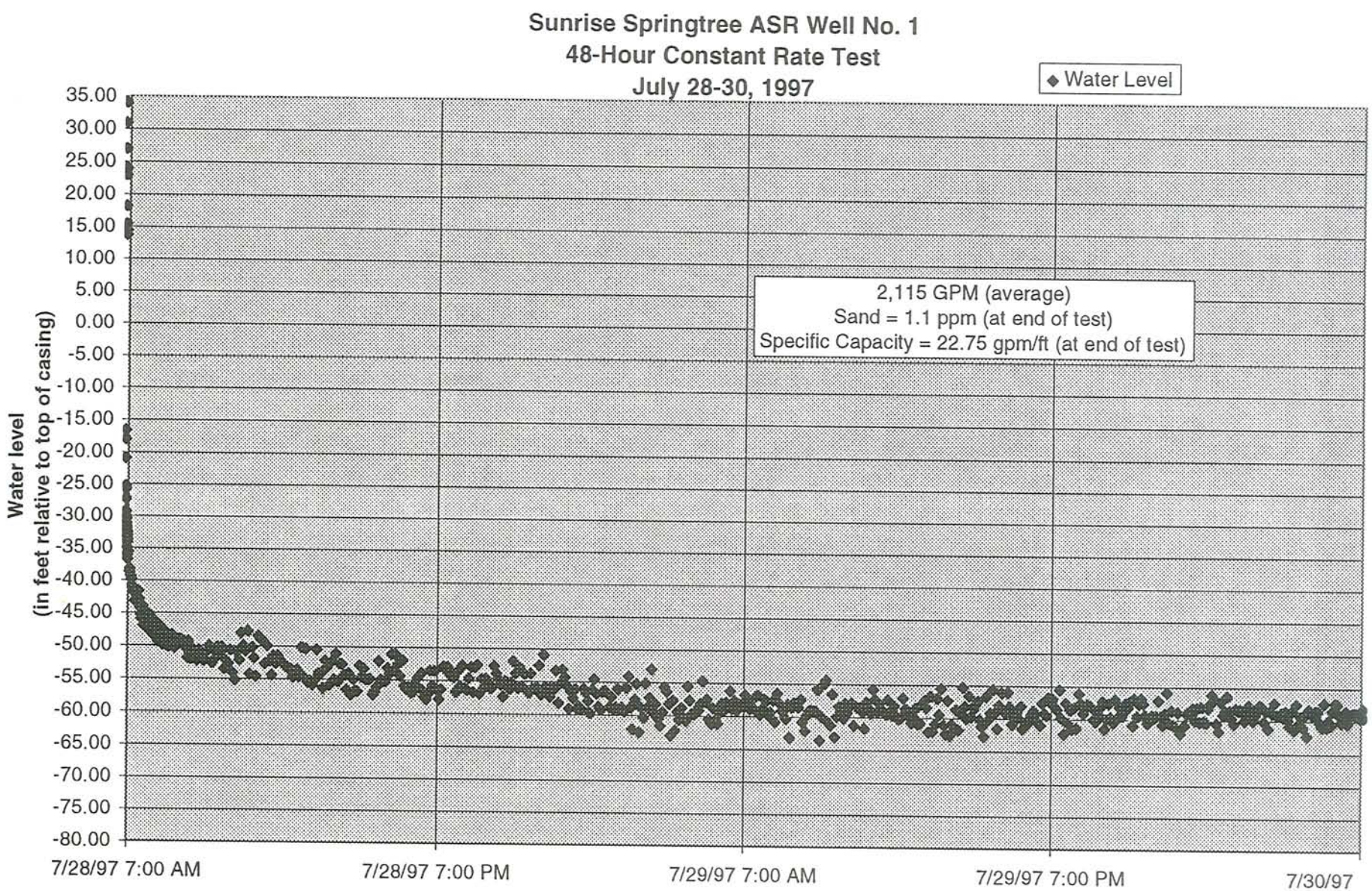
Constant Rate Pumping Test

Upon completion of the post-acidization development, a 48-hour constant rate pumping test was performed during July 30 and 31, 1997. The pumping rate for the test was 2,115 gpm. Water levels were recorded during pumping and recovery periods and plotted on semi-log paper for analysis by "the straight line" method described in Jacob (1944). The graphed water-level drawdown data is presented on **Figures 3-5** and the recovery water-level data is presented on **Figure 3-6.** Transmissivity estimated from the recovery water-level data was approximately 43,000 gallons per day per foot. Sand content at the end of the pumping portion of the test was 1.1 ppm.

WATER QUALITY

Pump Test Water Sample Analysis

Upon completion of the pumping portion of the 48-hour constant rate pumping test, a final construction water quality sample was collected. This water sample is representative of the open hole interval from 1,110 feet bls to 1,270 feet bls. The laboratory results indicated that there were no exceedances of primary drinking water standards in water collected from the completed open hole. Laboratory analyses sheets are contained in Appendix J. Analyses of selected cations and anions indicate that the water in the upper Floridan aquifer is brackish. **Table 3-5** a summary of the laboratory results.



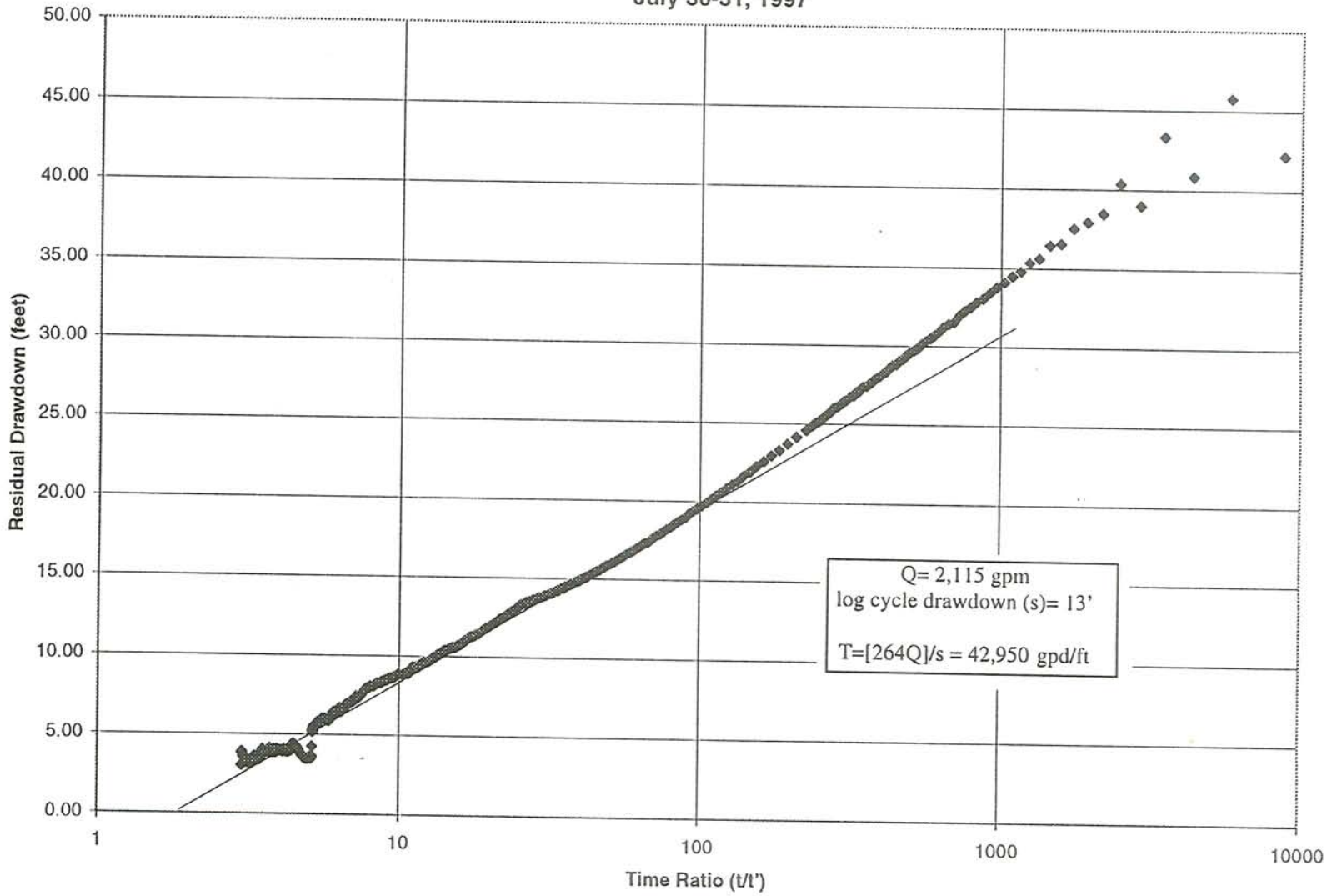
MONTGOMERY WATSON

Constant-Rate Pumping Test Drawdown Data

Figure 3-

Sunrise Springtree ASR Well No. 1
48-Hour Constant Rate Test Recovery
July 30-31, 1997

Data collected from pumping well only.



MONTGOMERY WATSON

Constant-Rate Pumping Test Recovery Data

Figure 3-6

Table 3-5
Final Construction Water Quality Summary

Parameter	Concentration
Chloride	2,449 mg/L
TDS	4,520 mg/L
Conductivity	7,310 mmhos/cm
Temperature (field)	31 Centigrade
Sulfate	644 mg/L
Sodium	1,219 mg/L
pH	7.58
Color	7.0 units
Iron	0.196 mg/L
Total Kjeldahl Nitrogen	1.26 mg/L
Volatile Organic Aromatics	BDL
Pesticides/PCBs	BDL
Unregulated Group I	BDL
Unregulated Group II	BDL
Unregulated Group III	BDL
Total Coliform	<1.0
Gross Alpha	<10.7 pCi/L
Total THMs	<0.5 mg/L

January 1998 Resampling Event

In fulfillment of the BCHD construction permit, a period of six months was allowed to pass before a second native water quality sample was collected. During January 13, 1998, a resampling event was conducted, during which a water sample was collected from the ASR well after 5 volumes of water were evacuated. The water samples were collected by City of Sunrise staff, and analyzed at the City's laboratory for the same constituents as those analyzed for the final construction water sample. **Table 3-6** presents the results from the resampling event. The laboratory report sheets are contained in Appendix J.

The water quality data collected from the Springtree ASR well is consistent with data collected from other wells completed within the Floridan aquifer system of Broward County. The aquifer contains water that is brackish, and concentrations of chloride, iron, sodium, sulfate, odor and TDS typically exceed the secondary federal drinking water maximum concentration limits (MCLs). None of the federal primary or other secondary MCLs were exceeded in water collected from the ASR well.

Table 3-6
Resampling Event Water Quality Summary

Parameter	Concentration
Chloride	3,600 mg/L
TDS	6,030 mg/L
Conductivity	9,300 mmhos/cm
Temperature (field)	28 Centigrade
Sulfate	774 mg/L
Sodium	1,660 mg/L
pH	8.15 units
Color	5 units
Iron	1.16 mg/L
Total Kjeldahl Nitrogen	0.97 mg/L
Volatile Organic Aromatics	BDL
Pesticides/PCBs	BDL
Unregulated Group I	BDL
Unregulated Group II	BDL
Unregulated Group III	BDL
Total Coliform	-10
Gross Alpha	0.0 +/- 12.8 pCi/L
Total THMs	1.7 mg/L

Section 4

Section 4
Cycle Testing Plan

Upon FDEP and BCHD approval, cycle testing of the ASR system will commence. Cycle testing will be conducted to evaluate the performance of the well during injection, storage and recovery, and to fulfill the requirements within the FDEP and BCHD construction permits. It is anticipated that recharge and recovery rates will be at 1,400 gpm, equivalent to 2 mgd. Cycle testing will include variable periods of recharge, storage and recovery, as presented in **Table 4-1.**

Table 4-1
Cycle Testing Plan

Cycle Number	Recharge** Days	Recharge Volume (mg)	Storage Days	Recovery Volume (mg)
1	10	20	0	*
2	20	40	0	*
3	20	40	0	*
4	20	40	30	*
5	60	120	30	*
6	60	120	60	*

"*" signifies that water will be recovered until chloride concentration exceeds 225 mg/L limit specified in the BCHD permit.
"**" signifies that recharge amounts may vary based upon the months which the cycles occur.

During the cycle testing, recovery efficiencies (recovery volume/recharge volume) will be calculated for each cycle. It is anticipated that recovery efficiencies will progressively increase throughout each of the cycles. Cycle 1 will consist of a relatively short recharge and recovery period, to allow for a "shakedown" of the system, and to establish a baseline effect of recharge water on the storage zone. Cycles 2 and 3 will be of slightly longer durations, with no storage periods. Cycle 4 will be of a similar volume as the two previous cycles, but will include a 30 day storage period. Cycle 5 will consist of a large recharge volume, with a 30 day storage period. Cycle 6 will consist of a similar recharge volume to the previous cycle, but will include a 60 day storage period. That cycle will be utilized to observe the effects of longer-term storage on recovery efficiencies.

Total flow into (during injection) and out of (during recovery) the well will be measured daily. Average maximum and minimum daily flows also will be recorded. Wellhead pressures will be monitored continuously, and the daily average, maximum

and minimum injection pressures will be recorded. Cumulative total injected and recovered water also will be recorded.

During the cycle testing period, water quality monitoring will be conducted to determine the geochemical effects of injection, storage and recovery of the treated water (injectate) and in fulfillment of the FDEP and BCHD construction permits. A water quality analysis of the treated water injectate from the Springtree WTP is contained in **Appendix L.**

Table 4-2 presents a summary of the water sampling analyses and frequencies that will be performed during cycle testing. To reconcile differences between the frequencies specified within the BCHD and FDEP permits, the shorter frequency listed in either permit was always selected for preparation of the table. Water samples will be collected from the sampling taps located along the wellhead piping. A minimum of three (3) well volumes of water will be evacuated from the well prior to sampling for the parameters during storage.

Upon completion of each cycle period, a technical memorandum will be prepared, summarizing the data collected during that cycle (a total of 6 memorandums will be prepared). Upon completion of all of the planned cycles, a Cycle Testing Report will be submitted to the BCHD, the FDEP and the SFWMD in support of operation of the system. The Cycle Testing Report will include recommendations for normal operation of the system. **Appendix M** has been reserved within this document so that the Cycle Testing Report can be inserted into this binder upon completion of cycle testing.

Section 5

Section 5
Conclusions and Recommendations

Construction of the ASR well system at the City of Sunrise Springtree WTP has been performed successfully. One 16-inch diameter ASR well with a steel casing set to 1,110 feet bls and an open hole extending from 1,110 feet bls to 1,270 feet bls is now ready for cycle testing at the design rate of 2 mgd. The storage zone of the well is completed within a transmissive limestone of the Upper Floridan aquifer. The storage zone is confined beneath 845 feet of low permeability clay and limestone.

The ASR well currently yields water at a rate of 2,115 gpm with a pumping water level of approximately 60 feet bls. The ambient water contained within the storage zone is brackish, and contains a chloride and TDS concentration of approximately 2,200 mg/L and 4,520 mg/L, respectively. There were no exceedances of primary drinking water standards in water collected from the storage zone, as confirmed during two sampling events which took place 5 months apart, prior to operation of the ASR well.

The surface equipment, including recharge and recovery pumps, and piping and electrical controls, have all been installed and the well has received bacteriological clearance. Montgomery Watson recommends initiation of cycle testing at the Springtree ASR well system. The cycle testing plan will consist of progressively longer periods of injection, storage and recovery of treated water from the ASR well. Water quality and flow information will be collected during the cycle testing period in support of the system construction permits. At the conclusion of cycle testing, a report detailing and interpreting the collected information will be prepared and submitted to the BCHD and the FDEP, in support of an application to operate the system.

Appendices

Appendix A

Construction Permits

BCHD Construction Permit

FLORIDA DEPARTMENT OF HEALTH

NOTICE OF PERMIT ISSUANCE

Lawton Chiles
Governor

James T. Howell, M.D., M.P.H.
Secretary

Broward County - MW (Log #8934)
City of Sunrise #1
(Sunrise #1/ASR Well No. 1)
March 3, 1997

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

Chris Helfrich, P.E., Assistant Director of Utilities
City of Sunrise
14150 N.W. 8th Street
Sunrise, FL 33325

RE: **PROJECT NAME:** Sunrise #1/ASR Well No. 1

PROJECT LOCATION: 4350 Springtree Drive, Sunrise

Dear Mr. Helfrich:

Enclosed is Permit Number **WC-06-302016** issued pursuant to Chapter 403, F.S.

A person whose substantial interests are affected by this permit may petition for an administrative proceeding (hearing) in accordance with Section 120.57, Florida Statutes. The petition must contain the information set forth below and must be filed (received) in the Office of Legal Counsel, BCHD, 201 West Broward Boulevard, Suite 513, Fort Lauderdale, FL 33301, within 14 days of receipt of this permit. Petitioner shall mail a copy of the petition to the applicant at the address indicated above at the time of filing. Failure to file a petition within this time period shall constitute a waiver of any right such person may have to request an administrative determination (hearing) under Section 120.57, Florida Statutes.

The petition shall contain the following information:

(a) The name, address, and telephone number of each petitioner, the applicant's name and address, the Department Permit File Number and the county in which the project is proposed;

(b) A statement of how and when each petitioner received notice of the Department's action or proposed action;

(c) A statement of how each petitioner's substantial interests are affected by the Department's action or proposed action;

(d) A statement of the material facts disputed by petitioner, if any;

(e) A statement of facts which petitioner contends warrant reversal or modification of the Department's action or proposed action;

(f) A statement of which rules or statutes petitioner contends require reversal or modification of the Department's action or proposed action; and

(g) A statement of the relief sought by petitioner, stating precisely the action petitioner wants the Department to take with respect to the Department's action or proposed action.

If a petition is filed, the administrative hearing process is designed to formulate agency action. Accordingly, the Department's final action may be different from the position taken by it in this permit. Persons whose substantial interests will be affected by any decision of the Department with regard to the application have the right to petition to become a party to the proceeding. The petition must conform to the requirements specified above and be filed must conform to the requirements specified above and be filed (received) within 14 days of receipt of this notice in the Office of Legal Counsel at the above address of the Department. Failure to petition within the allowed time frame constitutes a waiver of any right such person has to request a hearing under Section 120.57, F.S., and to participate as a party to this proceeding. Any subsequent intervention will only be at the approval of the presiding officer upon motion filed pursuant to Rule 28-5.207, F.A.C.

This permit is final and effective on the date filed with the Clerk of the Department unless a petition is filed in accordance with the above paragraphs or unless a request for extension of time in which to file a petition is filed within the time specified for filing a petition and conforms to Rule 62-103.070, F.A.C. Upon timely filing of a petition or request for an extension of time, this permit will not be effective until further Order of the Department.

When the Order (Permit) is final, any party to the Order has the right to seek judicial review of the Order pursuant to Section 120.68, Florida Statutes, by the filing of a Notice of Appeal pursuant to Rule 9.110, Florida Rules and Appellate Procedure, with the Clerk of the Department in the Office of Legal Counsel, BCHD, 201 West Broward Boulevard, Suite 513, Fort Lauderdale, FL 33301, and by filing a copy of the Notice of Appeal accompanied by the applicable filing fees with the appropriate District Court of Appeal. The Notice of Appeal must be filed within 30 days from the date the Final Order is filed with the Clerk of the Department.

Executed in Ft. Lauderdale , Florida,

Broward County Health Department

Thomas K. Mueller, P.E.
Environmental Engineering Director

David L. Roach
Senior Administrator

CERTIFICATE OF SERVICE

This undersigned duly designated deputy agency clerk hereby certifies that this NOTICE OF PERMIT ISSUANCE and all copies are mailed by certified mail before the close of business on March 3, 1997 to listed persons.

Clerk Stamp

FILING AND ACKNOWLEDGMENT

FILED, on this date, pursuant to Section 120.52(11), Florida Statutes, with the designated Department Clerk, receipt of which is hereby acknowledged.

Clerk: _____ Date: March 3, 1997

TKM/dn
Enclosures

Copies furnished to:
A. Wayne Welch, P.E., Montgomery Watson
Alfred Mueller, P.E., DEP

Broward County MW (Log #8934)
City of Sunrise #1
(Sunrise #1/ASR Well No. 1)
March 3, 1997

PERMITTEE:

Chris Helfrich, P.E., Assistant Director of Utilities
City of Sunrise
14150 N.W. 8th Street
Sunrise, FL 33325

RE:	**I.D. NUMBER:**	4061410
	PERMIT NUMBER:	WC-06-302016
	DATE OF ISSUE:	03/03/1997
	EXPIRATION DATE:	03/03/2002
	PROJECT NAME:	Sunrise #1/ASR Well No. 1
	PROJECT LOCATION:	4350 Springtree Drive, Sunrise

Dear Mr. Helfrich:

Effective March 3, 1997, this permit is issued according to the provisions of Chapter 403, F.S. , and Chapters 62-4, 62-550, 62-555, & 62-560, F.A.C. The above-named permittee is hereby authorized to perform the work or operate the facility shown on the approved applications, engineering plans, and other documents attached hereto or on file with Broward County Health Department (BCHD) and made a part hereof and specifically described as follows:

CONSTRUCT: One (1) 2 MGD, 16-inch ASR Well (approximately 1,200 ft deep); one (1) horizontal split-case recharge pump (1,400 gpm); one (1) submersible turbine recovery pump (1,400 gpm); one (1) chlorine gas injector (100 lb/d); one (1) manual ammoniator (50 lb/d) and a fiberglass enclosure; one (1) bi-directional venturi meter (400-2,200 gpm); associated pipings; and all related appurtenances as shown on the engineering plans and in the specifications for ASR Well No. 1 only.

SUBJECT TO: General Conditions 1-15 and Specific Conditions 1-12.

GENERAL CONDITIONS:

1. The terms, conditions, requirements, limitations and restrictions set forth in this permit, are "permit conditions" and are binding and enforceable pursuant to Sections 403.141, 403.727, or 403.859 through 403.861, F.S. The permittee is placed on notice that the Department will review this permit periodically and may initiate enforcement action for any violation of these conditions.

2. This permit is valid only for the specific processes and operations applied for and indicated in the approved drawings or exhibits. Any unauthorized deviation from the approved drawings, exhibits, specifications, or conditions of this permit may constitute grounds for revocation and enforcement action by the Department.

3. As provided in Subsections 403.087(6) and 403.722(5), F.S., the issuance of this permit does not convey any vested right or any exclusive privileges. Neither does it authorize any injury to public or private property or any invasion of personal rights, nor any infringement of federal, state, or local laws or regulations. This permit is not a waiver of or approval of any other Department permit that may be required for other aspects of the total project which are not addressed in this permit.

4. This permit conveys no title to land or water, does not constitute State's recognition or acknowledgement of title, and does not constitute authority for the use of submerged lands unless herein provided and the necessary title or leasehold interests have been obtained from the State. Only the Trustees of the Internal Improvement Trust Fund may express State's opinion as to title.

5. This permit does not relieve the permittee from liability for harm or injury to human health or welfare, animal, or plant life, or property caused by the construction or operation of this permitted source, or from penalties therefore; nor does it allow the permittee to cause pollution in contravention of Florida Statutes and Department rules, unless specifically authorized by an order from the Department.

6. The permittee shall properly operate and maintain the facility and systems of treatment and control (and related appurtenance) that are installed and used by the permittee to achieve compliance with the conditions of this permit as required by Department rules. This provision includes the operation of backup or auxiliary facilities or similar systems when necessary to achieve compliance with the conditions of the permit and when required by Department rules.

7. The permittee, by accepting this permit, specifically agrees to allow authorized Department personnel, upon presentation of credentials or other documents as may be required by law and at reasonable times, access to the premises where the permitted activity is located or conducted to:

(a) Have access to and copy any records that must be kept under conditions of the permit;

(b) Inspect the facility, equipment, practices, or operations regulated or required under this permit; and

(c) Sample or monitor any substances or parameters at any location reasonably necessary to assure compliance with this permit or Department rules. Reasonable time may depend on the nature of the concern being investigated.

8. If, for any reason, the permittee does not comply with or will be unable to comply with any condition or limitation specified in this permit, the permittee shall immediately provide the Department with the following information:

(a) A description of and cause of noncompliance; and

(b) The period of noncompliance, including date and times; or, if not corrected, the anticipated time the noncompliance is expected to continue, and steps being taken to reduce, eliminate, and prevent recurrence of the noncompliance. The permittee shall be responsible for any and all damages which may result and may be subject to enforcement action by the Department for penalties or for revocation of this permit.

9. In accepting this permit, the permittee understands and agrees that all records, notes, monitoring data and other information relating to the construction or operation of this permitted source which are submitted to the Department may be used by the Department as evidence in any enforcement case involving the permitted source arising under the Florida Statutes or Department rules, except where such use is prescribed by Sections 403.111 and 403.73, F.S. Such evidence shall only be used to the extent it is consistent with the Florida Rules of Civil Procedure and appropriate evidentially rules.

10. This permittee agrees to comply with changes in Department rules and Florida Statutes after a reasonable time for compliance; provided, however, the permittee does not waive any other rights granted by Florida Statutes or Department rules.

11. This permit is transferable only upon Department approval in accordance with Rule 62-4.120 and 62-730.300, F.A.C., as applicable. The permittee shall be liable for any non-compliance of the permitted activity until the transfer is approved by the Department.

12. This permit or a copy thereof shall be kept at the work site of the permitted activity.

13. This permit also constitutes:

(a) Determination of Best Available Control Technology (BACT)

(b) Determination of Preventions of Significant Deterioration (PSD)

(c) Certification of compliance with state Water Quality Standards (Section 401, PL 92-500)

(d) Compliance with New Source Performance Standards

14. The permittee shall comply with the following:

(a) Upon request, the permittee shall furnish all records and plans required under Department rules. During enforcement actions, the retention period for all records will be extended automatically unless otherwise stipulated by the Department.

(b) The permittee shall hold at the facility or other location designated by this permit records of all monitoring information (including all calibration and maintenance records and all original strip chart recordings for continuous monitoring instrumentation) required by the permit, copies of all reports required by this permit, and records of all data used to complete the application for the permit. These materials shall be retained at least three years from the date of the sample, measurement, report, or application unless otherwise specified by Department rule.

(c) Records of monitoring information shall include:

1. the date, exact place, and time of sampling or measurements;
2. the person responsible for performing the sampling or measurements
3. the date analyses were performed;
4. the person responsible for performing the analyses;
5. the analytical techniques or methods used;
6. the results of such analyses.

15. When requested by the Department, the permittee shall within a reasonable time furnish any information required by law which is needed to determine compliance with the permit. If the permittee becomes aware the relevant facts were not submitted or were incorrect in the permit application or in any report to the Department, such facts or information shall be corrected promptly.

SPECIFIC CONDITIONS:

1. The applicant is responsible for retaining a Florida registered professional engineer as the engineer of record in the application for supervision of the construction of this project, and upon completion, the engineer shall inspect the construction for complete conformity to the plans and specifications as approved. Appropriate certification documents [a letter of certification, one (1) set of as-built drawings, a business check or cash for $ 40.00, copies of pressure test and bacteriological clearance results (when applicable)] shall then be provided to **Broward County Health Department (BCHD)**.

2. Water system components which come into contact with drinking water shall be certified as being in conformance with ANSI/NSF Standard 61-1995 (Drinking Water System Components).

3. Before the start of the first test circle, analyze the native water from the ASR well for primary standards, ammonia as N, total phosphorus as P, BOD, COD, secondary standards, and unregulated organic contaminants two times, four to six months apart, and submit the test results to BCPHU, along with the well completion report including actual well yield, drawdown and sand test data, and detailed well construction drawings. All new wells shall be tested, cleaned, disinfected and bacteriologically cleared in accordance with Sections 62-550 and 62-555.515(3), F.A.C. The City shall notify the BCHD five days prior to the start of the first test circle.

4. Analyze, for two (2) years, the recovery stream continuously for conductivity; daily for chloride, sand, total and calcium hardness; alkalinity, turbidity, pH, temperature, color, and iron; weekly for sulfate, total nitrate and nitrite, sodium, ammonia as N, total phosphorous as P, TDS, BOD, COD, and H2S; and monthly for total coliform. Evaluate data after two years and then decide what testing may be necessary (frequency and parameters) beyond that point.

5. Analyze, for two (2) years, the recharge stream daily for conductivity, chloride, total and calcium hardness, alkalinity, turbidity, pH, temperature, color, and iron; weekly for sulfate, total nitrate and nitrite, sodium, ammonia as N, total phosphorous as P, TDS, BOD, and H2S; and monthly for total coliform.

6. Submit to BCHD data on transmissivity based on pump test information.

7. A monthly operating report for the ASR well shall be submitted to the BCHD by the 15th of the month for the preceding month. The report shall include daily pumpages (injection and recovery) and analytical test results for all required parameters to be monitored. The routine submittal of this report shall begin with the cycle testing demonstration project.

8. The entire recovery stream shall be pumped to the head of the plant and be fully treated for a minimum of four (4) cycles in the one (1) year cycle testing as part of the demonstration project. Treatment of the recovered water, if any is required in addition to disinfection, shall be determined upon conclusion of one (1) year cycle testing.

9. BCHD accepts Montgomery Watson's written proposal to automatically shut down ASR well recovery stream upon reaching 225 mg/l concentration of chloride. Telephone or fax notification shall be provided to BCHD prior to the start-up and termination of ASR well recovery.

10. Written approval, in accordance with the requirements of Chapter 403, F.S., and Chapter 62-4, 62-550, 62-555, and 62-560, F.A.C., from BCPHU shall be required before the ASR well can be put into operation on a routine basis.

11. This permit does not indicate a waiver or approval of any permits required by this agency for other aspects of the project.

12. Provide written documentation to the BCHD of a public education program, to be conducted by the City, to educate all customers on the potential advantages and disadvantages associated with the use of ASR recovered water.

Executed in Fort Lauderdale, Florida,

Broward County Health Department

Thomas K. Mueller, P.E.
Environmental Engineering Director

David L. Roach
Senior Administrator

TKM/dn

Copies furnished to:
A. Wayne Welch, P.E., Montgomery Watson
Alfred Mueller, P.E., DEP

FDEP Construction Permit

Department of Environmental Protection

FLORIDA

Southeast District
P.O. Box 15425
West Palm Beach, Florida 33416

Lawton Chiles
Governor

Virginia B. Wetherell
Secretary

NOV 13 1996

CERTIFIED MAIL
RETURN RECEIPT REQUESTED
Chris Helfrich, PE
Assistant Director of Utilities
City of Sunrise
14150 N.W. 8th Street
Sunrise, FL 33325

NOTICE OF PERMIT

BROWARD COUNTY
UIC - City of Sunrise
Springtree WTP
UC-06-283776 (Well ASR-2)

Dear Mr. Helfrich:

Enclosed is Permit Number UC-06-283776, to construct one Class V Aquifer Storage and Recovery well (ASR-2) at the City of Sunrise Springtree Water Treatment Plant (WTP), issued pursuant to Section(s) 403.087, Florida Statutes and Florida Administrative Codes 62-3, 62-4, 62-520, 62-528 and 62-550.

Any party to this Order (permit) has the right to seek judicial review of the permit pursuant to Section 120.68, Florida Statutes, by the filing of a Notice of Appeal pursuant to Rule 9.110, Florida Rules of Appellate Procedure, with the Clerk of the Department in the Office of General Counsel, 3900 Commonwealth Blvd., Mail Station No. 35, Tallahassee, Florida 32399-3000; and by filing a copy of the Notice of Appeal accompanied by the applicable filing fees with the appropriate District Court of Appeal. The Notice of Appeal must be filed within 30 days from the date this Notice is filed with the Clerk of the Department.

Should you have any questions, please contact William W. Cocke, PG at (561)681-6691 or Heidi Vandor, PG, at (561)681-6694, of this office.

Executed in West Palm Beach, Florida.

STATE OF FLORIDA
DEPARTMENT OF ENVIRONMENTAL PROTECTION

Carlos Rivero-deAguilar 11/12/96
Carlos Rivero-deAguilar Date
Director of District Management
Southeast District

CRA/AM/WWC/hv

cc: Lynette Ciardulli, Office of General Counsel, DEP/TAL
Richard Deuerling, DEP/TAL
Will Evans, DEP/TAL
Heidi Vandor, DEP/WPB
J.P. Listick, DEP/WPB
Nancy Marsh, USEPA/Atlanta
Ron Reese, USGS/Miami
Bill Cocke, DEP/WPB
Anne Murray, Montgomery Watson
Steven Anderson, SFWMD
Phong Nguyen, BCPHU
Garth Hinckle, BCDNRP

CERTIFICATE OF SERVICE

The undersigned duly designated deputy clerk hereby certifies that this NOTICE OF PERMIT and all copies were mailed before the close of business on _____ to the listed persons by NOV 13 1996

FILING AND ACKNOWLEDGMENT FILED, on this date, pursuant to the §120.52, Florida Statutes, with the designated Department Clerk, receipt of which is hereby acknowledged.

Clerk NOV 13 1996
Date

Department of Environmental Protection

Lawton Chiles
Governor

Southeast District
P.O. Box 15425
West Palm Beach, Florida 33416

Virginia B. Wetherell
Secretary

PERMITTEE:
Mr. Chris Helfrich, PE
Assistant Director of Utilities
City of Sunrise
14150 NW 8th Street
Sunrise, FL 33325

ID NUMBER: 5006M07487
PERMIT/CERTIFICATION NO: UC-06-283776
DATE OF ISSUE: NOV 13 1996
EXPIRATION DATE: NOV 19 1998
COUNTY: Broward County
LATITUDE/LONGITUDE: 26°10'4"N/80°15'38"W
PROJECT: City of Sunrise Springtree WTP
Class V Aquifer Storage and Recovery
Well ASR-2

This permit is issued under the provisions of Chapter 403.087, Florida Statutes (FS), and Florida Administrative Code (FAC) Rules 62-3, 62-4, 62-520, 62-528 and 62-550. The above named permittee is hereby authorized to perform the work or operate the facility shown on the application and approved drawing(s), plans, and other documents attached hereto or on file with the Department and made a part hereof and specifically described as follows:

TO CONSTRUCT: A Class V Group 7 16-inch (OD) Aquifer Storage and Recovery Well, ASR-2, with casing extending to a depth of 1000 feet below land surface (bls) and the borehole extending to a depth of approximately 1200 feet (bls). Final depths will be determined during construction and field testing. The proposed injection fluid is treated potable water from the Springtree WTP. Injection and recovery flow rates will be maintained at approximately 1400 gallons per minute (gpm). ASR-2 is part of the proposd two well Aquifer Storage and Recovery System at the site.

IN ACCORDANCE WITH: Application to Construct a Class V Group 7 Aquifer Storage and Recovery System received February 2, 1996, Request for Information (RFI) dated February 29, 1996, Response to RFI received March 29, 1996, RFI (meeting) on May 29, 1996, RFI response received June 10, 1996, public notice of the Draft Permit published in the Sun-Sentinel newspaper on August 19, 1996, consideration of public comment received as a result of the public meeting held on September 18, 1996 at 10:00 a.m., and public notice of the Intent to Issue Permit published in the Sun-Sentinel newspaper on October 9, 1996.

LOCATED AT: City of Sunrise Springtree Water Treatment Plant, 4350 Springtree Drive, Sunrise, Broward County, Florida.

TO SERVE: City of Sunrise

SUBJECT TO: General Conditions 1-17 and Specific Conditions 1-7.

GENERAL CONDITIONS:

The following General Conditions are referenced in Florida Administrative Code Rule 62-4.160.

1. The terms, conditions, requirements, limitations and restrictions set forth in this permit, are "permit conditions" and are binding and enforceable pursuant to Sections 403.141, 403.727, or 403.859 through 403.861, FS. The permittee is placed on notice that the Department will review this permit periodically and may initiate enforcement action for any violation of these conditions.

2. This permit is valid only for the specific processes and operations applied for and indicated in the approved drawings or exhibits. Any unauthorized deviation from the approved drawings, exhibits, specifications, or conditions of this permit may constitute grounds for revocation and enforcement action by the Department.

3. As provided in subsections 403.087(6) and 403.722(5), FS, the issuance of this permit does not convey any vested rights or any exclusive privileges. Neither does it authorize any injury to public or private property or any invasion of personal rights, nor any infringement of federal, state, or local laws or regulations. This permit is not a waiver of, or approval of, any other Department permit that may be required for other aspects of the total project which are not addressed in this permit.

4. This permit conveys no title to land or water, does not constitute State recognition or acknowledgment of title, and does not constitute authority for the use of submerged lands unless herein provided and the necessary title or leasehold interests have been obtained from the State. Only the Trustees of the Internal Improvement Trust Fund may express State opinion as to title.

5. This permit does not relieve the permittee from liability for harm or injury to human health or welfare, animal, or plant life, or property caused by the construction or operation of this permitted source, or from penalties therefore; nor does it allow the permittee to cause pollution in contravention of Florida Statutes and Department rules, unless specifically authorized by an order from the Department.

6. The permittee shall properly operate and maintain the facility and systems of treatment and control (and related appurtenances) that are installed and used by the permittee to achieve compliance with the conditions of this permit, are required by Department rules. This provision includes the operation of backup or auxiliary facilities or similar systems when necessary to achieve compliance with the conditions of the permit and when required by Department rules.

7. The permittee, by accepting this permit, specifically agrees to allow authorized Department personnel, upon presentation of credentials or other documents as may be required by law and at reasonable times, access to the premises where the permitted activity is located or conducted to:

(a) Have access to and copy any records that must be kept under conditions of the permit;
(b) Inspect facility, equipment, practices, or operations regulated or required under this permit;
(c) Sample or monitor any substances or parameters at any location reasonable necessary to assure compliance with this permit or Department rules. Reasonable time may depend on the nature of the concern being investigated.

8. If, for any reason, permittee does not comply with or will be unable to comply with any condition or limitation specified in the permit, permittee shall immediately provide the Department with the following:

(a) A description of and cause of noncompliance; and
(b) The period of noncompliance, including dates and times; or, if not corrected, the anticipated time the noncompliance is expected to continue, and steps being taken to reduce, eliminate, and prevent recurrence of the noncompliance. The permittee shall be responsible for any and all damages which may result and may be subject to enforcement action by the Department for penalties or for revocation of this permit.

9. In accepting this permit, permittee understands and agrees that all records, notes, monitoring data and other information relating to the construction or operation of this permitted source, which are submitted to the Department, may be used by the Department as evidence in any enforcement case involving the permitted source arising under the Florida Statutes or Department rules, except where such use is prescribed by Section 403.111 and 403.73, FS. Such evidence shall only be used to the extent it is consistent with the Florida Rules of Civil Procedure and appropriate evidentiary rules.

10. The permittee agrees to comply with changes in Department rules and Florida Statutes after a reasonable time for compliance; provided, however, the permittee does not waive any other rights granted by Florida Statutes or Department rules. A reasonable time for compliance with a new or amended surface water quality standard, other than those standards addressed in Rule 62-302.500, shall include a reasonable time to obtain or be denied a mixing zone for the new or amended standard.

11. This permit is transferable only upon Department approval in accordance with Rule 62-4.120 and 62-730.300 FAC, as applicable. The permittee shall be liable for any non-compliance of the permitted activity until the transfer is approved by the Department.

12. This permit or a copy thereof shall be kept at the work site of the permitted activity.

13. This permit also constitutes:

(a) Determination of Best Available Control Technology (BACT)
(b) Determination of Prevention of Significant Deterioration (PSD)
(c) Certification of compliance with state Water Quality Standards (Section 401, PL 92-500)
(d) Compliance with New Source Performance Standards

14. The permittee shall comply with the following:

(a) Upon request, the permittee shall furnish all records and plans required under Department rules. During enforcement actions, the retention period for all records will be extended automatically unless otherwise stipulated by the Department.
(b) The permittee shall hold at the facility or other location designated by this permit records of all monitoring information (including all calibration and maintenance records and all original strip chart recordings for continuous monitoring instrumentation) required by the permit, copies of all reports required by this permit, and records of all data used to complete the application for this permit. These materials shall be retained at least three years from the date of the sample, measurement, report, or application unless otherwise specified by Department rule.
(c) Records of monitoring information shall include:

1. the date, exact place, and time of sampling or measurements
2. the person responsible for performing the sampling or measurements
3. the dates analyses were performed
4. the person responsible for performing the analyses
5. the analytical techniques or methods
6. the results of such analyses

15. When requested by the Department, the permittee shall within a reasonable time furnish any information required by law which is needed to determine compliance with the permit. If the permittee becomes aware the relevant facts were not submitted or were incorrect in the permit application or in any report to the Department, such facts or information shall be corrected promptly.

16. In the case of an underground injection control permit, the following permit conditions also shall apply:

(a) All reports or information required by the Department shall be certified as being true, accurate and complete.
(b) Reports of compliance or noncompliance with, or any progress reports on, requirements contained in any compliance schedule of this permit shall be submitted no later than 14 days following each schedule date.
(c) Notification of any noncompliance, which may endanger health or the environment, shall be reported verbally to the Department within 24 hours and again within 72 hours, and a final written report provided within two weeks.

1. The verbal reports shall contain any monitoring or other information which indicate that any contaminant may endanger an underground source of drinking water and any noncompliance with a permit condition or malfunction of the injection system which may cause fluid migration into or between underground sources of drinking water.
2. The written submission shall contain a description of and a discussion of the cause of the noncompliance and, if it has not been corrected, the anticipated time the noncompliance is expected to continue, the steps being taken to reduce, eliminate, and prevent recurrence of the noncompliance and all information required by Rule 62-528.230(4)(b), FAC.

(d) The Department shall be notified at least 180 days before conversion or abandonment of an injection well, unless abandonment within a lesser period of time is necessary to protect waters of the state.

17. The following conditions also shall apply to a hazardous waste facility permit.

(a) The following reports shall be submitted to the Department:

1. Manifest discrepancy report. If a significant discrepancy in a manifest is discovered, the permittee shall attempt to rectify the discrepancy. If not resolved within 15 days after the waste is received, the permittee shall immediately submit a letter report, including a copy of the manifest, to the Department.
2. Unmanifested waste report. Permittee shall submit an unmanifested waste report to the Department within 15 days of receipt of unmanifested waste.
3. Biennial report. A biennial report covering facility activities during previous calendar year shall be submitted by March 1 of each even numbered year pursuant to Chapter 62-730, FAC

(b) Notification of any noncompliance which may endanger health or the environment, including the release of any hazardous waste that may endanger public drinking water supplies or the occurrence of a fire or explosion from the facility which could threaten the environment or human health outside the facility, shall be reported verbally to the Department within 24 hours, and a written report shall be provided within 5 days. The verbal report shall include the name, address, ID number, and telephone number of the facility, its owner or operator, the name and quantity of materials involved, the extent of any injuries, an assessment of actual or potential hazards, and the estimated quantity and disposition of recovered material. The written submission shall contain:

1. A description and cause of the noncompliance.
2. If not corrected, the expected time of correction, and the steps being taken to reduce, eliminate, and prevent recurrence of the noncompliance.

(c) Reports of compliance or noncompliance with, or any progress reports on, requirements in any compliance schedule shall be submitted no later than 14 days after each schedule date.
(d) All reports or information required by the Department by a hazardous waste permittee shall be signed by a person authorized to sign a permit application.

PERMITTEE:
Mr. Chris Helfrich, P.E.
Assistant Director of Utilities
City of Sunrise Springtree WTP

ID NUMBER: 5006M07487
PERMIT/CERTIFICATION NUMBERS: UC-06-283776
DATE OF ISSUE: NOV 13 1996
EXPIRATION DATE: NOV 13 1998

SPECIFIC CONDITIONS:

1. General Requirements

a. The measurement points for drilling and logging operations shall be surveyed and referenced to the National Geodetic Vertical Datum (NGVD) of 1929 prior to the onset of drilling activities for this ASR well.

b. Four (4) permanent surficial aquifer monitor wells identified as Pad Monitor Wells (PMWs) shall be located at the corners of the ASR well drilling pad and identified by location number and pad location, i.e. NW, NE, SW, and SE. These wells are to be retained in service, sampled weekly for chlorides (mg/l), conductivity (umhos), total dissolved solids (mg/l) and water levels (relative to NGVD) during the construction phase of the project. If located in a traffic, area the well heads must be protected by a traffic bearing enclosure and cover. Individual covers must be specifically marked to identify the well and its purpose. A copy of the FDEP Southeast District Summary Sheet is attached for your use when reporting the above information.

c. The permittee shall be subject to all requirements and regulations of Broward County, and the South Florida Water Management District regarding the construction, testing and operation of this ASR well.

d. Hurricane Preparedness - Upon the issuance of a "Hurricane Watch" by the National Weather Service, the preparations to be made include but are not limited to the following:

1) Secure all on-site salt, chemicals, and other stockpiled additive materials to prevent surface and/or groundwater contamination.
2) Properly secure drilling equipment and rig(s) to prevent damage to well(s) and any on-site treatment process equipment as well as public property.

e. The surface monitoring well equipment and piping shall be kept free of corrosion at all times.

f. Waters spilled during drilling of the system shall be contained and properly disposed.

2. Quality Assurance/Quality Control Requirements

a. The Engineer of Record shall certify all documents related to the completion all well construction. The Department shall be notified immediately of any change of the Engineer of Record.

b. All documents prepared for the geological/hydrogeological evaluation of this project shall be signed and sealed by a Florida Licensed Professional Geologist or qualified Florida Licensed Professional Engineer.

c. Continuous on-site supervision by qualified personnel (engineer and/or geologist) is required during all geophysical logging operations, coring, packer testing, casing installation and cementing operations.

3. Construction Testing Requirements

a. Blow-out preventers shall be installed on the wells prior to penetration of the Floridan Aquifer.

b. The Department shall be notified within 48 hours after work has commenced.

c. Department approval and TAC review is required prior to the following stages of construction:

1) Contract documents and spud date
2) Final ASR well casing seat
3) Plugging back pilot hole at base of storage zone
4) Method(s) of flow control during recharge of the ASR well during operation and operational testing

d. All casing seat requests for the ASR well shall be accompanied by technical justification, including but not limited to, geophysical logs with interpretations, and water quality data.

e. The submittal for the request for approval to plug back the pilot hole to modify the storage zone, shall include:

1) withdrawal test data and interpretations
2) water quality reports
3) geophysical log interpretations including flow analysis
4) identification of storage zone boundaries and characteristics
5) demonstration of confinement and evaluation of potential for upconing of poorer quality water

f. The geophysical logging program, during drilling of the ASR well, shall at a minimum, include:

1) Pilot hole to approximately 400 feet below land surface (bls):
   Caliper
   Natural gamma
   Spontaneous potential
   Long and short normal electric
2) Reamed hole to approximately 400 feet bls:
   Caliper
3) Cased hole to approximately 400 feet bls:
   Temperature log after each stage of cementing
   Gamma ray log, if needed
4) Pilot hole to the top of the Floridan Aquifer at approximately 1,000 feet bls:
   Caliper
   Natural gamma
   Spontaneous potential
   Long and short normal electric
5) Reamed hole to the top of the Floridan Aquifer at approximately 1,000 feet bls:
   Caliper
6) Cased hole to the top of the Floridan Aquiferat approximately 1000 feet bls:
   Temperature log after each stage of cementing
7) 16-inch open hole below the final casing to approximately 1300 feet bls:
   Caliper
   Natural gamma
   Dual induction
   Spontaneous potential
   Borehole compensated sonic with VDL display
   Temperature (shut-in and while pumping)
   Electric (long and short normal)
   Borehole television
   Flowmeter (static and dynamic)
8) Completed well
   Borehole television
   Temperature

g. Packer and/or interval testing and interpretation in the storage zone shall be performed to determine water quality characteristics (chloride, TDS conductivity, temperature and pH) and to provide a better definition of the quantitative characteristics (permeability values) of the zone. A five (5) gallon sample of formation fluid shall be collected at the end of the all packer and/or interval tests for which a background sample unaffected by injection can be obtained and has not already been aquired. Samples should be labeled as to well number, depth, type of sample and shipped to the Underground Injection Control Section of the Department of Environmental Protection, 2600 Blair Stone Road, Tallahassee FL 32399-2400.

h. The Department shall be notified at least seventy-two (72) hours prior to all testing for mechanical integrity.

i. All testing for mechanical integrity must be initiated during normal business hours, Monday through Thursday.

j. Pressure gages and flow meters shall be installed on the ASR well prior to initiating ASR activities at the site.

k. The pressure test for the final casing will be accepted if tested with a fluid-filled casing at 1.5 times the expected operating pressure with a test tolerance of + or - 5%. Verification of pressure gage calibration must be provided with the test reports.

l. No drilling operations shall begin without an approved disposal site for drilling fluids, cuttings, or waste. It shall be the permittee's responsibility to obtain the necessary approval(s) for disposal prior to the start of construction.

m. TAC meetings are scheduled on the 2nd and 4th Tuesday of each month subject to a five working day prior notice and timely receipt of critical data by all TAC members. Emergency meetings may be arranged when justified, to avoid undue construction delays.

4. Reporting Requirements

a. All reports and surveys required by this permit shall be submitted concurrently to all the members of the Technical Advisory Committee (TAC). The TAC shall consist of representatives from these agencies:

Department of Environmental Protection, West Palm Beach and Tallahassee
United States Environmental Protection Agency, Region IV, Atlanta
United States Geological Survey, Miami
South Florida Water Management District, West Palm Beach
Broward County DNRP
Broward County Public Health Unit

b. The Department and other applicable agencies must be notified immediately of any unusual events occurring during construction activities (e.g. on-site spills, artesian flows, large volumes of circulation losses, etc.). A written report describing the incident shall also be given to the Department within 72 hours of the start of the event. In addition, a final written report shall be sent to the Department within two weeks of the event. The final report shall contain a complete description of the occurrence, discuss its cause(s) and the steps being taken to reduce, eliminate, and prevent recurrence of the event and all other information deemed necessary by the Department.

c. A drilling and construction schedule shall be submitted to the Department and TAC prior to site preparation for the ASR well system.

d. Weekly progress reports shall be submitted throughout the construction and cycle testing periods, and shall include at a minimum the following information:

1) A cover letter summary of the daily engineer report, driller's log and a projection for activities in the next reporting period.
2) Daily engineers report and driller's log with detailed descriptions of all drilling progress, cementing, testing, logging, and casing installation activities.
3) Lithologic and geophysical logs and and water quality test results
4) Detailed description of any unusual construction-related events that occur during the reporting period.
5) Weekly water quality analysis and water levels for the four (4) pad monitor wells
6) Current status and progress of cycle testing

e. An interpretation of all test results and geophysical logs must be provided with all submittals.

f. Upon completion of analysis of cores and sample cuttings, the permittee shall contact the Underground Injection Control Section of the Department of Environmental Protection in Tallahassee to arrange their transfer to the Florida State Geologic Survey.

g. A report detailing necessity, or conversely the lack of necessity, for the installation of a monitor well must be submitted after one year of operational testing.

h. Upon completion of construction and the cycle testing phase of operational testing, , a final report shall be submitted to the Department and TAC. The report shall include, but not be limited to, all information and data collected under Rules 62-528.605, 62-528.615, and 62-528.635, FAC, with appropriate interpretations. To the extent possible, the report should include:

1) the transmissivity of the storage zone
2) the maximum ASR capacity within safe and economical pressure limits
3) detailed results and analysis of cycle testing
4) operation and maintenance manual
5) As-built drawings, of the ASR well, surface equipment, instrumentation and appurtenances, sealed by the Engineer of Record
6) summary of all water quality, water level and well performance data collected, with conclusions and recommendations
7) well location must be surveyed relative to permanent reference points by a Florida registered land surveyor, and located on a site plan by latitude and longitude.
8) mill certificates for all casing.

i. Pursuant to Rule 62-4.080(3), a permittee may request that a permit be extended as a modification of an existing permit. A request for an extension is the responsibility of the permittee and shall be submitted to the Department before the expiration of the permit. In accordance with Rule 62-4.070(4) FAC, a permit cannot be extended beyond the maximum 5 year statutory limit which ends on NOV 13 2003. Should operational testing need to continue beyond the 5 years of this permit, the permittee must renew this construction permit.

j. A request for authorization to use the ASR well shall be submitted at least 60 days prior to the expiration of this permit.

k. Operational testing of this ASR well shall cease upon expiration of this permit, unless an authorization to use is issued by the Department, or a timely renewal application (Rule 62-4.090, FAC) for this construction permit has been submitted to the Department.

l. In the event the ASR well must be plugged and abandoned, the permittee shall obtain an FDEP permit, as required by Rule 62-528.645, FAC.

5. Operational Testing Requirements

a. Operational testing shall not commence without written authorization from the Department.

b. Prior to operational testing, the following items must be submitted for TAC review and Department approval:

1) a draft operation and maintenance manual with emergency procedures
2) borehole television survey of the ASR well and the final casing of the well
3) lithologic and geophysical logs with interpretations
4) certification of mechanical integrity and interpreted test data
5) aquifer test data, analysis and interpretation
6) detailed cycle testing plan including the number of cycles and duration of cycles

7) background water quality results from the storage zone for primary and secondary drinking water standards (62-550, FAC) and minimum criteria parameters (62-520 FAC), as attached

8) water quality results of the injectate for primary, and secondary standards and minimum criteria, excluding asbestos, acrylamide, epichlorohydrin and the primary pesticide scan, including dissolved oxygen and total trihalomethanes

9) surface equipment completion certification or certification of interim completion for the purposes of testing

10) signed and sealed As-built engineering drawings of all subsurface, surface equipment and appurtenances

c. The permittee shall calibrate all pressure gages, flowmeters, chart recorders, and other related equipment associated with the ASR well system on a semi-annual basis. The permittee shall maintain all monitoring equipment and shall ensure that the monitoring equipment is calibrated and in proper operating condition at all times. Laboratory equipment, methods, and quality control will follow EPA guidelines as expressed in Standard Methods for the Examination of water and Wastewater. The pressure gages, flow meter, and chart records shall be calibrated using standard engineering methods.

d. Department or Department delegated local program potable water construction permits must be issued for all surface piping and appurtenances upstream of the ASR wellhead. Bacteriological clearance must be performed prior to operational testing of the ASR system.

6. Operational Testing Conditions

a. Upon receipt of written authorization from the Department, the operational testing of the ASR well is subject to the following conditions:

1) A qualified representative of the Engineer of Record must be present for the start-up operations.

2) Flows to the ASR well shall be monitored and controlled at all times to ensure the maximum injection rate does not exceed that rate at which the well was tested.

3) Any failure of the ASR well monitoring and recording equipment for a period of more than forty-eight (48) hours shall be reported immediately to the Department. A written report describing the incident shall also be given to the Department within 72 hours of the start of the event. In addition, a final written report shall be sent to the Department within two weeks of the event. The final report shall contain a complete description of the occurrence, discuss its cause(s) and the steps being taken to reduce, eliminate, and prevent recurrence of the event, and all other information deemed necessary by the Department.

4) The following data shall be collected and reported to the Department in Monthly Operating Reports (MORs), no later than the 15th day of the month immediately following the end of the sampling period. The results shall be sent to the Department of Environmental Protection, Southeast District Office, PO Box 15425, West Palm Beach, Florida, 33416. Copies of the results shall also be sent to the Underground Injection Control Section, Bureau of Drinking Water and Ground Water Resources, Department of Environmental Protection, 2600 Blair Stone Road, Tallahassee, FL 32399-2400.

a) ASR well performance:
* total daily flow to/from the well (mg)
* daily average, maximum and minimum injection pressure at the well (psig)
* average maximum and minimum daily flow to/from the well (gpm)
* cumulative total volume injected and recovered from the well (gal)

b) Cycle Testing: The ASR well shall be monitored during each injection, storage, and recovery cycle, in accordance with the parameters and frequency listed below.

	OPERATIONAL TESTING									
	CYCLE TESTING						NORMAL OPERATIONS			
							STORAGE		RECOVERY	
	DAILY	WEEKLY	BEGINNING OF INJECTION	STORAGE	BEGINNING OF RECOVERY	END OF RECOVERY	MONTHLY	QUARTERLY	MONTHLY	QUARTERLY
Chloride (mg/l)	X						X		X	
Conductivity (umhos/cm)	X						X		X	
TDS (mg/l)	X						X		X	
Total Trihalomethanes (mg/l)		X						X		X
Temperature (^{o}C)		X								
pH (std units)		X								
Turbidity (NTU)		X								
Total Iron (mg/l)		X								
Total Alkalinity (mg/l)		X								
Sulphate (mg/l)		X								
Gross Alpha (pCi/l)			X	X	X	X		X		X
Dissolved Oxygen (mg/l)			X	X	X	X				
Iron Hydroxide (mg/l)			X	X	X	X				
Primary, Secondary and Minimum Criteria								X		X

c) TKN and ammonia shall be sampled if background water aqualtiy data show significant differences when compared with the results of the injectate

d) The Department may require the monitoring of additional parameters if water quality monitoring of the Biscayne aquifer or the injection fluid indicates any of the following:

(i) quality of the injectate is deteriorating

(ii) results of the sampling indicate significant differences in water quality during consecutive sampling events

(iii) a source of contamination to the ASR storage zone is discovered that was not addressed in the permit

6) A minimum of three (3) well volumes of fluid shall be evacuated from the well prior to sampling for the chemical parameters listed above.

7) All data submissions, including MOR's, shall be clearly identified on each page with Facility Name, ID number, date of sampling/recording, operator's name, license and telephone number, and type of data shown. The lead plant operator or higher official must sign and date each submittal. A copy of the Southeast District, UIC Section, MOR summary sheet is attached for your use.

b. No fluids shall be injected without prior written authorization from the Department.

c. The only source of injectant shall be water meeting all Primary and Secondary drinking water quality standards and minimum criteria unless otherwise exempted.

7. Signatories

a. All reports and other submittals required to comply with this permit shall be signed by a person authorized under Rules 62-528.340(1) or (2), FAC.

b. In accordance with Rule 62-528.340(4), FAC, all reports shall contain the following certification:

" I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fines and imprisonment for knowing violations."

Issued this 12 day of NOV., 1996

STATE OF FLORIDA
DEPARTMENT OF ENVIRONMENTAL PROTECTION

Carlos Rivero-deAguilar
Director of District Management
Southeast District

PERMITTEE:
Mr. Chris Helfrich, P.E.
Assistant Director of Utilities
City of Sunrise Springtree WTP

ID NUMBER: 5006M07487
PERMIT/CERTIFICATION NUMBERS: UC-06-283776
DATE OF ISSUE: NOV 13 1996
EXPIRATION DATE: NOV 13 1998

PRIMARY DRINKING WATER STANDARDS
Updated January 1996

PARAMETER

Alachlor
Aldicarb
Aldicarb sulfoxide
Aldicarb sulfone
Aroclors (Polychlorinated Biphenyls or PCB's)
Alpha, Gross
Antimony
Arsenic
Asbestos
Atrazine
Barium
Benzene
Benzo(a)pyrene
Beryllium
Bis(2-ethylhexyl) adipate (Di(2-ethylhexyl) adipate)
Bis(2-ethylhexyl) phthalate (Di(2-ethylhexyl) phthalate)
Cadmium
Carbofuran
Carbon Tetrachloride (Tetrachloromethane)
Chlordane
Chlorobenzene (Monochlorobenzene)
Chloroethylene (Vinyl Chloride)
Chromium
Coliforms, Total
Cyanide
2,4-D (2,4-Dichlorophenoxyacetic acid)
Dalapon (2,2-Dichloropropionic acid)
Dibromochloropropane (DBCP)
1,2-Dibromoethane (EDB, Ethylene Dibromide)
1,2-Dichlorobenzene (o-Dichlorobenzene)
1,4-Dichlorobenzene (p-Dichlorobenzene or Para Dichlorobenzene)
1,2-Dichloroethane (Ethylene dichloride)
1,1-Dichloroethylene (Vinylidene chloride)
cis-1,2-Dichloroethylene (1,2-Dichlorethylene)
trans-1,2-Dichloroethylene (1,2-Dichlorethylene)
Dichloromethane (Methylene chloride)
1,2-Dichloropropane
Di(2-ethylhexyl) adipate (Bis(2-ethylhexyl) adipate)
Di(2-ethylhexyl) phthalate (Bis(2-ethylhexyl) phthalate)
Dinoseb
Diquat
EDB (Ethylene dibromide, 1,2-Dibromoethane)
Endothall
Endrin
Ethylbenzene
Ethylene dichloride (1,2-Dichloroethane)
Fluoride
Glyphosate (Roundup)
Gross Alpha
Heptachlor
Heptachlor Epoxide
Hexachlorobenzene (HCB)
gamma-Hexachlorocyclohexane (Lindane)
Hexachlorocyclopentadiene
Lead
Lindane (gamma-Hexachlorocyclohexane)
Mercury
Methoxychlor
Methylene chloride (Dichloromethane)
Monochlorobenzene (Chlorobenzene)
Nickel
Nitrate (as N)
Nitrite (as N)
Total Nitrate + Nitrite (as N)
Oxamyl
Pentachlorophenol
Perchloroethylene (Tetrachloroethylene)
Picloram
Polychlorinated biphenyl (PCB or Aroclors)
Radium
Roundup (Glyphosate
Selenium
Silver
Silvex (2,4,5-TP)
Simazine
Sodium
Styrene (Vinyl benzene)
Tetrachloroethylene (Perchloroethylene)
Tetrachloromethane (Carbon Tetrachloride)
Thallium
Toluene
Toxaphene
2,4,5-TP (Silvex)
1,2,4-Trichlorobenzene
1,1,1-Trichloroethane
1,1,2-Trichloroethane
Trichloroethylene (Trichloroethene, TCE)
Trihalomethanes, Total
Vinyl Chloride (Chloroethylene)
Xylenes (total)

SECONDARY DRINKING WATER STANDARDS

Aluminum
Chloride
Color
Copper
Corrosivity
Ethylbenzene
Fluoride
Foaming Agents (MBAS)
Iron
Manganese
Odor
pH
Silver
Sulfate
Toluene
Total Dissolved Solids (TDS)
Xylenes
Zinc

MUNICIPAL WASTEWATER MINIMUM CRITERIA
GROUND WATER MONITORING PARAMETERS

INORGANICS	Ammonia Nitrogen (organic) Orthophosphate (soluble) Phosphorus Total Kjeldahl Nitrogen
VOLATILE ORGANICS	Chloroethane Chloroform para-Dichlorobenzene 1,2-Dichloroethylene (cis-1,2-Dichloroethylene or trans-1,2-Dichloroethylene)
Base/Neutral Organics	Anthracene Butylbenzylphthallate Dimethylphthallate Naphalene Phenanthrene
PESTICIDES AND PCBs	Aldrin Dieldrin Dioxin
Acid Extractables	2-chlorophenol Phenol 2,4,6-trichlorophenol
Other	Conductivity Biological Oxygen Demand Temperature

UIC - ASR MONTHLY OPERATING REPORT DATA SUMMARY

REPORT MO/YR _____ – _____

FACIL . _____
LEAD OPERATOR _____
PHONE NO _____

WELL NO _____
CASING DEPTH _____
TOTAL DEPTH _____

DEP PERMIT NO _____
PERMIT EXPIRATION DATE _____
ID NUMBER _____

MO WELL DATA: AVERAGE DAILY FLOW TO/FROM THE WELL _____ MGD
MAXIMUM DAILY FLOW TO/FROM THE WELL _____ MG
MINIMUM DAILY FLOW TO/FROM THE WELL _____ MG
PEAK HOUR FLOW (MGD) ON MAX DAY _____ MGD
CUMULATIVE TOTAL VOLUME TO/FROM THE WELL _____

MAX SUSTAINED INJECTION PRESSURE _____ PSIG
MONTHLY AVERAGE INJECTION PRESSURE _____ PSIG
MONTHLY WELLHEAD PRES, NO FLOW (SHUT-IN) _____ PSIG
*MAXIMUM INJECTION PRESSURE PERMITTED _____ PSIG
(not to exceed 66% of tested pressure)
CASING PRESSURE DURING MIT _____ PSIG

KEY: *D=DAILY W=WEEKLY M=MONTHLY Q=QUARTERLY I=BEININING OF INJECTION S=STORAGE R=BEGINNING & END OF RECOVERY*

Frequency	Parameter	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	X
D M	Chloride (mg/l)																
D M	Conductivity (umhos/cm)																
D M	TDS (mg/l)																
W Q	Total Trihalomethanes (mg/l)																
W	Temperature (OC)																
W	pH (std units)																
W	Turbidity (NTU)																
W	Total Iron (mg/l)																
W	Total Alkalinity (mg/l)																
W	Sulphate (mg/l)																
I S R Q	Gross Alpha (pCi/l)																
I S R Q	Dissolved Oxygen (mg/l)																
I S R Q	Iron Hydroxide (mg/l)																
Q	Primary, Secondary and Minimum Criteria																

Frequency	Parameter	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
D M	Chloride (mg/l)																
D M	Conductivity (umhos/cm)																
D M	TDS (mg/l)																
W Q	Total Trihalomethanes (mg/l)																
W	Temperature (OC)																
W	pH (std units)																
W	Turbidity (NTU)																
W	Total Iron (mg/l)																
W	Total Alkalinity (mg/l)																
W	Sulphate (mg/l)																
I S R Q	Gross Alpha (pCi/l)																
I S R Q	Dissolved Oxygen (mg/l)																
I S R Q	Iron Hydroxide (mg/l)																
Q	Primary, Secondary and Minimum Criteria																

SOUTHEAST DISTRICT UIC SECTION

SURFICIAL AQUIFER MONITOR WELL QUARTERLY REPORT

FACILITY NAME _____ REPORT MO/YR. _____

OPERATOR NAME _____ LICENSE # _____

I.D.NUMBER _____ PERMIT # _____

INJECTION WELL # _____

SAMPLING DATE _____ TIME _____

	PMW #1	PMW #2	PMW #3	PMW #4
LOCATION	NE CORNER	NW CORNER	SE CORNER	SW CORNER
ELEVATION OF TOC (NGVD)				
DEPTH TO WATER (TOC)				
WATER LEVEL (NGVD)				
CHLORIDES (MG/L.)				
CONDUCTIVITY (UMHOS)				
TEMPERATURE (F)				

ANALYZED BY: _____ SAMPLED BY: _____

PHONE # _____ TITLE _____

SITE PLAN OF PMW LOCATIONS

Appendix B

Lithologic Descriptions

MONTGOMERY WATSON

PROJECT: City of Sunrise

Date: March 18, 1997

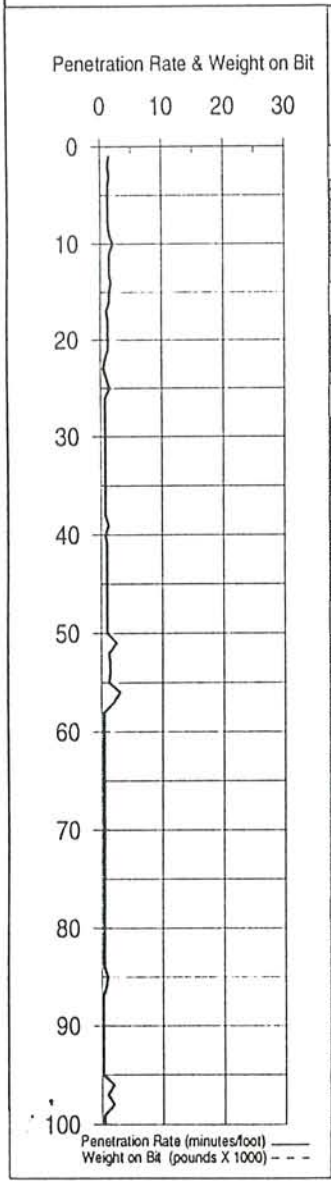
WELL: Springtree ASR

KEY TO LITHOLOGIC COLUMN

--SAND --LIMESTONE --CLAY

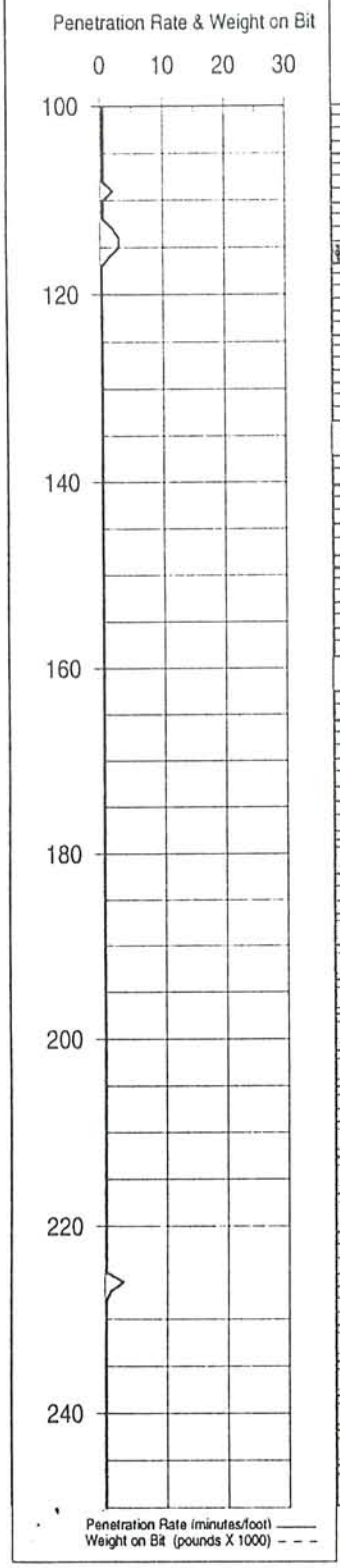
--SHELL --DOLOMITE --SILT

--CHERT --CALCITE



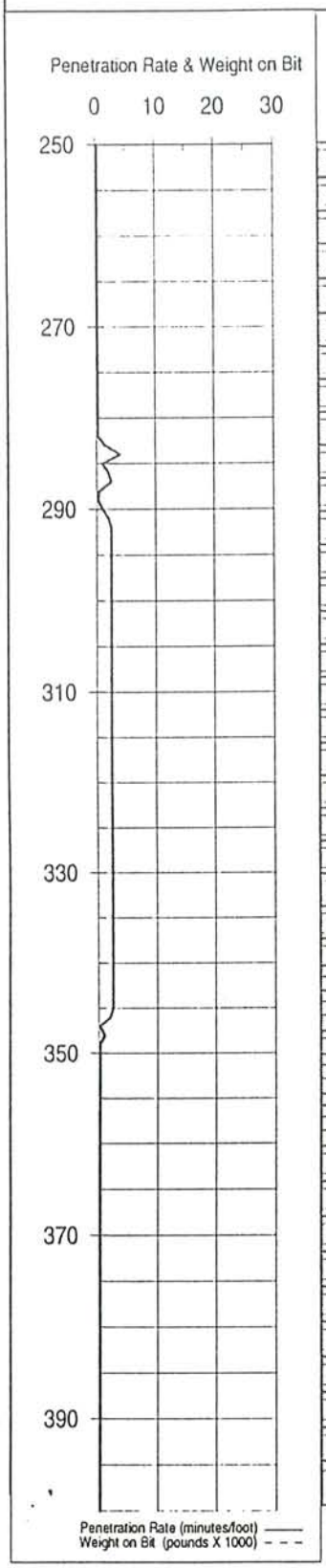
LITHOLOGY	DEPTH	LITHOLOGIC DESCRIPTION
	0	**SAND:** 35%; tan to clear; moderately rounded to angular; poorly sorted; Quartz sand. **Limestone:** 50%; tan to very pale orange; wackestone; contains quartz sand and shell debris; well cemented; recrystallized; moderately permeable; hard; abundant plecypods and gastropods. **Shell:** 15%; plecypod and gastropod hash.
	50	**Limestone:** 75%; very light gray; packstone; contains abundant quartz sand/shell/heavies/and coarse xlin calcite; moderate to well cemented; interparticle porosity is present; as well as vugular to microvugular textures; moderately hard; locally friable; plecypoda, gastropoda, and smaller forams. **Calcite:** 5%; very pale orange; translucent; xlin crystal form; secondary diagenesis. **Shell:** 15%; plecypoda, gastropoda, bryzoan, and foraminifera. **Limestone:** 5%; grayish orange; wackestone; limemud with minor sand; vugular porosity - possibly iron stained limestone formation.

WELL: Springtree ASR

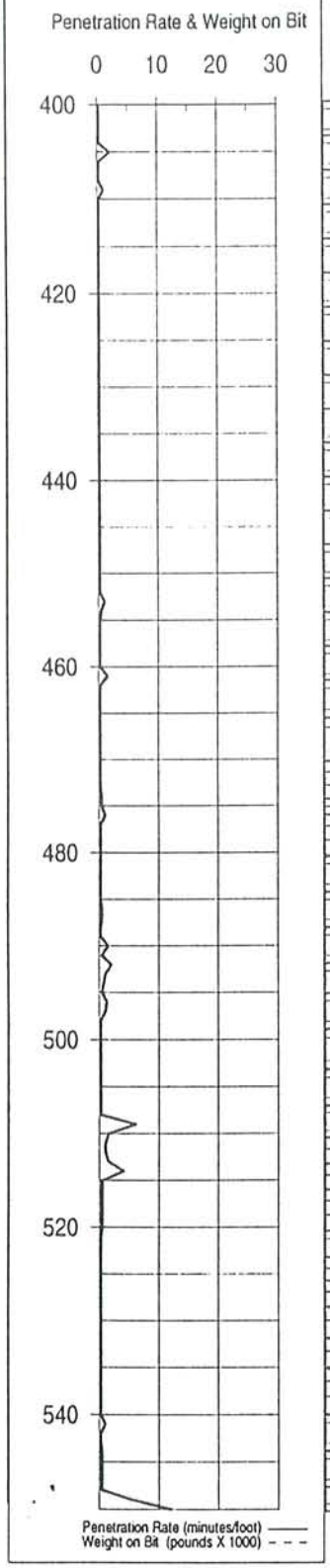


LITHOLOGY	DEPTH	LITHOLOGIC DESCRIPTION
	150	**Limestone:** 75%; very light gray to buff; packstone; contains recrystallized calcite and shell material; well to moderate cementation; low porosity; moderately hard; locally chalky texture; plecypoda, gastropoda and foraminifera. **Shell:** 25%; plecypoda, gastropoda and foraminifera.
	175	**Limestone and Shell as above unit:** 50% **Clay:** 50%; light olive green; plastic and massive; carbonate and dolomite cement; no porosity; contains quartz sand and silt and fossil debris; phosphate.
	190	**Limestone as above:** 5%; possible contamination. **Clay as above:** 95%.
	220	**Limestone:** 100%; very light gray to tan or white; wackestone; well cemented; contains sand and fossils; low porosity; very hard; gastropoda and plecypoda fragments.
	230	**Clay:** 100%; dark olive green; plastic; contains quartz sand, silt, minor shell material, and trace limestone and dolomite; carbonate cement; no porosity;clay can be nodular and soft; few plecypoda and gastropoda.

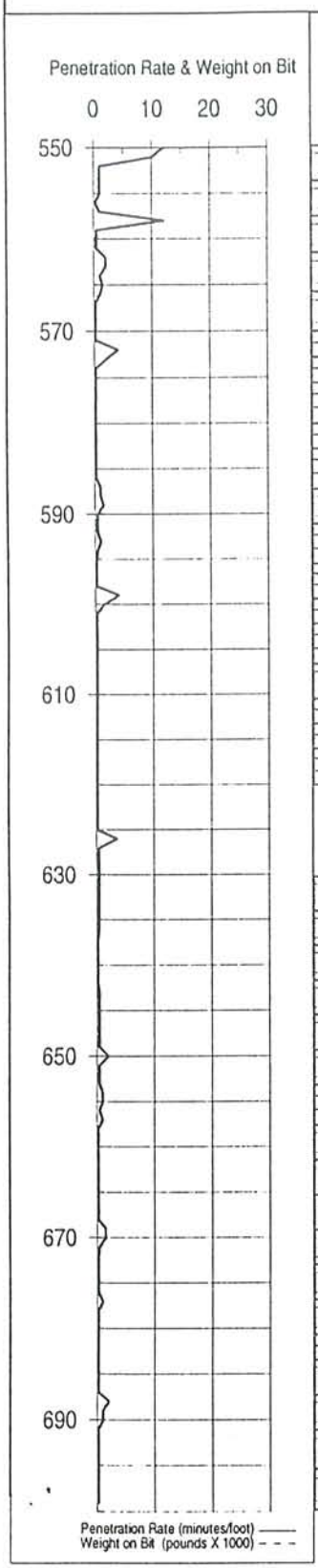
WELL: Springtree ASR



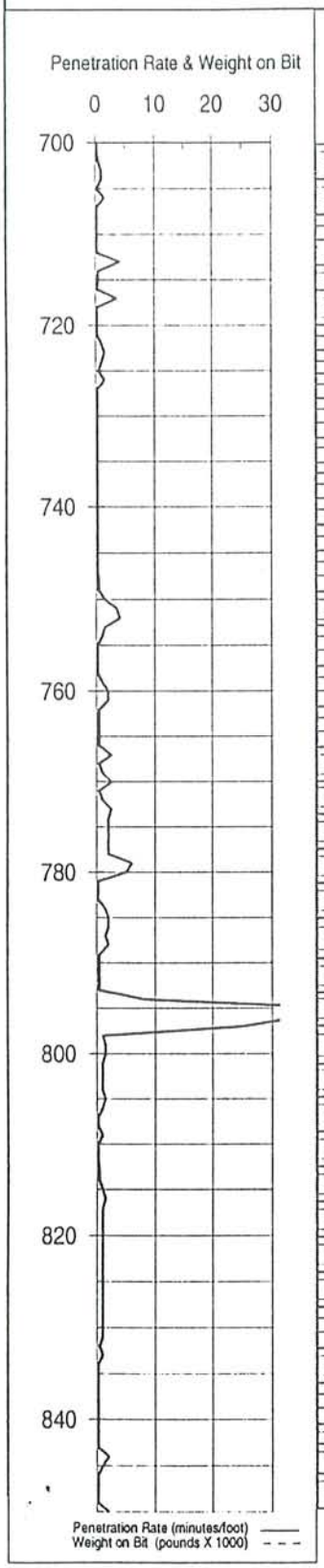
LITHOLOGY	DEPTH	LITHOLOGIC DESCRIPTION
	340	**Clay as above:** 15%. **Limestone:** 85%; light to medium gray; contains sand and few fossils; wackestone; recrystallized, no porosity; very hard; plecypod material.
	360	**Clay as above:** 100%.



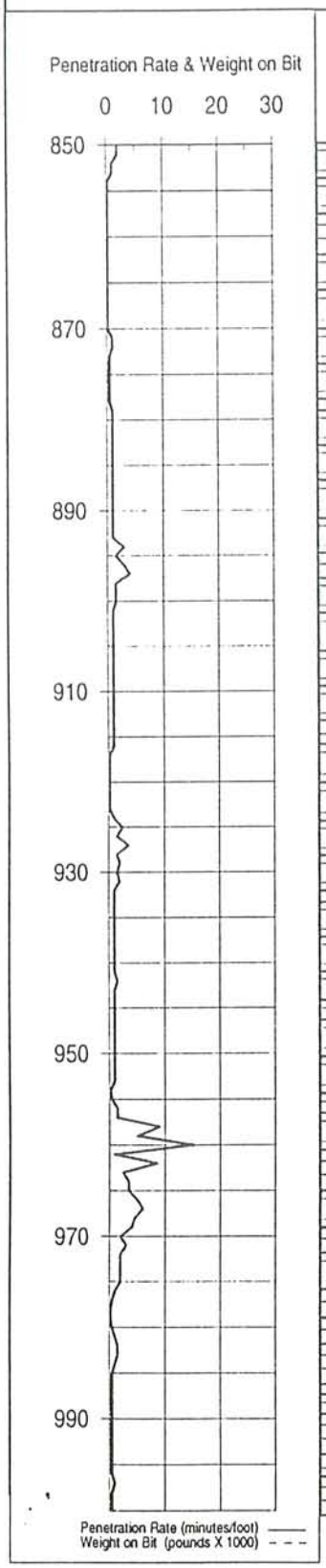
LITHOLOGY	DEPTH	LITHOLOGIC DESCRIPTION
	470	**Clay as above:** 10%. **Limestone as above:** 90%; light gray to white.
	480	**Clay as above:** 100%; nodular appearance; phosphate.
	510	**Limestone:** 80%; very light gray to white; mudstone; well cemented; hard; minor calcite debris; recrystallized. **Clay:** 20%; light olive green; plastic; silty; no porosity; soft; phosphates.
	530	**Limestone as above:** 100%.
	540	**Clay as above:** 100%.



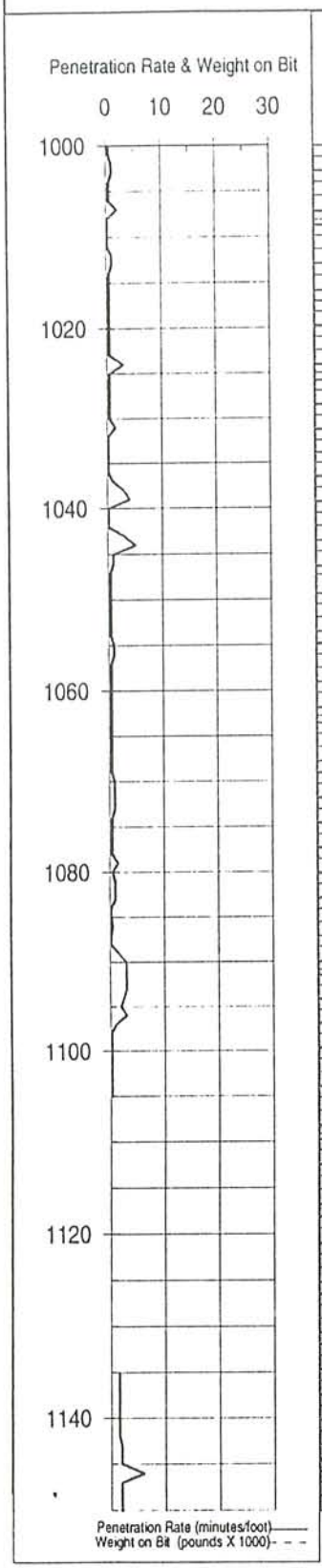
LITHOLOGY	DEPTH	LITHOLOGIC DESCRIPTION
	570	**Limestone and Clay as 510 - 530:**
	620	No recovery
	630	**Limestone and Clay as 510 - 530:** **Clay:** 90%. **Limestone:** 10%.



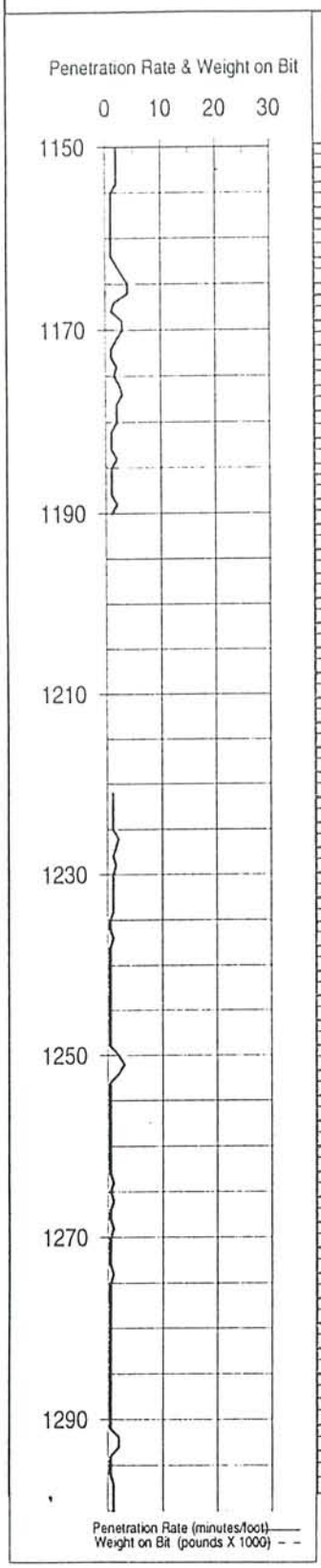
LITHOLOGY	DEPTH	LITHOLOGIC DESCRIPTION
	720	Limestone as 530 - 540:
	740	Limestone and Clay as 510 - 530:
	770	Clay as 510 - 530: 100%
	820	Limestone and Clay as 510 - 530: Clay: 75%. Limestone: 25%.



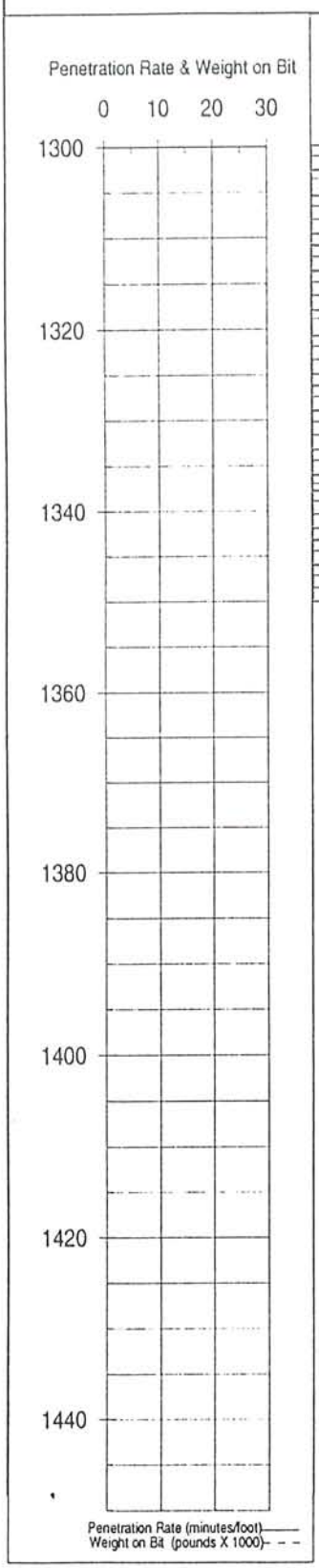
LITHOLOGY	DEPTH	LITHOLOGIC DESCRIPTION
	870	**Limestone and Clay as 510 - 530:** **Clay:** 95%. **Limestone:** 5%.
	950	**Clay:** 100%; dark olive green; nodular and plastic (palygorskite); contains dolomite cement; minor quartz silt; soft.
	960	**Limestone and Clay as 510 - 530:** **Clay:** 50%. **Limestone:** 50%.
	980	**Limestone and Clay as 510 - 530:** **Clay:** 20%; darker green color. **Limestone:** 80%.
	1000	



LITHOLOGY	DEPTH	LITHOLOGIC DESCRIPTION
	1000	**Limestone:** 95%; light gray to white; mudstone; carbonate cement; no porosity; contains phosphate nodules. **Clay as 510 - 530:** 5%.
	1035	**Limestone:** 95%; very light gray to very pale orange (some white); wackestone to packstone; contains fossils; lime mud matrix; fossils are present as cast and mold structures and recrystallized calcite; moldic and intergranular porosity is present; moderately hard; contains gastropods and plecypods and some smaller foraminifera. **Clay:** 5%; light green gray to white; plastic; calcite based; soft.
	1120	**Limestone:** 100%; very pale orange; packstone grainstone; contains echinoids and foraminifera; unit is peletal (biotic); poorly cemented, interparticle, intergranular and moldic porosity is present; poorly indurated and crumbles; echinoids, foraminifera and mollusca hash; soft.
	1140	**Limestone and clay as 1035 - 1120:**



LITHOLOGY	DEPTH	LITHOLOGIC DESCRIPTION
	1150	**Limestone:** 100%; grayish orange; packstone, grainstone; peletal; poorly cemented and friable; intergranular and moldic porosity; poorl indurated; foraminifera, echinoids and mollusca hash; soft.
	1210	**Limestone:** 100%; very pale orange; packstone; contains foraminifera and hash; highly recrystallized; peletal with fossil hash and red algae; intergranular porosity; moderately indurated; mollusc hash; soft.
	1230	**Limestone as 1150 - 1210:** contains red algae component.
	1290	**Limestone:** 85%; very pale orange to grayish orange; grainstone; biotics and carbonate sand and hash; moderately cemented;



LITHOLOGY	DEPTH	LITHOLOGIC DESCRIPTION
	1300	Intergranular porosity is cement filled; well indurated; moderately hard; mollusca hash; secondary cement. **Clay:** 15%; lime mud with terrageneous silt and clay residue; no porosity; plastic; no fossils.
	1350	

Notes

Core # 2

1191' - 1206'

Date 4-4-97

1191' - 1206' 20% Recovery

Limestone, 100%, Grayish Orange, Grainstone, moderate to poorly Cemented, Contains fossil hash - Mollusca Fragments, and Echinoid - forams. Porosity is Interparticulate & moldic - Cement reduced, Possible Bedding planes & Algal Laminae, Soft - poorly Indurated & crumbly, Mollusca - echinoids - forams - Algae.

Appendix C

Geophysical Logs

City of Sunrise
Springtree ASR Well #1
Bid No. 96(40) 12-15-06-12-M

GEOPHYSICAL LOG

DATE	RUN #	DEPTH	LOGGED INTERVAL (FROM/TO)	LOG TYPE
3/10/97	1	342	342 - 0	XY Caliper, Gamma Ray; Dual Induction, Spontaneous Potential
3/10/97	2	175	175 - 0	XY Caliper, Gamma Ray;
3/15/97	3	1,130	1,130 - 170	XY Caliper, Gamma Ray; Dual Induction, Spontaneous Potential
3/20/97	4	1,115	1,115 - 170	XY Caliper, Gamma Ray;
3/21/97	5	1,100	1,100 - 0	Temperature, Gamma Ray - Cement Top Log
4/1/97	6	1,221	1,221 - 1,050	XY Caliper, Gamma Ray; Fluid Resistivity, Temperature; Flowmeter
4/3/97	7	1,300	1,300 - 1,050	XY Caliper, Gamma Ray; Fluid Resistivity, Temperature; Flowmeter
4/4/97	8	1,350	1,350 - 1,100	XY Caliper, Gamma Ray; Fluid Resistivity, Temperature; Flowmeter; Dual Induction, Spontaneous Potential; Borehole Compensated Sonic
4/8/97	9	1,342	1,342 - 1,110	Video Log

Appendix D

Deviation Survey

MONTGOMERY WATSON

ASR WELL # 1 DEVIATION SURVEY

SPRINGTREE AQUIFER STORAGE AND RECOVERY WELL

BID NUMBER 96(40) 12-15-06-12-M

CONTRACTOR: Youngquist Brothers, Inc.

ARRANGE THE DEPTH INTERVALS TO CORRESPOND BETWEEN THE TWO TABLES BELOW

PILOT HOLE SURVEY

DATE	DEPTH (feet)	DEVIATION (angular min.)	OBSERVERS INITIALS
3/10/97	60	0.5	
3/10/97	120	0.5	
3/10/97	170	0.375	
3/10/97	230	0.5	
3/10/97	290	0.5	
3/13/97	350	0.25	
3/13/97	410	0.5	
3/13/97	470	0.4	
3/13/97	530	0.375	
3/14/97	593	0.75	
3/14/97	653	0.5	
3/14/97	713	0.9	
3/14/97	773	0.625	
3/14/97	833	0.75	
3/14/97	893	0.9	
3/14/97	950	0.25	
3/14/97	1010	0.5	

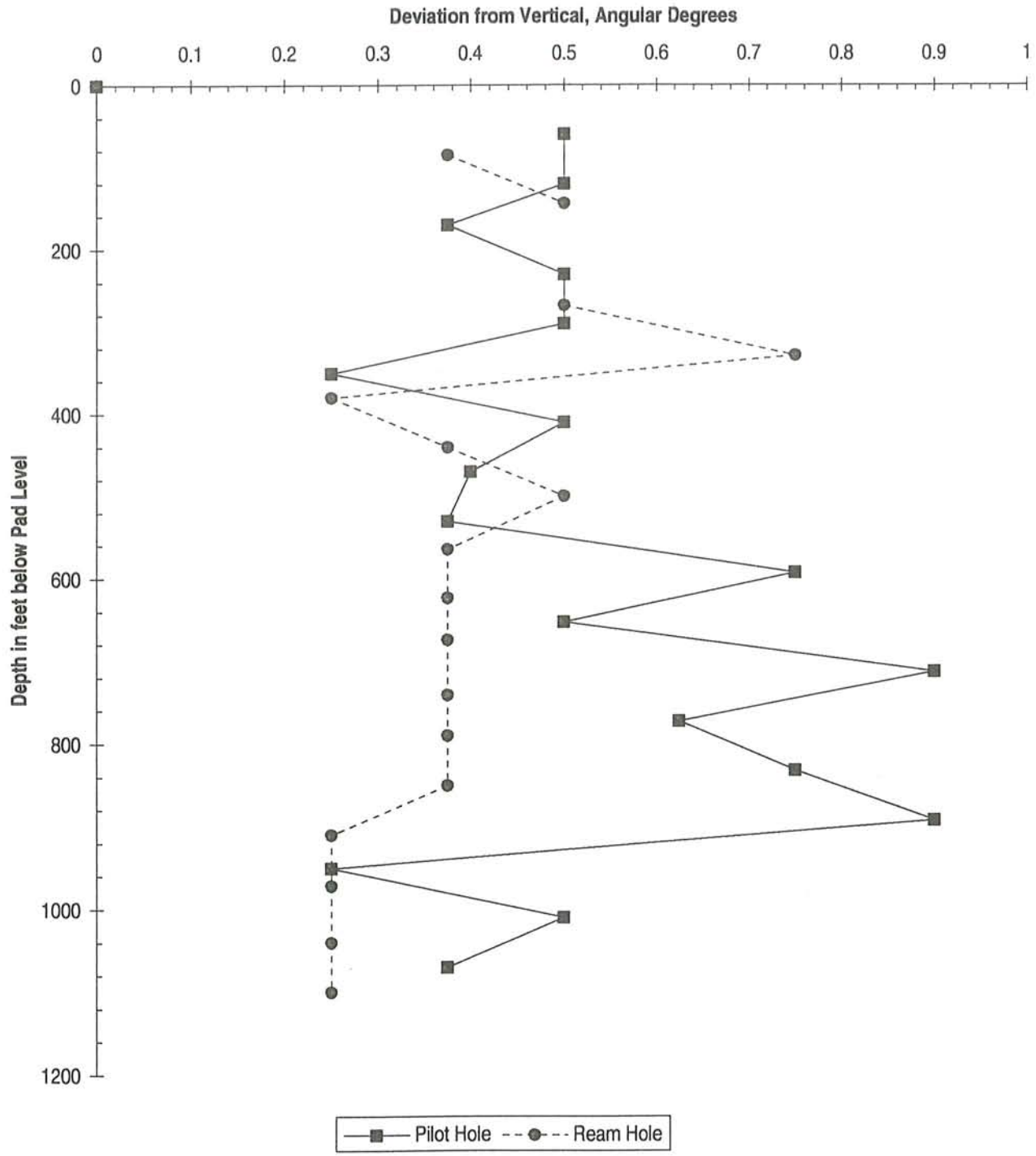
REAMED HOLE SURVEY

DATE	DEPTH (feet)	DEVIATION (angular min.)	OBSERVERS INITIALS
3/11/97	85	0.375	
3/12/97	144	0.5	
3/17/97	268	0.5	
3/17/97	329	0.75	
3/17/97	380	0.25	
3/17/97	440	0.375	
3/17/97	500	0.5	
3/18/97	564	0.375	
3/18/97	623	0.375	
3/18/97	674	0.375	
3/18/97	741	0.375	
3/18/97	790	0.375	
3/18/97	850	0.375	
3/18/97	910	0.25	
3/19/97	972	0.25	
3/19/97	1040	0.25	

DATE	DEPTH (feet)	DEVIATION (angular min.)	OBSERVERS INITIALS
3/10/97	60	0.5	
3/14/97	1070	0.375	

DATE	DEPTH (feet)	DEVIATION (angular min.)	OBSERVERS INITIALS
3/11/97	85	0.375	
3/20/97	1100	0.25	

ASR Pilot & Ream
Comparison of Deviation Surveys



Appendix E

Casing Mill Certificates

VASS PIPE & STEEL CO., INC.

A DEPENDABLE SOURCE YOU CAN COUNT ON

158 THIRD STREET, P.O. BOX 583 · MINEOLA · NY 11501 · TEL: 516.741.8398 · FAX: 516.741.8210

MONTGOMERY WATSON
CORRECTIONS TAKEN ✓ AMEND - RESUBMIT
CORRECTION NOTED REJECTED-RESUBMIT
REVIEWED BY RTV DATE 12-6-96
RECOMMENDED BY AMH DATE 12-10-96
PRIOR TO RECEIPT OF COMMENTS MADE ON C... CONTRACTOR FROM COMPLIANCE WITH CONTR... AND SPECIFICATIONS. THIS SHOP DRAWING ... FOR CONFORMANCE WITH THE DESIGN ... COMPLIANCE WITH THE CONTRACT ... CONTRACTOR IS RESPONSIBLE FOR ... ATING ALL QUANTITIES ... SES AND TECHNIQUES ... TRADES, AND SAFETY ... THE WORK.

11:33

LABORATORY REPORT AND MILL TEST CERTIFICATE

DATE Nov.22/96 CUSTOMER _____

SPECIFICATION Hydrotested in Accordance with A139B CUSTOMER'S P.O _____

DIA. & WALL 26" O.D. X .375 WT PHOENIX REF.# _____

HYDROTEST 810 PSI FOR 2 Min

PHYSICAL PROPERTIES

HEAT NO.	PIPE NO.	LONGITUDINAL TEST YIELD	TENSILE	% ELONGATION	TRANSVERSE WELD TENSILE	BREAK LOCATION
7349S	1	43900	69300	40.0	,72800	PM
7350S	6	44600	69500	40.0	73100	PM

LADLE ANALYSIS CHEMICAL COMPOSITION

HEAT NO	C	MN	S	P	SI	CR	NI	CU	MO	AL
7349S	.18	1.02	.009	.008	.23	.02	.01	.02	.01	.034
7350S	.18	1.04	.010	.007	.23	.03	.02	.01	.01	.034

The material listed on this report has been tested in accordance with the specification shown above.

Authorized Approval

A.U. Pipe 40' -0 +5"

검 사 증 명 서 (A)

MILL INSPECTION CERTIFICATE

현 대 강 관 주 식 회 사
HYUNDAI PIPE CO.,LTD.
*본 사·공 장 경남 울산시 중구 염포동 265번지
ULSAN PLANT : # 265, YUMPO-DONG, JUNG-KU, ULSAN, KOREA
TEL : 87-2101~9 FAX : (0522) 87-8916
TLX : HDPIPE K 53776
*서울사무소 서울특별시 중구 무교동 77번지 100-170
SEOUL OFFICE : # 77, MUKYO-DONG, JUNG-KU, SEOUL, KOREA
TEL : 773-0522 FAX : 775-7095
TLX : HDPIPE K 24656, K 22956

증명서번호 CERTIFICATE NO : E-6-08-024 페이지 PAGE : 1
발행일자 DATE OF ISSUE : AUG. 29. 1996. E4627705
계약번호 CONTRACT P/O NO :
품명 COMMODITY : E.R.W. STEEL PIPE
제조규격 SPECIFICATION : API 5LB/ASTM A53B
수요가 CUSTOMER :

EXCEPTIONS TAKEN
CORRECTION NOTED
REVIEWED BY RTV 12-6-96
RECOMMENDED BY AMM 12.10.96
CORRECTIONS OR COMMENTS MADE ON SHOP DRAWINGS DURING THIS REVIEW DO NOT RELIEVE CONTRACTOR FROM COMPLIANCE WITH ALL REQUIREMENTS OF RULES AND SPECIFICATIONS. THIS REVIEW IS ONLY FOR CONFORMANCE WITH THE DESIGN CONCEPT OF THE PROJECT AND COMPLIANCE WITH THE INFORMATION GIVEN IN THE CONTRACT DOCUMENTS.
GOOD

관종 TYPE OF PIPE END	치수 DIMENSION 외경 OUTDIA × 두께 THICK. × 길이 LENGTH	수량 QUANTITY PCS	중량 WEIGHT KG	수압시험 HYDRO-STATIC TEST Mpa kg/cm² PSI	5	6 VISUAL & DIMENSION TEST	7 FLATTENING TEST	8 WELD DUCTILITY TEST	9	10 DRIFT TEST	11 TEARING TEST	12 CRUSH TEST	13 REVERSE FLATTENING TEST	도금시험 COATING TEST 아연부착량 WEIGHT OF ZINC COAT g/m²	침입성 DIP TEST Time MIN	4 5	제강번호 HEAT NO	인장시험 TENSILE TEST 항복강도 YIELD STRENGTH	인장강도 TENSILE STRENGTH B #14	W #15	연신율 EL ELONGATION %	16	화학성분 CHEMICAL COMPOSITION C	Si	Mn	P	S	Cu	Ni	Cr	Mo	충격시험 IMPACT 흡수에너지 ENERGY	시험온도 TEMP.	비고 REMARK
#1	#2 #3 #4																	PSI	kg/mm² N/mm²			100	· 1000	100										
BPEB	OD 3-1/2" x .216" x21.000'	266	19,216	176	G	G	G	G	G								6238979	34.4	46.4		29	15	Tr	74	12	13	6	1	2	1	Tr			
	(88.9mm x 5.49mm x 6.401M)			2500														48900	66000															
BPEB	OD 4-1/2" x .237" x21.000'	290	29,841	155	G	G	G	G	G								8786929	33.1	45.4		30	15	Tr	75	10	9	6	1	2	1	Tr			
	(114.3mm x 6.02mm x 6.401M)			2200														47100	64600															
BPEB	OD 16" x .375" x21.000'	11	6,563	69	G	G	G	G	G								B09130	52.9	58.0	61.2	33	7	20	120	17	2	6	1	2	1	Tr			
	(406.4mm x 9.53mm x 6.401M)			980														75200	82500	87000														
BPEB	OD 4-1/2" x .237" x40.000'2 "	119	23,421	155	G	G	G	G	G								8786929	33.1	45.4		30	15	Tr	75	10	9	6	1	2	1	Tr			
	(114.3mm x 6.02mm x 12.243M)			2200														47100	64600															
BPEB	OD 14" x .500" x21.000'	26	17,871	105	G	G	G	G	G								A90981	33.4	51.2	54.6	36	16	1	82	15	8	6	Tr	1	2	1			
	(355.6mm x12.70mm x 6.401M)			1490														47500	72800	77700														
																	A92083	35.1	49.3	52.7	36	16	Tr	76	14	5	6	1	2	1	Tr			
																		49900	70100	75000														
BPEB	OD 16" x .500" x21.000'	25	19,730	92	G	G	G	G	G								B12185	30.1	47.5	50.1	36	16	1	75	12	7	6	1	2	1	2			
	(406.4mm x12.70mm x 6.401M)			1310														42800	67600	71300														
																	8786259	33.1	47.4	50.8	23	15	Tr	76	12	10	6	1	2	1	Tr			
																		47100	67400	72300														
BPEB	OD 14" x .500" x42.000'	11	15,121	105	G	G	G	G	G								A90981	33.4	51.2	54.6	36	16	1	82	15	8	6	Tr	1	2	1			
	(355.6mm x12.70mm x 12.302M)			1490														47500	72800	77700														
BPEB	OD 16" x .500" x42.000'	23	36,302	92	G	G	G	G	G								A92189	28.1	46.5	49.1	41	18	Tr	83	12	6	6	1	2	1	Tr			
	(406.4mm x12.70mm x 12.302M)			1310														40000	66100	69800														

참고 - NOTES #1 Type of pipe End 관종

SPE : Black Plain End Square-cut	GPE : Galvanized Plain End Square-cut
BPEB : Black Plain End Beveled	GPEB : Galvanized Plain End Beveled
BTC : Black Threaded & Coupled	GTC : Galvanized Threaded & Coupled
BVJ : Black Victaulic Joint	GVJ : Galvanized Victaulic Joint
ETC : Enameled Threaded & Coupled	

#2 NB : Normeal Bore 호칭경, OD : Outside Diameter
#3 Unit 단위 M : Meter, F : Feet I : Inch
#4 Flattening or Bending Test 편평 또는 굽힘시험
#5 Nondestructive Test 비파괴검사
#6 Crush Test 충압시험
#7 W : Weld Part 용접부
#8 G : Good
#9 Drift Test 관통시험
#10 Reverse Flattening Test 전개시험
#11 H : Heat Ladle Analysis 입인분석 P : Product Analysis 제품분석
#12 Unit 단위 M : mm I : Inch
#13 Visual & Dimension Test 육안 및 치수검사
#14 Weld Ductility Test 용접부 인성시험
#15 Flaring Test 입관시험
#16 B : Base Metal 모재부

본 제품은 관련규격에 합격되었음을 보증합니다

WE HEREBY CERTIFY THAT THE MATERIAL DESCRIBED HEREIN HAS BEEN ACCEPTED IN ACCORDANCE WITH THE PRESCRIBED SPECIFICATION AND ORDER.

SURVEYOR

INSPECTION MANAGER

HPS-B201-010-01T

검 사 증 명 서 (A)

MILL INSPECTION CERTIFICATE

현 대 강 관 주 식 회 사
HYUNDAI PIPE CO., LTD.
*본 사·공 장 경남 울산시 중구 염포동 265번지 682-070
ULSAN PLANT : # 265, YUMPO-DONG, JUNG-KU, ULSAN, KOREA
TEL : 87-2101~9 FAX : (0522) 87-8916
TLX : HDPIPE K 53776

*서울사무소 서울특별시 중구 무교동 77번지 100-170
SEOUL OFFICE : # 77, MUKYO DONG, JUNG-KU, SEOUL, KOREA
TEL : 773-0522 FAX : 775-7095
TLX : HDPIPE K 24656, K 22956

성적서번호 CERTIFICATE NO : E-6-07-117 페이지 PAGE : 1
발행일자 DATE OF ISSUE : AUG. 6. 1996. E4627702
계약번호 CONTRACT P.O NO :
품명 COMMODITY : E.R.W. STEEL PIPE
제조규격 SPECIFICATION : API 5LB/ASTM A53B
수요가 CUSTOMER :

G : GOOD

관종 TYPE OF PIPE END	치수 DIMENSION 외경 두께 길이 OUTDIA THICK. LENGTH	수량 QUANTITY PCS	중량 WEIGHT KG.	수압시험 HYDROSTATIC TEST Mpa kg/cm² PSI ※5	6 VISUAL & DIMENSION TEST	7 FLATTENING TEST	8 WELD DUCTILITY TEST	9 UT	10 DRIFT TEST	11 FLARING TEST	12 CRUSH TEST	13 REVERSE FLATTENING TEST	도막시험 COATING TEST 아연부착량 WEIGHT OF ZINC COAT g/m² OZ/FT²	도입성 DIP TEST Tr YES ※5 NO	제강번호 HEAT NO.	인장시험 TENSILE TEST 항복강도 YIELD STRENGTH PSI	인장강도 TENSILE STRENGTH B ※14 kg/mm²	W ※15 N/mm²	신율 ELONGATION %	화학성분 CHEMICAL COMPOSITION C	Si	Mn	P	S	Cu	Ni	Cr	Mo	V	충수에너지 IMPACT ENERGY J/cm²	시험온도 TEST TEMP. ℃	비고 REMARK
※1	※2 ※3 ※4																			※16	100	1000	100							
BPEB	OD 14" x .375" x42.000'	16	16,645	79	G	G	G	G	G						A92081	30.7	49.6	52.2	33	17	1	70	17	6	6	1	2	1	Tr			
	(355.6mm x 9.53mm x 12.802M)			1120												43700	70500	74200													
BPEB	OD 16" x .375" x42.000'	38	45,342	69	G	G	G	G	G						6239719	33.1	46.4	49.8	27	15	1	74	21	14	6	1	2	1	2			
	(406.4mm x 9.53mm x 12.802M)			980												47100	66000	70800													
															8787279	33.4	46.4	49.8	30	15	Tr	74	13	10	6	1	2	1	Tr			
																47500	66000	70800													
BPEB	OD 14" x .500" x42.000'	16	21,995	105	G	G	G	G	G						A92083	35.1	49.3	52.7	36	16	Tr	76	14	5	6	Tr	1	2	1			
	(355.6mm x12.70mm x 12.802M)			1490												49900	70100	75000													
BPEB	OD 16" x .500" x42.000'	34	53,664	92	G	G	G	G	G						A92189	28.1	46.5	49.1	41	18	Tr	83	12	6	6	1	2	1	Tr			
	(406.4mm x12.70mm x 12.802M)			1310												40000	66100	69800													
BPEB	OD 3-1/2" x .300" x40.000'2 "	266	49,683	176	G	G	G	G	G						A92083.	35.1	49.3		36	16	Tr	76	14	5	6	1	2	1	Tr			
	(88.9mm x 7.62mm x 12.243M)			2500												49900	70100														
	TOTAL ->	370	187,329																												

참고 NOTES ※1 Type of pipe End 관종

BPE : Black Plain End Squarecut	GPE : Galvanized Plain End Squarecut
BPEB : Black Plain End Beveled	GPEB : Galvanized Plain End Beveled
BTC : Black Threaded & Coupled	GTC : Galvanized Threaded & Coupled
BVJ : Black Victaulic Joint	GVJ : Galvanized Victaulic Joint
ETC : Enameled Threaded & Coupled	

※2 NB : Normal Bore호칭경, OD : Outside Diameter
※3 Unit 단위-M : Meter, F : Feet, I : Inch
※4 Unit 단위-M : mm, I : Inch
※5 G : Good
※6 Visual & Dimension Test 육안 및 치수검사
※7 Flattening or Bending Test 편평 또는 굽힘시험
※8 Weld Ductility Test 용접부 인성시험
※9 Nondestructive Test 비파괴검사
※10 Drift Test 관통시험
※11 Flaring Test 압광시험
※12 Crush Test 충압시험
※13 Reverse Flattening Test 잔개시험
※14 B : Base Metal 모재부
※15 W : Weld Part 용접부
※16 H : Heat Ladle Analysis 일연분석, P : Product Analysis 제품분석

본 제품은 관련규격에 합격되었음을 보증합니다.

WE HEREBY CERTIFY THAT THE MATERIAL DESCRIBED HEREIN HAS BEEN ACCEPTED IN ACCORDANCE WITH THE PRESCRIBED SPECIFICATION AND ORDER

SURVEYOR

INSPECTION MANAGER

INSPECTION CERTIFICATE

Supplier : HYUNDAI CORPORATION
Contract No (L/C No) HY6035339K
Specification : ASTM A53B/API 5LB
Kind of Article : E. R. W. Steel pipe

주 식 회 사 신 호 스 틸
Shin Ho Steel Co., Ltd
C.P.O.Box904Seoul, Korea.
DAEBUL PLANT

Customer : HYUNDAI CORPORATION, U.S.A
Issued Date : JUN. 08. 1996
Certificate No : B960608 - 069
Manufactured No : 94 - 5 - 211

Lot No. (Heat)	Q.TY (pcs)	Type	Nominal Size (in)	Dimension O.D (mm)	Dimension W.T (in)	Dimension Length (ft)	Weight (kg/m)	Chemical Comp.(%) C	Si	Mn	Cu	Ni	Cr	Mo	P	S	V	Tension Test Tensile Strength (kgf/mm²)	Yield Strength (kgf/mm²)	Elongation (%)	WTS (kgf/mm²)
										x 100					x 1000						
A87147	73	BPEB	14	355.6	0.250	42	54.6	15	TR	75	3	2	2	TR	16	7	3	51	37	33	52
A87502	11	BPEB	14	355.6	0.375	21	81.2	16	TR	76	2	3	2	TR	17	6	2	52	37	32	53
A83655	143	BPEB	14	355.6	0.375	42	81.2	17	TR	74	3	3	2	TR	15	5	3	50	36	34	51
A87049	111	BPEB	16	406.4	0.250	42	62.6	18	TR	76	3	3	3	TR	17	6	3	52	38	32	53
A81029	32	BPEB	16	406.4	0.500	42	123.3	16	TR	73	2	3	2	TR	15	7	2	49	35	35	50

Nominal Size (in)	NDT (UST)	F(B) Test	NDT	Hydrostatic Test (------, psi)	Ring Gage Test	Straigh - tness (%)	V.I	REMARK
14	pass	G	G	750	pass	0.1	G	
14	pass	G	G	1120	pass	0.1	G	
14	pass	G	G	1120	pass	0.1	G	
16	pass	G	G	660	pass	0.1	G	
16	pass	G	G	1310	pass	0.1	G	
			------	LAST ITEM	-------			

We hereby certify that the above products have been made in accordance with all requirements called for the order.

(1) O.D : Outside Diameter.
(2) W.T : Wall Thickness.
(3) WTS : Weld Tensile Test.
(4) F(B) : Flattening (Bend).
(5) V.I : Visual Inspection.
(6) WDT : Weld Ductility Test.
(7) NDT : Non Destructive Test.
UST : Ultrasonic Test.

Y. R. KIM
Inspector In charge

Appendix F

Cement Records

MONTGOMERY WATSON

ASR WELL #1 CEMENT PUMPING DATA

DATE(S): 3/12/97

City of Sunrise SPRINGTREE WTP ASR SYSTEM

BID PACKAGE 96(40) 12-15-06-12-M

CONTRACTOR: Youngquist Brothers, Inc.

PROJECT MANAGER: Anne Murray

COUNTY: Broward
OWNER: City of Sunrise

DESCRIPTION OF OPERATI Cementing 26-inch diameter intermediate casing.

CEMENT CONTRACT FCI
START TIME: 4:58
FINISH TIME: 5:24
STAGE NUMBER: 1

INITIAL READINGS: 0 psi
(HEADER PRESSURE)

THEORETICAL PRESSURES:
(CEMENT/ COLLAPSE)

TIME	TOTAL MINUTES	HEADER PRESSURE	LBS/ GA	BAR/ MI	TOTAL BARRELS	TOTAL FT³	COMMENTS
4:58	0	0					Pre-flush
5:00	0:02	0					Neat
5:05	0:07	10	15.9	4.9	25	140.37	
5:08	0:10	20	15.3	4.3	35	196.52	
5:12	0:14	30		4.3	46	258.29	
5:15	0:17	40	15.6	4.2	55	308.82	
5:18	0:20	50	15.6	4.2	77	432.35	
5:21	0:23	60	15.7	4.2	85	477.27	
5:24	0:26	70			97.1	545.21	Returns - pumping fhush/chase.
							Shutting top valve - pulling tremmie.
							Theoretical = 107 bbls.

Observer's initials MRS

MONTGOMERY WATSON

ASR WELL #1 CEMENT PUMPING DATA

DATE(S): 3/21/97

City of Sunrise SPRINGTREE WTP ASR SYSTEM

BID PACKAGE 96(40) 12-15-06-12-M

CONTRACTOR: Youngquist Brothers, Inc.

PROJECT MANAGER: Anne Murray

COUNTY: Broward
OWNER: City of Sunrise

DESCRIPTION OF OPERATI Cementing 16-inch diameter final casing.

CEMENT CONTRACT FCI
START TIME: 1:06
FINISH TIME: 2:16
STAGE NUMBER: 1

INITIAL READINGS: 0 psi
(HEADER PRESSURE)

THEORETICAL PRESSURES:
(CEMENT/ COLLAPSE)

TIME	TOTAL MINUTES	HEADER PRESSURE	LBS/ GA	BAR/ MI	TOTAL BARRELS	TOTAL FT³	COMMENTS
1:06	0						Pressuring casing - pumping pre-flush
1:09	0:03						Pumping 4% gel cement.
1:13	0:07	25	14.2	5	20	112.30	
1:20	0:14	60					
1:23	0:17		14.1	6.1	77	432.35	
1:27	0:21	110					
1:28	0:22	120	14.2	6	111	623.26	
1:35	0:29	175					
1:44	0:38	220					
1:46	0:40				247	1386.90	Switching to neat cement.
1:49	0:43		15.6	6	14 / 261	1465.51	
1:58	0:52	320	15.6	6	71 / 318	1785.56	
2:01	0:55				82 / 329	1847.33	
2:04	0:58	370					
2:12	1:06	400			128 / 375	2105.61	Switching to flush / chase.
2:16	1:10						End pumping
2:20	1:14	160					Pulling tremmie.

Observer's initials MRS

MONTGOMERY WATSON

City of Sunrise — SPRINGTREE WTP ASR SYSTEM

BID NUMBER 96(40) 12-15-06-12-M

CONTRACTOR: Youngquist Brothers, Inc.

BID ITEM: _____

CASING SIZE: 26 and 16 inch

ATTACH ALL CALCULATION SHEETS

A	B	C	D	E	F	G	H	I	J	K	L	M
DATE	STAGE NUMBER	CEMENT (ADDITIVES, BLENDS, MIXTURES)	YIELD (FT^3/SK)	QUANTITY PUMPED (FT^3)	THEORETICAL FILL		TAG DEPTH	ACTUAL FILL		PERCENT FILLED J/G x 100	CUMULATIVE TOTAL (FT^3)	INSPECTOR'S INITIALS
					INTERVAL	FOOTAGE	PAD LEVEL	INTERVAL	FOOTAGE			
3/12/97	1	Neat	1.18	545.2	0-174	174	0 / 140	0-174	174	100	545.2	MRS
3/21/97	1	4% gel / Neat	2.2 / 1.18	1387 / 719	0-1110	1110	.5 / 1088	0 / 1110	1110	100	2105.6	MRS

WRTC004 (REV 07/05/94)

Appendix G

Pressure Test Data

APPENDIX

ASR CASING PRESSURE TEST
16" FINAL CASING

Location: City of Sunrise
Well: Springtree ASR

Date: March 25, 1997
Contractor: Youngquist Brothers

Time	Casing Pressure	Time	Casing Pressure
11:00	160.00		
11:05	160.00		
11:10	160.00		
11:15	159.75		
11:20	159.00		
11:25	158.60		
11:30	158.50		
11:35	158.00		
11:40	158.00		
11:45	157.40		
11:50	157.00		
11:55	156.50		
12:00	156.00		

Witnessed By: _____
Mark Silverman, P.G., FDEP

Pressure Decrease: 2.50%

Certified By: _____
Anne Murray, P.G., Hydrogeologist

KELI
Kimball Electronic Laboratory, Inc.
Precision Measurement Equipment Specialists

Certificate of Calibration

Customer: BARFIELD INSTRUMENT CORPORATION
Certificate # 1000037412
Manufacturer: MCDANIEL
Model Number: 300 PSI
Nomenclature: PRESSURE TEST GAUGE
Serial/I.D. # BA0855
Specifications: +/- .25%FS
Cal. Procedure: MP03/C1
KELI Control # BAR-37412

The accuracy and calibration of this instrument is traceable to the National Institute of Standards and Technology through certified standards maintained in the laboratories of KELI Inc. and is guaranteed to meet published specifications. The metrology procedures utilized satisfy the requirements set forth in ANSI/NCSL Z540-1.

N.I.S.T. Traceability Test Report Numbers

Capacitance	-	255050	Resistance	-	811/256618
Inductance	-	253375	DC Voltage/Current	-	811/255765
Frequency	-	WWVB-VLF	AC Voltage/Current	-	811/257031, 251971
Pressure/Weight	-	243399-89	Dimensional	-	821/248026-91
Temperature	-	9424110	Flow	-	241918-7751606

In Tolerance When Received? N Cal. Tech:052 Relative Humidity: 50% Temperature: 74 Deg. F

In-House [Y] Cal. Cycle: 12 Mos. Calibration Date: 03/19/1997 Calibration Due: 03/19/1998

Remarks: ADJUSTED TO MEET MANUFACTURERS SPECIFICATIONS
RECEIVED READING 3% HIGH.

Standards Used

I.D. #		Cal. Date	Cal. Due
331	AMETEK T-150 DEAD WEIGHT TESTER	07/27/1995	07/27/1997

Quality Assurance

The following explanation, equations and examples show how to calculate the volume of water which is needed to pressure a casing string from static (0 psi) to some level of test pressure.

Volume from the compressability of water:

K = Bulk Modulus of Elasticity

$Kw = 3.2 \cdot 10^5$ Elasticity of water at 70 degreees F
Units are in pounds per square inch (psi)

To simply work this program you need to input:
- dP - The test pressure
- Wt - Wall thickness
- Dod - Outside diameter of the casing
- h - Length of casing to be tested

As an example: for a pressure change of 150 psi -
the change in volume of 1 cubic foot of water is

$V = 1 \quad dP = 150$

$$dV = \frac{V \cdot dP}{Kw} \qquad dV = 4.687 \cdot 10^{-4}$$

Now calculate the volume of water contained within the casing string

For 24 inch outside diameter casing
with 1/2 inch wall thickness that is 2700 feet long

$Wt = .5$ Wall thickness

$Dod = 16$ Outside diameter

$Did = Dod - (2 \cdot Wt)$ Inside diameter

$$Rod = \frac{Dod}{2}$$ Radius - OD

$$Rid = \frac{Did}{2}$$ Radius - ID

$h = 1100$ Length of pipe

Volume of water inside the casing:

$$Vid = \pi \cdot \left(\frac{Rid}{12}\right)^2 \cdot h$$

$Vid = 1.35 \cdot 10^3$ In cubic feet

Calculating the volume change:

$Vc = Vid \cdot dV \qquad Vc = 0.633$

Converting to gallons

$Vg = Vc \cdot 7.48 \qquad Vg = 4.733$

Volume from the stretching of the casing:

$Ks = 3 \cdot 10^7$ Elasticity of steel

Units are in pounds per square inch (psi)

$q = \frac{dP \cdot Dod}{2 \cdot Wt}$ $q = 2.4 \cdot 10^3$ Stress exerted on the casing wall due to the internal pressure

$\delta = \frac{q}{Ks}$ $\delta = 8 \cdot 10^{-5}$ The resulting strain

$Ci = \pi \cdot Dod$ $Ci = 50.265$ The initial circumference

$Cf = Ci + Ci \cdot \delta$ $Cf = 50.27$ The new circumference after the pressure in applied

$Dn = \frac{Cf}{\pi}$ $Dn = 16.001$ The new diameter of the casing while the pressure is held

$Rn = \frac{Dn}{2}$ $Rn = 8.001$ The new radius

$Vod = \pi \cdot \left(\frac{Rod}{12}\right)^2 \cdot h$ $Vod = 1.536 \cdot 10^3$ The volume that the casing occupies before the pressure is applied

$Vn = \pi \cdot \left(\frac{Rn}{12}\right)^2 \cdot h$ $Vn = 1.536 \cdot 10^3$ The volume that the casing occupies after the pressure is applied

$Vp = Vn - Vod$ $Vp = 0.246$ The volume change in cubic feet

Converting to gallons

$Vga = Vp \cdot 7.48$ $Vga = 1.838$

$Vt = Vg + Vga$

$Vt = 6.571$

Total volume of water needed to pressure the casing from 0 psi to some test pressure

Appendix H

Core Descriptions and Analyses

MONTGOMERY WATSON

ASR WELL CORE LOG

DATE(S): 3/27/97

CITY OF SUNRISE

Springtree ASR Well System

CORE 1

BID PACKAGE: 96(40) 12-15-06-12-M

CONTRACTOR: Youngquist Brothers, Inc.

TOTAL DEPTH:	1,155	feet
COUNTY:	Broward	
OWNER:	City of Sunrise	
DRILLING METHOD:	Soft Rock	
DRILLER(S):	J. Swartzentruber	
DATUM POINT:	Pad level	
DATUM POINT ELEVATION:		
HYDROLOGIC UNITS:	Ocala / Avon Park	
% RECOVERY	30%	
CORED INTERVAL	1,140 - 1,155	

DEPTH (feet below pad)			DEPTH INTERVAL	DESCRIPTION	DRILLING COMMENTS
1,140	to	1,155	15	**Limestone**: 100%; Pale yellowish brown; grainstone; grains are abraded remains of mollusks and foraminifera with possible red algae; poorly cemented and not well lithified; porosity and permeability appears moderate; minor cementation has occluded some porosity; soft; contains some echinoids, foraminifera and fossil hash.	Recovery of only 30%. Drilling smooth - no pressure or bit torque build up. Pump pressure = 65 psi. Formation not taking any weight - drilling as fast as desired.

Observer's initials TGU

MONTGOMERY WATSON

ASR WELL CORE LOG

DATE(S): 3/31/97

CITY OF SUNRISE

Springtree ASR Well System

CORE 2

BID PACKAGE: 96(40) 12-15-06-12-M

CONTRACTOR: Youngquist Brothers, Inc.

TOTAL DEPTH:	1,206	feet
COUNTY:	Broward	
OWNER:	City of Sunrise	
DRILLING METHOD:	Soft Rock	
DRILLER(S):	J. Swartzentruber	
DATUM POINT:	Pad level	
DATUM POINT ELEVATION:		
HYDROLOGIC UNITS:	Avon Park	
% RECOVERY	30%	
CORED INTERVAL	1,191 - 1,206	

DEPTH (feet below pad)			DEPTH INTERVAL	DESCRIPTION	DRILLING COMMENTS
1,191	to	1,206	15	**Limestone:** 100%; Grayish orange; grainstone; moderate to poorly cemented; contains fossil hash - mollusca fragments and echinoids and foraminifera; porosity is interparticle and moldic and shows signs of cement reduction; possible bedding planes and algal lamina; soft, poorly indurated and crumbly; mollusca, echinoids, foraminifera and algae.	Recovery of only 30%. Drilling smooth - slight bounce on bit, Pump pressure = 52 psi, 55 rpm. Drilling as fast as desired - very soft.

Observer's initials TGU

MONTGOMERY WATSON

ASR WELL #1 CORE LOG

DATE(S): 4/2/97

CITY OF SUNRISE

Springtree ASR Well System

CORE 3

BID PACKAGE: 96(40) 12-15-06-12-M

CONTRACTOR: Youngquist Brothers, Inc.

TOTAL DEPTH:	1,266	feet
COUNTY:	Broward	
OWNER:	City of Sunrise	
DRILLING METHOD:	Soft Rock	
DRILLER(S):	J. Swartzentruber	
DATUM POINT:	Pad level	
DATUM POINT ELEVATION:		
HYDROLOGIC UNITS:	Avon Park	
% RECOVERY	50%	
CORED INTERVAL	1,251 - 1,266	

DEPTH (feet below pad)			DEPTH INTERVAL	DESCRIPTION	DRILLING COMMENTS
1,251	to	1,266	1.5	**Limestone:** 100%; very pale orange; grainstone; calcite cement - biotic matrix; well cemented and recrystalized; porosity is moldic and intergranular; possible algal structures; moderately hard to soft; contains whole and broken mollusca and foraminifera.	Recovery of 50%. Drilling smooth and fast. No weight on bit. Low rpm and low pressure (58 psi, 35 rpm). Very soft.
1,251	to	1,266	5	**Limestone:** 100%; very pale orange to grayish orange; grainstone; moderate to poorly cemented; pelletal / granular; contains fossil hash - mollusca fragments and echinoids and foraminifera; porosity is intergranular and is cement reduced; possible algal lamina; soft, poorly indurated and crumbly; mollusca, echinoids, foraminifera and algae.	3.5 minutes - 0 to 5 feet 3.0 minutes - 5 to 10 feet 3.0 minutes - 10 - 15 feet 900 - 950 psi head torque.

Observer's initials TGU

MONTGOMERY WATSON

ASR WELL CORE LOG

DATE(S): 4/3/97

CITY OF SUNRISE

Springtree ASR Well System

CORE 4

BID PACKAGE: 96(40) 12-15-06-12-M

CONTRACTOR: Youngquist Brothers, Inc.

TOTAL DEPTH:	1,309	feet
COUNTY:	Broward	
OWNER:	City of Sunrise	
DRILLING METHOD:	Soft Rock	
DRILLER(S):	J. Swartzentruber	
DATUM POINT:	Pad level	
DATUM POINT ELEVATION:		
HYDROLOGIC UNITS:	Avon Park	
% RECOVERY	95%	
CORED INTERVAL	1,300 - 1,309	

DEPTH (feet below pad)			DEPTH INTERVAL	DESCRIPTION	DRILLING COMMENTS
1,300	to	1,309	9	**Limestone:** 90% - 100% very pale orange to grayish orange; grainstone; calcite cement - biotic grainstone matrix (hash); porosity is low to moderate, intergranualr and cement reduced; contains clay; soft to moderately hard; mollusca hash. **Clay:** 0 % - 10%; lime mud with terregeneous silt / clay residue; low stand - low energy; no fossils; plastic; no porosity.	Recovery of 95%. Drilling smooth and fast. No weight on bit. Low rpm and low pressure (55 psi, 45 rpm, 40 gpm). Some chattering of the bit. 4 minutes to core the entire 9 feet. At 1,309 feet the pressure increased to 180 psi - clay plugging of the bit.

Observer's initials TGU

Ardaman & Associates, Inc.

September 9, 1997
File Number 97-114

Youngquist Brothers, Inc.
15465 Pine Ridge Road
Fort Myers, Florida 33908

Attention: Mr. Michael Sordan
Drilling Superintendent

Subject: Laboratory Test Results on Rock Core Specimens, City of Sunrise Well ASR-1

Gentlemen:

Permeability, unconfined compression and specific gravity tests have been completed on 4 rock core samples provided by your firm from the City of Sunrise Well ASR-1. The permeability tests were performed in general accordance with ASTM Standard D 5084 "Measurement of Hydraulic Conductivity of Saturated Porous Materials Using a Flexible-Wall Permeameter" using constant-head (Method A) and falling-head with increasing tailwater (Method C) test methods. The unconfined compression tests were performed in general accordance with ASTM Standard D 2938 "Unconfined Compressive Strength of Intact Rock Core Specimens". The specific gravity was determined in general accordance with ASTM Standard D 854 "Specific Gravity of Soils". Due to the irregular shape and short length of the samples not all of the requested tests (i.e., vertical permeability test, horizontal permeability test and unconfined compression test) could be performed on each sample.

Permeability Tests

The permeability test results are presented in Table 1. The core samples provided for testing were too short to obtain separate vertically and horizontally oriented specimens. Accordingly, the vertical permeability tests were performed first on specimens maintained at the as-received diameter and cut to lengths of 8.2 to 10.2 cm. After completing the vertical permeability tests, horizontal permeability specimens were obtained by coring 5.1 cm diameter cylinders from two of the vertical specimens. The horizontal specimens were then trimmed to lengths of 6.9 to 7.7 cm to provide flat, parallel ends. Since the vertical permeability test specimens were cored upon completion of testing to obtain horizontal permeability test specimens (or unconfined compression test specimens), the final moisture contents of the vertical specimens were not measured. The dry densities and degrees of saturation of the vertical specimens, therefore, were estimated using the final moisture contents from the corresponding horizontal permeability or unconfined compression test specimens.

Each permeability test specimen was air-dried, deaired under vacuum, and then saturated with deaired tap water from the bottom upward while still under vacuum. Each specimen was then mounted in a triaxial-type permeameter and encased within a latex membrane. The specimens were confined using an average isotropic effective confining stress of 20 lb/in^2 and permeated with deaired tap water under a back-pressure of 80 or 169 lb/in^2. Satisfactory saturation was verified by a B-factor equal to or greater than 95%, or a B-factor that remained relatively constant for two consecutive increments of applied cell pressure. The inflow to and outflow from each specimen were monitored with time, and the coefficient of permeability was calculated for each recorded flow increment. The tests were continued until steady-state flow conditions were obtained, as evidenced by an outflow/inflow ratio between 0.75 and 1.25, and until stable values of the coefficient of

permeability were measured. The final degree of saturation was calculated upon completion of testing using the final dry mass, moisture content and volume, and the measured specific gravity. Although some of the calculated final degrees of saturation are low, the B-factors indicate satisfactory saturation. The calculated final degrees of saturation are potentially affected by occluded voids within the specimens, surface irregularities, and the use of final moisture contents for the vertical permeability test specimens from the corresponding horizontal permeability or unconfined compression test specimens.

Specific Gravity Tests

The specific gravity of each sample was determined on a representative approximately 100 gram specimen ground to pass the U.S. Standard No. 40 sieve. The specific gravity measured on each sample is presented in Table 1.

Porosity

The porosity, n, of each permeability test specimen was calculated using the measured dry density, γ_d, and measured specific gravity, G_s, from the equation: $n = 1 - (\gamma_d/(G_s)(\gamma_w))$ where γ_w = unit weight of water. The calculated porosities are presented in Table 1.

Unconfined Compression Tests

The unconfined compression tests were performed on 2.9 to 5.1 cm diameter specimens cored from the vertical permeability test specimens. The specimens were trimmed to lengths of 5.9 to 9.0 cm to provide a length to diameter ratio of approximately 2 and then capped with a sulfur capping compound. The specimens were loaded at constant rate of deformation of 0.0076 cm/minute to achieve a time to failure between 2 and 15 minutes. The compressive strengths and Young's modulus determined from the unconfined compression tests are summarized in Table 2. The stress-strain curves are presented in Figures 1 through 3.

If you have any questions or require additional testing services, please contact us.

Very truly yours,
ARDAMAN & ASSOCIATES, INC.

Shawkat Ali, Ph.D.
Geotechnical Engineer

Thomas S. Ingra, P.E.
Senior Project Engineer
Florida Registration No. 31987

SA/TSI/jo

cc: Montgomery Watson
M. Randal Skinner

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Youngquist Brothers, Inc.
File Number 97-114
September 9, 1997

Table 1

PERMEABILITY TEST RESULTS
CITY OF SUNRISE WELL ASR-1 CORE SAMPLES

Sample	Test Specimen Orientation	D-5084 Test Method*	G_s	Initial Conditions					$\bar{\sigma}_c$ (lb/in^2)	u_b (lb/in^2)	B Factor (%)	Average Hydraulic Gradient	Final Conditions			Coefficient of Permeability (cm/sec)
				Length (cm)	Diameter (cm)	w_c (%)	γ_d (lb/ft^3)	n					w_c (%)	γ_d (lb/ft^3)	S (%)	
1-ST	Vertical	C	2.71	8.24	9.62	29.8	89.5	0.47	20	80	72**	2.0	29.4†	89.5	90	1.6×10^{-3}
2-ST	Vertical	C	2.73	10.19	9.38	30.1	90.6	0.47	20	80	95	1.7	30.1†	90.6	93	1.9×10^{-4}
	Horizontal	A		6.91	5.04	30.1	90.7	0.47	20	80	96	14	30.1	90.7	93	2.4×10^{-4}
3-ST	Vertical	A	2.71	8.20	9.81	23.3	100.3	0.41	20	80	83**	18	23.4†	100.3	92	1.0×10^{-5}
	Horizontal	A		7.67	5.02	23.3	101.1	0.40	20	169	99	18	23.4	101.1	94	1.4×10^{-5}
4-ST	Vertical	A	2.70	8.44	9.72	21.8	97.3	0.42	20	169	89**	18	23.1†	97.3	85	1.4×10^{-4}

Where: w_c = Moisture content; γ_d = Dry density; G_s = Specific gravity; n = Porosity, $\bar{\sigma}_c$ = Average isotropic effective confining stress; u_b = Back-pressure, and S = Calculated degree of saturation using measured specific gravity.

* Method A = Constant-head test; Method C = Falling-head test with increasing tailwater level.

** B-Factor remained relatively constant for two consecutive increments of applied cell pressure.

† Vertical permeability test specimen was cored upon completion of testing to obtain horizontal permeability or unconfined compression test specimen. The final moisture content of the vertical test specimen was not measured, and was assumed to be the same as the horizontal permeability or unconfined compression test specimen.

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Youngquist Brothers, Inc.
File Number 97-114
September 9, 1997

Table 2

UNCONFINED COMPRESSION TEST RESULTS
CITY OF SUNRISE WELL ASR-1 CORE SAMPLES

Sample	Specimen Dimensions			w_c (%)	γ_d (lb/ft^3)	Loading Rate (cm/min)	t_f (min)	Unconfined Compressive Strength, σ_a(ult) (lb/in^2)		Young's Modulus E(lb/in^2)**
	Length L (cm)	Diameter D (cm)	L/D					Measured	Corrected*	
1-ST	5.91	2.89	2.04	29.4	88.4	0.0076	3.5	391	392	1.2×10^5
3-ST	9.05	5.12	1.77	12.7	99.8	0.0076	5.9	693	682	2.2×10^5
4-ST	5.92	3.04	1.95	23.1	99.3	0.0076	3.9	757	755	1.6×10^5

Where: w_c = Moisture content; γ_d = Dry density; and t_f = Time to failure.

* Unconfined compressive strength corrected to L/D ratio of 2 in accordance with ASTM Standard D 2938.
** Young's modulus calculated from the slope of the straight-line portion of the stress-strain curve.

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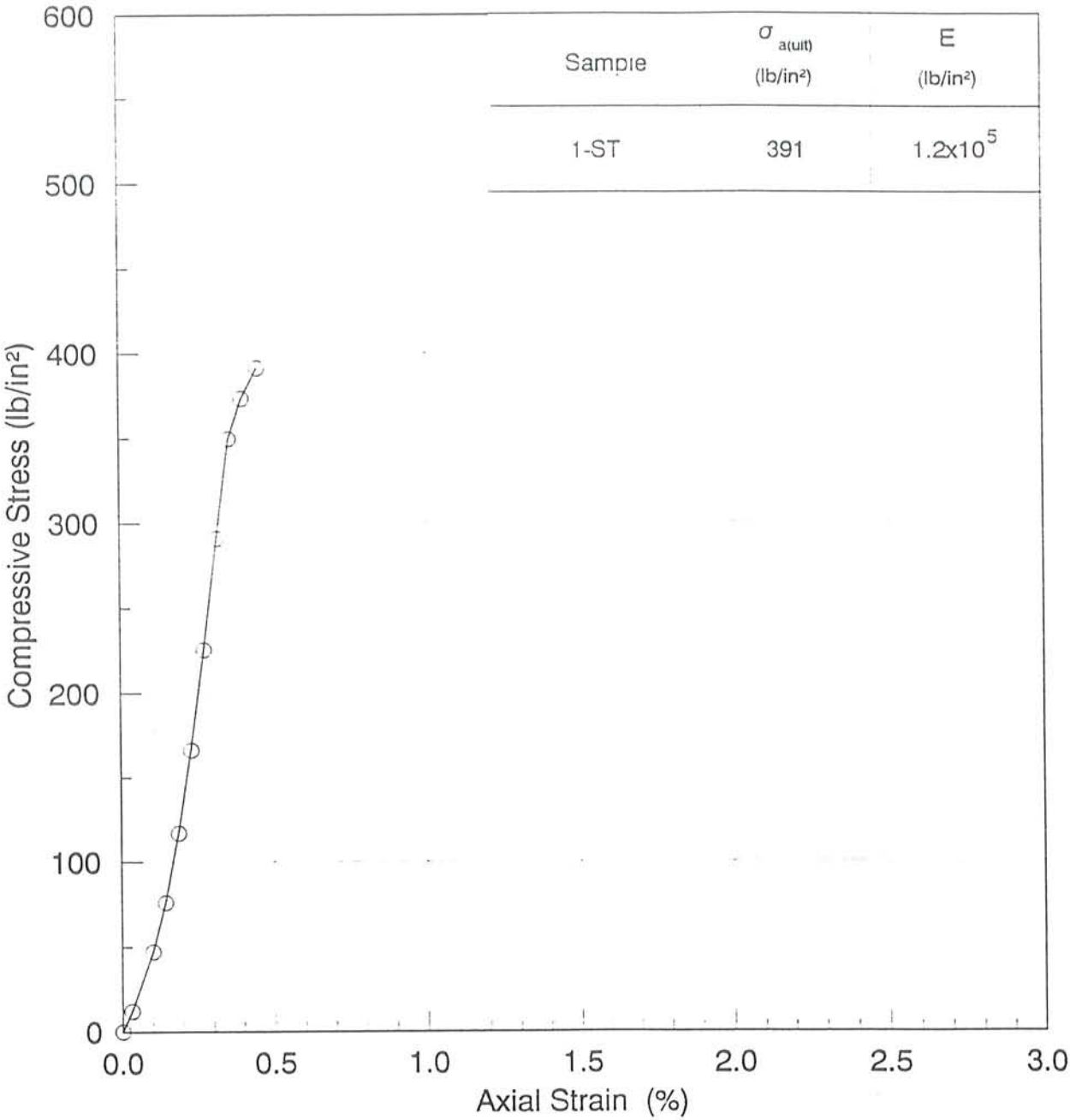


Sample	$\sigma_{a(ult)}$ (lb/in²)	E (lb/in²)
1-ST	391	1.2×10^5

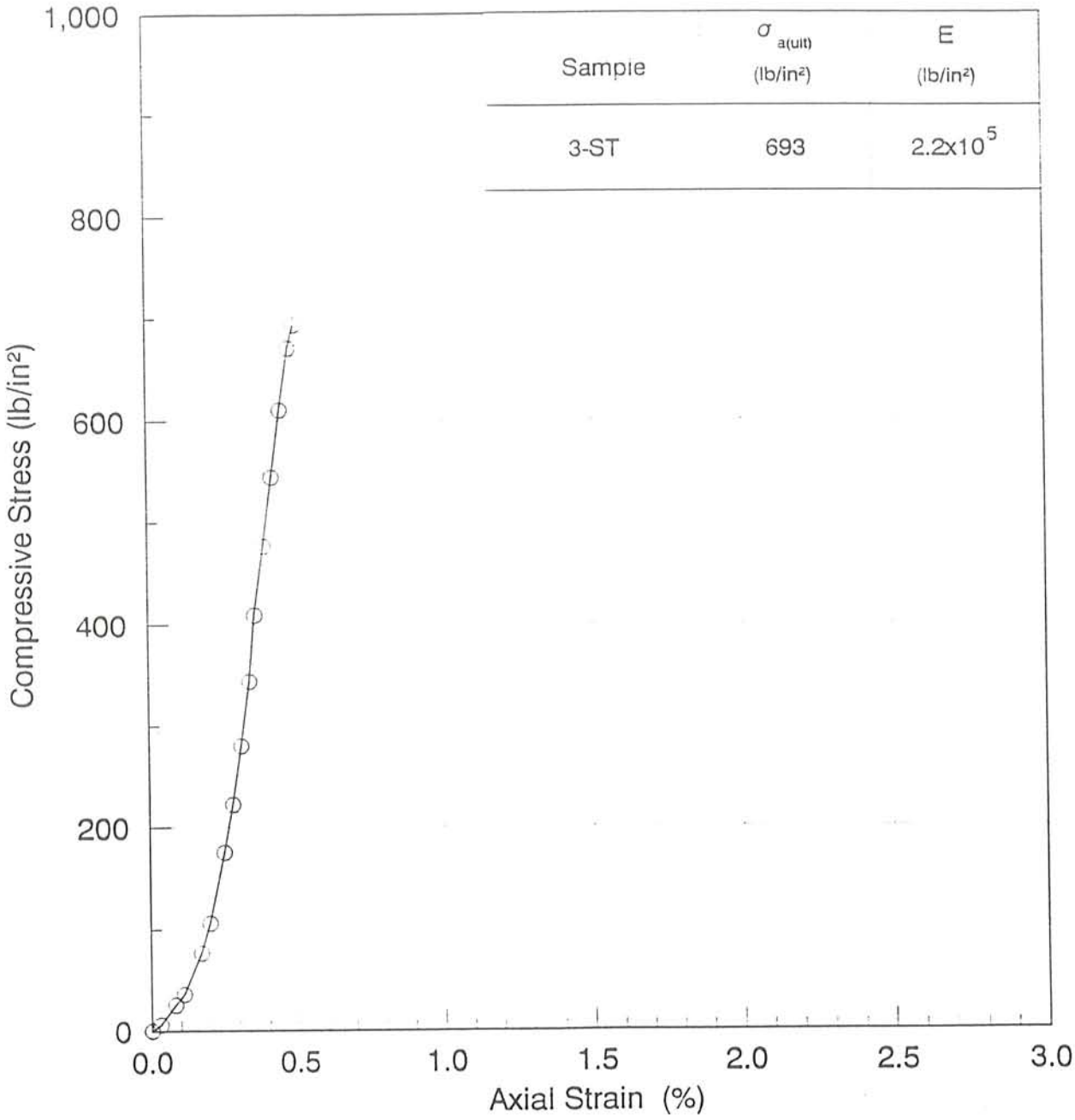
UNCONFINED COMPRESSION TEST

Ardaman & Associates, Inc.
Geotechnical, Environmental and Materials Consultants

CITY OF SUNRISE WELL ASR-1

YOUNGQUIST BROTHERS, INC.

DRAWN BY: SA	CHECKED BY: SA	DATE: 09-08-97
FILE NO.: 97-114	APPROVED BY:	FIGURE: 1



Sample	$\sigma_{a(ult)}$ (lb/in²)	E (lb/in²)
3-ST	693	2.2×10^5

UNCONFINED COMPRESSION TEST

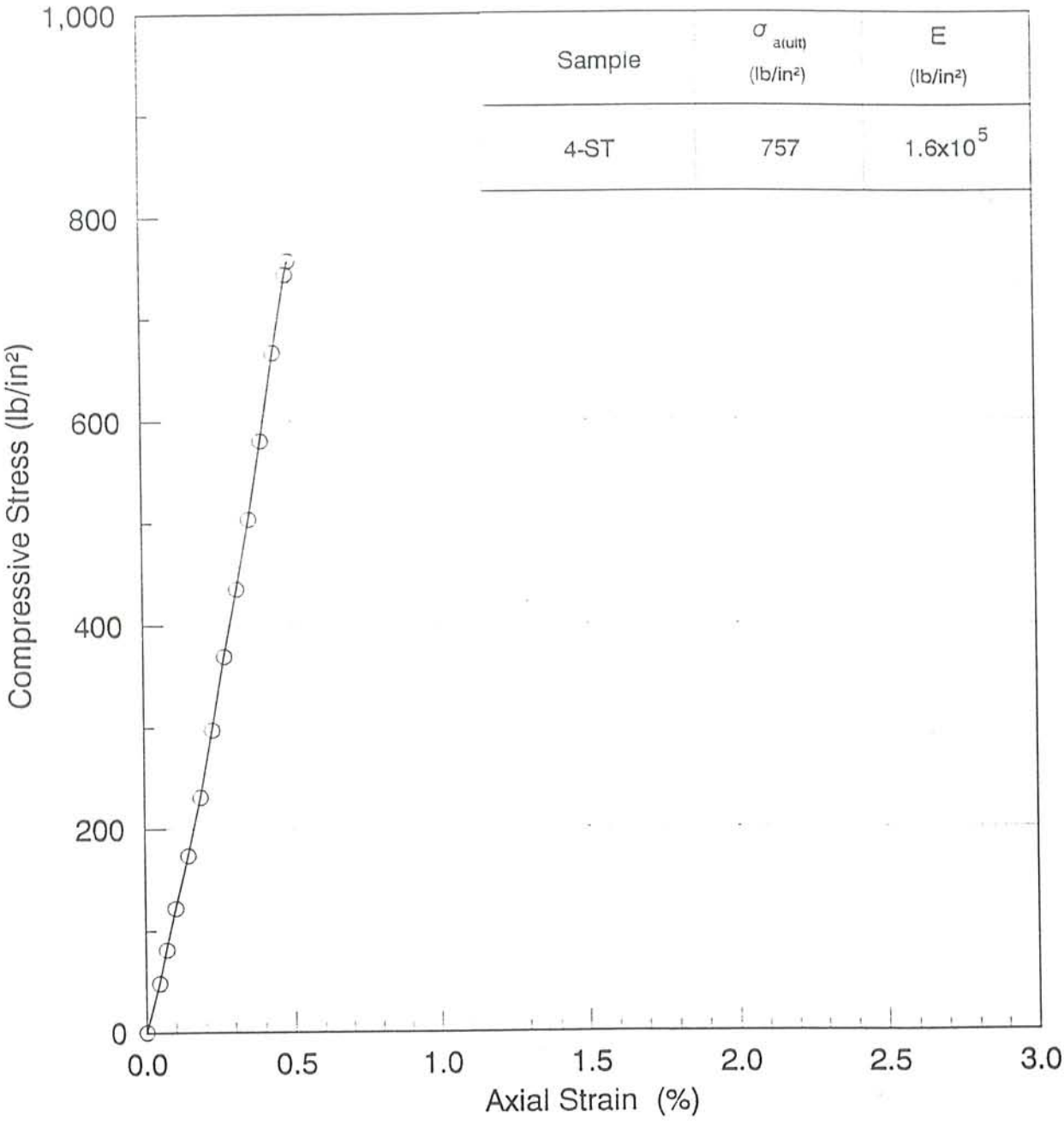
Ardaman & Associates, Inc.
Geotechnical, Environmental and Materials Consultants

CITY OF SUNRISE WELL ASR-1

YOUNGQUIST BROTHERS, INC.

DRAWN BY: SA	CHECKED BY: SA	DATE: 09-08-97
FILE NO.: 97-114	APPROVED BY:	FIGURE: 2

Sample	$\sigma_{a(ult)}$ (lb/in²)	E (lb/in²)
4-ST	757	1.6×10^5



UNCONFINED COMPRESSION TEST

Ardaman & Associates, Inc.
Geotechnical, Environmental and Materials Consultants

CITY OF SUNRISE WELL ASR-1

YOUNGQUIST BROTHERS, INC.

DRAWN BY: SA	CHECKED BY: SA	DATE: 09-08-97
FILE NO.: 97-114	APPROVED BY:	FIGURE: 3

Appendix I

Video Survey
Tape and Description

MONTGOMERY WATSON

ASR WELL #1 VIDEO SURVEY

DATE(S): 4/8/97

City of Sunrise SPRINGTREE WTP ASR SYSTEM

BID PACKAGE 96(40) 12-15-06-12-M

CONTRACTOR: Youngquist Brothers, Inc.

PROJECT MANAG Anne Murray

COUNTY: Broward

OWNER: City of Sunrise

VIDEO CONTRACT FGL

TOTAL DEPTH: 1,343

DESCRIPTION OF OPERATIONS: Pilot Hole

DEPTH IN FEET		REEL COUNTER		OBSERVATIONS
From	To	From	To	
1,110	1,130			Water very clear; formation contains large blocky
				fractures and breaks; borehole is very angular.
1,130				Tool hung up - attempting to dislodge
				Hole became dirty - giving time to clear.
				Tan to buff color - hole is in good shape - very round.
1,170				Banding / formation change.
1,177				Banding / formation change.
1,195				Enlarged hole.
1,197				Water is cloudy
1,230				Band of white material.
1,235				Band of white material.
1,267				Water is cloudy - stpping camera to check flow direction. Fluids
				seam to be moving in both the up and down directions (swirling).
1,272				Formation change
1,278				Layering / banding.
1,280				White formation - some traces of clay / mud cracking visible.
1,343				Total depth.

Observer's initials: _____

Appendix J

July 1997 Analyses Results

Upper Floridan Aquifer
Water Quality Analyses (2)

INTAKE #: 800006

Sanders Laboratories
Environmental Testing Services

Project Name: Springtree ASR
Project Location:
Sample Supply: Water
Collector: Richardo Cedeno
Sample Received Date/Time: 7/21/97 9:00

Date: 08-Aug-97

Youngquist Brothers, Inc.
15465 Pine Ridge Road
Fort Myers, FL 33908-

RECEIVED AUG 11 1997

Parameter ID	Analysis	Lab ID	Result	Unit	Method	D. L.	Analysis Date/Time	LabID	Analyst
	Inorganic Analysis 62-550.310(1) PWS030								
1005	Arsenic (.05)	D97006	<0.0022	mg/L	EPA 206.2	0.0022	7/23/97	84352	ua
1010	Barium (2)	D97006	<0.200	mg/L	EPA 208.2	0.200	7/29/97	84352	ua
1015	Cadmium (.005)	D97006	<0.003	mg/L	EPA 213.1	0.003	7/24/97	84352	ua
1020	Chromium (0.1)	D97006	<0.020	mg/L	EPA 218.1	0.020	7/25/97	84352	ua
	Cyanide (0.2)	D97006	<0.004	mg/L	EPA 335.2	0.004	7/23/97	84352	ua
5	Fluoride (4)	D97006	1.59	mg/L	EPA 340.2	0.2	7/24/97	84352	ua
1030	Lead (0.015)	D97006	<0.001	mg/L	EPA 239.2	0.001	7/25/97	84352	ua
1035	Mercury (0.002)	D97006	<0.001	mg/L	EPA 245.1	0.001	7/29/97	84352	ua
1036	Nickel (0.1)	D97006	0.016	mg/L	EPA 249.1	0.010	7/23/97	84352	ua
1040	Nitrate (10)	D97006	<0.01	mg/L	EPA 353.2	0.01	7/25/97	84352	ua
1041	Nitrite (1)	D97006	<0.01	mg/L	EPA 354.1	0.01	7/23/97	84352	ua
1045	Selenium (0.05)	D97006	<0.004	mg/L	EPA 270.2	0.004	7/24/97	84352	ua
1052	Sodium (160)	D97006	1,249	mg/L	EPA 273.1	0.003	7/24/97	84352	ua
1074	Antimony (0.006)	D97006	<0.005	mg/L	EPA 204.2	0.005	7/22/97	86413	ua
1075	Beryllium (0.004)	D97006	<0.002	mg/L	EPA 210.2	0.002	7/22/97	86413	ua
1085	Thallium (0.002)	D97006	<0.002	mg/L	EPA 279.2	0.002	7/23/97	86413	ua
	Secondary Chemical Analysis 62-550.320 PWS031								

HRS Certification#'s 84352 and E84380(Nokomis) 85449 and E85457(Ft. Myers)

625 N. Tamiami Trail • Nokomis, FL 34275 • Phone: (941) 488-8103 • (800) 255-3108 • Fax: (941) 484-6774

Parameter ID	Analysis	Lab ID	Result	Unit	Method	D. L.	Analysis Date/Time	LabID	Analys
1002	Aluminum (0.2)	D97006	<0.200	mg/L	EPA 202.1	0.200	7/29/97	84352	ua
1017	Chloride (250)	D97006	2,449	mg/L	SM4500Cl-B	5	7/22/97	84352	ua
22	Copper (1)	D97006	0.009	mg/L	EPA 220.2	0.001	7/22/97	84352	ua
025	Fluoride (2.0)	D97006	1.59	mg/L	EPA 340.2	0.2	7/24/97	84352	ua
1028	Iron (0.3)	D97006	0.196	mg/L	EPA 236.1	0.015	7/28/97	84352	ua
1032	Manganese (0.05)	D97006	0.007	mg/L	EPA 243.1	0.005	7/22/97	84352	ua
1050	Silver (0.1)	D97006	<0.010	mg/L	EPA 272.1	0.010	7/29/97	84352	ua
1055	Sulfate (250)	D97006	644	mg/L	EPA 375.4	5	7/22/97	84352	ua
1095	Zinc (5)	D97006	<0.005	mg/L	EPA 289.1	0.005	7/22/97	84352	ua
1905	Color (15)	D97006	7.0	PtCo unit	EPA 110.3	1.0	7/22/97	84352	ua
1920	Odor (3)	D97006	1.0	TON	EPA 140.1	1.0	7/22/97	84352	ua
1925	pH (6.5-8.5)	D97006	7.58	std units	EPA 150.1	n/a	7/22/97	84352	ua
1930	Total Dissolved Solids (500)	D97006	4,520	mg/L	EPA 160.1	7	7/22/97	84352	ua
2905	Foaming Agents (1.5)	D97006	<0.01	mg/L	EPA 425.1	0.01	7/22/97	86413	ua

Trihalomethane Analysis

62-550.310(2)(a)

PWS027

2950	Total THM's (0.10)	D97006	<0.5	mg/L	EPA 524.2	0.5	7/21/97	86413	ua

Volitale Organic Analysis

62-550.310(2)(b)

PWS028

2976	Vinyl Chloride	D97006	<0.5	ug/L	EPA 524.2	0.5	7/21/97	86413	ua
2964	Methylene Chloride	D97006	<0.5	ug/L	EPA 524.2	0.5	7/21/97	86413	ua
2979	trans-1,2-Dichloroethene	D97006	<0.5	ug/L	EPA 524.2	0.5	7/21/97	86413	ua
2977	1,1-Dichloroethene	D97006	<0.5	ug/L	EPA 524.2	0.5	7/21/97	86413	ua
2380	cis-1,2-Dichloroethene	D97006	<0.5	ug/L	EPA 524.2	0.5	7/21/97	86413	ua
2981	1,1,1-Trichloroethane	D97006	<0.5	ug/L	EPA 524.2	0.5	7/21/97	86413	ua
2982	Carbon Tetrachloride	D97006	<0.5	ug/L	EPA 524.2	0.5	7/21/97	86413	ua
2990	Benzene	D97006	<0.5	ug/L	EPA 524.2	0.5	7/21/97	86413	ua
2980	1,2-Dichloroethane	D97006	<0.5	ug/L	EPA 524.2	0.5	7/21/97	86413	ua
2984	Trichloroethene	D97006	<0.5	ug/L	EPA 524.2	0.5	7/21/97	86413	ua
2983	1,2-Dichloropropane	D97006	<0.5	ug/L	EPA 524.2	0.5	7/21/97	86413	ua
2991	Toluene	D97006	<0.5	ug/L	EPA 524.2	0.5	7/21/97	86413	ua
2985	1,1,2-Trichloroethane	D97006	<0.5	ug/L	EPA 524.2	0.5	7/21/97	86413	ua

HRS Certification#'s 84352 and E84380(Nokomis) 85449 and E85457(Ft. Myers)

Parameter ID	Analysis	Lab ID	Result	Unit	Method	D. L.	Analysis Date/Time	LabID	Analys
2987	Tetrachloroethene	D97006	<0.5	ug/L	EPA 524.2	0.5	7/21/97	86413	ua
2989	Chlorobenzene	D97006	<0.5	ug/L	EPA 524.2	0.5	7/21/97	86413	ua
2	Ethylbenzene	D97006	<0.5	ug/L	EPA 524.2	0.5	7/21/97	86413	ua
55	m & p-Xylenes	D97006	<0.5	ug/L	EPA 524.2	0.5	7/21/97	86413	ua
2955	o-Xylene	D97006	<0.5	ug/L	EPA 524.2	0.5	7/21/97	86413	ua
2996	Stryene	D97006	<0.5	ug/L	EPA 524.2	0.5	7/21/97	86413	ua
2969	1,4-Dichlorobenzene	D97006	<0.5	ug/L	EPA 524.2	0.5	7/21/97	86413	ua
2968	1,2-Dichlorobenzene	D97006	<0.5	ug/L	EPA 524.2	0.5	7/21/97	86413	ua
2378	1,2,4-Trichlorobenzene	D97006	<0.5	ug/L	EPA 524.2	0.5	7/21/97	86413	ua

Pesticide/PCB Chemical Analysis

62-550.310(2)(c)

PWS029

2005	Endrin (2)	D97006	<0.01	ug/L	EPA 505	0.01	7/23/97	86413	ua
2010	Lindane (.2)	D97006	<0.01	ug/L	EPA 505	0.01	7/23/97	86413	ua
2015	Methoxychlor (40)	D97006	<0.01	ug/L	EPA 505	0.01	7/23/97	86413	ua
2020	Toxaphene (3)	D97006	<0.01	ug/L	EPA 505	0.01	7/23/97	86413	ua
2031	Dalapon (200)	D97006	<1.30	ug/L	EPA 515.1	1.30	7/24/97	86413	ua
2032	Diquat (20)	D97006	<0.5	ug/L	EPA 549.1	0.5	7/28/97	86413	ua
	Endothall (100)	D97006	<10.0	ug/L	EPA 548	10.0	7/28/97	86413	ua
34	Glyphosate (700)	D97006	<10.0	ug/L	EPA 547	10.0	7/28/97	86413	ua
2035	Di(2-ethylhexyl) adipate (400)	D97006	<5.0	ug/L	EPA 525.1	5.0	7/23/97	86413	ua
2036	Oxamyl (Vydate) (200)	D97006	<50.0	ug/L	EPA 531.1	50.0	7/25/97	86413	ua
2037	Simazine (4)	D97006	<0.5	ug/L	EPA 507	0.5	7/24/97	86413	ua
2039	Di(2-ethylhexyl) phthalate (6)	D97006	<5.0	ug/L	EPA 525.1	5.0	7/23/97	86413	ua
2040	Picloram (500)	D97006	<0.2	ug/L	EPA 515.1	0.2	7/24/97	86413	ua
2041	Dinoseb (7)	D97006	<0.2	ug/L	EPA 515.1	0.2	7/24/97	86413	ua
2042	Hexachlorocyclopentadiene(50	D97006	<0.010	ug/L	EPA 505	0.010	7/23/97	86413	ua
2046	Carbofuran (40)	D97006	<10.0	ug/L	EPA 531.1	10.0	7/25/97	86413	ua
2050	Atrazine (3)	D97006	<0.2	ug/L	EPA 507	0.2	7/24/97	86413	ua
2051	Alachlor (2)	D97006	<0.010	ug/L	EPA 507	0.010	7/23/97	86413	ua
2065	Heptachlor (.4)	D97006	<0.010	ug/L	EPA 508	0.010	7/23/97	86413	ua
2067	Heptachlor Epoxide (.2)	D97006	<0.010	ug/L	EPA 508	0.010	7/23/97	86413	ua
2105	2,4-D (70)	D97006	<0.2	ug/L	EPA 515.1	0.2	7/24/97	86413	ua
2110	2,4,5-TP (Silvex) (50)	D97006	<0.2	ug/L	EPA 515.1	0.2	7/24/97	86413	ua

HRS Certification#'s 84352 and E84380(Nokomis) 85449 and E85457(Ft. Myers)

Parameter ID	Analysis	Lab ID	Result	Unit	Method	D. L.	Analysis Date/Time	LabID	Analyst
2274	Hexachlorobenzene (1)	D97006	<0.010	ug/L	EPA 508	0.010	7/23/97	86413	ua
2306	Benzo(a)pyrene (.2)	D97006	<0.2	ug/L	EPA 550	0.2	7/23/97	86413	ua
2	Pentachlorophenol (1)	D97006	<0.20	ug/L	EPA 515.1	0.20	7/23/97	86413	ua
	PCB (.5)	D97006	<0.01	ug/L	EPA 505	0.01	7/23/97	86413	ua
2931	Dibromochloropropane (.2)	D97006	<0.02	ug/L	EPA 504	0.02	7/23/97	86413	ua
2946	Ethylene Dibromide (.02)	D97006	<0.02	ug/L	EPA 504	0.02	7/23/97	86413	ua
2959	Chlordane (2)	D97006	<0.010	ug/L	EPA 508	0.010	7/23/97	86413	ua

Unregulated Group I Analysis

62-550.405

PWS035

2021	Carbaryl	D97006	<10.0	ug/L	EPA 531.1	10.0	7/25/97	86413	ua
2022	Methomyl	D97006	<2.5	ug/L	EPA 531.1	2.5	7/25/97	86413	ua
2043	Aldicarb Sulfoxide	D97006	<10.0	ug/L	EPA 531.1	10.0	7/25/97	86413	ua
2044	Aldicarb Sulfone	D97006	<10.0	ug/L	EPA 531.1	10.0	7/25/97	86413	ua
2045	Metolachlor	D97006	<10.0	ug/L	EPA 507	10.0	7/25/97	86413	ua
2047	Aldicarb	D97006	<5.0	ug/L	EPA 531.1	5.0	7/25/97	86413	ua
2066	3-Hydroxycarbofuran	D97006	<10.0	ug/L	EPA 531.1	10.0	7/25/97	86413	ua
2077	Propachlor	D97006	<1.0	ug/L	EPA 508	1.0	7/23/97	86413	ua
2	Aldrin	D97006	<0.090	ug/L	EPA 508	0.090	7/23/97	86413	ua
	Dieldrin	D97006	<0.020	ug/L	EPA 508	0.020	7/23/97	86413	ua
2440	Dicamba	D97006	<0.20	ug/L	EPA 515.1	0.20	7/24/97	86413	ua
2595	Metribuzin	D97006	<0.250	ug/L	EPA 507	0.250	7/24/97	86413	ua

Unregulated Group II Analysis

62-550.410

PWS034

2210	Chloromethane	D97006	<0.5	ug/L	EPA 524.2	0.5	7/21/97	86413	ua
2212	Dichlorodiflouromethane	D97006	<0.5	ug/L	EPA 524.2	0.5	7/21/97	86413	ua
2214	Bromomethane	D97006	<0.5	ug/L	EPA 524.2	0.5	7/21/97	86413	ua
2216	Chloroethane	D97006	<0.5	ug/L	EPA 524.2	0.5	7/21/97	86413	ua
2218	Trichlorofluoromethane	D97006	<0.5	ug/L	EPA 524.2	0.5	7/21/97	86413	ua
2251	Methyl-Tert-Butyl-Ether	D97006	<0.5	ug/L	EPA 524.2	0.5	7/21/97	86413	ua
2408	Dibromomethane	D97006	<0.5	ug/L	EPA 524.2	0.5	7/21/97	86413	ua
2410	1,1-Dichloropropylene	D97006	<0.5	ug/L	EPA 524.2	0.5	7/21/97	86413	ua
2412	1,3-Dichloropropane	D97006	<0.5	ug/L	EPA 524.2	0.5	7/21/97	86413	ua

Parameter ID	Analysis	Lab ID	Result	Unit	Method	D. L.	Analysis Date/Time	LabID	Analyst
2413	1,3-Dichloropropene	D97006	<0.5	ug/L	EPA 524.2	0.5	7/21/97	86413	ua
2414	1,2,3-Trichloropropane	D97006	<0.5	ug/L	EPA 524.2	0.5	7/21/97	86413	ua
3	2,2-Dichloropropane	D97006	<0.5	ug/L	EPA 524.2	0.5	7/21/97	86413	ua
41	Chloroform	D97006	<0.5	ug/L	EPA 524.2	0.5	7/21/97	86413	ua
2942	Bromoform	D97006	<0.5	ug/L	EPA 524.2	0.5	7/21/97	86413	ua
2943	Bromodichloromethane	D97006	<0.5	ug/L	EPA 524.2	0.5	7/21/97	86413	ua
2944	Dibromochloromethane	D97006	<0.5	ug/L	EPA 524.2	0.5	7/21/97	86413	ua
2965	O-Chlorotoluene	D97006	<0.5	ug/L	EPA 524.2	0.5	7/21/97	86413	ua
2966	P-Chlorotoluene	D97006	<0.5	ug/L	EPA 524.2	0.5	7/21/97	86413	ua
2967	M-Dichlorobenzene	D97006	<0.5	ug/L	EPA 524.2	0.5	7/21/97	86413	ua
2978	1,1-Dichloroethane	D97006	<0.5	ug/L	EPA 524.2	0.5	7/21/97	86413	ua
2986	1,1,1,2-Tetrachlorcethane	D97006	<0.5	ug/L	EPA 524.2	0.5	7/21/97	86413	ua
2988	1,1,2,2-Tetrachloroethane	D97006	<0.5	ug/L	EPA 524.2	0.5	7/21/97	86413	ua
2993	Bromobenzene	D97006	<0.5	ug/L	EPA 524.2	0.5	7/21/97	86413	ua

Unregulated Group III Analysis

62-550.415

PWS036 & 037

2262	Isophorone	D97006	<10.0	ug/L	EPA 625	10.0	7/23/97	86413	ua
4	2,4-Dinitrotoluene	D97006	<10.0	ug/L	EPA 625	10.0	7/23/97	86413	ua
32	Dimethylphthalate	D97006	<10.0	ug/L	EPA 625	10.0	7/23/97	86413	ua
2284	Diethylphthalate	D97006	<10.0	ug/L	EPA 625	10.0	7/23/97	86413	ua
2290	Di-n-Butylphthalate	D97006	<10.0	ug/L	EPA 625	10.0	7/23/97	86413	ua
2294	Butyl benzyl phthalate	D97006	<10.0	ug/L	EPA 625	10.0	7/23/97	86413	ua
9089	Di-n-octylphthalate	D97006	<10.0	ug/L	EPA 625	10.0	7/23/97	86413	ua
9108	2-Chlorophenol	D97006	<10.0	ug/L	EPA 625	10.0	7/23/97	86413	ua
9112	2-Methyl-4,6-dinitophenol	D97006	<10.0	ug/L	EPA 625	10.0	7/23/97	86413	ua
9115	Phenol	D97006	<10.0	ug/L	EPA 625	10.0	7/23/97	86413	ua
9116	2,4,6-Trichlorophenol	D97006	<10.0	ug/L	EPA 625	10.0	7/23/97	86413	ua

	Dioxin - 2,3,7,8-TCDD	D97006	<5.2	ug/L	EPA 1613	5.2	8/6/97	83331	ua

HRS Certification#'s 84352 and E84380(Nokomis) 85449 and E85457(Ft. Myers)

Radiochemical Analysis

62-550.310(5)

PWS033

Parameter ID	Analysis	Lab ID	Result	Unit	Method	D. L.	Analysis Date/Time	LabID	Analyst
,00	Gross Alpha	D97006	<10.7	pCi/L	EPA 900.1	+\-6.9	7/29/97	83141	ua
4020	Radium 226	D97006	2.1	pCi/L	EPA 903.1	+\-0.5	8/1/97	83141	ua
4030	Radium 228	D97006	<0.9	pCi/L	Brks/Blchrd	+\-0.6	7/31/97	83141	ua
	Total Coliform	D97006	<1.0	col/100ml	SM9222B	1.0	7/21/97 14:45	84352	ua
	Heterotrophic Plate Count	D97006	72	CFU/mL	SM9215B	1	7/21/97 19:10	84352	ua
	Ammonia-N	D97006	0.60	mg/L	EPA 350.3	0.05	7/29/97	84352	ua
	Nitrogen, Organic	D97006	0.66	mg/L	EPA 351.2	0.2	7/29/97	84352	ua
	Phosphorus, Total	D97006	0.03	mg/L	EPA 365.2	0.02	7/28/97	84352	ua
	Orthophosphate	D97006	<0.02	mg/L	EPA 365.2	0.02	7/22/97	84352	ua

HRS Certification#'s 84352 and E84380(Nokomis) 85449 and E85457(Ft. Myers)

Parameter ID	Analysis	Lab ID	Result	Unit	Method	D. L.	Analysis Date/Time	LabID	Analyst
	Nitrogen, Total Kjeldahl	D97006	1.26	mg/L	EPA 351.2	0.2	7/28/97	84352	ua
	Conductivity	D97006	7,310	umhos/c	EPA 120.1	1.0	7/22/97	84352	ua
	BOD	D97006	3.4	mg/L	EPA 405.1	1	7/23/97 8:30	84352	ua
	Chemical Oxygen Demand	D97006	47	mg/L	EPA 410.1	10.0	7/24/97	84352	ua
	Water Temperature, Field	D97006	31	C	EPA 170.1		7/21/97	84352	ua

Approved by:

Debra Sanders
Laboratory Director

Approved by:

Patrick N. Sterling
Laboratory Manager

Comments:

HRS Certification#'s 84352 and E84380(Nokomis) 85449 and E85457(Ft. Myers)

Sanders Laboratories
Environmental Testing Services

CHAIN-OF-CUSTODY RECORD

INTAKE FORM # 800006

Page 1 of 1

Client Youngquist Brothers
Address 15465 Pine Ridge Rd
Ft Myers, FL 33908
Phone 941-489-4444 Fax 941-489-4545

Report To: Eci McCullers
Bill To:
P.O. #
Project Name
Project Location: Spingtree ASR

Sample Supply: DW
Customer Type:
Field Report #:
Kit #
REQUESTED DUE DATE: 7/28/97

Sampled By (PRINT) RICARDO CEDENO
Sampler Signature

ITEM #	SAMPLE DESCRIPTION / LOCATION	JOB #	Sample DATE	TIME	TYPE	NO. OF CONTAINERS	PRESERVATIVES UNPRESERVED	H_2SO_4	HNO_3	HCL	ANALYSES REQUEST: 624-550	Primary Inorganics	Secondary Inorganics	TTHM	VOC	Pest/PCB	Group I, II, III	Diesel	GA Rad 226/228	T. Coliform + HPC	NH_3, Org N, TKN	Orthos, Cond, BOD, Temp, TOC	LAB NUMBER
1	D97 006		7/21/97	0900							X	X	X	X	X	X	X	X	X	X	X	X-D97006

OUT / DATE	SHIPMENT METHOD RETURNED / DATE	VIA	ITEM #	RELINQUISHED BY / AFFILIATION	DATE	TIME	ACCEPTED BY / AFFILIATION	DATE	TIME
	VIA GREYHOUND			SANDERS	7/21/97	0900		7/21/97	0900
COMMENTS:		COOLER #						7/22/97	0900

625 UNIT I, North Tamiami Trail, Nokomis, FL 34275 (941) 488-8103 • FAX 484-6774
16880 Gator Road, Fort Myers, FL 33912 • (941) 590-0337
5951 N.W. 151st Street, Suite 36, Miami Lakes, FL 33014 • (305) 826-9422

January 1998 Analyses Results

Appendix K

Certificate of Completion
and
As-Built Drawings

City of Sunrise
Springtree ASR Well System

Certification of Completion

We certify under penalty of law that the above-referenced system was constructed to completion under our supervision in accordance with the construction permits and supporting documents, to those dimensions indicated in the as-built drawings. Based on our inquiry of the individuals who have prepared these documents, the information submitted is, to the best of our knowledge and belief, true, accurate and complete.

Geoff Hart, P.E.
Project Engineer

Date 3/19/98

Anne Murray, P.G.
Project Hydrogeologist

Date 3/19/98

Appendix L

Injectate Water Quality Analysis

SPECTRUM
Laboratories, Inc. FORT LAUDERDALE • SAVANNAH

-PUBLIC DRINKING WATER ANALYSIS-

-PUBLIC WATER SYSTEM INFORMATION:

System Name: CITY OF SUNRISE I.D.# 4061410
Address: 10770 W OAKLAND PK BLVD, SUNRISE, FL 33351 PHONE : 954/846-7400
Type: (X) Community ( ) Nontransient Non-Community ( ) Non-Community

-SAMPLE INFORMATION:

Sample Date: 03/17/97 1005 Sample Time:
Sample Location: WTP 1 FINISHED Sample #:040-031797
Sampler Name & Phone: STAN CERWINSKI, SUNRISE 954/846-7400

Sampler's Signature:_____ Title:_____
Check Type(s): (X)Distribution ( )Recheck of MCL ( )Resample of Lab Invalidated Sample
( )Clearance ( )THM Max Res Time ( )Plant Tap
( )Distrib entry pt ( )Raw ( )Composite of Multiple Sites - Attach a format for each site

-LABORATORY CERTIFICATION INFORMATION:

Lab Name: Spectrum Laboratories, Inc. HRS #: 86144 Expiration Date: June 30th, 1997

Address: 1460 W. McNab Rd Ft. Lauderdale, Florida 33309 Phone 954/978-6400

Subcontracted Lab HRS #: Groups Analyzed:

-ANALYSIS INFORMATION

Date Sample(s) Received: 03/17/97
Group(s) Analyzed & results attached for compliance with 62-550, F.A.C.

(X)Nitrate	(X)Nitrite	( )Asbestos	(X)Trihalomethanes
Inorganics	Volatile Organics	Secondaries	Pesticides/PCBs
(X)All 17 ( )Partial	(X)All 21 ( )Partial	(X)All 14 ( )Partial	(X)All 30( )Partial
Group I Unregulateds	Group II Unregulateds	Group III Unregulateds	Radiochemicals
( )All 13 ( )Partial	(X)All 23 ( )Partial	( )All 11 ( )Partial	( )Single Sample
			( )Qtrly Composite*

*Provide radiochemical sample dates & locations for each quarter

I, Donald S. McCorquodale, do HEREBY CERTIFY that all attached analytical data are correct.

Signature _____

Title: Laboratory Director Date: MAR. 28 1997

-COMPLIANCE INFORMATION

Sample Collection Satisfactory: _____ Sample Analysis Satisfactory:_____

Resample Requested For:_____ Reason:_____

Person notified to resample:_____ Date Notified:_____

DER/ACPHU Reviewing Official:_____

INORGANIC ANALYSIS
62-550.310(1)
(PWS030)

Parameter ID	NAME (MCL mg/l)	Sample Number	Analysis Result (mg/l)	Analytical Method	MDL	Analysis Date
				EPA-		
1005	ARSENIC (.05)	040-031797	0.00	206.2	0.002	970320
1010	BARIUM (2)	040-031797	0.00	208.1	0.04	970324
1015	CADMIUM (.005)	040-031797	0.00	213.2	0.0001	970319
1020	CHROMIUM (0.1)	040-031797	0.00	218.1	0.02	970319
1024	CYANIDE (0.2)	040-031797	0.00	335.1	0.005	970319
1025	FLUORIDE (4)	040-031797	1.02	340.2	0.10	970320
1030	LEAD (.015)	040-031797	0.00	239.2	0.001	970319
1035	MERCURY (.002)	040-031797	0.00	245.1	0.0001	970324
1036	NICKEL (0.1)	040-031797	0.00	249.1	0.02	970319
1040	NITRATE (10)	040-031797	0.36	353.1	0.02	970325
1041	NITRITE (1)	040-031797	0.101	353.1	0.02	970318
1045	SELENIUM (.05)	040-031797	0.00	270.2	0.002	970320
1052	SODIUM (160)	040-031797	44.3	273.1	0.10	970319
1074	ANTIMONY (.006)	040-031797	0.00	402.2	0.0009	970320
1075	BERYLLIUM (.004)	040-031797	0.00	210.2	0.0002	970320
1085	THALLIUM (.002)	040-031797	0.00	279.2	0.002	970320
1094	ASBESTOS (7 MFL)	040-031797		600/4-83-043		

SECONDARY CHEMICAL ANALYSIS
62-550.320
(PWS031)

Parameter ID	NAME (MCL mg/l)	Sample Number	Analysis Result (mg/l)	Analytical Method	MDL	Analysis Date
				EPA-		
1002	ALUMINUM (0.2)	040-031797	0.00	202.1	0.01	970319
1017	CHLORIDE (250)	040-031797	63.5	325.3	1.00	970318
1022	COPPER (1)	040-031797	0.00	220.2	0.02	970319
1025	FLUORIDE (2)	040-031797	1.02	340.2	0.10	970320
1028	IRON (0.3)	040-031797	0.00	236.1	0.02	970325
1032	MANGANESE (.05)	040-031797	0.00	243.1	0.02	970326
1050	SILVER (0.1)	040-031797	0.00	272.1	0.01	970320
1055	SULFATE (250)	040-031797	15.8	375.4	1.00	970319
1095	ZINC (5)	040-031797	0.03	289.1	0.02	970319
1905	COLOR (15 COLOR UNITS)	040-031797	15	110.2	5.0	970318
1920	ODOR (3 THRESHOLD ODOR NO.)	040-031797	1	140.1	1.0	970318
1925	pH (6.5-8.5)	040-031797	8.96	150.1		970318
1930	TDS (500)	040-031797	120	160.1	1.00	970320
2909	FOAMING AGENTS (0.5)	040-031797	0.00	425.1	0.02	970318

TRIHALOMETHANE ANALYSIS
62-550.310(2)(a)
(PWS027)

Parameter ID	NAME (MCL mg/l)	Sample Number	Analysis Result (ug/l)	Analytical Method	Analysis Date
2950	TOTAL THMs (0.10)	040-031797	18.12	EPA-524.2	970320

RADIOCHEMICAL ANALYSIS*
62-550.310(5)
(PWS033)

Parameter ID	NAME	Sample Number	Analysis Result (pCi/l)	Analytical Method	Analysis Error	Analysis Date
4000	GROSS ALPHA	040-031797		EPA 900.0		
4012	PHOTON EMITTERS					
4020	RADIUM-226	040-031797		EPA 903.1		
4030	RADIUM-228	040-031797		EPA 904.0		
4101	MAN-MADE BETA					

*(Gross alpha generally only requirement, see 62-550.519, FAC)

VOLATILE ORGANIC ANALYSIS
62-550.310(2)(b)
(PWS028)

Parameter ID	NAME (MCL ug/l)	Sample Number	Analysis Result (ug/l)	Analytical Method	Det. Lt. Used (ug/l)	Analysis Date
2378	1,2,4-TRICHLOROBENZENE (70)	040-031797	0.00	EPA-524.2	0.2	970320
2380	Cis-1,2-DICHLOROETHYLENE (70)	040-031797	0.00	524.2	0.2	970320
2955	XYLENES (TOTAL) (10,000)	040-031797	0.00	524.2	0.2	970320
2964	DICHLOROMETHANE (5)	040-031797	0.00	524.2	0.2	970320
2968	O-DICHLOROBENZENE (600)	040-031797	0.00	524.2	0.2	970320
2969	PARA-DICHLOROBENZENE (75)	040-031797	0.00	524.2	0.2	970320
2976	VINYL CHLORIDE (1)	040-031797	0.00	524.2	0.2	970320
2977	1,1-DICHLOROETHENE (7)	040-031797	0.00	524.2	0.2	970320
2979	TRANS-1,2-DICHLOROETHYLENE (100)	040-031797	0.00	524.2	0.2	970320
2980	1,2-DICHLOROETHANE (3)	040-031797	0.00	524.2	0.2	970320
2981	1,1,1-TRICHLOROETHANE (200)	040-031797	0.00	524.2	0.2	970320
2982	CARBON TETRACHLORIDE (3)	040-031797	0.818	524.2	0.2	970320
2983	1,2-DICHLOROPROPANE (5)	040-031797	0.00	525.2	0.2	970320
2984	TRICHLOROETHENE (3)	040-031797	0.00	524.2	0.2	970320
2985	1,1,2-TRICHLOROETHANE (5)	040-031797	0.00	524.2	0.2	970320
2987	TETRACHLOROETHENE (3)	040-031797	0.00	524.2	0.2	970320
2989	MONOCHLOROBENZENE (100)	040-031797	0.00	524.2	0.2	970320
2990	BENZENE (1)	040-031797	0.00	524.2	0.2	970320
2991	TOLUENE (1,000)	040-031797	0.00	524.2	0.2	970320
2992	ETHYLBENZENE (700)	040-031797	0.00	524.2	0.2	970320
2996	STYRENE (100)	040-031797	0.00	524.2	0.2	970320

UNREGULATED GROUP I ANALYSIS
62-550.405
(PWS035)

Parameter #	NAME	Sample Number	Analysis Result (mg/l)	Analytical Method	Det. Lt. Used	Analysis Date
				EPA-		
2021	CARBARYL	040-031797		531	0.001	
2022	METHOMYL	040-031797		531	0.001	
2043	ALDICARB SULFOXIDE	040-031797		531	0.001	
2044	ALDICARB SULFONE	040-031797		531	0.001	
2045	METOLACHLOR	040-031797		507	0.00001	
2047	ALDICARB	040-031797		531	0.001	
2066	3-HYROXYCARBOFURAN	040-031797		531	0.001	
2076	BUTACLOR	040-031797		507	0.00001	
2077	PROPACHLOR	040-031797		507	0.00001	
2356	ALDRIN	040-031797		508	0.000005	
2364	DIELDRIN	040-031797		508	0.00001	
2440	DICAMBA	040-031797		515	0.00001	
2959	METRIBUZIN	040-031797		507	0.00005	

UNREGULATED GROUP II ANALYSIS
62-550.410
(PWS034)

Parameter #	NAME	Sample Number	Analysis Result (ug/l)	Analytical Method	Det. Lt. Used	Analysis Date
				EPA-		
2210	CHLOROMETHANE	040-031797	0.00	524.2	0.02	970320
2212	DICHLORODIFLUOROMETHANE	040-031797	0.00	524.2	0.02	970320
2214	BROMOMETHANE	040-031797	0.00	524.2	0.02	970320
2216	CHLOROETHANE	040-031797	0.00	524.2	0.02	970320
2218	TRICHLOROFLUOROMETHANE	040-031797	0.00	524.2	0.02	970320
2251	METHYL TERT BUTYL ETHER	040-031797	0.00	524.2	0.1	970320
2408	DIBROMOMETHANE	040-031797	0.00	524.2	0.02	970320
2410	1,1-DICHLOROPROPENE	040-031797	0.00	524.2	0.02	970320
2412	1,3-DICHLOROPROPANE	040-031797	0.00	524.2	0.02	970320
2224	trans-1,3-DICHLOROPROPENE	040-031797	0.00	524.2	0.02	970320
2228	cis-1,3-DICHLOROPROPENE	040-031797	0.00	524.2	0.02	970320
2414	1,2,3-TRICHLOROPROPANE	040-031797	0.00	524.2	0.02	970320
2416	2,2,-DICHLOROPROPANE	040-031797	0.00	524.2	0.02	970320
2941	CHLOROFORM	040-031797	17.1	524.2	0.02	970320
2942	BROMOFORM	040-031797	0.00	524.2	0.02	970320
2943	BROMODICHLOROMETHANE	040-031797	1.02	524.2	0.02	970320
2944	DIBROMOCHLOROMETHANE	040-031797	0.00	524.2	0.02	970320
2965	o-CHLOROTOLUENE	040-031797	0.00	524.2	0.02	970320
2966	p-CHLOROTOLUENE	040-031797	0.00	524.2	0.02	970320
2967	m-DICHLOROBENZENE	040-031797	0.00	524.2	0.02	970320
2978	1,1-DICHLOROETHANE	040-031797	0.00	524.2	0.02	970320
2986	1,1,1,2-TETRACHLOROETHANE	040-031797	0.00	524.2	0.02	970320
2988	1,1,2,2-TETRACHLOROETHANE	040-031797	0.00	524.2	0.02	970320
2993	BROMOBENZENE	040-031797	0.00	524.2	0.02	970320

PESTICIDE & PCB CHEMICAL ANALYSIS
62-550.310(2)(c)
(PWS029)

Parameter ID	NAME (MCL ug/l)	Sample Number	Analysis Result (ug/l)	Analytical Method	Det. Lt. Used (ug/l)	Analysis Date
2005	ENDRIN (2)	040-031797	0.00	EPA-508	0.01	970324
2010	LINDANE (.2)	040-031797	0.00	508	0.001	970324
2015	METHOXYCHLOR (40)	040-031797	0.00	508	0.01	970324
2020	TOXAPHENE (3)	040-031797	0.00	508	0.1	970324
2031	DALAPON (200)	040-031797	0.00	515	0.01	970324
2032	DIQUAT (20)	040-031797	0.00	549	0.44	970318
2033	ENDOTHALL (100)	040-031797	0.00	548	10.0	970327
2034	GLYPHOSATE (700)	040-031797	0.00	547	10.0	970325
2035	DI(2-ETHYLHEXYL)ADIPATE (400)	040-031797	0.00	506	0.1	970324
2036	OXAMYL (VYDATE) (200)	040-031797	0.00	531	1.0	970321
2037	SIMAZINE (4)	040-031797	0.00	507	0.01	970324
2039	DI(2-ETHYLHEXYL)PHTHALATE (6)	040-031797	0.00	525	0.1	970324
2040	PICLORAM (500)	040-031797	0.00	515	0.01	970324
2041	DINOSEB (7)	040-031797	0.00	515	0.1	970324
2042	HEXACHLOROCYCLOPENTADIENE (50)	040-031797	0.00	508	0.1	970324
2046	CARBOFURAN (40)	040-031797	0.00	531	1.0	970321
2050	ATRAZINE (3)	040-031797	0.00	507	0.01	970324
2051	ALACHLOR (LASSO) (2)	040-031797	0.00	505	0.01	970324
2063	2,3,7,8-TCDD (DIOXIN) (.00003)	040-031797		613	0.01	
2065	HEPTACHLOR (.4)	040-031797	0.00	508	0.005	970324
2067	HEPTACHLOR EPOXIDE (.2)	040-031797	0.00	508	0.005	970324
2105	2,4-D (70)	040-031797	0.00	515	0.01	970324
2110	2,4,5-TP(SILVEX) (50)	040-031797	0.00	515	0.005	970324
2274	HEXACHLOROBENZENE (1)	040-031797	0.00	508	0.01	970324
2306	BENZO(A)PYRENE (.2)	040-031797	0.00	525	0.01	970324
2326	PENTACHLOROPHENOL (1)	040-031797	0.00	515	0.01	970324
2383	PCBs (.5)					
	PCB 1016	040-031797	0.00	508	0.1	970324
	PCB 1221	040-031797	0.00	508	0.1	970324
	PCB 1232	040-031797	0.00	508	0.1	970324
	PCB 1242	040-031797	0.00	508	0.1	970324
	PCB 1248	040-031797	0.00	508	0.1	970324
	PCB 1254	040-031797	0.00	508	0.1	970324
	PCB 1260	040-031797	0.00	508	0.1	970324
2931	DIBROMOCHLOROPROPANE (.2)	040-031797	0.00	524	0.02	970320
2946	ETHYLENE DIBROMIDE (.02)	040-031797	0.00	504	0.01	970320
2959	CHLORDANE (2)	040-031797	0.00	508	0.1	970324

Appendix M

Cycle Testing Report