CITY OF FORT LAUDERDALE
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SOUTH FLORIDA WATER MANAGEMENT DISTRICT

City of Fort Lauderdale

Fiveash Water Treatment Plant
Aquifer Storage and Recovery System

Fort Lauderdale Project No. 8880/P-9771

Well Construction Report

September 1998

MONTGOMERY WATSON

MONTGOMERY WATSON

G-2917 ASR-1
G-2918 FMV-1

September 24, 1998

Mr. Jose L. Calas, P.E.
UIC Program Manager
Florida Department of Environmental Protection
400 North Congress Avenue
West Palm Beach, Florida 33401

SUBJECT: City of Fort Lauderdale
Fiveash WTP Aquifer Storage and Recovery System
Construction Report and Request to Proceed with Cycle Testing
FDEP Permit No. 0128340-002-UC
Fort Lauderdale Project No. 8880/P-9771
(Montgomery Watson Project No. 1324007.28090280)

Dear Mr. Calas:

On behalf of the City of Fort Lauderdale, Montgomery Watson is pleased to submit four (4) copies of this Report detailing the construction and testing of the new Class V Aquifer Storage and Recovery (ASR) well system at the Fiveash Water Treatment Plant. The Fiveash ASR system has been constructed under a Class V, Group 7 treated water well construction permit, however, the City intends to cycle test and operate the well under a raw water construction permit which is currently pending approval. A Water Quality Criteria Exemption for the constituents of color, iron and odor has been issued by the FDEP for operation of the raw water system.

This report details the methods of construction and testing of the new ASR well and presents interpretations of the collected data. Record drawings of the constructed well accompany this document. Signed and sealed as-built drawings for the remainder of the system will be forwarded to the Department according to an approved variance dated September 9, 1998.

This document is accompanied by a draft Operations and Maintenance manual, and is respectfully submitted in support of a request to proceed with operational (cycle) testing of the system using raw water. We are confident that the information contained within these documents will be sufficient for the Department to provide the City with approval for cycle testing.

2328 - 10th Avenue North
Suite 501
Lake Worth, Florida
33461-6616

Tel: 561 586 8830
Fax: 561 586 8834

Please review these reports and provide your comments regarding the request to proceed with cycle testing at your earliest convenience. If you have any questions or comments, please do not hesitate to contact us.

Very truly yours,
MONTGOMERY WATSON

Robert T. Verrastro, P.G.
Senior Hydrogeologist

for
Anne Murray, P.G.
Project Manager

cc: TAC Members
Maurice Tobon, City of Fort Lauderdale
Wayne Welch, Montgomery Watson

SE Technical Advisory Committee Distribution List

Mr. Steven D. Anderson
South Florida Water Management District
3301 Gun Club Road
West Palm Beach FL 33406
Phone Number: 561/686-8800 ext. 6853
Fax Number: 561/687-6436

Mr. Jose L. Calas, P.E.
Florida Dept. of Environmental Protection
Underground Injection Control Division
400 North Congress Avenue
West Palm Beach FL 33401
Phone Number: 561/681-6696
Fax Number: 561/681-6760

Mr. Len Fishkin
Florida Dept. of Environmental Protection
Underground Injection Control Division
400 North Congress Avenue
West Palm Beach FL 33401
Phone Number: 561/681-6600
Fax Number: 561/681-6760

Mr. Garth Hinckle, P.E.
Broward County Department of Natural
Resource Protection
218 S.W. 1st Avenue
Ft. Lauderdale FL 33301
Phone Number: 954/519-1450
Fax Number: 954/519-1496

Mr. Scott Hoskins
Compliance Enforcement
USEPA, Region IV Atlanta Federal Center
100 Alabama Street, S.W.
Atlanta GA 30303
Phone Number: 404/562-9450
Fax Number: 404/562-9439

Ms. Nancy Marsh
Permitting
USEPA, Region IV Atlanta Federal Center
100 Alabama Street, S.W.
Atlanta GA 30303
Phone Number: 404/562-9450
Fax Number: 404/562-9439

Ms. Cathy McCarty
FDEP, Bureau of Water Facility
Mail Stop 3530
2600 Blair Stone Road
Tallahassee FL 32399
Phone Number: 850/921-9412
Fax Number: 850/414-9031

Mr. Phong Nguyen
Broward County Public Health Unit
2421 S.W. 6th Avenue
Ft. Lauderdale FL 33315
Phone Number: 954/467-4846
Fax Number: 954/467-4898

Mr. Ron Reese
U.S. Geological Survey
Water Resources Division
9100 N.W. 36th Street - Suite 107
Miami FL 33178
Phone Number: 305/594-0655
Fax Number: 305/526-2881

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:

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City of Fort Lauderdale

Fiveash Water Treatment Plant
Aquifer Storage and Recovery System
Fort Lauderdale Project No. 8880/ P-9771

Well Construction Report

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

Geoff Hart, P.E.	22777 License Number	9/17/98 Date
Anne M. Murray, P.G.	1095 License Number	9/17/98 Date

City of Fort Lauderdale

Fiveash Water Treatment Plant
Aquifer Storage and Recovery System
Fort Lauderdale Project No. 8880/P-9771

Well Construction Report

Submitted by
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Sunrise, Florida 33325

September 1998

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Executive Summary

This report documents the drilling and testing of ASR-1, a new Class V, Group 7 Aquifer Storage and Recovery Well for the City of Fort Lauderdale. The report has been submitted in support of a request to proceed with operational testing of the system. The well is located at the Fiveash Water Treatment Plant, on N.W. 9 Avenue, within the City limits. This report documents the results of the construction and testing of the well system, which includes new Floridan aquifer and surficial aquifer monitoring wells. Construction took place between November 1997 and June 1998. The purpose of the ASR system is to store raw groundwater from the Prospect Wellfield during times of excess and recover this water during peak, seasonal or emergency demands. The system was constructed under a Class V, Group 7 treated water well construction permit, however, a raw water construction permit for the system is anticipated shortly from the FDEP. The raw water construction permit is supported by a Water Quality Criteria Exemption dated July 27, 1998 by the FDEP for the constituents of color, iron and odor.

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 information collected during this project demonstrates the successful construction of the well system, which is now ready for testing. The following conclusions are derived from the information presented and interpreted in this report:

- The ASR well (ASR-1) was constructed with 16-inch (outer) diameter steel casing to a total depth of 1,200 feet below land surface (bls).

- The open hole of the ASR well extends from 1,055 feet bls to 1,200 feet bls.

- A Floridan aquifer monitor well (FMW-1) also was constructed at the site, consisting of 6-inch diameter steel casing installed to a depth of 1,055 feet bls; an open hole extended to 1,175 feet bls.

- A surfical aquifer monitoring well (SMW-1) was also constructed at the site, consisting of 2-inch diameter PVC casing set to 180 feet bls and a gravel packed screen set from 180 feet bls to 200 feet bls.

- The well casings have internal mechanical integrity, as determined from hydrostatic pressure tests and video surveys.

- The data demonstrate the existence of a storage zone with a transmissivity of approximately 146,000 gallons per day per foot.

- The ASR well yields water at a rate of 2,100 gallons per minute (equivalent to 3 mgd) with a pumping water level of approximately 90 feet bls. The static (non-pumping) water-level at the well as approximately 31 feet above land surface during March 1998.

- The storage zone contains ambient water with a chloride concentration of 3,500 milligrams per liter (mg/L) and a total dissolved solids concentration of 7,900 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 a clay-rich limestone of the Ocala Formation.

Surface facilities include piping, a recharge pump, electronically-actuated control valves, a bi-directional flowmeter, electric submersible pump, electrical systems, and instrumentation and control. Raw water is conveyed both to and from the ASR system via an onsite 12-inch water main. Recovered water will be pumped from the ASR well and conveyed to the head of the Fiveash WTP for treatment and distribution during the cycle testing period. Recharge and recovery rates are approximately 1,400 gallons per minute, equivalent to 2 million gallons of water per day (mgd).

Construction of the ASR system is now complete. A draft operations and maintenance (O&M) manual is included with this submittal. A final O&M manual will be prepared during the cycle testing period, as a companion document to this report. It outlines required operational, monitoring, and maintenance of the ASR system. This report is presented to FDEP in support of a request for operational testing of the system.

Montgomery Watson recommends that the City of Fort Lauderdale 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 raw groundwater. 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 Fort Lauderdale Fiveash Water Treatment Plant (WTP). The Fiveash WTP is located in the northeast corner of Section 21 of Township 49 South and Range 42 East, in Broward County, Florida. **Figure 1-1** presents a project location map.

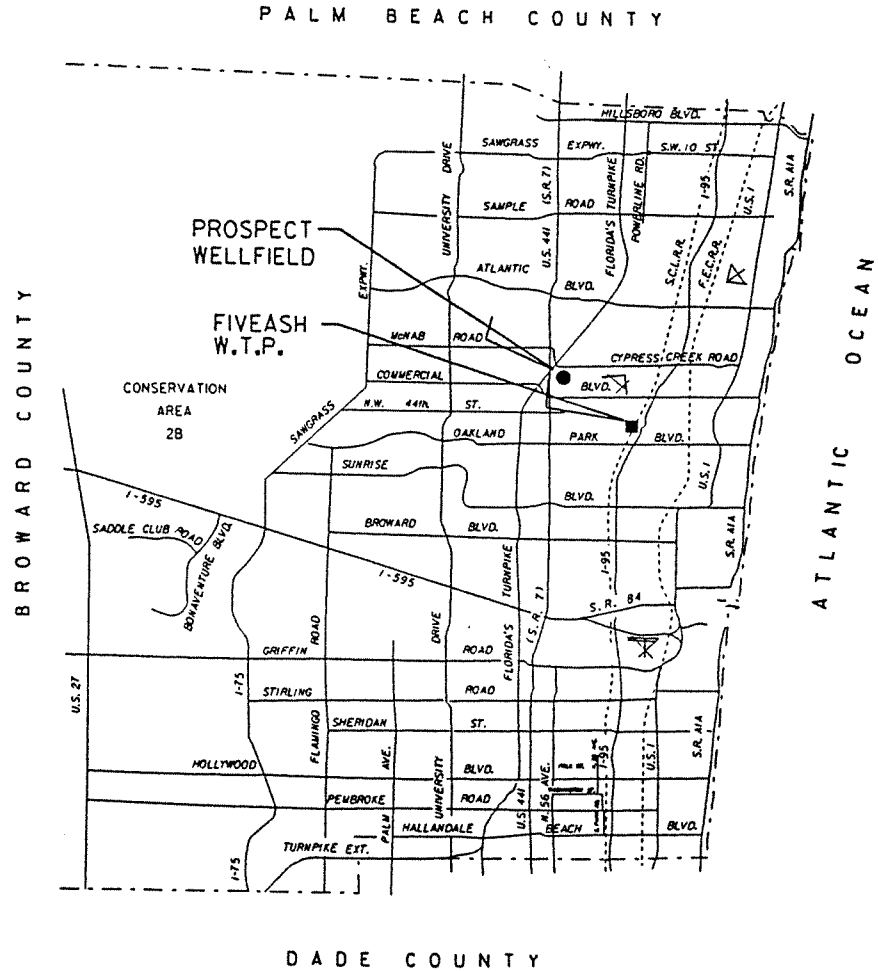
This report provides support for a request to proceed with operational (cycle) testing of the new ASR well system. Construction of the subject well (ASR-1) was in accordance with Construction Permit 0128340-002-UC issued by the Florida Department of Environmental Protection (FDEP) and Permit Number WC-06-297981 issued by the Broward County Health Department. **Appendix A** includes copies of the construction permits and Water Quality Criteria Exemption obtained for this project. The ASR well system design incorporates recharge (injection) and recovery of up to 2 million gallons per day (mgd) of raw water from the Prospect Wellfield.

PROJECT BACKGROUND

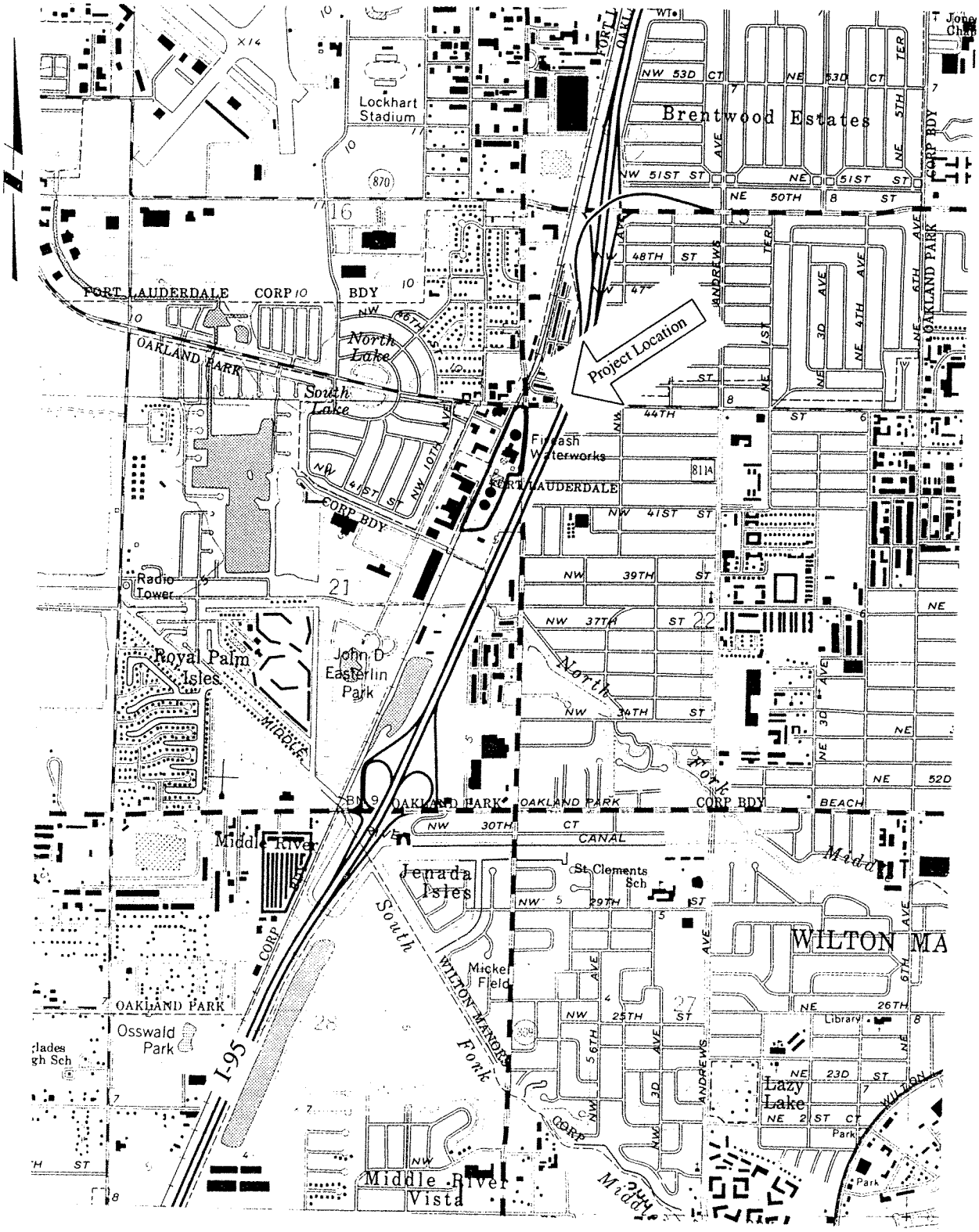
The location of the Fiveash WTP is at 4321 N.W. 9 Avenue in the City of Fort Lauderdale. A vicinity map is presented on **Figure 1-2**. In 1954, the Fiveash WTP consisted of an 8 million gallon per day (mgd) facility supplied by the Executive Airport Wellfield. In 1958, plant capacity doubled to 16 mgd, and further increased to 32 mgd in 1963. The Executive Airport Wellfield, consisting exclusively of Biscayne aquifer wells, underwent expansion between 1958 and 1963 to meet additional plant capacity increases.

Approximately six years after completion of the Executive Airport Wellfield, construction of the Prospect Wellfield commenced. These wells consist exclusively of Biscayne aquifer wells located near Prospect Lake. In the mid-1980's, volatile organic compounds were detected in the groundwater in the vicinity of the Executive Airport Wellfield. As a result, pumpage shifted westward to the Prospect Wellfield, which has since supplied the majority of the City's raw water. Subsequent expansions of the Prospect Wellfield took place during 1980 and 1985 that provided additional raw water supply for the Fiveash WTP. The latest plant expansion, completed in 1980, increased the Fiveash WTP treatment capacity to its current rating of 70 mgd.

On January 16, 1997, the South Florida Water Management District (SFWMD) re-issued the City of Fort Lauderdale's Water Use Permit (No. 06-00123-W) for public water



MONTGOMERY WATSON	**Project Location Map**	**Figure 1-1**



City of Ft. Lauderdale, Florida
Fiveash ASR System

Vicinity Map

Figure 1-2

MONTGOMERY WATSON

JOB No.: FILE No.: Plot Date:

supply. The City's Water Use Permit provides for an average annual withdrawal of 52.4 mgd, and a maximum daily withdrawal of 64.6 mgd. The City operates two WTPs, Peele-Dixie and Fiveash, which have a combined treatment capacity of 90 mgd. The Dixie Wellfield, restricted to a maximum daily withdrawal of approximately 10 mgd, provides the Peele-Dixie WTP raw water. The raw water supply for Fiveash WTP is approximately 45 mgd from the Prospect Wellfield. By implementing use of the ASR well, the City will take advantage of surplus raw water available during low-demand months from the Prospect Wellfield. The City anticipates using the new ASR well system for daily or seasonal peaking and as an emergency supply for the system.

On October 15, 1997, the FDEP issued a construction permit to the City of Fort Lauderdale 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. The permit also included construction of Floridan aquifer and surficial aquifer monitoring wells.

Opening of sealed bids received from contractors by the City occurred on January 15, 1997. Youngquist Brothers, Inc. (Youngquist) of Fort Myers, Florida was the low bidder and awarded the contract to construct the ASR well system on February 18, 1997, with a bid of $1,297,700. Permitting issues delayed issuance of the Notice to Proceed until November 3, 1997. Youngquist mobilized to the site during late November 1997 and construction was complete by June 1998. Surface facilities are due to be completed by late October 1998.

Subsequent sections of this report present the ASR well system construction and testing program. Also presented is information on the site hydrogeology and the results of the testing. Presented in this report is a plan for cycle testing the new ASR well system; implementation of this plan will be dependent upon regulatory acceptance.

Section 2

Section 2
Hydrogeologic Setting

REGIONAL GEOLOGIC SETTING

Southern 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 and monitor wells penetrate sediments from land surface to a depth of 1,300 feet bls. Within these sediments are the surficial and Floridan aquifer systems. These two aquifer systems are separated by an intermediate confining unit.

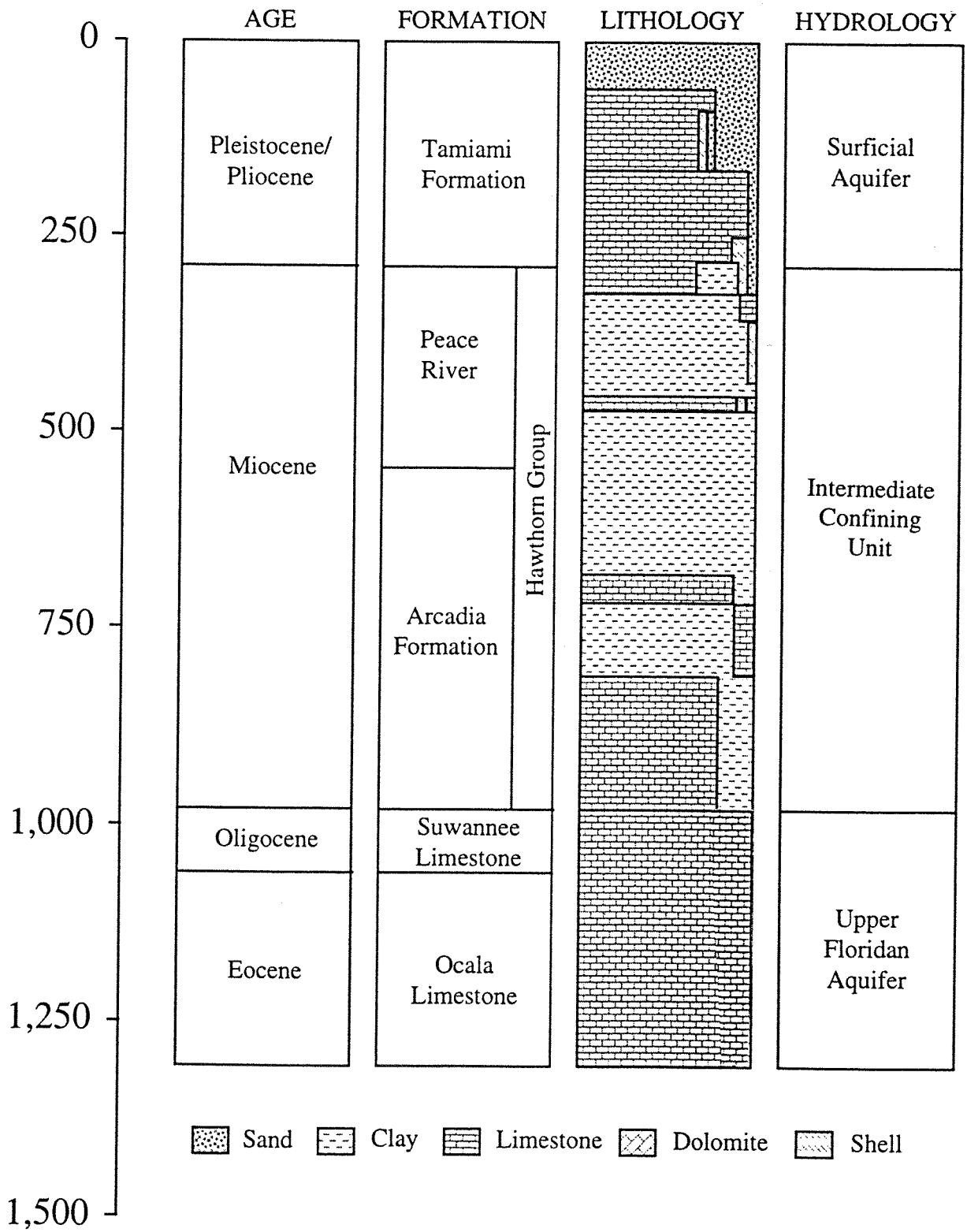
LOCAL GEOLOGY

Plio-Pleistocene Series

During the drilling and testing of ASR-1 and FMW-1 Plio-Pleistocene aged limestone, sand, sandstone, clay and shells were observed from land surface to a depth of approximately 270 feet bls. **Figure 2-1** presents a summary of the lithology penetrated at the wellsite. These sediments are representative of the Pamlico Sand, Anastasia Formation and the Fort Thompson Formation, and were deposited between one to five million years ago. These sediments are light-gray colored, loosely cemented and contained abundant fossil shells. Porosity within these sediments is relatively high (between 20% to 30%). The surficial aquifer monitor well (SMW-1), was set and installed in this unit at a total depth of 200 feet below land surface.

Miocene Series

The Plio-Pleistocene sediments unconformably overly dense phosphatic clays and limey silts of the Hawthorn Group. The Hawthorn Group sediments extend from 270 feet bls to 970 feet, to a total thickness of 700 feet. From 270 feet bls to 555 feet bls, clay-rich sediments representing the Peace River Formation are present. From 555 feet bls to 970 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 logs to be discussed in a subsequent section.



MONTGOMERY WATSON

Lithologic Summary

Figure 2-1

Oligocene Series

Lying below the Hawthorn Group sediments is the Oligocene-aged Suwannee limestone, at a depth of 970 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 1,030 feet bls.

Eocene Series

The top of the Ocala limestone was encountered at a depth of 1,030 feet bls,. This formation is 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 limestone was present to the total drilled depth of the pilot borehole, which was 1,300 feet bls.

HYDROGEOLOGIC DESCRIPTION

Surficial Aquifer System

The surficial aquifer system is present to a depth of 270 feet bls at the site. Within the surficial aquifer system in Broward County is the Biscayne aquifer, which is the source of most of the drinking water in southern Florida. 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.

Intermediate Confining Unit

From 270 feet bls to 970 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 970 feet bls to the total depth penetrated at the site (1,300 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 and total dissolved solids concentrations of approximately 3,500 mg/L and 8,000 mg/L respectively.

Section 3

Section 3
System Construction

The construction and testing program was developed to determine 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 a zone in the upper Floridan aquifer that will accept injection and withdrawal of water at the design rate of 2 mgd.
- Sufficient confinement exists above the injection zone to prevent upward movement (loss) of the stored water.
- The constructed well has mechanical integrity.

The construction sequence consisted of installation of ASR-1, followed by installation of FMW-1, then SMW-1. **Table 3-1** presents a construction and testing chronology.

Table 3-1
Construction and Testing Chronology

Date	ASR-1	FMW-1	SMW-1
Nov. 29, 1998	Begin drilling pilot hole.		
Nov. 30, 1997	Pilot hole TD at 471'. Geophysical logs.		
Dec. 3, 1997	Cement 26" casing to 198'.		
Dec. 8, 1997	Pilot hole TD at 1,125'. Geophysical logs.		
Dec. 18, 1997	Cement 16" casing to 1,055'.		
Dec. 19, 1997	Pressure test on 16" casing.		
Dec. 23, 1997	Pilot hole and cores TD at 1,300'.		
Dec. 24, 1997	Video survey.		
Dec. 28, 1997	Open-hole plug back to 1,200'.		
Dec. 30, 1997	Complete air development.		
Jan. 4, 1998		Begin drilling pilot hole	
Jan. 5, 1998			Begin drilling pilot hole.
Jan. 6, 1998		Cement 14" casing to 370'	
Jan. 9, 1998			Cement casing and screen to 200'.
Jan. 11, 1998		Pilot hole packer test #1	Complete air development.
Jan. 13, 1998		Pilot hole packer test #2	
Jan. 16, 1998		Pilot hole packer test #3	
Jan. 23, 1998		Cement 6" casing to 1,055'	
Jan. 29, 1998		Pressure test on 6' casing	
March 13, 1998		Geophysical logs	
March 15, 1998		Pumping development complete	
March 16, 1998		Step-rate pumping test	
March 17, 1998		Constant-rate pumping test	
March 24, 1998	Pumping development complete.		
March 25, 1998	Step-rate pumping test.		
March 30, 1998	Constant-rate pumping test.		

SITE DEVELOPMENT

Construction at the site proceeded with installation of two 40-foot by 40-foot steel reinforced concrete containment pads at the sites of ASR-1 and FMW-1. The purpose of these containment pads 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 fluid spills from the well, principally saline water, thereby protecting the surficial aquifer system. A plant schematic and location of the project staging area is shown on the site plan presented on **Figure 3-1.**

Four water-table monitoring wells were constructed at each corner of the containment pads prior to the initiation of drilling ASR-1 and FMW-1. The pad monitor wells were all constructed of Schedule 40 PVC casing and screen to 15 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 November 1997, the water table was observed to be approximately 8 feet bls at the site. Results from the background sampling indicated that chloride concentrations in water collected from the wells averaged approximately 5 to 50 milligrams per liter (mg/L), conductivity concentrations ranged from 150 to 670 micromhos per centimeter (µmhos/cm) and TDS concentrations of approximately 100 to 400 mg/L. Results from the baseline analyses were used for comparison with water samples collected weekly during ASR-1 and FMW-1 well drilling and testing activities. The pad monitor well located at the northeast corner of the ASR-1 pad (ASR-1 PMW-3) showed elevated levels for conductivity, chloride, and TDS between January 9, 1998, and February 20, 1998. These increased levels were attributed to the accumulation of water produced from the upper Floridan aquifer around the monitor well. The western ASR-1 pad monitor well (ASR-1 PMW-2) showed elevated levels beginning February 12, 1998, and continuing through May 1998. Concentrations of the constituents did not change substantially in any of the remaining six wells over the course of the project. The water-table monitoring wells were left in place after construction for future monitoring.

ASR-1 DRILLING PROGRAM

A generalized drilling and testing sequence for ASR-1 consisted of drilling a 12-inch diameter pilot hole to the base of the surficial aquifer system. The pilot hole then was geophysically logged 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

WARNING
UNDERGROUND UTILITIES EXIST IN THIS AREA. CONTRACTOR SHALL EXERCISE CAUTION WHEN EXCAVATING IN THE SURROUNDING AREAS.

ELECTRICAL NOTES:

1. FEEDER ASRF-1 AND 2" (4) 2C #16 SHLD AND 1 #12, (2) 6 C #16 SHLD IN REINFORCED CONCRETE DUCT BANK FROM PULL BOX TO PUMP CONTROL PANEL.
2. (2)-16"x16"x6" NEMA-4X STAINLESS STEEL BOX. MOUNT BOX ON BUILDING WALL 4 FEET ABOVE GRADE.
3. RUN ASRF-1 FEEDER EXPOSED 12 FEET AFF TO MCC-K.
4. MCC-K IN ELECTRICAL ROOM.
5. CORE DRILL EXISTING BUILDING.
6. CUT AND PATCH EXISTING ASPHALT.
7. ATTACH TO BUILDING GROUND GRID

GENERAL NOTES:

1. FOLLOWING WELL DEVELOPMENT, THE CONTRACTOR SHALL CLEAN AND REMOVE ALL SAND, SILT, AND OTHER MATERIAL, DISINFECT TANK AND RETURN TANK TO POTABLE WATER STORAGE USE IN ACCORDANCE WITH SPECIFICATION SECTION 02620.
2. ALL GROUNDWATER FROM DEWATERING IS TO REMAIN WITHIN PIPE TRENCH LIMITS.

PROPOSED 7 MG GROUND STORAGE TANK No.4
EXISTING 5 MG GROUND STORAGE TANK No.3
EXISTING 4 MG GROUND STORAGE TANK No.2
AMMONIA STORAGE TANKS
AMMONIATOR BUILDING
SLUDGE DISTRIBUTION STRUCTURE
PUMP CONTROL PANEL
12'x56' FIELD TRAILER
FINAL WELL PAD
FLORIDAN AQUIFER MONITORING WELL
SHALLOW WATER TABLE MONITOR WELLS (TYP.) SEE DETAIL 4, SHEET G-5
SHALLOW AQUIFER MONITOR WELL SEE DETAIL 6 SHEET G-5
40'x40' TEMPORARY DRILLING PAD SEE DETAIL 5, SHEET G-5
SEE MONITOR WELLHEAD & SUBMERSIBLE SUMP PUMPS DETAIL 2 & 7, SHEET G-5
TEMPORARY PIPING FOR WELL DEVELOPMENT TO BE ROUTED BY CONTRACTOR
CONTRACTOR TO ROUTE TEMPORARY PIPING FROM WELL THROUGH NEAREST VENT ON TANK ROOF AND CONNECT TEMPORARY DRAIN PIPING TO TANK DRAIN
CONNECT TO EXISTING 6" FORCE MAIN W/ 4"x6" TAPPING SLEEVE & VALVE SEE DETAIL M-144, SHEET G-4 CONTRACTOR TO VERIFY LOCATION OF EXISTING 6" FORCE MAIN
PROPOSED 42" FINISHED WATER TRANSFER LINE (BY OTHERS)
EXISTING 42" HIGH SERVICE LINE
EXISTING 60" TRANSFER LINE
ASR WELL STA.0+00.00 FOR DETAIL SEE SHEET M-1
SEE SHEET C-2 MATCH LINE A - A
BURIED VALVE 12" BUTTERFLY VALVE I-V-016 I-V-017 C-215
DETAIL 1 G-7
SEE DETAIL #3 A, SHEET G-6
SEE DETAIL #1 A, SHEET G-6
6" FM (11)
12" RW (11)
6" PW (12)
1½" NH3 (16)
1" CLS (16)
2-12" 90° MJ BENDS STA.3+63.64, 3+95.41
12"-90° MJ BEND STA.3+34.57
1-12" 90° MJ BEND 1-12" 90° FL. BEND STA.3+27.14
1-12" 90° MJ BEND 1-12" 90° FL. BEND STA.3+22.17
12"-45° MJ BEND STA.1+96.89
2-12" 22.5° MJ BENDS STA.1+26.15, 1+29.77 STA.1+50.81, 1+57.44
2-12" 22.5° MJ BENDS STA.1+70.61, 1+74.75
12"-90° MJ ELBOW & 12"-90° FLANGED ELBOW
12"-45° MJ BEND STA.0+92.97
12"x8" REDUCER
12"-45° FLANGED BEND
12"-MJ TEE STA.0+74.10
12"-45° MJ BEND
0+74.35
0+30
0+00 CORNER OF EXIST. RESERVOIR
4+88.26
74.83'
4+28.71
81.32'
93.42'
38'-0"
13'-6"
3/4"C 3#12
ASRM-IF
WP GFI
LCP
HS E-42C HAND-OFF
PROJECT ENGINEER P. E. NO. DATE

DWG. FILE #492.7879

REV	DATE	BY	DESCRIPTION
2	8/97	GJT	REVISED PER CONTRACTOR
1	12/96	GJT	REVISED PER B.C.P.H.U.

SCALE: 1" = 20'
WARNING: 0 ½ 1 — IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE.
DESIGNED B. FIERLE/J. NETZEL
DRAWN G. TAMAYO
CHECKED G. HART
SUBMITTED
PROJECT MANAGER P. E. NO. DATE
MONTGOMERY WATSON P. E. NO. DATE

MONTGOMERY WATSON
Plantation, Florida

CITY OF FORT LAUDERDALE
FIVEASH ASR SYSTEM
Site Plan

SHEET 3-1

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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. Once completed, the well was then pump tested and a final water sample was collected. **Figure 3-2** presents an as-built diagram of ASR-1.

Lithologic Determination

Lithologic samples were collected at 10-foot intervals during drilling. 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 the Florida Geological Survey in Tallahassee. A geolograph was used on the drilling rig throughout the drilling operation to continually track the weight on bit and penetration rate.

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).

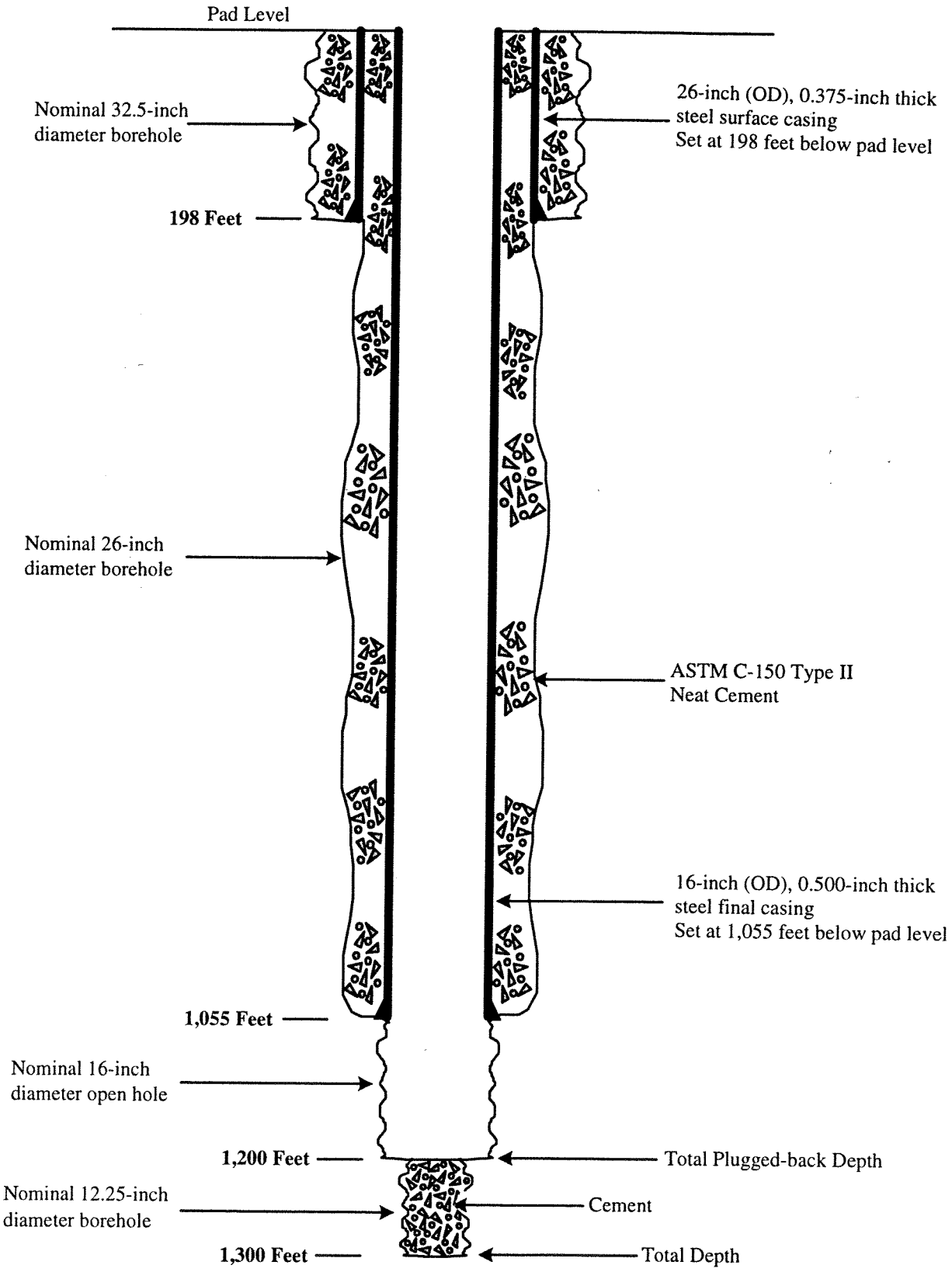
Dual Induction/Electric/SP: measures the electrical properties of the formation. The resistivity of the formation is affected by lithology, porosity, and water quality. These logs are comprised of "shallow", "medium" and "deep"-penetrating sondes, that investigate at various distances from the borehole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



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ASR-1 As-Built Diagram

Figure 3-2

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 and 470 feet bls , and between 470 feet and 1,125 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)
- Fluid Resistivity
- Flowmeter (under pumping and non-pumping [static] 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 upper Floridan aquifer.

Casings

The two casings in ASR-1 were centralized in the borehole using strap-type centralizers welded at intervals along the pipe, at 90 degree intervals around the casing at each position. The 26-inch outer diameter surface casing was constructed from 0.375-inch wall thickness steel pipe, conforming to the standards of API 5L Grade B or ASTM A139, Grade B. Casing joints were welded. The 16-inch outer diameter final casing was constructed of 0.500-inch wall thickness seamless steel pipe, conforming to the standards of API 5L 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.

Cementing

The annulus between each successive casing was cemented using sulfate-resistant cement. The cement used in ASR-1, FMW-1, and SMW-1 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 tremie pipe and by performance of a temperature log/gamma ray log inside the casing. The tag and logs were conducted approximately 5 hours after completion of each stage.

ASR-1 Construction Sequence

Drilling of ASR-1 commenced on the morning of November 29, 1997. A 12.25-inch diameter pilot hole was drilled by the mud rotary method to a depth of 471 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 32.5-inch diameter to a depth of 207 feet bls. Deviation surveys of the pilot boreholes and reamed holes were measured approximately every 60 feet to track hole straightness. A summary copy of the deviation surveys is 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 198 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 20 feet bls in one stage. Cementing records are contained in **Appendix F.**

Twenty-four hours after the completion of cementing, drilling of the 12.25-inch diameter pilot hole resumed. The pilot hole was drilled by the mud rotary method to a depth of 1,125 feet bls. During drilling of this interval, 3 conventional cores were collected at intervals between 949 feet and 1,022 feet bls. The core barrel was 20 feet long and 4 inches in diameter. The cores were described in the field for color, matrix,

depth of 1,125 feet bls. During drilling of this interval, 3 conventional cores were collected at intervals between 949 feet and 1,022 feet bls. The core barrel was 20 feet long and 4 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 G.** Results of the core analysis will be discussed in a subsequent section. Caliper, dual induction, spontaneous potential and gamma ray geophysical logs then were performed.

The final casing setting depth of 1,055 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 December 12, 1997. The pilot hole was then reamed to a nominal 26-inch diameter to a depth of 1,065 feet bls. The installation of the 16-inch diameter final casing took place on December 16, 1997; cementing was accomplished in one stage.

Hydrostatic Pressure Test

A hydrostatic pressure test was performed on the ASR-1 final casing on December 19, 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 173 pounds per square inch (psi). After a one-hour period, a pressure loss of 5 psi (representing a 2.8% decline) was observed, which was within the 5% decline tolerance allowed by the FDEP. The hydrostatic pressure test results, along with the pressure gauge certification are presented in **Appendix H.** This test successfully rated the well to inject at an operating wellhead pressure of 114 psi. (66% of tested pressure).

Open Hole Drilling

Upon completion of the hydrostatic pressure test of ASR-1, the drilling rig was reconfigured from the mud rotary to the reverse-air method. A 12.25-inch diameter pilot hole was drilled to a total depth of 1,300 feet bls. During drilling of this interval, 4 conventional cores were collected at intervals between 1,126 feet and 1,291 feet bls.

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 1,171 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 1,130 feet and 1,300

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 description is contained in **Appendix I.**

Pilot Hole Plug-Back

The lithologic, hydrologic, and geophysical data collected from the pilot borehole drilled to 1,300 feet bls indicated that highly porous limestone existed to a depth of approximately 1,185 feet bls. Below this depth, the limestone contained a higher percentage of clay and silt. In addition, a flowmeter log conducted through this interval indicated that the portion of the hole from below 1,170 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 1,200 feet bls. The pilot hole was subsequently filled with a neat cement plug installed through a tremie pipe. Following cementing, the pilot hole was reamed to a 16-inch nominal diameter to 1,200 feet bls. The well then was 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 December 24, 1997. No internal flaws in the well casing or joints were observed during the test, further confirming the internal mechanical integrity of the well.

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 800 gallons per minute (gpm) to 1,800 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 23 gpm/ft at a pumping rate of approximately 1,400 gpm, after approximately 4 days of development. Upon completion of development the static water level exhibited at the well was approximately 31 feet above land surface.

Step-Rate Pumping Test

On March 25, 1998, a step-rate pumping test was performed on the well at incremental 1-hour pumping rates of 970 gpm, 1,380 gpm, 1,850 gpm and 2,100 gpm for a cummulative period of 4 hours. Water levels were recorded with a calibrated pressure transducer and an Instrumentation Northwest multi-channel datalogger system during the test. Water level data collected from the test is summarized graphically and contained in **Appendix J**. 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 approximately 60 feet while pumping near this rate during the step-rate pumping test.

Constant-Rate Pumping Test

On March 30 and 31, 1998, a constant-rate pumping test was performed on the ASR well, at a rate of 2,100 gpm. Water levels during the pumping test were recorded with a calibrated pressure transducer and an Instrumentation Northwest multi-channel datalogger system. Water level data collected from the test is summarized graphically and contained in Appendix J. During the test, a maximum drawdown of approximately 120 feet was recorded in the well equating to a specific capacity of approximately 18 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.

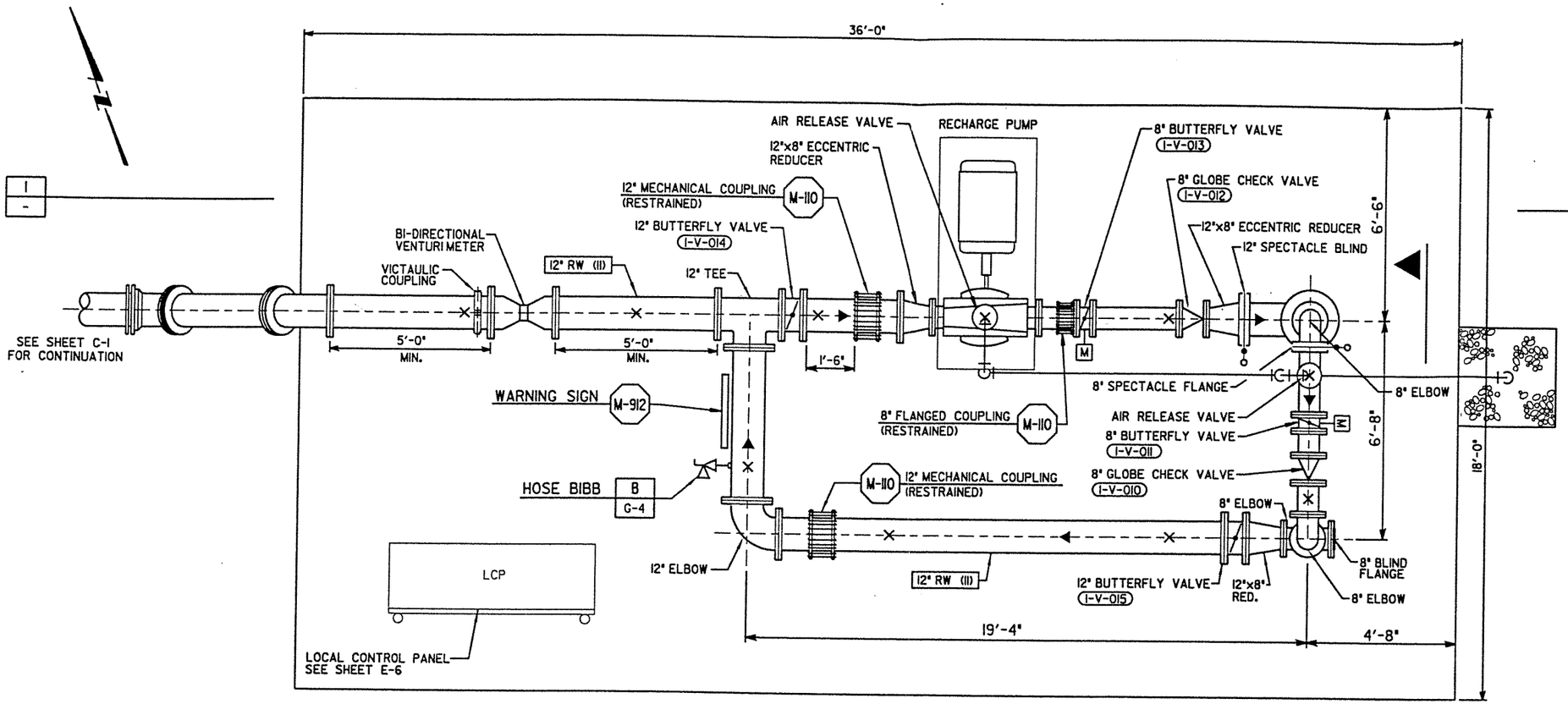
Surface Completion

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 raw water main at the Fiveash WTP. **Figure 3-3** presents a wellhead piping plan. The certification of completion of construction required by the FDEP for this system is contained in **Appendix L.**

FMW-1 DRILLING PROGRAM

A generalized drilling and testing sequence for FMW-1 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 reamed. Casing was 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 the final casing. After setting and cementing the final casing, the well was developed, pump tested, and a final water sample was collected. **Figure 3-4** presents an as-built diagram of FMW-1.

NOTE:
CONTRACTOR TO INCREASE SLAB THICKNESS AND REINFORCEMENT IF REQUIRED TO SUPPORT DRILLING EQUIPMENT. SUBMIT REVISED DRAWINGS SIGNED AND SEALED BY FLORIDA P.E.



PLAN
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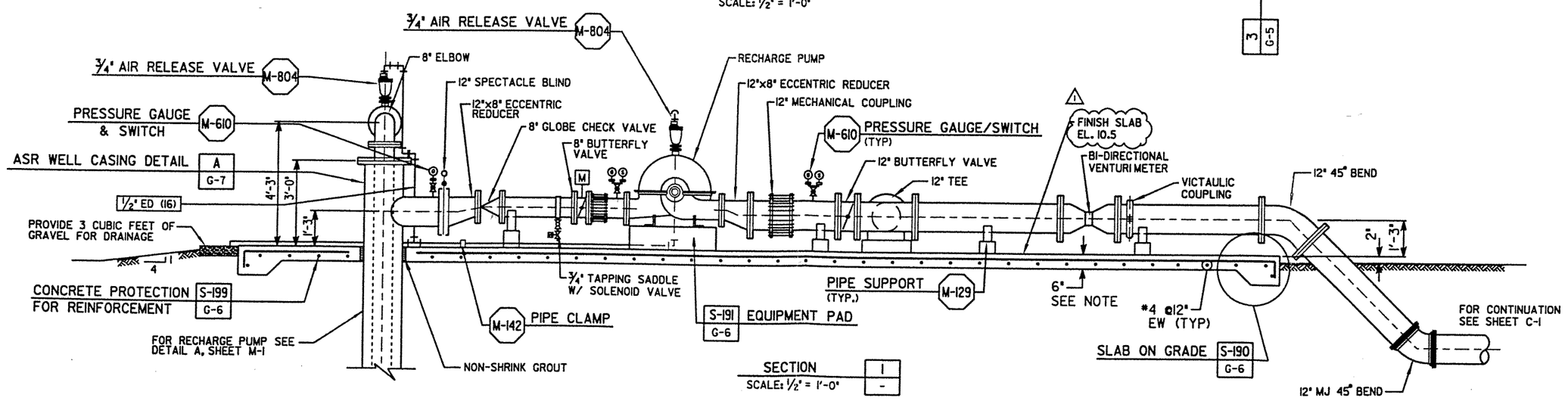

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WARNING: IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE. (0, ½, 1)

DESIGNED B. FIERLE
DRAWN G. TAMAYO
CHECKED G. HART

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

MONTGOMERY WATSON
Plantation, Florida

CITY OF FORT LAUDERDALE
FIVEASH ASR SYSTEM

Wellhead Piping Plan

SHEET 3-3

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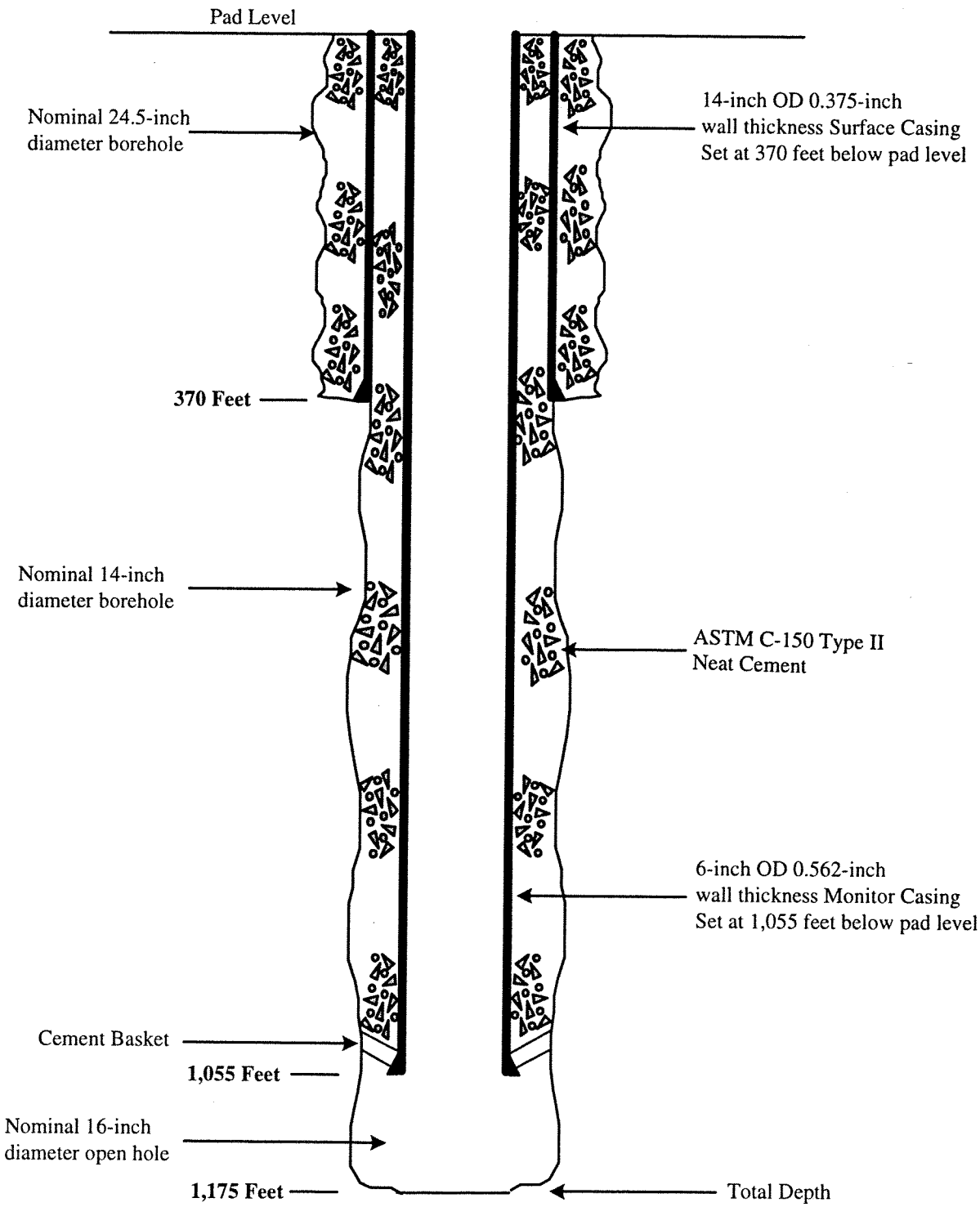


MONTGOMERY WATSON

FMW-1 As-Built Diagram

Figure 3-4

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 the Florida Geological Survey in Tallahassee. A geolograph was used on the drilling rig throughout the drilling operation to continually track the weight on bit and penetration rate.

Geophysical Logs

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

- XY Caliper Log
- Gamma Ray Log
- Dual Induction/Electric/SP
- Fluid Resistivity
- Temperature Log
- Compensated Sonic Log
- Borehole Television (Video) Log
- Flowmeter Log

Drilling Methods

Well FMW-1 was drilled using the mud rotary method.

Casings

The two casings in FMW-1 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 14-inch outer diameter surface casing was constructed from 0.375-inch wall thickness steel pipe, conforming to the standards of ASTM A53, Grade B. Casing joints were welded. The 6.625-inch outer diameter final casing was constructed of 0.562-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.

Cementing

The annulus between each successive casing was cemented using sulfate-resistant cement. The cement used in FMW-1 was ASTM C 150, Type II, with additives where necessary. Additives consisted only of bentonite, up to 4%, for cementing casings. Only neat cement was used during cementing for 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. The final casing of FMW-1 was cemented in place using a cement basket and the tremie method.

Construction Sequence

Drilling of FMW-1 commenced on January 5, 1998. A 12.25-inch diameter pilot hole was drilled by the mud rotary method to a depth of 400 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, SP, 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 24.5-inch diameter to a depth of 380 feet bls. A caliper log then was performed on the reamed hole, followed by setting of the 14-inch diameter surface casing to a depth of 370 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 surface in one stage. Cementing records are contained in Appendix F.

Twenty-four hours after the completion of cementing, drilling of the 12.25-inch diameter pilot hole resumed. The pilot hole was drilled by the mud rotary method to a depth of 1,180 feet bls. Caliper, Dual-Induction, spontaneous potential and gamma ray geophysical logs were then performed. A final casing setting depth of 1,055 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 January 20, 1998. The pilot hole then was reamed to a nominal 13-inch diameter, to a depth of 1,175 feet bls. The installation of the 6.625-inch diameter final casing took place on January 22, 1998.

Hydrostatic Pressure Test

A hydrostatic pressure test was performed on the FMW-1 final casing on January 29, 1998. A 3-inch packer was lowered inside the 6.625-inch casing to 1,041 feet bls and was inflated to 213 psi. The initial test pressure was 125 psi. After a one-hour period, a pressure increase of 1 psi (representing a 0.8% rise) was observed, which was within the 5% tolerance allowed by the FDEP. The hydrostatic pressure test results, along with the pressure gauge certification are presented in Appendix H.

Video Survey

Upon completion of the geophysical logs, the borehole was flushed with fresh water and a final video survey was performed on March 7, 1998. No internal flaws in the well casing or joints were observed during the test, further confirming the internal mechanical integrity of the well. A copy of the video survey description is contained in Appendix I.

Development

Following completion of the video survey, FMW-1 was developed by attaching a centrifugal pump to the well to pump and surge. Pumping rates of approximately 80 - 120 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 2 gpm/ft at a pumping rate of approximately 120 gpm, after approximately 2 days of development.

Step-Rate Pumping Test

On March 16, 1998, a step-rate pumping test was performed on the well at incremental pumping rates of 100 gpm, 120 gpm, 140 gpm and 160 gpm for periods of 4 hours. Water levels were recorded with a calibrated pressure transducer and an Instrumentation Northwest multi-channel datalogger system during the test. Water level data collected during the test is summarized graphically and contained in Appendix J. The maximum drawdown in the well was approximately 45 feet during pumpage at 160 gpm during the step-rate pumping test.

Constant-Rate Pumping Test

During the period between late March 16, 1998, and March 18, 1998, a constant-rate pumping test was performed on FMW-1 at a rate of 164 gpm. This test was performed after water levels had recovered to within one foot of pre-pumping levels of the step-

rate test. Water levels during the pumping test were recorded with a calibrated pressure transducer and an Instrumentation Northwest multi-channel datalogger system. Water level data collected during the test is summarized graphically and contained in Appendix J. During the test, a maximum drawdown of approximately 50 feet was recorded in the well, equating to a specific capacity of approximately 3.3 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 K. 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 FMW-1 wellhead to the Fiveash WTP. A certification of completion is contained in Appendix L.

SMW-1 DRILLING PROGRAM

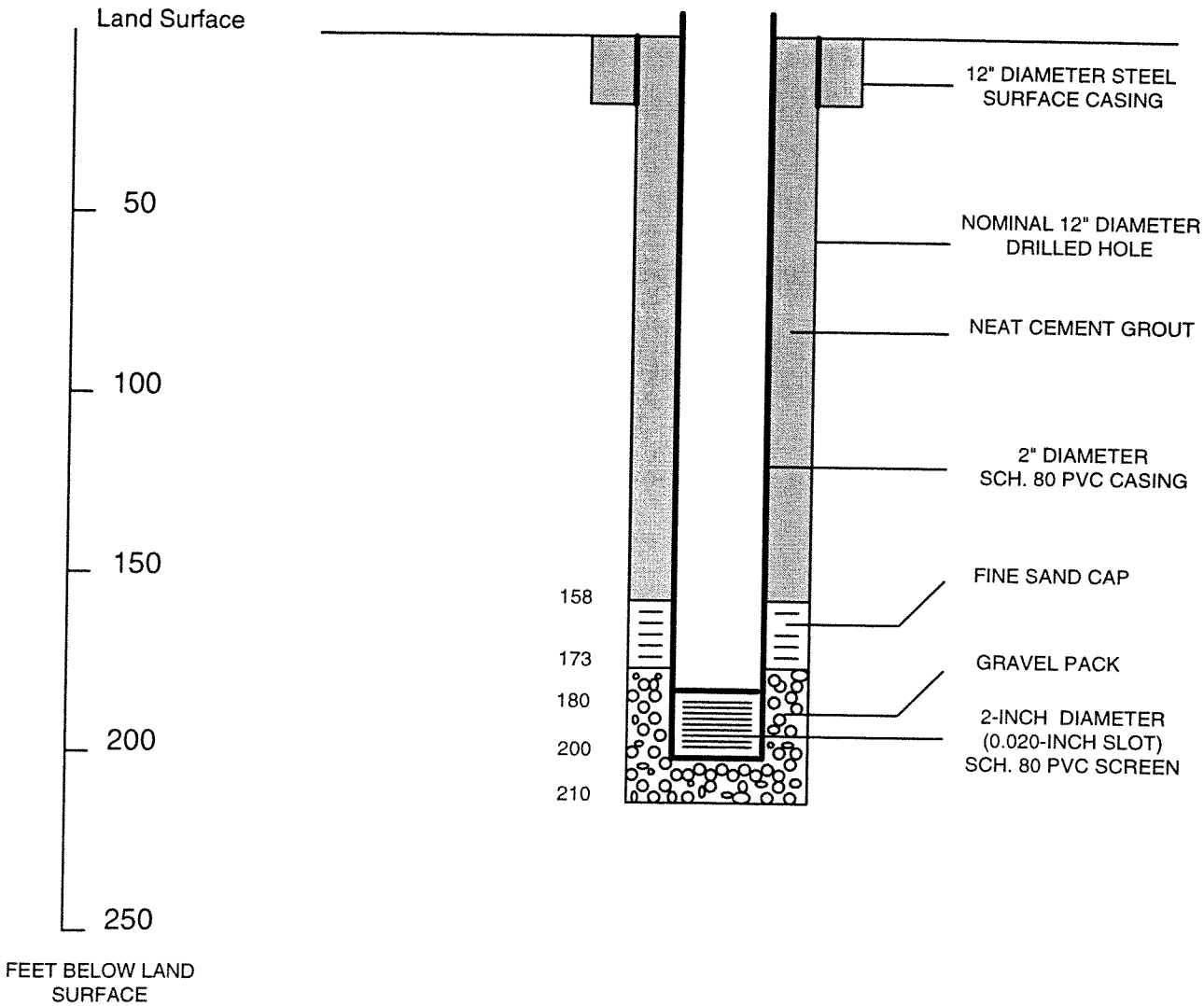
Construction of the shallow monitor well (SMW-1) began by drilling an 8-inch diameter borehole to 210 feet bls. The well casing and screen were then installed and cemented in place to a total depth of 200 feet bls. Following cementing, the well was developed and a final water sample was taken. **Figure 3-5** presents an as-built diagram of SMW-1.

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 diagenetic fabrics.

Drilling Methods

Well SMW-1 was drilled using the mud rotary method.



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SMW-1 As-Built Diagram

Figure 3-5

Casings

The casing in SMW-1 was constructed of 180 feet of 2-inch (inside diameter) flush-joint threaded Schedule 40 PVC casing and 20 feet of 0.020-inch slotted screen and a 5-foot sump. All field joints were threaded by qualified workers in accordance with the requirements of ASTM F480. Following installation of the casing, a 6-20 sieve size gravel pack was placed from the bottom of the well to 10 feet above the top of screen using the tremie method. A five-foot thick sand pack of medium size sand (passing U.S. Standard Sieve No. 35 and retained on U.S. Standard Sieve No. 60) was then placed over the gravel.

Cementing

The cement used in SMW-1 was ASTM C 150, Type II, with additives where necessary. Additives consisted only of bentonite, up to 4%. The cement was emplaced in stages through a tremie pipe located in the annular space between the casing and the borehole near the bottom of the open hole. After each stage of cementing, the top of the cement was verified by a physical tag with the tremie pipe. The final casing was cemented with three stages of pumping.

Construction Sequence

Drilling of SMW-1 commenced on January 5, 1998. The pilot hole was drilled to 210 feet bls and was reamed to a nominal 8-inch diameter. Following drilling, the 2-inch diameter casing was set to 195 feet bls. Determination of the casing setting depth was primarily based on lithologic sample examination and correlation to ASR-1 and FMW-1. Installation of the casing was performed on January 9, 1998.

Following drilling operations, SMW-1 was developed by the air-lift method. At the completion of development, a final water sample was taken by 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 K.

Section 4

Section 4
Well Testing

INTRODUCTION

During the construction of ASR-1, the FMW-1 and the SMW-1, extensive testing was conducted, including collection of lithologic samples, conventional cores, performance of packer pumping tests, water quality sampling, and performance of borehole geophysical logs. The testing was performed to define the hydrogeology of the upper Floridan aquifer, confirm the mechanical integrity of the final well casings, to aid in the selection of the storage and monitoring zones, and to finalize the design of the well and pump. **Figure 4-1** presents a summary of testing performed at ASR-1 and **Figure 4-2** presents the relative positions of cores and pumping tests performed in both FMW-1 and ASR-1.

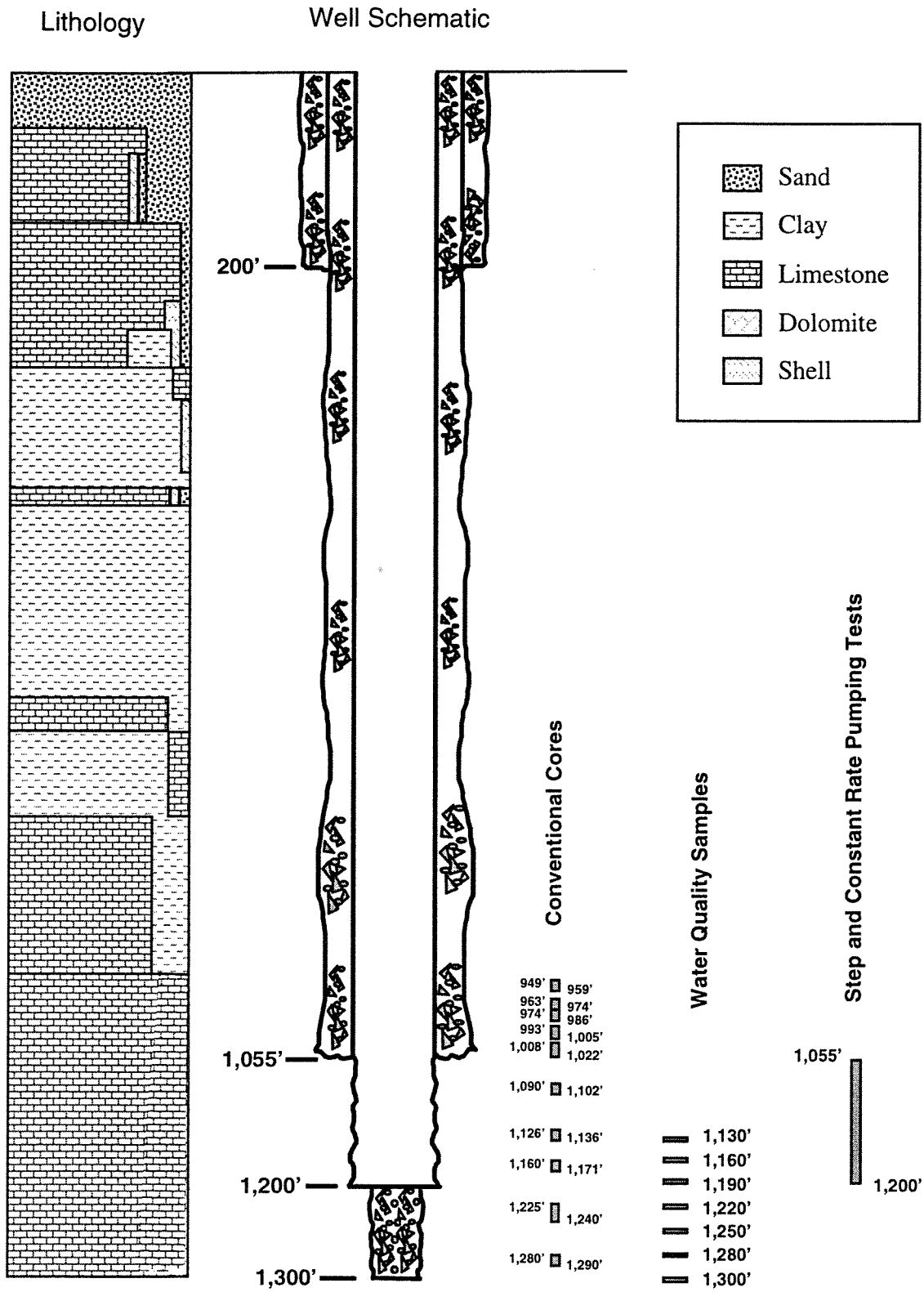
PILOT HOLE TESTING

Core Analyses

A total of ten conventional cores were collected within the Suwannee and Ocala formations penetrated by the ASR-1 and FMW-1 wells. **Table 4-1** presents a summary of the cored intervals and the corresponding laboratory analyses. The uppermost three cores contained phosphatic limestones of low porosity. The lower cores (below 1050 feet) contained a higher concentration of clean limestone. The lower part of this interval was subsequently plugged back, and the final borehole of ASR-1 was completed to 1,200 feet. Detailed core descriptions and the geotechnical analyses of the cores are contained in Appendix G.

Table 4-1
Core Analysis Summary

Core Number	Depth Interval (feet bls)	Lithology	Porosity	Permeability (cm/sec)
ASR-1	949-959	Limestone	--	--
ASR-2	974-986	Limestone	--	--
ASR-3	1008-1022	Limestone	0.24	4.7×10^{-3}
ASR-4	1126-1136	Limestone	--	--
ASR-5	1160-1171.5	Limestone	--	--
ASR-6	1225-1240	Limestone	0.41	1.2×10^{-4}
ASR-7	1280-1291	Limestone	0.42	9.4×10^{-4}
FMW-1	963-974	Limestone	0.30	5.9×10^{-5}
FMW-2	993-1005	Limestone	0.40	1.2×10^{-3}
FMW-3	1090-1102	Limestone	0.46	1.4×10^{-3}



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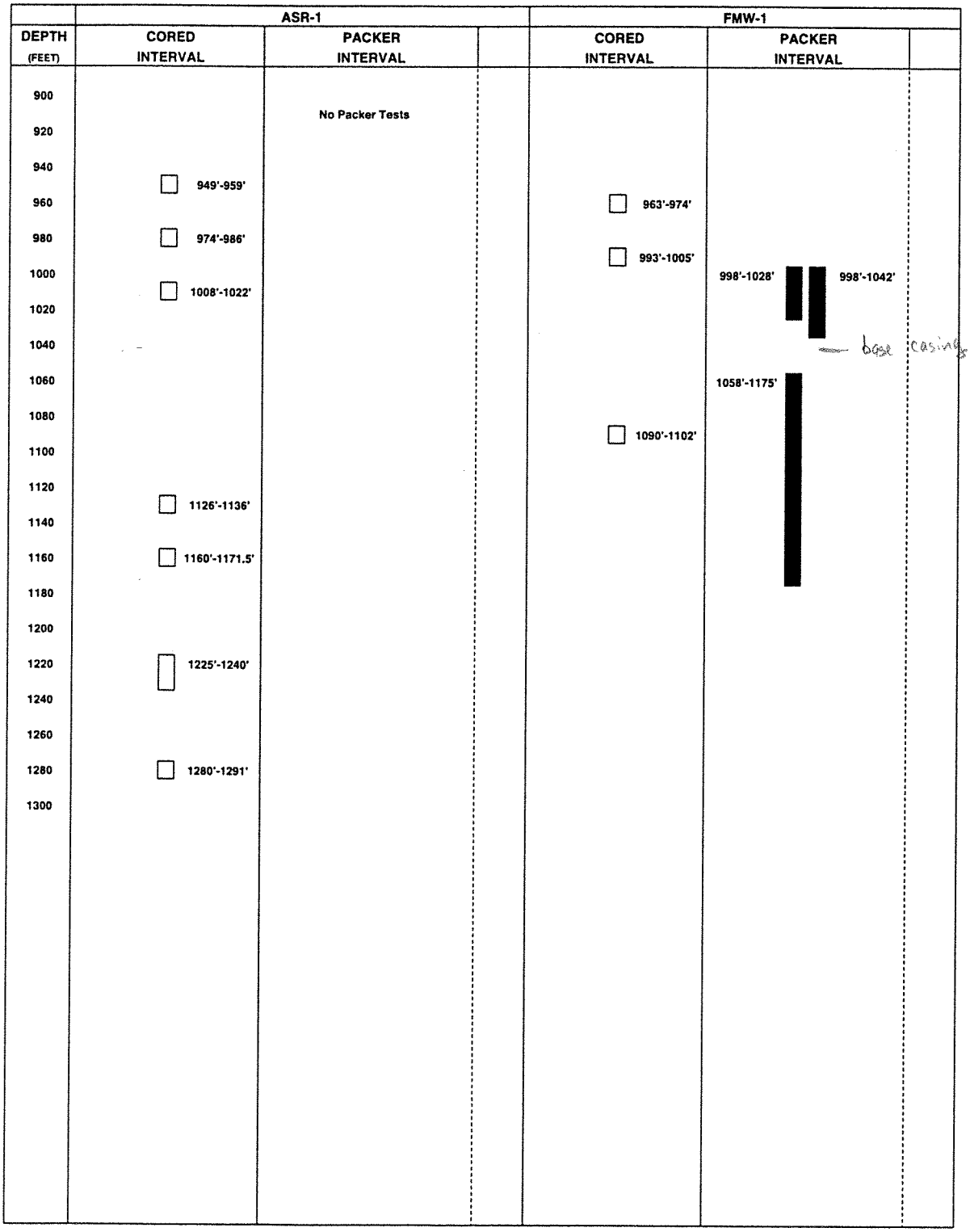
ASR-1 Testing Summary

Figure 4-1

G-2917

G-2918



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FMW-1 and ASR-1 Testing Comparison

Figure 4-2

Water Samples During Drilling

Flowing water samples were collected from ASR-1 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 4-2** presents a summary of the information collected from these analyses. Water quality remained fairly consistent throughout the entire drilled interval of the pilot hole to a total depth of 1,300 feet bls. This information indicated that upconing of poor quality water from below the storage zone (ultimately completed between 1,055 feet bls and 1,200 feet bls in ASR-1) is not likely to occur.

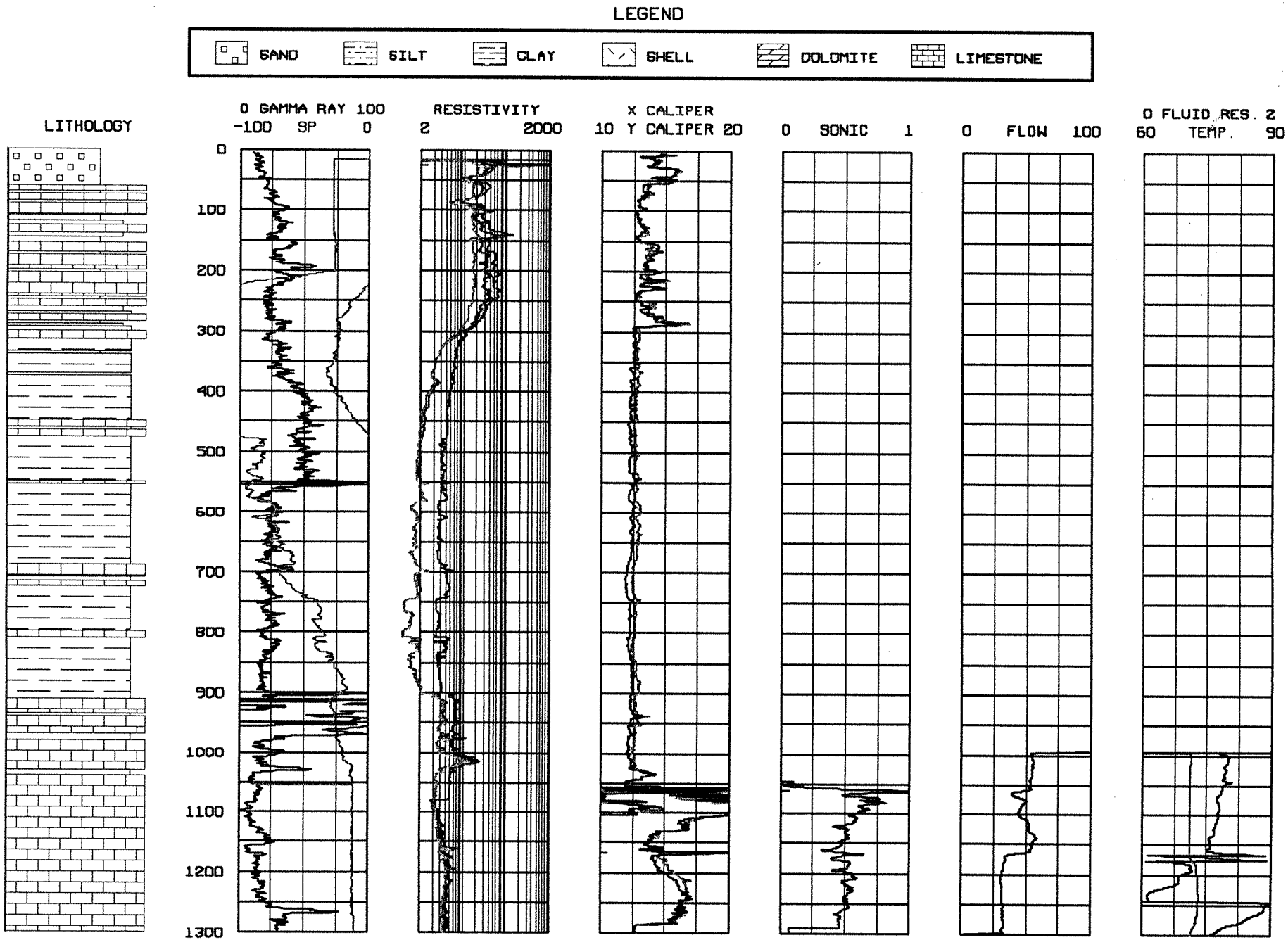
Table 4-2
Water Quality During Drilling of ASR-1

Depth (feet bls)	Conductivity (umhos/cm)	Chlorides (mg/L)
1,130	10,500	4,500
1,160	10,800	4,500
1,190	10,400	5,000
1,220	9,200	4,500
1,250	9,500	4,500
1,280	9,000	4,500
1,300	7,800	4,000

Geophysical Logging Interpretation

The geophysical logs conducted on the pilot hole of ASR-1 refined the lithologic descriptions and depths of formation contacts at the site. **Figure 4-3** presents a geophysical log summary. The gamma ray log revealed relatively uniform counts throughout the Hawthorn Group sediments to a depth of approximately 900 feet bls. At that depth, a sharp increase in gamma counts is observed and the Dual-Induction log revealed an abrupt increase in resistivity near this same depth. This unit is the pebbly phosphatic zone which comprises the lower unit of the Hawthorn Group, which extends to a depth of approximately 970 feet bls. In the transition between the Hawthorn Group sediments and the upper Suwannee limestone, the caliper log did not indicate a change in the character of the drilled hole. The softness of these transitional sediments suggested that they were not favorable for a final casing seat for the ASR well.

Between 970 feet bls and 1,032 feet bls, the gamma ray log showed considerable variation, suggesting the presence of thinly-bedded clay and limestone layers within the



Geophysical Log Summary

Figure 4-3

Suwannee limestone. These variations were confirmed by the lithology and drilling rate. At a depth of 1,032 feet bls, the gamma ray log revealed much lower counts, indicating a formation which was cleaner and more homogenous, typical of the more massive Ocala limestone. This formation was harder (more competent) than the overlying Suwannee limestone.

FINAL CASING SEAT JUSTIFICATION – ASR-1

Penetration to a total depth of 1,055 feet bls into the competent limestones of the Ocala Formation was proposed for the final casing seat of ASR-1. This was recommended because the transitional sediments between the Suwannee limestone and the Ocala limestone contained approximately 20% clay and drilled easily. The Ocala limestone was much more competent, contained less clay and represented a more rigid structural foundation for the cemented casing.

FINAL CASING HYDROSTATIC PRESSURE TEST – ASR-1

A hydrostatic pressure test was performed on the 16-inch diameter ASR-1 final casing on December 19, 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 173 pounds per square inch (psi). After a one-hour period, a pressure loss of 5 psi (representing a 2.8% decline) was observed, which was within the 5% decline tolerance allowed by the FDEP. The hydrostatic pressure test results, along with the pressure gauge certification are presented in Appendix H.

STORAGE ZONE DEPTH SELECTION – ASR-1

Upon completion of the drilling of the pilot hole to a depth of 1,300 feet bls, Montgomery Watson developed an interpretation of the characteristics of the open-hole interval that was based upon the following data:

- The lithologic samples, conventional cores and video survey log indicated that porous gray-colored lime grainstone was present from the base of the well casing to a depth of approximately 1,185 feet bls. Below this interval, the limestone became very fine grained and contained high percentages of chalk and clay. Particularly low porosity was observed during the video survey below 1,185 feet bls.

- The field water quality data collected indicated that water from the upper Floridan aquifer contained a chloride concentration of 4,500 milligrams per liter (mg/L) near the base of the well casing, decreasing to 4,000 mg/L at 1,300 feet bls. Conductivity concentration is also observed to decrease with increasing depth, from 10,500 micromhos per centimeter

(mmhos/cm) near the base of the casing to 7,800 mmhos/cm at 1,300 feet bls. These trends of decreasing concentrations with depth suggest improvement in water quality near the bottom of the pilot hole.

- The geophysical logs confirmed the existence of a favorable storage zone extending from the base of the well casing to approximately 1,170 feet bls.

    - The *flowmeter log* was conducted under static and dynamic (flowing) conditions, at a rate of 500 gallons per minute (gpm). The dynamic log indicates flow contribution to a depth of approximately 1,170 feet bls. Below this depth, the static and dynamic logs were nearly identical, indicating minimal flow contribution from the below 1,170 feet bls.

    - The *caliper log* indicated a large washout near the base of the well casing and somewhat fractured, uneven borehole to a depth of approximately 1,170 feet bls.

    - The *temperature log* indicated a relatively uniform water temperature of 71 degrees Fahrenheit (F) from the base of the well casing to a depth of 1,180 feet bls. Below this depth, the water temperature increased to 73 degrees F, indicating slightly lower water circulation conditions (more "stagnant" flow).

Based on this information, Montgomery Watson recommended completing the ASR well with an open hole extending from 1,055 feet bls to 1,200 feet bls. The pilot hole drilled to a total depth of 1,300 feet bls would be plugged back with neat cement grout to a depth of 1,200 feet bls. The formation penetrated below this depth did not appear to contribute to the storage zone of the well. With the plug-back depth, the water-producing interval of the storage zone would extend from the base of the well casing (at 1,055 feet bls) to approximately 1,170 feet bls, and a 30-foot long "sump" would remain at the base of the open hole (to a total depth of 1,200 feet bls).

PACKER TESTING – FMW-1

The pilot hole below the surface casing of FMW-1 was drilled by the mud rotary method to a depth of 1,180 feet bls. During the drilling of this pilot hole, geophysical logs were conducted and conventional cores were collected. In addition, several single-packer pumping tests were performed on FMW-1 to ascertain the hydraulic characteristics of the storage zone and the clayey (leaky) sediments overlying the storage zone. **Table 4-3** presents a summary of the packer tests performed on FMW-1. During these pumping tests, water levels were recorded in the pumped well (FMW-1) and also in ASR-1, which served as an observation well. The water level information was plotted on log-semi-log paper and analyzed by the Jacob 1944 "straight line" method for computation of transmissivity. The water level information and the results of the aquifer analysis are presented on **Table 4-4.**

Table 4-3
Packer Pumping Tests Conducted on FMW-1

Test #	Date	Pumped Interval (feet bls)	Pumping Rate (gpm)
1	January 12, 1998	998 – 1,028	160
2	January 13, 1998	998 –1,042	160
3	January 15, 1998	1,058 – 1,175	600

Table 4-4
FMW-1 Packer Pumping Test Data Summary

Test Number/ Pumping Rate (gpm)	Pre-Pumped Water Level (relative to land surface)	Pumping Water Level	Drawdown (feet)	Specific Capacity (gpm/ft)	Transmissivity (gpd/ft)
1/160 998-1028'	+31	-3	34	4.7	35,200
2/160 998-1175'	+31	-1	32	5	60,340
3/600 1058-1175	+ 33	+20	13	46	176,000

Storage Zone

MONITORING ZONE DEPTH SELECTION – FMW-1

A final casing setting depth of 1,055 feet bls was selected for FMW-1 based on analysis of the lithologic samples, the geophysical logs and the packer pumping test data. This depth represented the top of the hard, competent limestones of the Ocala limestone. Above this interval were more clay-rich, less transmissive sediments. The open hole of FMW-1 would extend to the base of the storage zone strata penetrated by the ASR well, at a depth of 1,175 feet bls.

HYDROSTATIC PRESSURE TEST – FMW-1

A hydrostatic pressure test was performed on the FMW-1 final casing on January 29, 1998. A 3-inch packer was lowered inside the 6.625-inch casing to 1,041 feet bls and was inflated to 213 psi. The initial test pressure was 125 psi. After a one-hour period, a pressure increase of 1 psi (representing a 0.8% rise) was observed, which was within the 5% tolerance allowed by the FDEP. The hydrostatic pressure test results, along with the pressure gauge certification are presented in Appendix H.

PUMPING DEVELOPMENT AND TEST ANALYSES

Well Development Testing

Upon completion of the plug-back to 1,200 feet in the ASR-1 well, 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 (2.0 mgd). After approximately 35 hours of air lift and turbine pumping development, the sand content measured was less than the 5 ppm criteria. The FMW-1 was developed by air-lift and turbine pumping for 23 hours. During March 1998, the static water level exhibited by the wells was 31 feet above land surface. Land surface elevation at the site was approximately 10 feet NGVD.

Step-Rate Pumping Test – ASR-1

On March 25, 1998 a step-rate pumping test was performed on ASR-1. During the test, the well was pumped at four pumping periods, each period lasting one hour. Pumping rates started at 968 gpm and increased to 2,104 gpm during the test. Results of the step-rate pumping test are presented on **Table 4-5.** Water levels recorded during the step-rate pumping test summarized on graphics contained in Appendix J. During pumpage at the design rate of 2 mgd (1,377 gpm) the water level declined to approximately 30 feet below land surface.

Table 4-5
Step-rate Pumping Test Summary ASR-1

Pumping Rate (gpm)	Drawdown (ft)	Specific Capacity (gpm/ft)	Sand Content (ppm)
968	38	25.50	Nr
1,377	60	22.95	Nr
1,849	96	19.25	Nr
2,104	119	17.68	0.44

Note: "nr" signifies data not recorded.

Constant Rate Pumping Test – ASR-1

A 24-hour constant rate pumping test was performed on ASR-1 on March 30th and 31st, 1998. The pumping rate for the test was 2,100 gpm (equivalent to 3 mgd). Water levels were recorded during pumping and recovery periods and plotted for analysis. Approximately 120 feet of drawdown was induced in the pumped well during this test, which equates to a specific capacity of approximately 17.5 gallons per minute per foot of

drawdown. The graphed water-level data collected during the test is summarized on graphics contained in Appendix J. The transmissivity of the storage interval estimated from the Jacob 1944 "straight line" analysis of water-level data was approximately 146,000 gallons per day per foot. Sand content at the end of the pumping portion of the test was less than 5 ppm.

Step-Rate Pumping Test – FMW-1

On March 16, 1998 a step-rate pumping test was performed on the FMW-1 well. Results of the step-rate pumping test are presented on **Table 4-6.** Water levels recorded during the step-rate pumping test are presented on graphics contained in Appendix J. During the step-rate pumping test, flowmeter and temperature geophysical logs were performed and are contained in Appendix F. Pumping rates for these test were lower and drawdowns were proportionally greater than those measured during the pumping tests at ASR-1. This was attributed to the relatively small casing diameter at FMW-1 and higher resulting friction losses.

Table 4-6
Step-rate Pumping Test Summary FMW-1

Pumping Rate (gpm)	Drawdown (ft)	Specific Capacity (gpm/ft)
100	26	3.8
120	32	3.75
140	37	3.8
160	44	3.6

Constant Rate Pumping Test – FMW-1

A 24-hour constant rate pumping test was performed on FMW-1 on March 17th and 18th, 1998. The pumping rate for the test was 164 gpm. Water levels were recorded during pumping and recovery periods and plotted for analysis. Approximately 47 feet of drawdown was induced in the pumped well during this test, which equates to a specific capacity of approximately 3.5 gallons per minute per foot of drawdown. The graphed water-level data collected during the test is presented on graphics contained in Appendix J. Sand content at the end of the pumping portion of the test was less than 5 ppm.

WATER QUALITY

Final Pumping Test Water Analysis

Upon completion of the pumping portion of the constant rate pumping test on FMW-1 a final water quality sample was collected. This water sample is representative of the open hole interval from 1,050 feet bls to 1,200 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 K. Analyses of selected cations and anions indicate that the water in the Upper Floridan aquifer is brackish. **Table 4-7** a summary of the laboratory results. Water quality results area also presented for FMW-1 and SMW-1.

Table 4-7
Final Construction Water Quality Summary

Constituent	Concentration FMW-1	Concentration SMW-1
Chloride	3,524 mg/L	24 mg/L
TDS	7,880 mg/L	279 mg/L
Conductivity	9,345 umhos/cm	nc
Odor	50 units	1 unit
Sulfate	725 mg/L	21 mg/L
Sodium	1,827 mg/L	15.9 mg/L
PH	7.61 units	7.74 units
Color	17 units	3 units
Iron	0.156 mg/L	0.642 mg/L
Volatile Organic Aromatics	BDL	BDL
Pesticides/PCBs	BDL	BDL
Unregulated Group I	BDL	BDL
Unregulated Group II	BDL*	BDL
Unregulated Group III	BDL	nc
Total Coliform	6 col/100ml	nc
Gross Alpha	30.7 pCi/L	10.7 pCi/L
Total THMs	0.0017 mg/L	<0.0004 mg/L
Purgeable Organics	BDL*	nc
Semivolatile Organics	0.97 ug/L diethylpthalate⊕	nc

"*" signifies that chloroform was detected in the sample however, it was suspected present as a result of laboratory impact.
"⊕" signifies that this concentration is below the federal drinking water standard of 6 ug/L
"nc" signifies not calculated
Constituents listed in bold font are those for which the water quality criteria exemption was obtained.

The water quality data collected from the ASR well and FMW-1 was consistent with data collected from other wells completed within the upper Floridan aquifer of Broward County. The aquifer contains water that is brackish, and concentrations of chloride, iron, sodium, sulfate, odor and TDS typically exceed the secondary drinking water maximum concentration limits (MCLs). None of the federal primary or other secondary MCLs were exceeded in water collected from the wells constructed during this project.

Injectate Water Quality

The water that will be injected, stored and recovery from ASR-1 will be raw water supplied to the Fiveash WTP by the Prospect Wellfield. **Table 4-8** presents a summary of water quality parameters analyzed from a composite sample of the Prospect Wellfield raw water collected on May 22, 1998. Laboratory data sheets for the analysis are contained in Appendix M.

Table 4-8
Prospect Wellfield Raw Water Quality Summary

Constituent	Concentration
Chloride	48 mg/L
TDS	506 mg/L
Conductivity	nc
Odor	2 units
Sulfate	15 mg/L
Sodium	34.4 mg/L
PH	7.35 units
Color	58 units
Iron	0.78 mg/L
Volatile Organic Aromatics	BDL
Pesticides/PCBs	BDL
Unregulated Group II	BDL
Total THMs	<0.001 mg/L

Notes: Constituents listed on bold font are those for which the water quality criteria exemption was obtained

Section 5

Section 5
Cycle Testing Plan

Upon FDEP and BCHD approval, cycle testing of the ASR system will commence. Cycle testing will be conducted with raw groundwater 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 5-1.**

Table 5-1
Cycle Testing Plan

Cycle Number	Recharge** Days	Recharge Volume (mg)	Storage Days	Recovery Volume (mg)
1	10	20	0	20
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 100 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 duration, 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 raw water (injectate) and in fulfillment of the FDEP and BCHD construction permits. A water quality analysis of the raw water injectate from the Fiveash WTP is contained in **Appendix L.**

Table 5-2 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 final memorandum will be submitted to the BCHD, the FDEP and the SFWMD in support of operation of the system. The final memorandum will include recommendations for normal operation of the system. **Appendix N** has been reserved within this document so that all of the technical memorandums can be inserted into this binder during cycle testing.

Table 5-2
Cycle Testing Water Quality Sampling

Parameter	Frequency							
	Continuous	Daily	Weekly	Monthly	Beginning of Injection	Storage	Beginning of Recovery	End of Recovery
Conductivity	Recovery	AFS						
Chloride		AFS						
Total Hardness		A	F					
Calcium Hardness		A	F					
Alkalinity		A	F					
Turbidity		A	F					
pH		A	F					
Temperature		A	F					
Color		A	F					
Iron		A	F					
TDS		AFS						
Sulfate			AF					
Total Nitrate			AF					
Total Nitrite			AF					
Sodium			AF					
Ammonia			AF					
Total Phosphorus			AF					
Trihalomethane			AF					
BOD			AF					
COD			AF					
Hydrogen Sulfide			AF					
Total Coliform				AF				
Gross Alpha					AF	AF	AF	AF
Dissolved Oxygen					AF	AF	AF	AF
Iron Hydroxide					AF	AF	AF	AF
Pseudomonas				AF				

Notes: "A" signifies Aquifer Storage and Recovery Well (ASR-1)
"F" signifies Floridan Aquifer Monitor Well (FMW-1)
"S" signifies Shallow Monitor Well (SMW-1)

Section 6

Section 6
Conclusions and Recommendations

Construction of the ASR well system at the City of Fort Lauderdale Fiveash WTP has been performed successfully. One 16-inch diameter ASR well with a steel casing set to 1,055 feet bls and an open hole extending from 1,055 feet bls to 1,200 feet bls is now ready for cycle testing at the design rate of 2 mgd. The storage zone of the well is completed within the transmissive Ocala limestone of the Upper Floridan aquifer. The storage zone is confined beneath 750 feet of low permeability clay and limestone.

The ASR well currently yields water at a rate of 2,100 gpm with a pumping water level of approximately 90 feet bls. The ambient water contained within the storage zone is brackish, and contains chloride and TDS concentrations of approximately 3,500 mg/L and 7,900 mg/L, respectively. There were no exceedances of primary drinking water standards in water collected from the storage zone.

Montgomery Watson recommends initiation of cycle testing at the Fiveash ASR well system with raw groundwater from the Prospect Wellfield. 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 for long-term operation of 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 #8845)
City of Ft. Lauderdale (Fiveash)
(Ft. Laud.-Fiveash/ASR Well System)
January 22, 1997

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

Gregory Kisela, Utility Director
City of Ft. Lauderdale
949 N.W. 38th Street
Ft. Lauderdale, FL 33309

RE: PROJECT NAME: Ft. Laud.-Fiveash/ASR Well System

PROJECT LOCATION: 949 N.W. 38th Street, Ft. Lauderdale

Dear Mr. Kisela:

Enclosed is Permit Number **WC-06-297981** 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, DOH/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, DOH/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 January 23, 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: Gloria D. Bunnell Date: January 22, 1997

TKM/dn
Enclosures

Copies furnished to:
Geoff Hart, P.E., MW
Alfred Mueller, P.E., DEP

FLORIDA DEPARTMENT OF HEALTH

RECEIVED
UTILITIES DEPARTMENT
1998 JAN 21 AM 11:30

Lawton Chiles
Governor

James A. Holt, M.D., M.P.H.
Secretary

WATER TREATMENT PLANT CONSTRUCTION PERMIT

AMENDED (January 15, 1998)

Broward County MW (Log #8845)
City of Ft. Lauderdale (Fiveash)
(Ft. Laud.-Fiveash/ASR Well System)
January 22, 1997

PERMITTEE:

Gregory Kisela, Utility Director
City of Ft. Lauderdale
949 N.W. 38th Street
Ft. Lauderdale, FL 33309

RE:		
	I.D. NUMBER:	4060486-02
	PERMIT NUMBER:	WC-06-297981
	DATE OF ISSUE:	01/22/1997
	EXPIRATION DATE:	01/22/2002
	PROJECT NAME:	Ft. Laud.-Fiveash/ASR Well System
	PROJECT LOCATION:	949 N.W. 38th Street, Ft. Lauderdale

Dear Mr. Kisela:

Effective January 22, 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) 1,200-foot ASR well with a 16-inch diameter final casing (1,000 ft deep) using raw water from the Biscayne Aquifer for recharge and recovery (2.0 MGD); one (1) 1,200-foot monitoring well with a 6-inch diameter final casing (1,000 ft deep); one (1) horizontal split-case pump

(1,400 gpm) for recharge; one (1) submersible turbine pump (1,400 gpm) for recovery; 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.

SUBJECT TO: General Conditions 1-15 and Specific Conditions 1-13.

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. Show the conductivity element on the recovery piping as indicated in red on sheet M-1 of the engineering plans.

4. Before the start of the first test cycle, analyze the native water from the ASR well two times, four to six months apart, for primary standards, ammonia as N, total phosphorus as P, BOD, COD, secondary standards, and unregulated organic contaminants, and submit the test results to the BCHD, along with a copy of the UIC operational testing approval from DEP, and 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 applicant shall notify the BCHD five days prior to the start of the first test cycle.

5. 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 H_2S; and monthly for total coliform. After two years the BCHD will evaluate the data and decide what testing may be necessary (frequency and parameters) beyond that point.

6. 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 H_2S; and monthly for total coliform.

7. Analyze the water from the monitoring well weekly for chloride, total and calcium hardness, alkalinity, turbidity, pH, temperature, conductivity, color, iron, sulfate, total nitrate and nitrite; sodium, ammonia as N, total phosphorus as P, TDS, BOD, COD, and H_2S; and monthly for total coliform.

8. Submit to the BCHD data on transmissivity based on pump test information of the ASR and Floridan monitor well on an annual basis.

9. 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.

10. The entire recovery stream from the ASR well shall be pumped to the head of the plant and be fully treated along with the raw water from the Biscayne Aquifer.

11. Provide a control system to automatically shut down the recovery stream upon reaching 225 mg/l concentration of chloride. Telephone or fax notification shall be provided to the BCHD prior to the start-up and termination of ASR well recovery.

12. 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 the BCHD shall be required before the ASR well can be put into operation on a routine basis.

12. Provide to the BCHD copy and proof of distribution of a public notice educating customers on the use of ASR recovered water.

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

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:
Geoff Hart, P.E., MW
John Morra, P.E., DEP Southeast District
City of Ft. Lauderdale Building Department

FDEP Construction Permit

Department of Environmental Protection

Lawton Chiles
Governor

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

Virginia B. Wetherell
Secretary

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

NOTICE OF PERMIT

OCT 15 1997

Mr. Gregory A. Kisela, PE
Public Services Director
City of Fort Lauderdale
949 N.W. 38th Street
Lauderdale, FL 33309

BROWARD COUNTY
UIC - City of Fort Lauderdale
Fiveash Water Treat Plant
Permit No.: 0128340-002-UC; Well ASR-1 Fort
(formerlyUC-06-296564)

Dear Mr. Kisela:

Enclosed is Permit Number 0128340-002-UC (previously UC-06-296564), to construct one Class V Aquifer Storage and Recovery well (ASR-1) system at the City of Fort Lauderdale Fiveash 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 thirty (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, P.G. at (561) 681-6691 or Len Fishkin, P.G., at (561) 681-6742, of this office.

Executed in West Palm Beach, Florida.

RECEIVED
OCT 20 1997

MONTGOMERY WATSON
PALM BEACH COUNTY OFFICE

CRA/AM/WWC/lf

STATE OF FLORIDA
DEPARTMENT OF ENVIRONMENTAL PROTECTION

For Carlos Rivero-deAguilar
Director of District Management
Southeast District

10/15/97
Date

cc: Scott Hoskins, USEPA/ATL
Richard Deuerling, DEP/TAL
Len Fishkin, FDEP/ WPB
Garth Hinckle, BCDNRP/FTL
Nancy Marsh, USEPA/ATL
Bill Cocke, FDEP/WPB
Steven Anderson, SFWMD/WPB
Anne Murray, MWA/PLN
Ron Reese, USGS/MIA
Cathy McCarty, FDEP/TLH
Phong Nguyen, BCPHU
Bob Verrastro, MWA/LW

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 OCT 15 1997

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

OCT 15 1997
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. Gregory A. Kisela, P.E.
Assistant Director of Utilities
City of Fort Lauderdale
43211 N.W. 9th Avenue
Fort Lauderdale, FL 33325

ID NUMBER: 5006P98283
PERMIT/CERTIFICATION NO: 0128340-002-UC
(formerly: UC-06-296564)
DATE OF ISSUE: OCT 15 1997
EXPIRATION DATE: OCT 15 2002
COUNTY: Broward County
LATITUDE/LONGITUDE: 26°10'30"/N/80°09'15"W
PROJECT: City of Fort Lauderdale Fiveash WTP
Class V Aquifer Storage and Recovery
Well (ASR-1) System

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:

PROJECT: Construction permit for Aquifer Storage and Recovery (ASR) Well ASR-1, Floridan aquifer monitor well, FMW-1, and shallow monitoring well, SMW-1.

TO CONSTRUCT: A Class V Group 7 sixteen (16)-inch outside diameter (OD) Aquifer Storage and Recovery Well, ASR-1, with casing extending to a depth of approximately 1,000 feet below land surface (bls) and the borehole extending to a depth of approximately 1,200 feet (bls). Final depths will be determined during construction and field testing. The proposed injection fluid is treated potable water from the Fiveash Water Treatment Plant (WTP). During continuous injection and recovery, flow rates will be maintained at approximately 1,400 gallons per minute (gpm). ASR-1 is part of the proposed Aquifer Storage and Recovery System (ASR) at the Fiveash site. A Floridan aquifer test/monitor well, FMW-1, will be constructed with an open-hole completion designed to monitor water quality within the storage zone of ASR-1 from approximately 1,000 feet to 1,200 feet below land surface. Construction of FMW-1 is planned prior to ASR-1 to provide hydrogeologic information. To accommodate operation of the system with untreated Biscayne aquifer water if that system is permitted, a two (2)-inch diameter shallow monitor well, SMW-1, shall be installed and will include a screened interval in the overlying zone of the USDW.

IN ACCORDANCE WITH: Pre-application Meeting held on August 7, 1996; Draft Permit Application and Predesign Report received on September 6, 1996; Pre-application meeting held on September 10, 1996; Application to Construct a Class V Group 7 Aquifer Storage and Recovery System received October 25, 1996; Request for Information (RFI) sent on January 7, 1997; RFI meeting on January 10, 1997; Received RFI Response dated January 29, 1997 on January 31, 1997; Public Notice of Draft Permit published in the Fort Lauderdale Sun Sentinel on June 30, 1997, and in consideration of public comment received as a result of the public meeting held on August 4, 1997 at 10:00 a.m.; Public Notice of Intent to Issue Permit published in the Fort Lauderdale Sun Sentinel on September 13, 1997.

LOCATED AT: City of Fort Lauderdale Fiveash Water Treatment Plant, Fort Lauderdale, Broward County, Florida.

TO SERVE: City of Fort Lauderdale.

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

ID NUMBER: 5006P98283
PERMIT/CERTIFICATION NO: 0128340-002UC; (formerly UC-06-296564)
DATE OF ISSUE: OCT 15 1997
EXPIRATION DATE: OCT 15 2002

ENERAL 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 nor private property nor 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 that 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 that 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.

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.

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(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 fourteen (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 twenty-four (24) hours and again within seventy-two (72) hours, and a final written report provided within two (2) 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 one hundred eighty (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 fifteen (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 fifteen (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 twenty-four (24) hours, and a written report shall be provided within five (5) days. The verbal report shall include the name, address, identification 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; and
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 fourteen (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.

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ID NUMBER: 5006P98283
PERMIT/CERTIFICATION NO: 0128340-002UC; (formerly UC-06-296564)
DATE OF ISSUE: OCT 15 1997
EXPIRATION DATE: OCT 15 2002

SPECIFIC CONDITIONS:

1. General Requirements

a. This permit is to construct and operationally test with treated water, the City of Fort Lauderdale Fiveash WTP Class V, Group 7 ASR Well ASR-1, and if needed, an associated Floridan aquifer monitor well, FMW-1, and a shallow aquifer monitor well, SMW-1. This permit does not authorize the construction or operational testing of any other well or wells associated the City of Fort Lauderdale Fiveash WTP ASR well system. Pad Monitor Wells shall be used to monitor during the construction of the system with untreated Biscayne aquifer water, if that system is permitted.

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

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.

g. Pad Monitor Wells (PMWs) shall be installed to accommodate operation of the system with untreated Biscayne water, if that system is permitted. Four (4) permanent surficial aquifer monitor wells identified as Pad Monitor Wells shall be located at the corners of the drilling pad and identified by ASR well number, location number, and pad location, i.e. NW, NE, SW, and SE. These wells shall be sampled and analyzed prior to the onset of drilling for chlorides (mg/l), conductivity (umhos), total dissolved solids, and water level (relative to NGVD). Initial analyses must be submitted prior to the initiation of work on the Class V, Group 7, potable water ASR well. These wells are to be retained in service, sampled weekly for the above parameters, during the construction phase and quarterly thereafter. 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.

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ID NUMBER: 5006P98283
PERMIT/CERTIFICATION NO: 0128340-002UC; (formerly UC-06-296564)
DATE OF ISSUE: OCT 15 1997
EXPIRATION DATE: OCT 15 2002

2. C 'ity 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, aquifer 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 System.

b. The Department shall be notified within forty-eight (48) hours after work has commenced.

c. Department approval and Underground Injection Control Technical Advisory Committee (UIC-TAC) review is required prior to the following stages of construction:

1) Contract documents approval and spud date;
2) Monitor zone & storage zone selections and final ASR & monitor well casing seats;
3) Plugging back pilot hole at base of storage zone; and
4) Method(s) of flow control during recharge of the ASR well during operation and operational testing.

d. The geophysical logging program, as defined in the Design Report (dated October 25, 1996) and in the response to a RFI (dated January 29, 1997), during drilling of the ASR well, shall at a minimum, include:

1) Pilot hole to approximately four hundred (400) feet below land surface (bls):
Caliper
Natural gamma;
Spontaneous potential; and
Long and short normal electric.
2) Reamed hole to approximately four hundred (400) feet bls:
Caliper.
3) Cased hole to approximately four hundred (400) feet bls:
Temperature log after each stage of cementing unless the cement returns are observed at land surface; and
Gamma ray log, if needed.
4) Pilot hole to the top of the storage zone at approximately one thousand (1,000) feet bls:
Caliper;
Natural gamma;
Spontaneous potential; and
Long and short normal electric.

5) During testing of the uppermost interval of the Floridan aquifer (from 900 to 1,100 feet bls):
   Fluid resistivity;
   Temperature;
   Caliper; and
   Flow meter (while pumping at a rate sufficient to stress the aquifer).
6) Reamed hole to the top of the storage zone at approximately one thousand (1,000) feet bls:
   Caliper.
7) Cased hole to the top of the Floridan Aquifer approximately one thousand (1,000) feet bls:
   Temperature log after each stage of cementing unless cement returns seen at land surfaces.
   Cement bond log.
8) During pumping tests during drilling:
   Fluid resistivity;
   Temperature;
   Caliper; and
   Flowmeter (with a minimum rate of 250 gpm).
9) Sixteen (16)-inch open hole below the final casing to approximately 1,300 feet bls:
   Caliper;
   Natural gamma;
   Dual induction;
   Spontaneous potential;
   Borehole compensated sonic with VDL display;
   Temperature (static and dynamic);
   Electric (long and short normal);
   Downhole television survey; and
   Flowmeter (static and dynamic) with a minimum rate of 500 gpm.
10) Completed well:
   Downhole television survey;
   Temperature (static and dynamic);
   Flowmeter (static and dynamic);
   Cement Bond Log; and
   Caliper.
11) During the twenty-four (24) pump testing:
   Temperature;
   Fluid resistivity;
   Caliper; and
   Flowmeter.

e. Interval tests shall be performed in the storage zone after thorough development of the borehole, to conduct geophysical logging, 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. Packer testing of the uppermost Floridan aquifer will be used to: 1.) evaluate the hydraulic or confining characteristics of the zone, 2.) perform geophysical logs, and 3.) collect water samples to be analyzed for chlorides, conductivity, total dissolved solids, pH, temperature bicarbonate, calcium, potassium, sodium, and magnesium. 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 acquired. Samples should be labeled as to well number, depth, type of sample and shipped to the Underground Injection Control Program of the Department of Environmental Protection, M.S. 3530, 2600 Blair Stone Road, Tallahassee FL 32399-2400.

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

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

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

i. The pressure test for the final casing will be accepted if tested with a fluid-filled casing at one-and-a-half (1.5) times the expected operating pressure with a test tolerance of plus (+) or minus (-) five (5)%. Verification of pressure gage calibration within six (6) months of test date must be provided with the test reports.

j. 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.

k. UIC-TAC meetings are scheduled on the second (2nd) and fourth (4th) Tuesday of each month subject to a five (5) working day prior notice and timely receipt of critical data by all UIC-TAC members. Department approval at a scheduled UIC-TAC meeting shall be based on the Permittee's presentation that shows compliance with Department rules and this permit. Emergency meetings may be arranged when justified, to avoid undue construction delays.

l. Upon approval by the Department, the monitor zone of each monitor well will be positioned in a transmissive interval. The monitor zone in each monitor well must have sufficient yield for collection of a representative sample.

m. Department or Department-delegated local program potable water construction permits must be issued for all surface piping and appurtenances upstream of the ASR well-head. Bacteriological clearances must be performed prior to operational testing of the ASR well system.

4. Reporting Requirements

a. All reports and surveys required by this permit shall be submitted concurrently to all the members of the UIC-TAC. The UIC-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 (USGS), Miami;
South Florida Water Management District (SFWMD), West Palm Beach;
Broward County Department of Natural Resources Protection (BCDNRP), Fort Lauderdale; and
Broward County Public Health Unit (BCPHU), Fort Lauderdale.

b. The Department and other applicable agencies must be notified immediately, within twenty-four hours (24), of any unusual events occurring during construction activities (e.g. on-site spills, artesian flows, large volumes of circulation losses, equipment damage due to: fire, wind, and drilling difficulties, etc.) A written report describing the incident shall also be given to the Department within seventy-two (72) hours of the start of the event. In addition, a final written report shall be sent to the Department within two (2) weeks of the event. The final report shall contain a complete description of the occurrence, a discussion of 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.

- A drilling and construction schedule shall be submitted to the Department and UIC-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 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 monitor wells; and
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. All final casing seat requests, for the ASR well and monitor well shall be accompanied by technical justification, including but not limited to, geophysical logs with interpretations, and water quality data. Monitor well final casing seat request shall address the monitoring of movement of exempted parameters into the uppermost zone of the Floridan aquifer and monitoring of this zone, if needed.

g. 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.

h. 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; and
5) demonstration of confinement and evaluation of potential for upconing of poorer quality water.

i. 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) the maximum lateral extent of the storage zone, if the well will be used for storage and recovery of untreated Biscayne aquifer water;
5) operation and maintenance manual;
6) record (or As-Built) drawings, of the ASR well, surface equipment, instrumentation and appurtenances, sealed by the Engineer of Record;
7) summary of all water quality, water level and well performance data collected, with conclusions and recommendations;

8) 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; and
9) mill certificates for all casing.

j. 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 five (5) year statutory limit. Should operational testing need to continue beyond the five (5) years of this permit, the Permittee must renew this construction permit.

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

l. Operational testing of this ASR well shall cease upon expiration of this permit, unless authorization 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.

m. 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 injectant 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 record (or As-Built) engineering drawings of As-Built conditions of all subsurface, surface equipment and appurtenances; and
11) flow control plan.

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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.

. 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 seventy-two (72) hours of the start of the event. In addition, a final written report shall be sent to the Department within two (2) 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 fifteenth (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); and
* 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.

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DATE OF ISSUE: OCT 15 1997
EXPIRATION DATE: OCT 15 2002

	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)	AFS						AFS		AFS	
Conductivity (umhos/cm)	AFS						AFS		AFS	
TDS (mg/l)	AFS						AFS		AFS	
Total Trihalomethanes (mg/l)		AF					AF	AF	AF	AF
Temperature (^{o}C)		AF					AF		AF	
pH (std units)		AF					AF		AF	
Turbidity (NTU)		AF					AF		AF	
Total Iron (mg/l)		AF					AF		AF	
Total Alkalinity (mg/l)		AF					AF		AF	
Sulfate (mg/l)		AF					AF		AF	
Gross Alpha (pCi/l)			AF	AF	AF	AF		A		A
Dissolved Oxygen (mg/l)			AF	AF	AF	AF				
Iron Hydroxide (mg/l)			AF	AF	AF	AF				
Primary, Secondary and Minimum Criteria								A		A

A:ASR-1 F:FMW-1 S:SMW-1 (if constructed)

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

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 injectant is deteriorating;
(ii) results of the sampling indicate significant differences in water quality during consecutive sampling events; and
(iii) a source of contamination to the ASR storage zone is discovered that was not addressed in the permit.

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

6) All data submissions, including MOR's, shall be clearly identified on each page with facility name, identification 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 15th day of October, 1997

STATE OF FLORIDA
DEPARTMENT OF ENVIRONMENTAL PROTECTION

Carlos Rivero-deAguilar
Director of District Management
Southeast District

ID NUMBER: 5006P98283
PERMIT/CERTIFICATION NO: 0128340-002UC; (formerly UC-06-296564)
DATE OF ISSUE: OCT 15 1997
EXPIRATION DATE: OCT 15 2002

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
Chlor nzene (Monochlorobenzene)
Chlo ylene (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
Ethy zene
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)

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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 Butylbenzylphthaliate Dimethylphthaliate Naphalene Phenanthrene
PESTICIDES AND PCBs	Aldrin Dieldrin Dioxin
Acid Extractables	2-chlorophenol Phenol 2,4,6-trichlorophenol
Other	Conductivity Biological Oxygen Demand Temperature

Water Quality Criteria Exemption

BEFORE THE STATE OF FLORIDA
DEPARTMENT OF ENVIRONMENTAL PROTECTION

IN RE:	)	
	)	
Petition for Water Quality Exemptions by City of Fort Lauderdale	)	OGC File No. 98-0411 Broward County

FINAL ORDER

BY THE DEPARTMENT:

On November 6, 1996, the Department received from the City of Fort Lauderdale (Petitioner) a petition for exemptions, pursuant to rule 62-520.500 of the Florida Administrative Code. The Petitioner requested relief from rule 62-520.420 of the Florida Administrative Code (standards for Class G-I and Class G-II ground water), for an installation that will discharge into a Class G-II ground water. The exemptions are color (exemption request 100 color units, maximum contaminant level (MCL) 15 color units), odor (exemption request 8 odor threshold number, MCL 3 odor threshold number), and iron (exemption request 6.0 mg/L, MCL 0.30 mg/L). The installation is the City of Fort Lauderdale Fiveash Water Treatment Plant (WTP) aquifer storage and recovery (ASR) facility, which is to be located at 4321 N.W. 9 Avenue, Fort Lauderdale (latitude 26°10'30" north and longitude 80°09'15" west) in Broward County, Florida.

After reviewing the petition, the Department has concluded that the requirements and criteria set forth in rule 62-520.500

of the Florida Administrative Code have been satisfied. A copy of the Department's Intent to Grant is attached as Exhibit I.

The letter with the Notice of Intent, notified the petitioner of the Department's proposed agency action and advised it of its right to a hearing pursuant to sections 120.569 and 120.57 of the Florida Statutes. On May 13, 1998, notice was given in the Sun Sentinel, Fort Lauderdale, Florida, and on May 8, 1998, notice was published in the Florida Administrative Weekly, informing the public of the Department's intended action and offering an opportunity for hearing pursuant to sections 120.569 and 120.57 of the Florida Statutes. A copy of these notices are attached as Exhibits II and III, respectively.

The petitioner and interested parties having been advised of their rights under chapter 120 of the Florida Statutes, and having failed or declined to file a petition pursuant to sections 120.569 and 120.57 of the Florida Statutes are hereby deemed to have waived those rights.

IT IS THEREFORE ORDERED that the petition of the City of Fort Lauderdale requesting exemptions under rule 62-520.500 of the Florida Administrative Code from the color, odor, and iron water quality criteria set forth in rule 62-520.420 of the Florida Administrative Code for the ground waters specified herein is hereby GRANTED, subject to the conditions:

(a) The exemptions are granted for the duration of the Fort Lauderdale Fiveash WTP raw water ASR Class V well construction permit, 0128340-003-UC. Future exemptions must

be petitioned for by the applicant in conjunction with an operation permit for any ASR project at this site.

(b) The exemptions provide relief only from the color, odor, and iron standards contained in rule 62-550.320 of the Florida Administrative Code, as referenced in rule 62-520.420 of the Florida Administrative Code at the approved alternative levels of 100 color units, 8 odor threshold number, and 6.0 mg/L, respectively. All other ground water quality standards, including the primary drinking water standards contained in rule 62-550.310 of the Florida Administrative Code, and the minimum criteria contained in rule 62-520.400 of the Florida Administrative Code, apply to this ASR project.

(c) The petitioner shall monitor water quality in accordance with the specific conditions of construction permit 0128340-003-UC and any authorization for operational testing issued under that permit.

(d) If any of the conditions in 1. and 2. below occur because of injection at the Fort Lauderdale Fiveash WTP Raw Water Aquifer Storage and Recovery Facility, injection into the ASR well shall cease until a water quality criteria exemption that addresses any additional parameters exceeding water quality standards, or an aquifer exemption pursuant to rule 62-528.300(3) of the Florida Administrative Code, as appropriate, has been obtained.

1. Surficial Aquifer Monitor Well

a. The MCL is exceeded for any parameter contained in the primary drinking water standards; or

b. The MCL or natural background level (whichever is poorer) is exceeded for any parameter contained in the secondary drinking water standards or minimum criteria.

2. Storage Zone Monitor Well

a. The MCL is exceeded for any parameter contained in the primary drinking water standards; or

b. The MCL or natural background level (whichever is poorer) is exceeded for any parameter contained in the secondary drinking water standards or minimum criteria except color, odor, or iron; or

c. Color, odor, or iron exceed the approved alternative level of 100 color units, 8 odor threshold number, and 6.0 mg/L, respectively.

(e) The permittee shall use the data obtained during operational testing to assess the distance from the ASR well that the color, odor, and iron standard would be exceeded. Based on the reassessment, the permittee shall determine if additional monitoring is necessary to protect underground sources of drinking water prior to obtaining an operation permit.

These exemptions, unless otherwise ordered, shall be valid for the duration of the Fiveash WTP ASR project Class V well construction permit. Additionally, the applicant must petition the Department for exemptions in conjunction with an operation permit for any ASR project at this site.

Any party to this order has the right to seek judicial review of the order pursuant to section 120.68 of the Florida Statutes by the filing of a Notice of Appeal pursuant to rule 9.110 of the Florida Rules of Appellate Procedure, with the Clerk of the Department in the Office of General Counsel, 3900 Commonwealth Boulevard, Mail Station #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 Order is filed with the Clerk of the Department.

DONE AND ORDERED this 27 day of July 1998 in Tallahassee, Florida.

STATE OF FLORIDA DEPARTMENT
OF ENVIRONMENTAL PROTECTION

Virginia B. Wetherell

VIRGINIA B. WETHERELL
Secretary

3900 Commonwealth Boulevard
Tallahassee, Florida

Telephone: (904)488-1554

Copies furnished to:

Carlos Rivero-deAguilar, DEP/West Palm Beach
Richard Drew
Al Mueller, DEP/West Palm Beach
Bill Cocke, DEP/West Palm Beach
Richard J. Deuerling
Cynthia Christen
Cathy McCarty
Nancy Marsh, EPA/Atlanta
Anne Murray, Montgomery Watson/Plantation

(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.

A petition that does not dispute the material facts on which the Department's action is based shall state that no such facts are in dispute and otherwise shall contain the same information as set forth above, as required by rule 28-106.301 of the Florida Administrative Code.

Because the administrative hearing process is designed to formulate final agency action, the filing of a petition means that the Department's final action may be different from the position taken by it in this order. Persons whose substantial interests will be affected by any such final decision of the Department on the application have the right to petition to become a party to the proceeding, in accordance with the requirements set forth above.

Mediation under section 120.573 of the Florida Statutes is not available for this proceeding.

The application is available for public inspection during normal business hours, 8:00 a.m. – 5:00 p.m., Monday through Friday, except legal holidays, at the Tallahassee Office, 2600 Blair Stone Road, Room 212E, Tallahassee, Florida 32399-2400.

NOTICE OF AVAILABILITY
FLORIDA FINDING OF NO SIGNIFICANT IMPACT
VOLUSIA COUNTY, FLORIDA
TREATMENT & REUSE FACILITIES

The Florida Department of Environmental Protection has determined that the proposed Volusia County's Wastewater Treatment Facilities will not have a significant adverse effect on the environment. The total project cost is estimated at $10,476,000 consisting of $2,546,000 for Phase I, and $7,930,000 for Phase II. The project is expected to qualify for a State Revolving Fund loan composed of Federal and State matching funds. A full copy of the Florida Finding of No Significant Impact can be obtained by writing: Troy Mullis, Bureau of Water Facilities Funding, Department of Environmental Protection, 2600 Blair Stone Road, MS #3505, Tallahassee, Florida 32399-2400.

STATE OF FLORIDA
DEPARTMENT OF ENVIRONMENTAL PROTECTION

In the Matter of an Petition for Water Quality Exemptions, City of Fort Lauderdale Fiveash Water Treatment Plant)	OGC File No. 98-0411 Broward County

INTENT TO GRANT

The Department of Environmental Protection gives notice of its intent to grant water quality criteria exemptions to the City of Fort Lauderdale's Fiveash Water Treatment Plant, Mr. Gregory A. Kisela, Public Services Director, 949 N.W. 38 Street, Fort Lauderdale, Florida, 33309 for the proposed project as detailed in the petition specified above. The Department is issuing this Intent to Grant for the reasons stated below.

On September 9, 1996, the Department received a petition from the applicant, City of Fort Lauderdale (City), for the exemptions for installations discharging into Class G-II ground water pursuant to rule 62-520.500 of the Florida Administrative Code. The City requested exemptions from ground water standards contained in rule 62-520.420(1) of the Florida Administrative Code. Specifically, the petition requested exemptions from three secondary drinking water standards, color, odor, and iron, which are incorporated as ground water standards. The exemption request for color is 100 color units and the maximum contaminant level (MCL) for color contained in the secondary drinking water

standards is 15 color units. The exemption request for odor is 8 odor threshold number and the MCL for odor contained in the secondary drinking water standards is 3 odor threshold number. The exemption request for iron is 6.0 mg/L and the MCL for iron contained in the secondary drinking water standards is 0.30 mg/L. As secondary drinking water standards, these standards are aesthetically based and do not pose a health threat at the requested levels. The installation is the Fiveash Water Treatment Plant (FWTP) Aquifer Storage and Recovery (ASR) Facility which is located at 4321 N.W. 9 Avenue, Fort Lauderdale, Florida, in Broward County. The water to be used for this ASR project is raw ground water from the Prospect Wellfield. The source of the raw ground water for the Prospect Wellfield is the Biscayne aquifer. The receiving aquifer is the upper Floridan aquifer.

The Department also has permitting jurisdiction under chapter 403 of the Florida Statutes. The project is not exempt from permitting procedures. The Department has determined that in addition to the exemptions, a construction permit is required for the facility.

The Department has reviewed the above petition for the exemptions under the requirements of rule 62-520.500 of the Florida Administrative Code, and hereby gives notice of its intent to grant the exemptions to FWTP for its aquifer storage and recovery facility based on the following findings:

(1) Granting these exemptions is clearly in the public interest.

Storing excess water of good quality by ASR projects for future use meets the public demand for a reliable supply of water at a reasonable cost, while not adversely affecting the environment. The water to be used for this ASR operation has a total dissolved solids (TDS) concentration that ranges between 270 mg/L and 545 mg/L. The secondary drinking water standard for TDS is 500 mg/L. The receiving aquifer has TDS concentration estimated to be between approximately 1,000 to 5,000 mg/L. Since the injected fluid will have a lower concentration of TDS than the ground water in the injection zone, and it meets all of the primary drinking water standards, storing excess water of good quality using ASR technology for future use meets the public demand for a reliable supply of water at a reasonable cost, while not adversely affecting the environment. Granting the water quality criteria exemptions for color, odor, and iron will provide a cost effective method of storing excess raw water during the wet season to be used after treatment for potable water needs when the demand is high and the supply is low during the dry season. ASR can minimize salt water intrusion by reducing the impacts of wellfield pumping during the dry season.

(2) Compliance with presently specified criteria is unnecessary for the protection of present and future potable water supplies.

The storage zone water of the upper Floridan aquifer system is classified as Class G-II ground water (TDS concentration of less than 10,000 mg/L), but is not potable without significant treatment. When water from this aquifer is withdrawn for potable use, it is typically treated by reverse osmosis technology which would reduce the color, odor, and iron concentrations to below the drinking water standards.

(3) Granting the exemptions will not interfere with existing uses or the designated use of the waters or of contiguous water.

A well inventory and water use survey was conducted within the FWTP area. There are no existing uses of the Floridan aquifer within a one mile radius of the ASR well and no future wells are anticipated. Existing uses of the Floridan aquifer in the vicinity of the FWTP beyond a one-mile radius from the ASR site are for other ASR facilities, ambient monitoring, and Class I injection well monitoring.

(4) The economic, environmental, and social costs of compliance with existing criteria outweigh the economic, environmental, and social benefits of compliance.

Compliance with the criteria would mean that the recharge water would have to be treated before being injected. The treatment method used by the FWTP is lime softening. The operational costs for providing the additional treatment

necessary for the removal of color, odor, and iron to the secondary drinking water standard MCLs prior to injection is estimated to be $0.45 per 1000 gallons of water by lime softening treatment. Granting a water quality criteria exemption for color, odor, and iron would provide a cost effective method of storing raw water for potable water needs when the demand is high and the supply is low, thereby offsetting the use of ground water.

The exemption for color, odor, and iron will not result in any adverse environmental impact to either the receiving aquifer or to any existing or anticipated future use of the aquifer, since the water in the receiving aquifer is brackish and can not be used without treatment. The ASR operation will improve the water quality of the storage zone by reducing the TDS concentration.

(5) An adequate monitoring program approved by the Department has been established to ascertain the location of the stored water, to detect any leakage of the stored water to other aquifers or surface waters, and to detect any adverse effect on underground geologic formations or waters.

This program has been designed to meet the requirements set forth in rule 62-528.615 of the Florida Administrative Code. Two monitoring wells will be constructed, one within the ASR storage zone, and another in the surficial aquifer system

overlying the ASR storage zone. Monitoring will include recharge water quality, recovered water quality, quality of water in the overlying surficial aquifer system, and effects of the storage plume on the ambient water quality and geologic formation within the storage zone aquifer. These monitoring data will be reported and reviewed on a monthly basis.

(6) The exemptions will not present a danger to the public health, safety, or welfare.

The recharge water is raw water from the Biscayne aquifer used to supply the FWTP and meets all primary drinking water standards. Color, odor, and iron are regulated as secondary drinking water standards. Secondary drinking water standards, by definition, are aesthetically based. Exceedence of the secondary drinking water standards for color, odor, and iron at the alternative levels requested should have no adverse effects upon the health or safety of persons or on the Floridan or Biscayne aquifer systems.

If water from the upper Floridan aquifer system in the vicinity of the FWTP were to be used for a potable water supply in the future, an advanced form of water treatment, such as reverse osmosis, would be required because of the elevated TDS levels. This method of water treatment would

also remove the slightly elevated concentrations of color, odor, and iron in the raw water.

The Department intends to grant these exemptions subject to the following conditions:

(a) The exemptions are granted for the duration of the Fort Lauderdale Fiveash Water Treatment Plant raw water ASR Class V well construction permit, 0128340-003-UC. Future exemptions must be petitioned for by the applicant in conjunction with an operation permit for any ASR project at this site.

(b) The exemptions provide relief only from the color, odor, and iron standards contained in rule 62-550.320 of the Florida Administrative Code, as referenced in rule 62-520.420 of the Florida Administrative Code at the approved alternative levels of 100 color units, 8 odor threshold number, and 6.0 mg/L, respectively. All other ground water quality standards, including the primary drinking water standards contained in rule 62-550.310 of the Florida Administrative Code, and the minimum criteria contained in rule 62-520.400 of the Florida Administrative Code, apply to this ASR project.

(c) The permittee shall monitor water quality in accordance with the specific conditions of construction permit 0128340-003-UC

and any authorization for operational testing issued under that permit.

(d) If any of the conditions in 1. and 2. below occur because of injection at the Fort Lauderdale Fiveash Water Treatment Plant Raw Water Aquifer Storage and Recovery Facility, injection into the ASR well shall cease until a water quality criteria exemption that addresses any additional parameters exceeding water quality standards, or an aquifer exemption pursuant to rule 62-528.300(3) of the Florida Administrative Code, as appropriate, has been obtained.

1. Surficial Aquifer Monitor Well

   a. The MCL is exceeded for any parameter contained in the primary drinking water standards; or

   b. The MCL or natural background level (whichever is poorer) is exceeded for any parameter contained in the secondary drinking water standards or minimum criteria.

2. Storage Zone Monitor Well

   a. The MCL is exceeded for any parameter contained in the primary drinking water standards; or

b. The MCL or natural background level (whichever is poorer) is exceeded for any parameter contained in the secondary drinking water standards or minimum criteria except color, odor, or iron; or

c. Color, odor, or iron exceed the approved alternative level of 100 color units, 8 odor threshold number, and 6.0 mg/L, respectively.

(e) The permittee shall use the data obtained during operational testing to assess the distance from the ASR well that the color, odor, and iron standard would be exceeded. Based on the reassessment, the permittee shall determine if additional monitoring is necessary to protect underground sources of drinking water prior to obtaining an operation permit.

Pursuant to section 403.815 of the Florida Statutes, and DEP rule 62-103.150 of the Florida Administrative Code, you (the applicant) are required to publish at your own expense the enclosed Notice of Intent to Grant the Water Quality Exemption. The notice shall be published one time only within 30 days, in the legal ad section of a newspaper of general circulation in the area affected. For the purpose of this rule, "publication in a newspaper of general circulation in the area affected" means publication in a newspaper meeting the requirements of sections 50.011 and 50.031 of the Florida Statutes, in the county where the activity is to take place. The applicant shall provide an

original copy of the proof of publication to Mr. Richard Deuerling of the Department, at 2600 Blair Stone Road, Twin Towers Office Building, Mail Station 3530, Tallahassee, Florida 32399-2400, within seven days of publication. Failure to publish the notice and provide proof of publication within the allotted time may result in the denial of the exemption.

The Department will grant the exemption unless a petition for an administrative proceeding (hearing) is filed pursuant to the provisions of sections 120.569 and 120.57 of the Florida Statutes.

A person whose substantial interests are affected by the Department's proposed exemption decision may petition for an administrative proceeding (hearing) in accordance with sections 120.569 and 120.57 of the Florida Statutes. The petition must contain the information set forth below and must be filed (received) in the Office of General Counsel of the Department at 3900 Commonwealth Boulevard, Mail Station #35, Tallahassee, Florida 32399-3000. Petitions filed by the exemption applicant and the parties listed below must be filed within 21 days of receipt of this intent. Petitions filed by other persons must be filed within 21 days of publication of the public notice or within 21 days of their receipt of this intent, whichever first occurs. Under section 120.60(3) of the Florida Statutes, however, any person who asked the Department for notice of agency action may file a petition within 21 days of receipt of such notice, regardless of the date of publication. The petitioner must mail a copy of the petition to the applicant at the address

indicated above, at the time of filing. The failure of any person to file a petition within the time period shall constitute a waiver of that person's right to request an administrative determination (hearing) under sections 120.569 and 120.57 of the Florida Statutes, or to intervene in this proceeding and participate as a party to it. Any subsequent intervention (in a proceeding initiated by another party) will only be at the discretion of the presiding officer upon the filing of a motion in compliance with rule 28-106.205 of the Florida Administrative Code.

A petition that disputes the material facts on which the Department's action is based must contain the following information:

(a) The name, address, and telephone number of each petitioner, the applicant's name and address, the Department 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.

A petition that does not dispute the material facts on which the Department's action is based shall state that no such facts are in dispute and otherwise shall contain the same information as set forth above, as required by rule 28-106.301 of the Florida Administrative Code.

Because the administrative hearing process is designed to formulate final agency action, the filing of a petition means that the Department's final action may be different from the position taken by it in this notice. Persons whose substantial interests will be affected by any such final decision of the Department on the application have the right to petition to become a party to the proceeding, in accordance with the requirements set forth above.

Mediation under section 120.573 of the Florida Statutes is not available for this proceeding.

Any party to this order has the right to seek judicial review of it under section 120.68 of the Florida Statutes, by filing a notice of appeal under rule 9.110 of the Florida Rules of Appellate Procedure with the clerk of the Department in the office of General Counsel, Mail Station 35, 3900 Commonwealth Boulevard, 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 after this order is filed with the clerk of the Department.

DONE AND ENTERED this 24th day of April 1998 in Tallahassee, Florida.

Kirby B. Wetherell

for Virginia B. Wetherell
Secretary

State of Florida Department
of Environmental Protection
The Douglas Building
3900 Commonwealth Boulevard
Tallahassee, Florida 32399-3000

Copies furnished to:

Carlos Rivero-deAguilar, DEP/WPB
Richard Drew
Al Mueller, DEP/WPB
Richard Deuerling, P.G.
William Cocke, P.G., DEP/WPB
Cynthia Christen
Nancy Marsh, EPA/Atlanta
Cathy McCarty, P.G.
Anne Murray, P.G., Montgomery Watson/Plantation

STATE OF FLORIDA
DEPARTMENT OF ENVIRONMENTAL PROTECTION
NOTICE OF INTENT
TO GRANT WATER QUALITY CRITERIA EXEMPTIONS

The Department of Environmental Protection gives notice of its intent to grant water quality criteria exemptions to the City of Fort Lauderdale's Fiveash Water Treatment Plant, Mr. Gregory A. Kisela, Public Services Director, 949 NW 38 Street, Fort Lauderdale, Florida 33309 for the proposed project as detailed in the petition specified above. The Department is issuing this Intent to Grant for the reasons stated below.

On September 9, 1996, the Department received a petition from the applicant, City of Fort Lauderdale (City), for the exemptions for installations discharging into Class G-II ground water pursuant to rule 62-520.500 of the Florida Administrative Code. The City requested exemptions from ground water standards contained in rule 62-520.420(1) of the Florida Administrative Code. Specifically, the petition requested exemptions from three secondary drinking water standards, color, odor, and iron, which are incorporated as ground water standards. The exemption request for color is 100 color units and the maximum contaminant level (MCL) for color contained in the secondary drinking water standard is 15 color units. The exemption request for odor is 8 odor threshold number and the MCL for odor contained in the secondary drinking water standards is 3 odor threshold number. The exemption request for iron is 6.0 mg/L and the MCL for iron contained in the secondary drinking water standards is 0.30 mg/L. As secondary drinking water standards, these standards are aesthetically based and do not pose a health threat at the requested levels. The installation is the Fiveash Water Treatment Plant (FWTP) Aquifer Storage and Recovery (ASH) Facility which is located at 4321 NW 9 Avenue, Fort Lauderdale, Florida, in Broward County. The water to be used for this ASR project is raw ground water from the Prospect Wellfield. The source of the raw ground water for the Prospect Wellfield is the Biscayne aquifer. The receiving aquifer is the upper Floridan aquifer.

A person whose substantial interests are affected by the Department's proposed water quality exemption decision may petition for an administrative hearing in accordance with sections 120.569 and 120.57 of the Florida Statutes. The petition must contain the information set forth below and must be filed (received) in the Department's Office of General Counsel, 3900 Commonwealth Boulevard, Mail Station 35, Tallahassee, Florida, 32399-3000. Petitions must be filed within fourteen (14) days of publication of this public notice or within fourteen (14) days of receipt of the notice of intent, whichever occurs first. A petitioner must mail a copy of the petition to the applicant at the address indicated above, at the time of filing. The failure of any person to file a petition within the appropriate time period shall constitute a waiver of that person's right to request an administrative determination (hearing) under Sections 120.569 and 120.57 of the Florida Statutes, or to intervene in this proceeding and participate as a party to it. Any subsequent intervention will be only at the discretion of the presiding officer upon the filing of a motion in compliance with rule 28-106.205 of the Florida Administrative Code.

A petition must contain the following information: (a) The name, address, and telephone number of each petitioner; the Department's OGC File Number (98-0411) and the county in which the subject matter or activity is located; (b) a statement of how and when each petitioner received notice of the Department's action; (d) a statement of how each petitioner's substantial interests are affected by the Department's action; (d) a statement of the material facts disputed by the petitioner, if any, (B) a statement of facts that the petitioner contends warrant reversal or modification of the Department's action; (f) a statement of which rules or statutes the petitioner contends require reversal or modification of the Department's action and (g) a statement of the relief sought by the petitioner, stating precisely the action that the petitioner wants the Department to take.

Because the administrative hearing process is designed to formulate final agency action, the filing of a petition means that the Department's final action may be different from the position taken by it in this notice of Intent. Persons whose substantial interests will be affected by any such final decision of the Department on the application have the right to petition to become a party to the proceeding, in accordance with the requirements set forth above.

Mediation under section 120.573 of the Florida Statutes is not available for the proceeding.

The water quality exemption criteria is available for public inspection during normal business hours, 8:00 am. to 5:00 pm., Monday through Friday, except legal holidays, at the Department of Environmental Protection, Southeast District office, 400 North Congress Avenue, West Palm Beach, Florida 33401. Please contact Bill Cocke at (561) 681-6691 or Len Fishkin at (561) 681-6742 for additional information or to obtain a copy of the Notice of Intent to Grant or Statement of Fact.

Lucy Masilah
City Clerk
May 13, 1998

EXHIBIT II

8972 Denial, addition of 8 nursing home beds, Palm Beach County/Subdistrict 4, Health Care and Retirement Corporation of America d/b/a Heartland Health Care and Rehabilitation Center – Boca Raton, (PRH) same as applicant

8974 Denial, addition of up to 8 nursing home beds, Palm Beach County/Subdistrict 4, Mariner Health Care of Lake Worth, Inc., (PRH) same as applicant

8976 Denial, addition of 4 hospital based skilled nursing care beds through the conversion of 4 acute care beds, Broward County, AMISUB (North Ridge Hospital), Inc. d/b/a North Ridge Medical Center, (PRH) same as applicant

8977 Denial, addition of 6 hospital based skilled nursing unit beds, Broward County, University Hospital, Ltd. d/b/a Columbia University Hospital and Medical Center, (PRH) same as applicant

8978 Denial, addition of 11 hospital based skilled nursing beds, Broward County, North Broward Hospital District, (PRH) same as applicant

8981 Denial, establish an 8 bed hospital based skilled nursing unit, Dade County/Subdistrict 1, Larkin Community Hospital, Inc. d/b/a Larkin Community Hospital, (PRH) same as applicant

8981 Supports denial, establish an 8 bed hospital based skilled nursing unit, Dade County/Subdistrict 1, Larkin Community Hospital, Inc. d/b/a Larkin Community Hospital, (PRH) South Miami Hospital, Inc.

8982 Denial, addition of 12 hospital based skilled nursing beds, Dade County/Subdistrict 1, South Miami Hospital, Inc., (PRH) same as applicant

8983 Approval, establish a 17 bed hospital based skilled nursing unit, Dade County/Subdistrict 1, Tenet HealthSystem North Shore, Inc., (PRH) Larkin Community Hospital, Inc. d/b/a Larkin Community Hospital

8983 Approval, establish a 17 bed hospital based skilled nursing unit, Dade County/Subdistrict 1, Tenet HealthSystem North Shore, Inc., (PRH) South Miami Hospital, Inc.

DEPARTMENT OF BUSINESS AND PROFESSIONAL REGULATION

NOTICE OF QUOTA LIQUOR LICENSE DRAWINGS

The Division of Alcoholic Beverages and Tobacco, Department of Business and Professional Regulation announces Quota Liquor License Drawings to which all persons are invited for the following counties: BAY (1), BREVARD (2), BROWARD (6), CHARLOTTE (1), CLAY (1), COLLIER (1), DADE (6), ESCAMBIA (1), FLAGLER (1), HILLSBOROUGH (2), INDIAN RIVER (1), LEE (2), LEON (1), MANATEE (1), MARION (1), OKALOOSA (1), ORANGE U (4), OSCEOLA (1), PALM BEACH (5), PASCO (2), PINELLAS (2), POLK (2), ST. JOHNS (1), ST. LUCIE (1), SARASOTA (1), SEMINOLE (2), VOLUSIA (2)

DATE AND TIME: May 8, 1998, 9:00 a.m. (EST)

PLACE: Department of Business and Professional Regulation, The Johns Building, Conference Room, Room 259, 725 South Bronough Street, Tallahassee, FL

PURPOSE: To conduct double random drawings from the pool of qualified applicants for new quota liquor licenses in each county and establish each qualified applicant's standing to receive one of the new licenses.

DEPARTMENT OF ENVIRONMENTAL PROTECTION

NOTICE OF INTENT TO GRANT WATER QUALITY EXEMPTION

The Department of Environmental Protection gives notice of its intent to grant water quality exemptions for the aesthetically based secondary drinking water standards for color (standard 15 color units, exemption limit 100 color units), odor (standard 3 odor threshold number, exemption limit 8 odor threshold number), and iron (standard 0.30 mg/L, exemption limit 6.0 mg/L) to the City of Fort Lauderdale, Gregory A. Kisela, Public Service Director. The water quality exemption is for the raw water aquifer storage and recovery (ASR) demonstration project at the City of Fort Lauderdale's Fiveash Water Treatment Plant (FWTP). The exemptions are granted for the duration of the FWTP raw water ASR Class V well construction permit. Future exemptions must be petitioned for by the applicant in conjunction with an operation permit for any ASR project at this site. The raw water ASR well is located at the Fiveash Water Treatment Plant on 4321 N. W. 9 Avenue, Fort Lauderdale, Florida, in Broward County.

A person whose substantial interests are affected by the Department's proposed exemption decision may petition for an administrative proceeding (hearing) in accordance with sections 120.569 and 120.57 of the Florida Statutes. The petition must contain the information set forth below and must be filed (received) in the Office of General Counsel of the Department, 3900 Commonwealth Boulevard, Mail Station #35, Tallahassee, Florida 32399-3000, within 21 days of publication of this notice. The petitioner must mail a copy of the petition to the applicant Mr. Gregory A. Kisela, Public Service Director, City of Fort Lauderdale, 949 N. W. 38 Street, Fort Lauderdale, FL 33309, at the time of filing. The failure of any person to file a petition within the time period shall constitute a waiver of any right of that person's right to request an administrative determination (hearing) under sections 120.569 and 120.57 of the Florida Statutes, or to intervene in this proceeding and participate as a party to it. Any subsequent intervention (in a proceeding initiated by another party) will only be at the discretion of the presiding officer upon the filing of a motion in compliance with rule 28-106.205 of the Florida Administrative Code.

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 File Number and the county in which the project is proposed;

EXHIBIT III

CERTIFICATE OF SERVICE

I HEREBY CERTIFY that a true and correct copy of the foregoing FINAL ORDER has been furnished by the United States Mail to Mr. Gregory A. Kisela, Fort Lauderdale Public Services Director, 949 N.W. 38 Street, Fort Lauderdale, Florida, 33309, this 28th day of July 1998.

Cynthia K. Christen
Assistant General Counsel
3900 Commonwealth Boulevard
Mail Station 35
Tallahassee, Florida 32399-3000

Telephone: (904) 488-9730

FILING AND ACKNOWLEDGMENT

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

Barbara O'Neal
Clerk

July 28, 1998
Date

Appendix B

Lithologic Descriptions for ASR-1

LITHOLOGIC DESCRIPTION

Date :12-10-97
Contractor : Youngquist Brothers.
Location : 5-ASH ASR
Well : ASR-1

0'-30' Sand 100%, white to light tan and brown, coarse grained, well rounded and well sorted, unimodal, quarts based with trace lithics-heavies-and feldspar. Sand is mostly clean but has been mixed with drilling mud and fill material.

30'-60' Sand 100%, white to light tan, fine grained, well rounded and well sorted, unimodal, quarts based with trace lithics-heavies-and feldspar. Sand is mostly clean.

60'-90' Limestone 75%, medium to light gray, wackestone - packstone, contains carbonate sand- quarts sand, recrystalized (clear tan rhombs), well cemented, intergranular porosity is present. Rock is recrystalized calcite. Contains fragments of plecypoda, and gastropoda.

Sand 25%, white to light tan and brown, fine grained, well rounded and well sorted, unimodal, quarts based with trace lithics-heavies-and feldspar. Sand is mostly clean.

90'-170' Limestone 65%, light gray to white, fine grained wackestone - packstone, contains carbonate sand- abundant bioclast fragments- and trace quarts and lithics, poorly cemented, porosity is present.

Sand 30%, white to light tan, fine grained, well rounded and well sorted, unimodal, quarts based with trace lithics-heavies-and feldspar. Sand is mostly clean but has been mixed with drilling mud.

Shell 5%, tan opaque, recrystalized and low Mg calcite constituents, some are etched, breakage is common (possibly secondary), hash like in zones. Fossils including gastropods and plecypods.

170'-200 Limestone 95%, medium to light gray, wackestone-packstone, contains carbonate sand- quarts sand, recrystalized (clear tan rhombs), well cemented, intergranular and moldic porosity is present. Rock is recrystalized calcite. Contains fragments of plecypoda, and gastropoda.

Sand 5%, white to light tan and brown, fine grained, well rounded and well sorted, unimodal, quarts based with trace lithics-heavies-and feldspar. Sand is mostly clean.

200-250 Limestone, 95%, medium to dark gray, wackestone to recrystalized packstone, contains carbonate sand- bioclasts- and trace quarts and lithics, possible Mn, recrystalized (clear tan rhombus, can make up as much as 25% of total volume), cemented with abundant pore filling calcite spar cement (white),moderately cemented, porosity is intergranular with some primary forms remaining, biotics include diverse molluscs and bryzoans.

Observer_____

Sand 5%, white to light tan and brown, fine grained, well rounded and well sorted, unimodal, quarts based with trace lithics-heavies-and feldspar. Sand is mostly clean.

250-270 Limestone, 85%, medium to dark gray, wackestone to sandy packstone, contains carbonate sand- bioclasts- and trace quarts and lithics, possible Mn, recrystalized (clear tan rhombus, can make up as much as 25% of total volume), cemented with abundant pore filling calcite spar cement (white),moderately cemented, porosity is intergranular with some primary forms remaining, biotics include diverse molluscs and bryzoans.

Sand 5%, white to light tan and brown, fine grained, well rounded and well sorted, unimodal, quarts based with trace lithics-heavies-and feldspar. Sand is mostly clean.

Shell 10%, tan opaque, recrystalized and low Mg calcite constituents, some are etched, breakage is common (possibly secondary), hash like in zones. Fossils including gastropods and plecypods.

270-310 Limestone, 65%, medium gray to light green, wackestone, contains carbonate sand- bioclasts- and trace quarts and lithics, possible Mn, recrystalized (clear tan rhombus, can make up as much as 25% of total volume), cemented with abundant pore filling calcite spar cement (white),moderately cemented, porosity is intergranular with some primary forms remaining, biotics include diverse molluscs and bryzoans.

Yellowish gray to olive clay, 20%, The clay is plastic, and interbedded with minor light olive gray to white limestone. The clay contains quartz sand, silt, and minor plecypoda material, and calcite and dolomite cement. Contains isolated occurrences of plecypods. Clay is dominantly montmorillonite.

Sand 5%, white to light tan and brown, fine grained, well rounded and well sorted, unimodal, quarts based with trace lithics-heavies-and feldspar. Sand is mostly clean.

Shell 5%, tan opaque, recrystalized and low Mg calcite constituents, some are etched, breakage is common (possibly secondary), hash like in zones. Fossils including gastropods and plecypods.

310-350 Clay, 90%, Yellowish gray to olive ,The clay is nodular,and interbedded with minor light olive gray to white limestone. The clay contains quartz sand, silt, and minor plecypoda material, and calcite and dolomite cement. Contains isolated occurrences of plecypods. Clay is dominantly montmorillonite.

Limestone 10%, light gray to white, fine grained wackestone - packstone, contains carbonate sand- abundant bioclast fragments- and trace quarts and lithics, poorly cemented, porosity is present.

350-425 Clay, 95%, Yellowish gray to olive ,The clay is nodular,and interbedded with minor light olive gray to white limestone. The clay contains quartz sand, silt, and minor plecypoda material, and calcite and dolomite cement. Contains isolated occurrences of

plecypods. Clay is dominantly montmorillonite.

Shell 5%, tan opaque, recrystalized and low Mg calcite constituents, some are etched, breakage is common (possibly secondary), hash like in zones. Fossils including gastropods and plecypods.

425-450 Clay, 100%, light green to dark olive, the clay is plastic, and is interbedded with minor amounts of light olive gray to white limestone. The clay contains quartz sand, silt, and minor plecypoda material (fragmented), and calcite and dolomite cement. Porosity and, permeability are absent due to plastic nature of clay.

450-470 Limestone, 65%, medium gray to light green, wackestone, contains carbonate sand-bioclasts- and trace quarts and lithics, possible Mn, recrystalized (clear tan rhombus, can make up as much as 25% of total volume), cemented with abundant pore filling calcite spar cement (white),moderately cemented, porosity is

Yellowish gray to olive clay, 20%, The clay is plastic, and interbedded with minor light olive gray to white limestone. The clay contains quartz sand, silt, and minorplecypoda material, and calcite and dolomite cement. Contains isolated occurrences of plecypods. Clay is dominantly montmorillonite.

Sand 5%, white to light tan and brown, fine grained, well rounded and well sorted, unimodal, quarts based with trace lithics-heavies-and feldspar. Sand is mostly clean.

Shell 5%, tan opaque, recrystalized and low Mg calcite constituents, some are etched, breakage is common (possibly secondary), hash like in zones. Fossils including gastropods and plecypods.

470-550 Clay, 100%, dark olive, the clay is plastic, and is interbedded with minor amounts of light olive gray to white limestone. The clay contains quartz sand, silt, and minor plecypoda material (fragmented), and calcite and dolomite cement. Porosity and, permeability are absent due to plastic nature of clay.

550-555 Limestone100% Complexly interbedded, argillaceous limestone. Limestone is generally light gray to white, poor to moderately indurated, mudstones and wackestones. Porosity is low.Grains include minor fossil debris, and peloids.

555-690 Clay, 100%, light green to gray, the clay is plastic, and is interbedded with minor amounts of light olive gray to white limestone. The clay contains quartz sand, silt, and minor plecypoda material (fragmented), and calcite and dolomite cement. Porosity and, permeability are absent due to plastic nature of clay.

690-720 Limestone90% Complexly interbedded, argillaceous limestone. Limestone is generally light gray to white, poor to moderately indurated, mudstones and wackestones. Porosity is low.Grains include minor fossil debris, and peloids.

Observer_____

Clay, 10%, light green to gray, the clay is plastic, and is interbedded with minor amounts of light olive gray to white limestone. The clay contains quartz sand, silt, and minor plecypoda material (fragmented), and calcite and dolomite cement. Porosity and, permeability are absent due to plastic nature of clay.

720-910 Clay, 90%, light green to gray, the clay is plastic, and is interbedded with minor amounts of light olive gray to white limestone. The clay contains quartz sand, silt, and minor plecypoda material (fragmented), and calcite and dolomite cement. Porosity and, permeability are absent due to plastic nature of clay.

Limestone10% Complexly interbedded, argillaceous limestone. Limestone is generally light gray to white, poor to moderately indurated, mudstones and wackestones. Porosity is low.Grains include minor fossil debris, and peloids.

910-970 Clay, 20%, light green to gray, the clay is plastic, and is interbedded with minor amounts of light olive gray to white limestone. The clay contains quartz sand, silt, and minor plecypoda material (fragmented), and calcite and dolomite cement. Porosity and, permeability are absent due to plastic nature of clay.

Limestone80% Complexly interbedded, argillaceous limestone. Limestone is generally medium gray to white, poor to moderately indurated, mudstones and wackestones. Porosity is low.Grains include minor fossil debris, and peloids, abundant quartz and phosphate sand is present, poorly sorted, rounded to angular.

970-1030 Limestone, 90% white to medium gray, moderately indurated boundstones to wackstones,locally grades to packstone and grainstone. Contains phosphate nodules. Some bioclasts are represented as moldic porosity, and high secondary porosity and permeability are present (intergranular, interparticle and moldic). Locally the rock is recrystalized. Well indurated, and contains coarse spar cement (reducing). Biotics include reef fauna assemblage (diverse mollusk, foram, bryozoan, corals).

Clay, 10%, light green to gray, the clay is plastic, and is interbedded with minor amounts of light olive gray to white limestone. The clay contains quartz sand, silt, and minor plecypoda material (fragmented), and calcite and dolomite cement. Porosity and, permeability are absent due to plastic nature of clay.

1030-1050 Limestone, 80%, Moderately soft, highly fossiliferous, very pale orange to tan, pelletal, wackestones, and packstones, with 5% to 10% intergranular porosity. Locally, the unit is composed of thin layers of very hard micrite, of low porosity and permeability. Abundant foraminifera, and echinoids.

Clay, 20%, light green to gray, the clay is plastic, and is interbedded with minor amounts of light olive gray to white limestone. The clay contains quartz sand, silt, and minor plecypoda material (fragmented), and calcite and dolomite cement. Porosity and, permeability are absent due to plastic nature of clay.

Observer_____

1050-1300 Limestone, 80%, Moderately soft, highly fossiliferous, very pale orange to tan, pelletal, wackestones, and packstones, with 15% to 40% intergranular porosity. Locally, the unit is composed of thin layers of very hard micrite, of low porosity and permeability. Abundant foraminifera, and echinoids.

Observer_____

Lithologic Descriptions for FMW-1

LITHOLOGIC DESCRIPTION

Date : 1-20-98
Contractor : Youngquist Brothers.
Location : 5-ASH ASR
Well : FMW-1

0'-30' Sand 100%, white to light tan and brown, coarse grained, well rounded and well sorted, unimodal, quarts based with trace lithics-heavies-and feldspar. Sand is mostly clean but has been mixed with drilling mud and fill material.

30'-60' Sand 100%, white to light tan, fine grained, well rounded and well sorted, unimodal, quarts based with trace lithics-heavies-and feldspar. Sand is mostly clean.

60'-90' Limestone 75%, medium to light gray, wackestone - packstone, contains carbonate sand- quarts sand, recrystalized (clear tan rhombs), well cemented, intergranular porosity is present. Rock is recrystalized calcite. Contains fragments of plecypoda, and gastropoda.

Sand 25%, white to light tan and brown, fine grained, well rounded and well sorted, unimodal, quarts based with trace lithics-heavies-and feldspar. Sand is mostly clean.

90'-170' Limestone 65%, light gray to white, fine grained wackestone - packstone, contains carbonate sand- abundant bioclast fragments- and trace quarts and lithics, poorly cemented, porosity is present.

Sand 30%, white to light tan, fine grained, well rounded and well sorted, unimodal, quarts based with trace lithics-heavies-and feldspar. Sand is mostly clean but has been mixed with drilling mud.

Shell 5%, tan opaque, recrystalized and low Mg calcite constituents, some are etched, breakage is common (possibly secondary), hash like in zones. Fossils including gastropods and plecypods.

170'-200 Limestone 95%, medium to light gray, wackestone-packstone, contains carbonate sand- quarts sand, recrystalized (clear tan rhombs), well cemented, intergranular and moldic porosity is present. Rock is recrystalized calcite. Contains fragments of plecypoda, and gastropoda.

Sand 5%, white to light tan and brown, fine grained, well rounded and well sorted, unimodal, quarts based with trace lithics-heavies-and feldspar. Sand is mostly clean.

200-250 Limestone, 95%, medium to dark gray, wackestone to recrystalized packstone, contains carbonate sand- bioclasts- and trace quarts and lithics, possible Mn, recrystalized (clear tan rhombus, can make up as much as 25% of total volume), cemented with abundant pore filling calcite spar cement (white),moderately cemented, porosity is intergranular with some primary forms remaining, biotics include diverse molluscs and bryzoans.

Observer_____

Sand 5%, white to light tan and brown, fine grained, well rounded and well sorted, unimodal, quarts based with trace lithics-heavies-and feldspar. Sand is mostly clean.

250-270 Limestone, 85%, medium to dark gray, wackestone to sandy packstone, contains carbonate sand- bioclasts- and trace quarts and lithics, possible Mn, recrystalized (clear tan rhombus, can make up as much as 25% of total volume), cemented with abundant pore filling calcite spar cement (white),moderately cemented, porosity is intergranular with some primary forms remaining, biotics include diverse molluscs and bryzoans.

Sand 5%, white to light tan and brown, fine grained, well rounded and well sorted, unimodal, quarts based with trace lithics-heavies-and feldspar. Sand is mostly clean.

Shell 10%, tan opaque, recrystalized and low Mg calcite constituents, some are etched, breakage is common (possibly secondary), hash like in zones. Fossils including gastropods and plecypods.

270-310 Limestone, 65%, medium gray to light green, wackestone, contains carbonate sand- bioclasts- and trace quarts and lithics, possible Mn, recrystalized (clear tan rhombus, can make up as much as 25% of total volume), cemented with abundant pore filling calcite spar cement (white),moderately cemented, porosity is intergranular with some primary forms remaining, biotics include diverse molluscs and bryzoans.

Yellowish gray to olive clay, 20%, The clay is plastic, and interbedded with minor light olive gray to white limestone. The clay contains quartz sand, silt, and minor plecypoda material, and calcite and dolomite cement. Contains isolated occurrences of plecypods. Clay is dominantly montmorillonite.

Sand 5%, white to light tan and brown, fine grained, well rounded and well sorted, unimodal, quarts based with trace lithics-heavies-and feldspar. Sand is mostly clean.

Shell 5%, tan opaque, recrystalized and low Mg calcite constituents, some are etched, breakage is common (possibly secondary), hash like in zones. Fossils including gastropods and plecypods.

310-350 Clay, 90%, Yellowish gray to olive ,The clay is nodular,and interbedded with minor light olive gray to white limestone. The clay contains quartz sand, silt, and minor plecypoda material, and calcite and dolomite cement. Contains isolated occurrences of plecypods. Clay is dominantly montmorillonite.

Limestone 10%, light gray to white, fine grained wackestone - packstone, contains carbonate sand- abundant bioclast fragments- and trace quarts and lithics, poorly cemented, porosity is present.

350-425 Clay, 95%, Yellowish gray to olive ,The clay is nodular,and interbedded with minor light olive gray to white limestone. The clay contains quartz sand, silt, and minor

plecypoda material, and calcite and dolomite cement. Contains isolated occurrences of plecypods. Clay is dominantly montmorillonite.

Shell 5%, tan opaque, recrystalized and low Mg calcite constituents, some are etched, breakage is common (possibly secondary), hash like in zones. Fossils including gastropods and plecypods.

425-450 Clay, 100%, light green to dark olive, the clay is plastic, and is interbedded with minor amounts of light olive gray to white limestone. The clay contains quartz sand, silt, and minor plecypoda material (fragmented), and calcite and dolomite cement. Porosity and, permeability are absent due to plastic nature of clay.

450-470 Limestone, 65%, medium gray to light green, wackestone, contains carbonate sand-bioclasts- and trace quarts and lithics, possible Mn, recrystalized (clear tan rhombus, can make up as much as 25% of total volume), cemented with abundant pore filling calcite spar cement (white),moderately cemented, porosity is

Clay, 20%, yellowish gray to olive clay is plastic, and interbedded with minor light olive gray to white limestone. The clay contains quartz sand, silt, and minorplecypoda material, and calcite and dolomite cement. Contains isolated occurrences of plecypods. Clay is dominantly montmorillonite.

Sand 5%, white to light tan and brown, fine grained, well rounded and well sorted, unimodal, quarts based with trace lithics-heavies-and feldspar. Sand is mostly clean.

Shell 5%, tan opaque, recrystalized and low Mg calcite constituents, some are etched, breakage is common (possibly secondary), hash like in zones. Fossils including gastropods and plecypods.

470-550 Clay, 100%, dark olive, the clay is plastic, and is interbedded with minor amounts of light olive gray to white limestone. The clay contains quartz sand, silt, and minor plecypoda material (fragmented), and calcite and dolomite cement. Porosity and, permeability are absent due to plastic nature of clay.

550-555 Limestone100% Complexly interbedded, argillaceous limestone. Limestone is generally light gray to white, poor to moderately indurated, mudstones and wackestones. Porosity is low.Grains include minor fossil debris, and peloids.

555-690 Clay, 100%, light green to gray, the clay is plastic, and is interbedded with minor amounts of light olive gray to white limestone. The clay contains quartz sand, silt, and minor plecypoda material (fragmented), and calcite and dolomite cement. Porosity and, permeability are absent due to plastic nature of clay.

690-720 Limestone90% Complexly interbedded, argillaceous limestone. Limestone is generally light gray to white, poor to moderately indurated, mudstones and wackestones. Porosity is low.Grains include minor fossil debris, and peloids.

Observer_____

Clay, 10%, light green to gray, the clay is plastic, and is interbedded with minor amounts of light olive gray to white limestone. The clay contains quartz sand, silt, and minor plecypoda material (fragmented), and calcite and dolomite cement. Porosity and, permeability are absent due to plastic nature of clay.

720-910 Clay, 90%, light green to gray, the clay is plastic, and is interbedded with minor amounts of light olive gray to white limestone. The clay contains quartz sand, silt, and minor plecypoda material (fragmented), and calcite and dolomite cement. Porosity and, permeability are absent due to plastic nature of clay.

Limestone10% Complexly interbedded, argillaceous limestone. Limestone is generally light gray to white, poor to moderately indurated, mudstones and wackestones. Porosity is low.Grains include minor fossil debris, and peloids.

910-970 Clay, 20%, light green to gray, the clay is plastic, and is interbedded with minor amounts of light olive gray to white limestone. The clay contains quartz sand, silt, and minor plecypoda material (fragmented), and calcite and dolomite cement. Porosity and, permeability are absent due to plastic nature of clay.

Limestone80% Complexly interbedded, argillaceous limestone. Limestone is generally medium gray to white, poor to moderately indurated, mudstones and wackestones. Porosity is low.Grains include minor fossil debris, and peloids, abundant quartz and phosphate sand is present, poorly sorted, rounded to angular.

970-1030 Limestone, 90% white to medium gray, moderately indurated boundstones to wackstones,locally grades to packstone and grainstone. Contains phosphate nodules. Some bioclasts are represented as moldic porosity, and high secondary porosity and permeability are present (intergranular, interparticle and moldic). Locally the rock is recrystalized. Well indurated, and contains coarse spar cement (reducing). Biotics include reef fauna assemblage (diverse mollusk, foram, bryozoan, corals).

Clay, 10%, light green to gray, the clay is plastic, and is interbedded with minor amounts of light olive gray to white limestone. The clay contains quartz sand, silt, and minor plecypoda material (fragmented), and calcite and dolomite cement. Porosity and, permeability are absent due to plastic nature of clay.

1030-1050 Limestone, 80%, Moderately soft, highly fossiliferous, very pale orange to tan, pelletal, wackestones, and packstones, with 5% to 10% intergranular porosity. Locally, the unit is composed of thin layers of very hard micrite, of low porosity and permeability. Abundant foraminifera, and echinoids.

Clay, 20%, light green to gray, the clay is plastic, and is interbedded with minor amounts of light olive gray to white limestone. The clay contains quartz sand, silt, and minor

plecypoda material (fragmented), and calcite and dolomite cement. Porosity and, permeability are absent due to plastic nature of clay.

1050-1175 Limestone, 80%, Moderately soft, highly fossiliferous, very pale orange to tan, pelletal, wackestones, and packstones, with 15% to 40% intergranular porosity. Locally, the unit is composed of thin layers of very hard micrite, of low porosity and permeability. Abundant foraminifera, and echinoids.

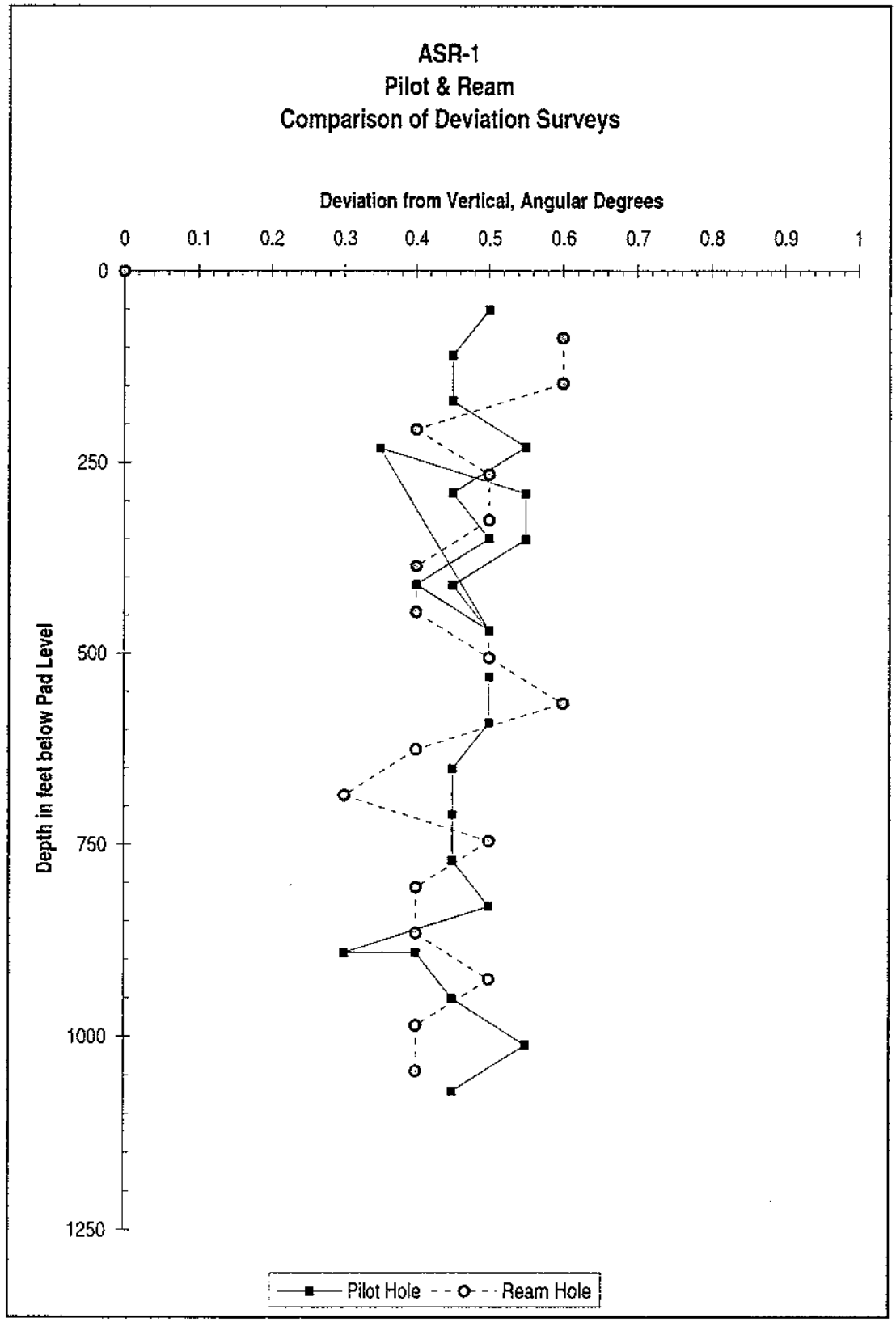
Appendix C

Geophysical Logs

Geophysical Logs in Volume 2

Appendix D

Deviation Survey


ASR-1
Pilot & Ream
Comparison of Deviation Surveys
Deviation from Vertical, Angular Degrees
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
Depth in feet below Pad Level
0
250
500
750
1000
1250
Pilot Hole
Ream Hole

Appendix E

Casing Mill Certificates

VASS PIPE & STEEL CO., INC.
A DEPENDABLE SOURCE YOU CAN COUNT ON
P.O. BOX 583 • MINEOLA • NY 11501 • TEL: 516.741.8398 • FAX: 516.741.8210

SERVICE CO BY RTV 12-6-96
RECOMMENDED BY AHM 12-10-96
CORRECTIONS OR COMMENTS MADE ON SHOP DRAWINGS DURING REVIEW DO NOT RELIEVE CONTRACTOR FROM COMPLIANCE WITH CONTRACT DRAWINGS AND SPECIFICATIONS. THIS SHOP DRAWING HAS BEEN REVIEWED FOR CONFORMANCE WITH THE DESIGN CONCEPT AND GENERAL COMPLIANCE WITH THE CONTRACT DOCUMENTS ONLY. CONTRACTOR IS RESPONSIBLE FOR CONFIRMING AND CORRELATING ALL QUANTITIES AND DIMENSIONS, FABRICATION PROCESSES AND TECHNIQUES, COORDINATION OF WORK WITH OTHER TRADES, AND SATISFACTORY AND SAFE PERFORMANCE OF THE WORK.

RECEIVED
DEC 2 1996

#33

LABORATORY REPORT AND MILL TEST CERTIFICATE

DATE Nov.22/96 CUSTOMER

SPECIFICATION Hydrotested in Accordance with A139 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
73495	I	43900	69300	40.0	.72800	PM
73508	6	44600	69500	40.0	73100	PM

LADLE ANALYSIS CHEMICAL COMPOSITION

HEAT NO	C	MN	S	P	SI	CR	NI	CU	MO	AL
73495	.18	1.02	.009	.008	.23	.02	.01	.02	.01	.034
73508	.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

Actual 40' -0" +5"

Set to 190' 615.

JOE T. POTTSON
V. P. SALES
BARTOW STEEL, INC.
1-800-237-86
FAX 941-619-87?9

NAPA PIPE CORPORATION
1025 Kaiser Road
Napa, CA. 94558
(707) 257-5000

CERTIFIED REPORT OF MECHANICAL PROPERTIES AND/OR CHEMICAL ANALYSIS OF PIPE

DATE: 05/08/97 REPORT NO. 97- 8009- 1

M.O. 27780 JOB# 8009 SPEC API 5L GRADE X42 0.3750 WALL x 26.000 O.D. DOUBLE SUBMERGED ARC WELDED

CUSTOMER P.O. # 192120

ADDRESS

C.E.= C+Mn/6+(Cr+Mo+V)/5+(Cu+Ni)/15

THIS CERTIFICATE COMPLIES WITH API SR15 REQUIREMENTS

HEAT / SLAB	MARK*	YIELD (PSI)	TENSILE (PSI)	ELONG IN 2"	MAT.OF FRACT**	Y/T RATIO	BEND TEST	***	CHEMICAL ANALYSIS C	Mn	P	S	Si	Cu	Ni	V	Cb	Al	Cr	Mo	Ti	N2	Ca	B	C.E.
383470 CS-2	TS	55030	69290	39		0.79		L	.07	0.47	.002	.005	.24	.29	.10	.000	.000	.025	.05	.04	.000	.0072	.0045	.	19
LOT#; 8C090000	TW		73410		DOW		OK	C	.08	0.48	.002	.004	.23	.28	.10	.000	.000	.026	.05	.04	.000	.0065	.0034	.	20
								C2	.07	0.48	.002	.004	.23	.29	.10	.000	.000	.025	.05	.04	.000	.0065	.0033	.	19

	BODY CHARPY								TRANSITION
	ENERGY-ft.lbs.								
	% SHEAR								
WELD CHARPY	*DROP WEIGHT*								TRANSITION
ENERGY-ft.lbs	ENERGY-ft.lbs.								
at	% SHEAR								
ZONE CHARPY									
ENERGY-ft.lbs									
at									

MATERIAL 100% MELTED & MANUFACTURED IN THE U.S.A.
NAPA PIPE CERTIFIES THAT PIPE SHOWN ON THIS TEST REPORT COMPLIES WITH API 5L GRADE B and GRADE X42.

THIS IS A CERTIFICATION OF HEAT# 383470

* LS - LONGITUDINAL STEEL
TS - TRANSVERSE STEEL
TW - TRANSVERSE WELD

*** L - LADLE ANALYSIS
C - CHECK ANALYSIS
C2 - CHECK ANALYSIS

HYDRO TEST PRESSURE 1150 PSI
HOLD TIME 10 sec

API 5L 41st EDITION APR 1-95
Fig 4 Transverse Strip Specimen

I certify the above information to be correct as contained in the records of the company.

Barbara Hagedorn

** OOW - OUT OF WELD
EOW - EDGE OF WELD
ITW - IN THE WELD

This order was nondestructively tested using ultrasonic and radiological methods.

RTR Penetrameters: 15 API
End X-Ray Penetrameters: 7 API
UT Reference Standard: 1/16 DRILLED HOLE API N5 NOTCHES

JOE H. FORTSON
V. P. SALES
BARTOW STEEL, INC.
1-800-237-8669
FAX 941-619-8779

NAPA PIPE CORPORATION
1025 Kaiser Road
Napa, CA. 94558
(707) 257-5000

CERTIFIED REPORT OF MECHANICAL PROPERTIES AND/OR CHEMICAL ANALYSIS OF PIPE

DATE: 05/08/97 REPORT NO. 97- 8009- 2

M.O. 27780 JOB# 8009 SPEC API 5L GRADE X42 0.3750 WALL x 26.000 O.D. DOUBLE SUBMERGED ARC WELDED

CUSTOMER P.O. # 192120

ADDRESS

C.E.= C+Mn/6+(Cr+Mo+V)/5+(Cu+Ni)/15

THIS CERTIFICATE COMPLIES WITH API SR15 REQUIREMENTS

HEAT / SLAB	MARK*	YIELD (PSI)	TENSILE (PSI)	ELONG IN 2"	WAT.OF FRACT**	Y/T RATIO	BEND TEST	***	CHEMICAL ANALYSIS C	Mn	P	S	Si	Cu	Ni	V	Cb	Al	Cr	Mo	Ti	N2	Ca	B	C.E.
383474 / E7-2	TS	57170	70770	35		0.80		L	.08	0.49	.004	.006	.24	.27	.10	.000	.000	.030	.06	.04	.000	.0078	.0014	.	21
LOT#: 80090001	TW		74720		OOW		OK	C	.09	0.48	.003	.005	.25	.26	.10	.000	.000	.027	.05	.04	.000	.0074	.0014	.	21
								C2	.08	0.49	.003	.005	.26	.27	.10	.000	.000	.028	.05	.04	.000	.0073	.0010	.	20

	BODY CHARPY								TRANSITION
	ENERGY-ft.lbs.								
	% SHEAR								
WELD CHARPY	*DROP WEIGHT*								TRANSITION
ENERGY-ft.lbs	ENERGY-ft.lbs.								
at	% SHEAR								
ZONE CHARPY									
ENERGY-ft.lbs									
at									

MATERIAL 100% MELTED & MANUFACTURED IN THE U.S.A.
NAPA PIPE CERTIFIES THAT PIPE SHOWN ON THIS TEST REPORT COMPLIES WITH API 5L GRADE B and GRADE X42.

THIS IS A CERTIFICATION OF HEAT# 383474

* LS - LONGITUDINAL STEEL
TS - TRANSVERSE STEEL
TW - TRANSVERSE WELD

** OOW - OUT OF WELD
EOW - EDGE OF WELD
ITW - IN THE WELD

*** L - LADLE ANALYSIS
C - CHECK ANALYSIS
C2 - CHECK ANALYSIS

This order was nondestructively tested using ultrasonic and radiological methods.

HYDRO TEST PRESSURE 1150 PSI
HOLD TIME 10 sec

API 5L 41st EDITION APR 1-95
Fig 4 Transverse Strip Specimen

RTR Penetrameters: 15 API
End X-Ray Penetrameters: 7 API
UT Reference Standard: 1/16 DRILLED HOLE
API N5 NOTCHES

I certify the above information to be correct as contained in the records of the company.

Barbara Ingestad

검 사 증 명 서 (A)

MILL INSPECTION CERTIFICATE

현 대 강 관 주 식 회 사
HYUNDAI PIPE CO.,LTD.
울산광역시 중구 염포동 265번지 우편번호 682-792
ULSAN PLANT : # 265, YEMPO-DONG, JUNG-KU, ULSAN, KOREA
TEL : 82-2101~9 FAX : (0522)82-3815
TLX : HDPIPE K 53276
서울특별시 중구 무교동 77번지 우편번호 100-120
SEOUL OFFICE : #77, MUKYO-DONG, JUNG-KU SEOUL, KOREA
TEL : 773-0522 FAX : 775-2035
TLX : HDPIPE K 24656, K 22956

증명서 번호 CERTIFICATE NO. S-7-03-372 페이지 PAGE : 2
발행일자 DATE OF ISSUE APR. 3. 1997. 주문번호 P47028000
주문자 CUSTOMER
품명 COMMODITY E.R.W. STEEL PIPE
규격 SPECIFICATIONS API 5LB/ASTM A53B

치수 DIMENSION OUTDIA. THICK. LENGTH	수량 QUANTITY PCS	중량 WEIGHT KG	수압시험 HYDRO-STATIC TEST Max Applied PSI	육안검사 VISUAL EXAMINATION	편평시험 FLATTENING TEST	확관시험 FLARING TEST	충격시험 IMPACT TEST	굽힘시험 BENDING TEST	인장시험 TENSILE TEST 항복강도 YIELD STRENGTH PSI	인장강도 TENSILE STRENGTH PSI	신장율 ELONGATION %	화학성분 CHEMICAL COMPOSITION C	Si	Mn	P	S	Cu	Ni	Cr	Mo	V	충격시험 IMPACT 흡수에너지 ENERGY ft-lbs	전단면적 SHEAR %	비고 REMARK	제강번호 HEAT NO.
B 00 16" x .500" x42.000'	20	31,567	92	G	G	G	G	G	34.8	49.1	52.5	34	18	1	78	15	8	6	1	2	1	Tr			A01670
(406.4mm x12.70mm x 12.802M)			1310						40500	69800	74700													
									32.9	51.8	54.0	40	17	Tr	74	17	8	6	1	2	1	Tr			A04753
									46800	73800	76800													
B 00 18" x .375" x42.000'	115	154,802	62	G	G	G	G	G	30.8	49.1	52.5	38	18	1	81	19	8	6	1	2	1	Tr			A04638
(457.0mm x 9.53mm x 12.802M)			830						43600	69800	74700													
									33.4	48.7	51.7	38	17	Tr	72	16	5	6	1	2	1	Tr			A04640
									47500	69300	73500													
									33.5	50.5	53.1	38	17	1	79	17	9	6	1	2	1	Tr			A05012
									47500	71800	75500													
									31.1	49.8	52.2	41	16	3	78	16	6	6	1	2	1	Tr			A07232
									44200	70600	74200													
B 00 18" x .500" x42.000'	30	69,500	32	G	G	G	G	G	33.4	48.7	51.7	38	17	Tr	72	18	5	6	1	2	1	Tr			A01640
(457.0mm x12.70mm x 12.802M)			1170						47500	69300	73500													
B 00 24" x .375" x40.000'	80	137,344	46	G	G	G	G	G	31.7	49.3	52.7	38	16	1	77	13	8	6	1	2	1	Tr			A05792
(610.0mm x 9.53mm x 12.192M)			650						45100	70100	75000													

12—NOTES [문 1] Type of pipe End 관종

PE : Black Plain End Square-cut	GPE : Galvanized Plain End Square-cut
PEB : Black Plain End Beveled	GPEB : Galvanized Plain End Beveled
TC : Black Threaded & Coupled	GTC : Galvanized Threaded & Coupled
VJ : Black Victaulic Joint	GVJ : Galvanized Victaulic Joint
EC : Ensurlic Threaded & Coupled	

[문 2] NB : Nominal Bore 호칭경, OD : Outside Diameter
[문 3] Unit 단위 (M : Metric, F : Feet, I : Inch)
[문 4] Flattening or Bending Test 압편 또는 굽힘시험
[문 5] Nondestructive Test 비파괴검사
[문 6] Crush Test 충압시험
[문 7] W : Weld Zone 용접부
[문 8] O : Good
[문 9] Drift Test 관통시험
[문 10] Reverse Flattening Test 역압시험
[문 11] H : Heat Ladle Analysis 용탕분석 P : Product Analysis 제품분석
[문 12] Unit 단위 (M : Metric, I : Inch)
[문 13] Visual & Dimension Test 육안 및 치수검사
[문 14] Weld Ductility Test 용접부 연성시험
[문 15] Flaring Test 압확시험
[문 16] a : Base Metal 모재부

본 제품은 귀사규격에 입각하여 검증을 무증합니다.

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

SURVEYOR

INSPECTION MANAGER

검 사 증 명 서
INSPECTION CERTIFICATE

동부제강주식회사
DONGBU STEEL CO. LTD

- HEAD OFFICE : 21-8, CHO-DONG, JUNG-KU, SEOUL, 100-300, KOREA
- SEOUL WORKS : 123, ORYU-DONG, GURO-GU, SEOUL, 152-102, KOREA
- INCHEON WORKS : 590-1, KAJWA-DONG, SEO-KU, INCHEON 403-251, KOREA
- BUSAN WORKS : 725-4, HAKJANG-DONG, BUK-GU, BUSAN 618-020, KOREA

증명서번호 CERTIFICATE NO. : M93-10-014
발행일자 DATE OF ISSUE : 93.10.30
구문번호 ITEM NO. : PTC04J15X
계약번호 PURCHASE ORDER NO. : 1816-8039
품명 COMMODITY : E.R.W. STEEL PIPE
시방규격 SPECIFICATION : ASS GR.B/API 5L-B/KS SLT-42
수요자 CUSTOMER : BARTOW STEEL
선급일자 SHIPPER : DAEWOO CORP.

ITEM NO	관종 TYPE	주문치수 ORDER SIZE	수량 QUANTITY 본수 PIECES	총길이 TOTAL LENGTH	중량(kg) WEIGHT	수압시험 HYDROSTATIC TEST (kg/cm²)	비파괴시험 N.D.T	기계시험 M.T	재강번호 HEAT NO.	인장시험 TENSILE TEST 항복강도 Y.S or Y.P (N/mm², PSI, kg/mm²)	인장강도 T.S	연신율 E.L (%)	충격시험 IMPACT TEST (joule)	편평시험 FLATTENING TEST	화학성분 CHEMICAL COMPORTION(%) C	Si	Mn	P	S	Cu	Ni	Cr	Mo	V	아연도금시험 ZINC COATING TEST	도복장 COATING & PAINTING
1	API 5L	12-3/4"XO.500"X40'	33	1,320'	39,204	1650G	G	G	GA29517	45,371	74,527	32			.15	.1	.70	.014	.6							
2	API 5L	14"XO.500"X40'	91	3,640'	108,376	980G	G	G	GA28766	45,513	74,385	33			.14	.1	.69	.015	.7							
3	API 5L	16"XO.500"X40'	27	1,080'	40,586	310G	G	G	GA29301	45,371	74,527	32			.15	.1	.70	.014	.6							
		*** TOTAL ***	151	6,040'	183,166																					
						1	A	S		111 M																
STANDARD										MIN	35,000	50,000	#													
										MAX					26		115	050								

※G : GOOD
FLT : FLATTENING
BND : BENDING
W.B : WELD DUCTILITY (용접부연성)
W.G.Z : WEIGHT OF ZINC
C.S : COPPER SULPHATE (황산동침적, DIPS)
UNF : UNIFORMITY (균일성)
ALK : ALKALINITY
P.D : PINHOLE DETECTOR
S.I.T : SALT IMMERSION TEST (HOUR)

비고 REMARKS: 81.5:29.5
82:28.0

상기 강관은 지정된 규격의 시험을 통하여 합격되었음을 증명합니다.
We hereby certify that the material herein has been made and tested in accordance with the above specification and also with the requirements called for by the above order.

Surveyor to.

MANAGER OF QUALITY CONTROL

Attn: Dave Collins

TUBACERO INTERNATIONAL CORP.

TUBACERO, S.A. DE C.V.

ANALYSIS AND TEST CERTIFICATE OF PIPE
CERTIFICADO DE ANALISIS Y PRUEBAS DE TUBERIA

CERTIFICATE / CERTIFICADO 960589

3 PB39	16.000	0.500"	API SPEC 5L (95)	ERW		GRADO X-42/B	N Y L S A	737	11-12-96	15/11/96

Pipe No.	Heat No.	L O C	YIELD L.E.	TENSILE U.T.	YS/TS LE/UT	% E	ANALY	C	Mn	P	S	Si
0009	16624	B		75920			P	03	083	07	12	06
		T	66512	72308	0.91	34	P	04	063	09	12	07
0012	16625	B		79873			P	04	083	09	11	09
		T	68037	74513	0.91	32	P	05	083	10	12	10

METHOD / METODO	STANDARD / ESTANDAR	PRESSURE / PRESION	TIME / TIEMPO	TEMPERATURE / TEMPERATURA
UT /	5 /	2230	10 SEG.	1600 °F

WE HEREBY CERTIFY THAT MATERIAL DESCRIBED HEREIN HAS BEEN MADE IN ACCORDANCE WITH RULES OF THE CONTRACT

SIGNATURE / FIRMA

Ing. RAYMUNDO HERNANDEZ S.
QUALITY CONTROL

CONTROL DE CALIDAD 04

F-TUAC-

검 사 증 명 서 (A)

MILL INSPECTION CERTIFICATE

현 대 강 관 주 식 회 사
HYUNDAI PIPE CO., LTD.
본사·공장 경남 울산시 중구 염포동 265번지
ULSAN PLANT : # 265, YOMPO-DONG, JUNG-KU, ULSAN, KOREA
TEL : 37-2101~9 FAX : (0522) 37-8916
TLX : HDPIPE K 53776
서울사무소 서울특별시 종구 무교동 77번지
SEOUL OFFICE : # 77, MUKYO-DONG, JUNG-KU, SEOUL, KOREA
TEL : 773-0322 FAX : 775-7095
TLX : HDPIPE K 24636, K 22956

증명서번호 CERTIFICATE NO : S-7-04-225 페이지 PAGE : 1
발행일자 DATE OF ISSUE : APR. 30. 1997. E4702800
계약번호 CONTRACT/P/O NO :
품명 COMMODITY : E.R.W. STEEL PIPE
규격 SPECIFICATION : API 5LB/ASTM A53B
수요가 CUSTOMER :

ITEM	치수 DIMENSION 외경 × 두께 × 길이 (OUTDIA. × THICK. × LENGTH)	수량 QUANTITY (PCS)	중량 WEIGHT (KG)	수압시험 HYDROSTATIC TEST Mpa kg/cm² PSI	5	6	7	8	9	제강번호 HEAT NO.	항복강도 YIELD STRENGTH (PSI)	인장강도 TENSILE STRENGTH B	인장강도 TENSILE STRENGTH W (kg/mm² / N/mm²)	연신율 ELONGATION (%)	C (×100)	Si	Mn	P (×1000)	S	Cu (×100)	Ni	Cr	Mo	V	충격시험 IMPACT	비고 REMARK
3 00	14" x .375" x21.000'	95	49,416	79	G	G	G	G	G	A08610	34.9	50.0	53.4	38	17	1	76	14	10	6	1	2	1	Tr		
	(355.6mm x 9.53mm x 6.401M)			1120							49600	71100	76000													
										A08613	34.3	48.9	51.0	38	17	1	74	18	8	6	1	2	1	Tr		
											48800	69600	72500													
3 00	14" x .375" x42.000'	97	100,913	79	G	G	G	G	G	A08610	34.9	50.0	53.4	36	17	1	76	14	10	6	1	2	1	Tr		
	(355.6mm x 9.53mm x 12.802M)			1120							49600	71100	76000													
										A08813	34.3	48.9	51.0	38	17	1	74	18	8	6	1	2	1	Tr		
											48800	69800	72500													
3 00	16" x .500" x42.000'	32	50,508	92	G	G	G	G	G	A09163	29.7	47.5	50.1	40	17	1	76	20	7	6	1	2	1	Tr		
	(406.4mm x12.70mm x 12.802M)			1310							42200	67600	71300													
										A09870	30.7	49.0	52.4	39	19	1	77	15	8	6	1	2	1	Tr		
											43700	69700	74500													
3 00	20" x .500" x42.000'	3	5,857	74	G	G	G	G	G	A05753	31.2	48.6	51.2	37	18	Tr	75	17	8	6	1	2	1	Tr		
	(508.0mm x12.70mm x 12.802M)			1050							44400	69100	72800													
										A07216	32.0	49.3	52.7	38	18	Tr	76	18	8	6	1	2	1	Tr		
											45500	70100	75000													
	TOTAL ->	227	206,794																							

NOTES 주1 Type of pipe End 관종
- PE : Black Plain End Square-cut — GPE : Galvanized Plain End Square-cut
- PEB : Black Plain End Beveled — GPEB : Galvanized Plain End Beveled
- TC : Black Threaded & Coupled — GTC : Galvanized Threaded & Coupled
- VJ : Black Victaulic Joint — GVJ : Galvanized Victaulic Joint
- TC : Enameled Threaded & Coupled

주2 NB : Normal Bore 호칭경, OD : Outside Diameter
주3 Unit 단위 (M : mm, I : inch)
주4 Unit 단위 (M : Meter, F : Feet, I : Inch)
주5 G : Good
주6 Visual & Dimension Test 외관 및 치수검사
주7 Flattening or Bending Test 편평 또는 굽힘시험
주8 Weld Ductility Test 용접부 연성시험
주9 Nondestructive Test 비파괴검사
주10 Drift Test 확관시험
주11 Flaring Test 확관시험
주12 Crush Test 용압시험
주13 Reverse Flattening Test 역편평시험
주14 B : Base Metal 모재
주15 W : Weld Part 용접부
주16 H : Heat (Ladle) Analysis 용인분석, P : Product Analysis 제품분석

본 제품은 상기규격에 합격되었음을 보증합니다.

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

SURVEYOR

S. H. Kim
INSPECTION MANAGER

검 사 증 명 서 (A)

MILL INSPECTION CERTIFICATE

현 대 강 관 주 식 회 사
HYUNDAI PIPE CO., LTD.
울산공장 울산광역시 중구 염포동 365번지 (우)681-010
ULSAN PLANT : # 365, YUMPO-DONG, JUNG-KU, ULSAN, KOREA
TEL : 87-2101~9 FAX : 052)287-8916
TLX : HDPIPE K 53776
서울사무소 서울특별시 중구 무교동 77번지 (우)100-120
SEOUL OFFICE : # 77, MUKYO-DONG, JUNG-KU SEOUL, KOREA
TEL : 773-0522 FAX : 775-7095
TLX : HDPIPE K 24655, K 27955

증명서 번호 CERTIFICATE No. : E-7-04-226 페이지 PAGE : 1
발행일자 DATE OF ISSUE : APR. 30. 1997. E4702800
계약번호 CONTRACT P.O NO :
품명 COMMODITY : E.R.W. STEEL PIPE
시방규격 SPECIFICATION : API 5LB/ASTM A53B
수요가 CUSTOMER :

U : 10000

종 TYPE	치수 DIMENSION 외경 OUTSIDE DIA. × 두께 THICK. × 길이 LENGTH	수량 QUANTITY PCS	중량 WEIGHT KG	수압시험 HYDRO-STATIC TEST	외관검사 VISUAL & DIMENSION TEST	편평시험 FLATTENING TEST	굽힘시험 BEND TEST	인장시험 TENSILE TEST	충격시험 IMPACT TEST	용접부 경도시험 WELD HARDNESS TEST	코팅검사 COATING TEST 외관검사 VISUAL TEST	코팅두께 COATING THICK.	시방번호 HEAT NO.	인장시험 TENSILE TEST 항복강도 YIELD STRENGTH	인장강도 TENSILE STRENGTH	연신율 EL.	화학성분 CHEMICAL COMPOSITION C	Si	Mn	P	S	Cu	Ni	Cr	Mo	V	충격시험 IMPACT	비고 REMARK
PEB	OD 14" x .375" x21.000'	95	49,418	79	G	G	G	G	G				A08610	34.9	50.0	53.4	36	17	1	76	14	10	6	1	2	1	Tr	
	(355.6mm x 9.53mm x 6.401M)			1120										49800	71100	76000												
													A08613	34.3	48.9	51.0	38	17	1	74	16	8	6	1	2	1	Tr	
														48800	69600	72500												
PEB	OD 14" x .375" x42.000'	97	100.913	79	G	G	G	G	G				A08610	34.9	50.0	53.4	36	17	1	76	14	10	6	1	2	1	Tr	
	(355.6mm x 9.53mm x 12.802M)			1120										49800	71100	76000												
													A08613	34.3	48.9	51.0	38	17	1	74	16	8	6	1	2	1	Tr	
														48800	69600	72500												
PEB	OD 16" x .500" x42.000'	32	50.508	92	G	G	G	G	G				A09163	29.7	47.5	50.1	40	17	1	76	20	7	6	1	2	1	Tr	
	(406.4mm x12.70mm x 12.802M)			1310										42200	67600	71300												
													A09870	30.7	49.0	52.4	39	19	1	77	15	8	6	1	2	1	Tr	
														43700	69700	74500												
PEB	OD 20" x .500" x42.000'	3	5,957	74	G	G	G	G	G				A05753	31.2	48.6	51.2	37	16	Tr	75	17	8	6	1	2	1	Tr	
	(508.0mm x12.70mm x 12.802M)			1060										44400	69100	72800												
													A07216	32.0	49.3	52.7	38	16	Tr	78	18	8	6	1	2	1	Tr	
														45500	70100	75000												
	TOTAL ->	227	206,796																									

NOTES [1] Type of pipe End 관끝

BPE : 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 : Expanded Threaded & Coupled			

[2] NB : Nominal Bore 호칭경, OD : Outside Diameter
[3] Unit 단위 M : Meter, F : Feet, I : Inch.
[4] Flattening or Shearing Test 편평 또는 전단시험
[5] Hardness Test 경도시험
[6] Crush Test 압궤시험
[7] W : Weld Part 용접부
[8] G : Good
[9] Odd Test 특수시험
[10] Reverse Flattening Test 반대편평시험
[11] H : Heat (Ladle) Analysis 용탕분석, P : Product Analysis 제품분석
[12] Unit 단위 M : Metric, I : Inch
[13] Visual & Dimension Test 외관 및 치수검사
[14] Weld Quality Test 용접부 건전성시험
[15] Fusing Test 융착시험
[16] B : Brass Metal 황동

본 제품은 위 규격에 합격하였음을 보증합니다.

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

SUBVEYOR

INSPECTION MANAGER

S-B 701-619-GLT

△ HYUNDAI PIPE CO LTD

USS A division of USX Corporation

CERTIFIED TEST REPORT

(TYPE B - IN ACCORDANCE WITH ISO 10474/EN10204/DIN50049)

MILL OF	ITEM NO.	SHIPPERS NO.	P.O. NUMBER
OIL	40 01		17709

MATERIAL COND: AS-ROLLED

O.D.: 14.000(355.600) in (mm) | WALL: 0.375 (9.525) in (mm)

PRODUCT IDENTIFICATION	FLAT	BEND	GRAIN SIZE	MIN COLLAPSE	CHARPY V-NOTCH IMPACT TESTING											
					DIR	TEST LOC.	TEMP	SIZE	TEST COND.	FT-LBS 1	FT-LBS 2	FT-LBS 3	FT-LBS AVG	% SHEAR 1	% SHEAR 2	% SHEAR 3	% SHEAR AVG
R44950	OK																
R44951	OK																
			** END OF DATA THIS SHEET **														

LEGEND: L - LONGITUDINAL T - TRANSVERSE B - BODY W - WELD HAZ - HEAT AFFECTED ZONE

TESTING / INSPECTION INFORMATION

TEST / INSPECTION	YES	RESULTS / COMMENTS
FULL LENGTH VISUAL	X	
FULL LENGTH EMI	X	OD X OD/ID ____ L X L/T ____
FULL LENGTH MPI		
FULL LENGTH UT		OD ____ OD/ID ____ L ____ L/T ____
END AREA INSPECTION (PLAIN END)		MPI ____ UT ____
SPECIAL END AREA (SEA) INSP.		MPI ____ UT ____
FULL LENGTH DRIFT		DRIFT MANDREL SIZE:
FULL LENGTH UT OF WELD	X	OD OD/ID X L X L/T

ADDITIONAL NOTES/COMMENTS

MANUFACTURING TOOK PLACE IN THE USA. NO REPAIRS BY WELDING. NO MERCURY OR MERCURY COMPOUNDS ARE ADDED TO THE STEEL AND ALL MERCURY BEARING EQUIPMENT IS PROTECTED BY A DOUBLE BOUNDARY OF CONTAINMENT.

THIS IS TO CERTIFY THAT THE PRODUCT DESCRIBED HEREIN WAS MANUFACTURED, SAMPLED, TESTED AND/OR INSPECTED IN ACCORDANCE WITH THE SPECIFICATION AND FULFILLS THE REQUIREMENTS IN SUCH RESPECTS

PREPARED BY THE OFFICE OF F.J. MIKULSKI MGR. MET. & C.A. USS TUBULAR PRODUCTS

DATE 09/05/97

U.S. STEEL GROUP
A division of USX Corporation

CERTIFIED TEST REPORT

(TYPE B - IN ACCORDANCE WITH ISO 10474/EN[illegible]/DIN50049)

MILL ID / ITEM NO.	SHIPPER'S NO.	P.O. NUMBER	RELEASE NO.	
DM20648 01		17709		

SOLD TO ADDRESS	MAIL TO ADDRESS	VENDOR
BARTOW STEEL INC P O BOX 1789 BARTOW FL 33830-1789	BARTOW STEEL INC P O BOX 1789 BARTOW FL 33830-1789	USS TUBULAR PRODUCTS 301 FOURTH AVE. MCKEESPORT, PA 15132

SPECIFICATION AND GRADE

PIPE CARBON EW STD PIPE API 5L-X41ST EDITION DTD 4/1/95 GRADE B/X42 AND ASTM A53-X96 GRADE B TRIPLE STENCIL ASME SA53-X1995 EDITION 1996 ADDENDUM GRADE B BLK REG MILL COAT PE BEV 30 DEG

MATERIAL COND.: AS-ROLLED

O.D.: 14.000 (355.600) in (mm)

WALL: 0.375 (9.525) in (mm)

PRODUCT IDENTIFICATION	TENSILE TEST TYPE/ ORIENTATION	TEST COND.	GAUGE WIDTH IN	YIELD PSI	EXT % .50	TENSILE PSI	Y/T	ELONG % IN 2"	HARDNESS SCALE:	MIN HYDRO PSI	DWELL (SEC)
				MIN: 42000		MIN: 60000	MAX.	MIN 28.0	MIN:	1910	10
				MAX:		MAX:			MAX:		
R44950	STRIP/T/B	AR	1.500	48960	.50	68690	0.71	39.0		1910	10
R44951	STRIP/T/B	AR	1.500	49650	.50	71400	0.70	42.0		1910	10
		**	END OF DATA THIS SHEET **								

LEGEND: L - LONGITUDINAL, U - UPSET; T - TRANSVERSE, N - NORMALIZED; QT - QUENCHED & TEMPERED, SR - STRESS RELIEVED; AR - AS ROLLED; B - BODY; W - WELD

PRODUCT IDENTIFICATION	TYPE		C	MN	P	S	SI	CU	NI	CR	MO	AL	N	V	B	TI	CB	CO				CE.*
R44950	HEAT		20	89	009	007	158	01	01	04	003	032		007								
R44950	PROD		19	91	010	007	154	01	02	04	005	025		003								
R44950	PROD		19	91	009	007	151	01	02	04	008	026		003								
R44951	HEAT		20	89	009	007	159	01	02	04	003	033		008								
R44951	PROD		19	89	009	007	146	01	02	04	007	027		003								
R44951	PROD		19	89	009	006	144	01	02	04	006	028		003								
			** END OF DATA THIS SHEET **																			

*CE. IS BASED ON THE FOLLOWING EQUATION(S).

DECIMAL POSITIONS FOR ELEMENTS ARE INDICATED BY THE LEFT MARGIN, VERTICAL DOTTED LINE OR DECIMAL POINT.

JOE H. FORTSON
V. P. SALES
BARTOW STEEL, INC.
1-800-237-8669
FAX 941-619-8779

NORTH STAR STEEL
Seamless Tubular Products

CERTIFIED TEST REPORT

HEAT NO.: SLN K50420

PRODUCT DESCRIPTION :
6.625 OD 0.562 WALL 36.39 LBS/FT PEB DRL
SEAMLESS HOT ROLLED
GRADE :API 5L X42/B REV. APRIL 1,1995

CUSTOMER :

CUSTOMER ORDER NO.: 192640

CUSTOMER SPEC.:

NSSO MILL ORDER NO.: 0-0037831-6

NSSH W/O NO.:

NSSH LOT NO.:

MECHANICAL PROPERTIES: LONGITUDINAL

SPECIMEN CROSS SECTION			STRENGTH (KSI)		ELONGATION	
WIDTH (IN)	THICK (IN)	AREA (SQIN)	YIELD	TENSILE	GAGE LENGTH	% ELONG
1.468	0.576	0.8456	47.3	75.3	2.0	31.8

COMMENTS
Melted & Manufactured in the USA
This pipe is also manufactured to:
ASTM A106B/C Rev.95 ASTM A530 Rev.96
ASME SA106B/C Rev.95 ASME SA530 Rev.95

CHEMICAL ANALYSIS: NS61 Electromagnetic inspected. Reference Standard was a test joint with 10% OD Longitudinal and Transverse notches.

	C	Mn	P	S	Si	Cu	Ni	Cr	Mo	Sn	Cb	V	Al	Ca	B	Ti	N	CE
HEAT	0.21	0.92	0.006	0.006	0.26	0.22	0.12	0.09	0.03	0.013	<0.003	0.003	0.030	0.0033	<0.0005	<0.005	0.0093	0.41
PRODUCT #1	0.21	0.92	0.005	0.005	0.27	0.21	0.10	0.09	0.03	0.013	<0.003	0.060	0.036	0.0029	<0.0005	<0.005	0.0100	0.41
PRODUCT #2	0.20	0.91	0.005	0.005	0.27	0.21	0.10	0.09	0.03	0.012	<0.003	0.060	0.035	0.0029	<0.0005	<0.005		0.40

HYDROSTATIC TEST (psi): 3000 for 5 seconds minimum.

SUPPLEMENTAL REQUIREMENTS	YES	NO	REMARKS
HARDNESS	X		RB AVG 80
CHARPY IMPCT TST			
FLATTENING TEST	X		PASSED
NACE TEST		X	
JOMINY HARDEN			
GRAIN SIZE			
OTHER			Satisfies NACE MR-01-75

This material has been produced and tested in accordance with the requirements of applicable specifications unless otherwise listed below. We hereby certify that the above test results are representative of those contained in the records of the company. Any modification to this certification as provided by North Star Steel without the expressed written consent of North Star Steel negates the validity of this test report.
North Star Steel is not responsible for the inability of this material to meet specific applications.

SIGNED _____

DATE 01-03-97

APPROVAL: _____

SWORN AND SUBSCRIBED TO BEFORE ME

THIS _____ DAY _____

_____
Notary Public

MY COMMISSION EXPIRES _____

THIS CERTIFICATE IS NOTORIZED ONLY WHEN REQUESTED

V. P. SALES
BARTOW STEEL, INC.
1-800-237-8669
FAX 941-619-8779

NO. H STAR STEEL
Seamless Tubular Products

CERTIFIED TEST REPORT

HEAT NO.: SLN K10212	CUSTOMER :	NSSO MILL ORDER NO.: 0-0036432-0
PRODUCT DESCRIPTION : 6.625 OD 0.562 WALL 36.39 LBS/FT PEB DRL SEAMLESS HOT ROLLED GRADE : API 5L X42/B REV. APRIL 1,1995	CUSTOMER ORDER NO.: 191040	NSSH W/O NO.:
	CUSTOMER SPEC.:	NSSH LOT NO.:

MECHANICAL PROPERTIES: LONGITUDINAL

SPECIMEN CROSS SECTION			STRENGTH (KSI)		ELONGATION	
WIDTH (IN)	THICK (IN)	AREA (SQIN)	YIELD	TENSILE	GAGE LENGTH	% ELONG
1.483	0.550	0.8157	51.1	80.4	2.0	38.5

COMMENTS

Melted & Manufactured in the USA
This pipe is also manufactured to:
ASTM A106B/C Rev.94a ASTM A53B Rev.95
ASME SA106-B/C Rev.93 ASME SA53B Rev.94

CHEMICAL ANALYSIS: NS68 Electromagnetic inspected. Reference Standard was a test joint with 10% OD Longitudinal and Transverse notches.

	C	Mn	P	S	Si	Cu	Ni	Cr	Mo	Sn	Cb	V	Al	Ca	B	Ti	N	CE
HEAT	0.23	0.90	0.007	0.001	0.20	0.17	0.15	0.16	0.04	0.012	<0.003	0.001	0.023	0.0035	<0.0005	0.007	0.0097	0.44
PRODUCT #1	0.24	0.89	0.009	0.002	0.20	0.16	0.11	0.13	0.02	0.010	<0.003	0.002	0.030	0.0057	<0.0005	<0.005	0.0089	0.44
PRODUCT #2	0.22	0.90	0.010	0.002	0.19	0.16	0.13	0.15	0.03	0.011	<0.003	0.003	0.022	0.0035	<0.0005	<0.005		0.42

HYDROSTATIC TEST (psi): 3000 for 5 seconds minimum.

SUPPLEMENTAL REQUIREMENTS	YES	NO	REMARKS
HARDNESS	X		RB AVG 84
CHARPY IMPCT TST			
FLATTENING TEST	X		PASSED
NACE TEST		X	
JOMINY HARDEN			
GRAIN SIZE			
OTHER			Satisfies NACE MR-01-75

This material has been produced and tested in accordance with the requirements of applicable specifications unless otherwise listed below. We hereby certify that the above test results are representative of those contained in the records of the company. Any modification to this certification as provided by North Star Steel without the expressed written consent of North Star Steel negates the validity of this test report.
North Star Steel is not responsible for the inability of this material to meet specific applications.

SIGNED A. F. Wilmith

DATE 1-27-97

APPROVAL

SWORN AND SUBSCRIBED TO BEFORE ME

THIS _____ DAY _____

Notary Public

MY COMMISSION EXPIRES _____

THIS CERTIFICATE IS NOTORIZED ONLY WHEN REQUESTED

V. P. SALES
BARTOW STEEL, INC.
1-800-237-8669
FAX 941-619-8779

NORTH AR STEEL
Seamless Tubular Products

CERTIFIED TEST REPORT

HEAT NO.: SLN J90207	CUSTOMER :	NSSO MILL ORDER NO.: 0-0034545-0
PRODUCT DESCRIPTION : 6.625 OD 0.562 WALL 36.39 LBS/FT PEB DRL SEAMLESS HOT ROLLED GRADE :API 5L X42/B REV. APRIL 1,1995	CUSTOMER ORDER NO.: 187680	NSSH W/O NO.:
	CUSTOMER SPEC.:	NSSH LOT NO.:

MECHANICAL PROPERTIES: LONGITUDINAL

SPECIMEN CROSS SECTION			STRENGTH (KSI)		ELONGATION	
WIDTH (IN)	THICK (IN)	AREA (SQIN)	YIELD	TENSILE	GAGE LENGTH	% ELONG
1.459	0.555	0.8097	51.7	77.7	2.0	34.9

COMMENTS

This pipe is also manufactured to:
ASTM A106B/C Rev.94a ASTM A53B Rev.95
ASME SA106-B/C Rev.93 ASME SA53B Rev.94

Melted and Manufactured in the USA.

CHEMICAL ANALYSIS: NS&B Electromagnetic inspected. Reference Standard was a test joint with 10% OD Longitudinal and Transverse notches.

	C	Mn	P	S	Si	Cu	Ni	Cr	Mo	Sn	Cb	V	Al	Ca	B	Ti	N	CE
HEAT	0.22	0.86	0.012	0.004	0.21	0.19	0.09	0.11	0.02	0.013	<0.003	0.002	0.038	0.0032	<0.0005%	<0.005	0.0067	0.41
PRODUCT #1	0.24	0.86	0.012	0.004	0.21	0.20	0.09	0.11	0.02	0.010	0.003	0.001	0.036	0.0017	<0.0005%	<0.005	0.0073	0.43
PRODUCT #2	0.24	0.85	0.012	0.004	0.21	0.19	0.09	0.11	0.02	0.010	0.003	0.002	0.035	0.0016	<0.0005%	<0.005	0.0089	0.43

HYDROSTATIC TEST (psi): 3000 for 5 seconds minimum.

SUPPLEMENTAL REQUIREMENTS	YES	NO	REMARKS
HARDNESS	X		RB AVG 82
CHARPY IMPCT TST			
FLATTENING TEST	X		PASSED
NACE TEST		X	
JOMINY HARDEN			
GRAIN SIZE			
OTHER			Satisfies NACE MR-01-75

This material has been produced and tested in accordance with the requirements of applicable specifications unless otherwise listed below. We hereby certify that the above test results are representative of those contained in the records of the company. Any modification to this certification as provided by North Star Steel without the expressed written consent of North Star Steel negates the validity of this test report.
North Star Steel is not responsible for the inability of this material to meet specific applications.

SIGNED Jeff Schultz

DATE 9-24-96

APPROVAL

SWORN AND SUBSCRIBED TO BEFORE ME

THIS _____ DAY _____

Notary Public

MY COMMISSION EXPIRES _____

THIS CERTIFICATE IS NOTORIZED ONLY WHEN REQUESTED

Appendix F

Cement Records for ASR-1

MONTGOMERY WATSON

ASR-1 CEMENTING RECORD

CITY OF FORT LAUDERDALE FIVEASH WTP ASR WELL SYSTEM

JOB NUMBER 1324007.28090290

CONTRACTOR: Youngquist Brothers, Inc.

BID ITEM: _____

CASING SIZE: 26-inch, 16-inch, and plug-back

ATTACH ALL CALCULATION SHEETS

A	B	C	D	E	F	G	H	I	J	K	L	M
DATE	STAGE NO.	CEMENT (ADDITIVES, BLENDS, MIXTURES)	YIELD (FT³/SK)	QUANTITY PUMPED (FT³)	THEORETICAL FILL INTERVAL	THEORETICAL FILL FOOTAGE	TAG DEPTH PAD LEVEL	ACTUAL FILL INTERVAL	ACTUAL FILL FOOTAGE	PERCENT FILLED J/G x 100	CUMULATIVE TOTAL (FT³)	INSPECTOR'S INITIALS
12/3/97	1	Neat none	1.18	539	198-0	198	20	198-20	178	90	539	NAJ
12/16/97	1	4% Gel / Neat	1.52/1.18	1,168 / 730	1,065-0	1,065		1,065-			1,898	NAJ
12/18/97	2	4% Gel	1.52	112	-0			-0			2,010	
12/27/97	1	Neat none	1.18	129	1,300-1,200	100	1,226	1,300-1,226	74	74	129	NAJ
12/28/97	2	Neat none	1.18	45	1,226-1,200	26	1,183	1,226-1,183	43	165	174	NAJ

MONTGOMERY WATSON

ASR-1 CEMENT PUMPING DATA

DATE(S): 12/3/97

CITY OF FORT LAUDERDALE **FIVEASH WTP ASR WELL SYSTEM**

JOB NUMBER 1324007.28090290

CONTRACTOR: Youngquist Brothers, Inc.

PROJECT MANAGER: Anne M. Murray

COUNTY: Broward **DESCRIPTION OF OPERATIO** Cement 26-inch casing
OWNER: City of Ft. Lauderdale

CONTRACTOR: FCI **INITIAL READINGS:** 0
START TIME: 11:05 (HEADER PRESSURE)
FINISH TIME: 11:38
STAGE NUMBER: 1 **THEORETICAL PRESSURES:**
(CEMENT/ COLLAPSE)

TIME	TOTAL MINUTES	HEADER PRESSURE	LBS/ GAL	BAR/ MIN	TOTAL BARRELS	TOTAL FT³	COMMENTS
11:05	0				0		Begin cementing
11:13	0:08	22	15.4	2.75	25	140.4	Neat
11:15	0:10	28	15.6	2.9	41	230.2	
11:18	0:13	36	15.6	2.9	49	275.1	
11:20	0:15	40	15.4	2.9	56	314.4	
11:22	0:17	44					Air leaking at connection
11:24	0:19	46	15.3	2.9	68	381.8	
11:25	0:20	48					Leak stopped
11:26	0:21	50					Mud returns
11:28	0:23	52	15.6	2.9	80	449.2	
11:31	0:26	54	15	2.9	89	499.7	
11:32	0:27				90	505.3	Emptying hopper
11:33	0:28	48					Flushing hose onto pad
11:36	0:31	48		0	96	539.0	End cementing
11:36	0:31		8.8	3.8	96	539.0	Begin chase

Observer's initials NAJ

TIME	TOTAL MINUTES	HEADER PRESSURE	LBS/ GAL	BAR/ MIN	TOTAL BARRELS	TOTAL FT^3	COMMENTS
11:37	0:32				98.5	553.0	End chase - 2.5 bbl
11:38	0:33	47					No cement returns will tag
							at 1600 hours

Observer's initials NAJ

MONTGOMERY WATSON

ASR-1 CEMENT PUMPING DATA

DATE(S): 12/16/97

CITY OF FORT LAUDERDALE FIVEASH WTP ASR WELL SYSTEM

JOB NUMBER 1324007.28090290

CONTRACTOR: Youngquist Brothers, Inc.

PROJECT MANAGER: Anne M. Murray

COUNTY: Broward
OWNER: City of Ft. Lauderdale

DESCRIPTION OF OPERATIO: Cement 16-inch casing
2-3/8-inch cement tubing to 1031 feet (17 stands)

CONTRACTOR: FCI
START TIME: 21:43
FINISH TIME: 23:08
STAGE NUMBER: 1

INITIAL READINGS: 0
(HEADER PRESSURE)

THEORETICAL PRESSURES:
(CEMENT/ COLLAPSE)

TIME	TOTAL MINUTES	HEADER PRESSURE	LBS/ GAL	BAR/ MIN	TOTAL BARRELS	TOTAL FT³	COMMENTS
21:25							Pre-flush with 15 bbl water
21:43							Begin flush 5 barrel
21:47	0	0					Begin cementing 4%
21:50	0:03	10					
21:54	0:07	10	14	5			
21:56	0:09	20	14.2	4.5			
21:59	0:12	30					
22:02	0:15	50	14.2	5	61	342.5	
22:04	0:17						
22:06	0:19	70	14.2	4.75	80	449.2	
22:11	0:24	90	14.1	4.75	98	550.2	
22:18	0:31	130	14.3	4.75	130	729.9	
22:21	0:34	150	14.2	5	150	842.2	
22:25	0:38	170	14.2	5	170	954.5	
22:29	0:42	180	14.1	5	188	1055.5	

Observer's initials NAJ

TIME	TOTAL MINUTES	HEADER PRESSURE	LBS/ GAL	BAR/ MIN	TOTAL BARRELS	TOTAL FT³	COMMENTS
22:30	0:43	190	14.2	5	197	1106.1	
22:31	0:44	200			208	1167.8	Switch from 4% to neat
22:37	0:50	230	15.6	4	227	1274.5	
22:39	0:52	240	15.7	4	239	1341.9	
22:41	0:54	250	15.7	4	249	1398.0	
22:43	0:56	260	15.6	4	256	1437.3	
22:45	0:58	270	15.6	4	265	1487.9	
22:47	1:00	280	15.6	4	274	1538.4	
22:50	1:03	290	15.6	4	285	1600.2	
22:54	1:07	300	15.6	4	300	1684.4	
22:58	1:11	310	15.6	4	310	1740.5	
22:59	1:12	311	15.6	4	320	1796.7	
23:01	1:14	320	15.6	4	330	1852.8	
23:03	1:16						
23:05	1:18	330			338	1897.7	Stop cement shut-in = 280 psi
23:07	1:20	240					
23:08	1:21				343	1925.8	Chase 5.2 barrel
23:24	1:37	215					
23:32	1:45	205					
							4% 208 bbl 1166 ft^3 767 sacks
							neat 135 bbl 757 ft^3 641 sacks

Observer's initials NAJ

WRTC009 (REV 06/29/94)

PAGE 2 OF 2

MONTGOMERY WATSON

ASR-1 CEMENT PUMPING DATA

DATE(S): 12/27/97

CITY OF FORT LAUDERDALE FIVEASH WTP ASR WELL SYSTEM

JOB NUMBER 1324007.28090290

CONTRACTOR: Youngquist Brothers, Inc.

PROJECT MANAGER: Anne M. Murray

COUNTY: Broward **DESCRIPTION OF OPERATIO** Plug-back pilot hole from 1,300 to 1,200
OWNER: City of Ft. Lauderdale

CONTRACTOR: FCI **INITIAL READINGS:** N/A
START TIME: 12:55 (HEADER PRESSURE)
FINISH TIME: 13:00
STAGE NUMBER: 1 **THEORETICAL PRESSURES:**
(CEMENT/ COLLAPSE)

TIME	TOTAL MINUTES	HEADER PRESSURE	LBS/ GAL	BAR/ MIN	TOTAL BARRELS	TOTAL FT^3	COMMENTS
12:40	0	N/A					Flushing Line
12:48		N/A			5		Flushing Tubing
12:55	0	N/A	15.6		0		Begin Pumping Neat
12:56	1	N/A	15.6	5	5		Raising and Lowering Tremie
12:57	2	N/A	15.6	5	10		Raising and Lowering Tremie
13:00	5	N/A	15.6	5	23		End Pumping Cement
13:01	6	N/A	15.6				Begin Chase
13:03	8	N/A	15.6				End Chase 5.5 bbl

Observer's initials _____

WRTC009 (REV 06/29/94)

PAGE ___ OF ___

WRTC_CEMENTING WORKSHEET (REV 4/16/97)

MONTGOMERY WATSON

ASR-1 CEMENT PUMPING DATA

DATE(S): 12/28/97

CITY OF FORT LAUDERDALE — FIVEASH WTP ASR WELL SYSTEM

JOB NUMBER 1324007.28090290

CONTRACTOR: Youngquist Brothers, Inc.

PROJECT MANAGER: Anne M. Murray

COUNTY: Broward
OWNER: City of Ft. Lauderdale

DESCRIPTION OF OPERATIONS: Plug-back pilot hole from 1,226 to 1,200

CONTRACTOR: FCI
START TIME: 11:52
FINISH TIME: 11:54
STAGE NUMBER: 2

INITIAL READINGS: N/A
(HEADER PRESSURE)

THEORETICAL PRESSURES:
(CEMENT/ COLLAPSE)

TIME	TOTAL MINUTES	HEADER PRESSURE	LBS/ GAL	BAR/ MIN	TOTAL BARRELS	TOTAL FT^3	COMMENTS
11:48	0	N/A					Begin Pre-flush
11:52	0	N/A	15.6	5	0	0	Begin Pumping Neat
11:54	2	N/A	15.6	5	8	44.9	End Pumping Cement
11:54							Begin Chase
11:55							End Chase 5.5 bbl

Observer's initials _____

Cement Records for FMW-1

MONTGOMERY WATSON

FMW-1 CEMENT PUMPING DATA

DATE(S): 1/7/98

CITY OF FORT LAUDERDALE **FIVEASH WTP ASR WELL SYSTEM**

JOB NUMBER 1324007.28090290

CONTRACTOR: Youngquist Brothers, Inc.

PROJECT MANAGER: Anne M. Murray

COUNTY: Broward **DESCRIPTION OF OPERATIO** Cement 14-inch casing

OWNER: City of Ft. Lauderdale from 370 ft bpl to surface (T=1,100 ft^3 = 196 bbl)

CONTRACTOR: FCI **INITIAL READINGS:** 0

START TIME: 1:19 (HEADER PRESSURE)

FINISH TIME: 1:58

STAGE NUMBER: 1 **THEORETICAL PRESSURES:**

(CEMENT/ COLLAPSE)

TIME	TOTAL MINUTES	HEADER PRESSURE	LBS/ GAL	BAR/ MIN	TOTAL BARRELS	TOTAL FT^3	COMMENTS
01:10	0	0			0		Pre-flush with 16 bbl water
01:18	0	0			16		End Pre-flush
01:19	0	0			0		Begin cementing 4%
01:21	0:02	0	14.2	5	6		
01:24	0:05	3.5	14.2	5	25		
01:27	0:08	10					
01:28	0:09	15	14.2	6	47		
01:29	0:10	20					
01:32	0:13	30	14.2	6	68		
01:34	0:15	40					
01:36	0:17	45			90		End 4% - Switching to Neat
01:38	0:19	50					
01:40	0:21	60	15.7	4.25	109		
01:43	0:24	70	15.7	4.25	124		
01:46	0:27	80	15.7	3.5	137		

Observer's initials NAJ

TIME	TOTAL MINUTES	HEADER PRESSURE	LBS/ GAL	BAR/ MIN	TOTAL BARRELS	TOTAL FT^3	COMMENTS
01:52	0:33	90	15.7	4.25	152	853.4	
01:55	0:36	100	15.7	4	167	937.6	
01:58	0:39	105	15.7		186	1044.3	Cement Returns/End Cementing
01:58	0:39	105			0	0.0	Begin Chase
02:00	0:41	110			5	28.1	End Chase/Shut-in

Observer's initials NAJ

MONTGOMERY WATSON

FMW-1 CEMENT PUMPING DATA

DATE(S): 1/22/98

CITY OF FORT LAUDERDALE **FIVEASH WTP ASR WELL SYSTEM**

JOB NUMBER 1324007.28090290

CONTRACTOR: Youngquist Brothers, Inc.

PROJECT MANAGER: Anne M. Murray

COUNTY: Broward **DESCRIPTION OF OPERATIO** Cement 6-inch casing
OWNER: City of Ft. Lauderdale cement basket w/ tremie

CONTRACTOR: FCI **INITIAL READINGS:** 0
START TIME: (HEADER PRESSURE)
FINISH TIME:
STAGE NUMBER: 1 **THEORETICAL PRESSURES:**
(CEMENT/ COLLAPSE)

TIME	TOTAL MINUTES	HEADER PRESSURE	LBS/ GAL	BAR/ MIN	TOTAL BARRELS	TOTAL FT^3	COMMENTS
17:20	5		15.6		1	5.6	Neat

MRS

PAGE 1 OF 1

MONTGOMERY WATSON

FMW-1 CEMENT PUMPING DATA

DATE(S): 1/23/98

CITY OF FORT LAUDERDALE **FIVEASH WTP ASR WELL SYSTEM**

JOB NUMBER 1324007.28090290

CONTRACTOR: Youngquist Brothers, Inc.

PROJECT MANAGER: Anne M. Murray

COUNTY: Broward **DESCRIPTION OF OPERATIO** Cement 6-inch casing
OWNER: City of Ft. Lauderdale initial tag at 1,030 ft bpl

CONTRACTOR: FCI
START TIME: 8:40
FINISH TIME: 8:45
STAGE NUMBER: 2

INITIAL READINGS: 0
(HEADER PRESSURE)

THEORETICAL PRESSURES:
(CEMENT/ COLLAPSE)

TIME	TOTAL MINUTES	HEADER PRESSURE	LBS/ GAL	BAR/ MIN	TOTAL BARRELS	TOTAL FT³	COMMENTS
08:40			15.6		10	56.1	Neat
08:44					4		Chase

MRS

PAGE 1 OF 1

MONTGOMERY WATSON

FMW-1 CEMENT PUMPING DATA

DATE(S): 1/22/98

CITY OF FORT LAUDERDALE FIVEASH WTP ASR WELL SYSTEM

JOB NUMBER 1324007.28090290

CONTRACTOR: Youngquist Brothers, Inc.

PROJECT MANAGER: Anne M. Murray

COUNTY: Broward
OWNER: City of Ft. Lauderdale

DESCRIPTION OF OPERATIO: Cement 6-inch casing
cement top log = 960 tag = 924

CONTRACTOR: FCI
START TIME: 15:54
FINISH TIME: 16:50
STAGE NUMBER: 3

INITIAL READINGS: 0
(HEADER PRESSURE)

THEORETICAL PRESSURES:
(CEMENT/ COLLAPSE)

TIME	TOTAL MINUTES	HEADER PRESSURE	LBS/ GAL	BAR/ MIN	TOTAL BARRELS	TOTAL FT³	COMMENTS
15:54					0	0	Begin pumping Neat
16:00	00:06		15.7	4.9	24	134.7	
16:04	00:10		15.7	5	48	269.5	
16:05	00:11				48	269.5	Pulling 4 stands tremie pipe
16:15	00:21				48	269.5	Resume pumping cement
16:17	00:23		15.8	4.9	52	292.0	
16:24	00:30		15.7	4.9	105	589.5	
16:45	00:51		15.7	4.9	144	808.5	End cement - Begin chase

MRS

Appendix G

Core Descriptions and Analyses

MONTGOMERY WATSON

WELL # ASR-1 CORE DESCRIPTION

DATE(S): 12/6/97

CITY OF FORT LAUDERDALE - FIVEASH WTP ASR WELL

JOB NUMBER 1324007
COST CODE 28090290

CONTRACTOR: Youngquist

TOTAL DEPTH:	959	feet
COUNTY:	Broward	
OWNER:	City of Fort Lauderdale	
DRILLING METHOD:	Carbide Aggressive Drilling	
DRILLER(S):	Ronnie Thames	
DATUM POINT:	Pad level	
DATUM POINT ELEVATION:	8.0 NGVD	
HYDROLOGIC UNITS:	Upper Floridan	
% RECOVERY	10 %	
CORED INTERVAL	949 - 959	

DEPTH (feet below pad)			DEPTH INTERVAL	DESCRIPTION	DRILLING COMMENTS
949	to	950	1	Limestone, argillaceous , Limestone is medium gray to white, poor to moderately indurated, succrosic mudstones and wackestones. Porosity is inter-granular and low. Grains include trace fossil debris, and peloids, abundant phosphate is present.	Penetration rate = 2 minute/foot. Weight on bit = 2 K. RPM of kelly = 30. Pump pressure held at a constant of 65 psi.
950	to	959	9	NO RECOVERY	Penetration rate = 30 seconds/foot. Weight on bit = 0 K. RPM of kelly = 30. Pump pressure held at a constant of 85 psi.

Description by M.R.S

MONTGOMERY WATSON

WELL # ASR-1 CORE DESCRIPTION

DATE(S): 12/7/97

CITY OF FORT LAUDERDALE - FIVEASH WTP ASR WELL

JOB NUMBER 1324007
COST CODE 28090290

CONTRACTOR: Youngquist

TOTAL DEPTH:	986	feet
COUNTY:	Broward	
OWNER:	City of Fort Lauderdale	
DRILLING METHOD:	Carbide Aggressive Drilling	
DRILLER(S):	Ronnie Thames	
DATUM POINT:	Pad level	
DATUM POINT ELEVATION:	8.0 NGVD	
HYDROLOGIC UNITS:	Upper Floridan	
% RECOVERY	10 %	
CORED INTERVAL	974 - 986 ASR-2 x	

DEPTH (feet below pad)			DEPTH INTERVAL	DESCRIPTION	DRILLING COMMENTS
974	to	975	1	Limestone, limestone is light gray to white, well indurated, mudstone to wackestone. Porosity is inter-granular and moldic. Permeability is low. Grains include fossil debris, and peloids, minor phosphate is present.	Penetration rate = 5 minute/foot. Weight on bit = 2 K. RPM of kelly = 30. Pump pressure held at a constant of 70 psi.
975	to	986	9	NO RECOVERY	Penetration rate = 30 seconds/foot. Weight on bit = 0 K. RPM of kelly = 30. Pump pressure held at a constant of 85 psi.

Description by M.R.S

MONTGOMERY WATSON

WELL # ASR-1 CORE DESCRIPTION

DATE(S): 12/8/97

CITY OF FORT LAUDERDALE - FIVEASH WTP ASR WELL

JOB NUMBER 1324007
COST CODE 28090290

CONTRACTOR: Youngquist

TOTAL DEPTH:	1022	feet
COUNTY:	Broward	
OWNER:	City of Fort Lauderdale	
DRILLING METHOD:	Carbide Aggressive Drilling	
DRILLER(S):	Ronnie Thames	
DATUM POINT:	Pad level	
DATUM POINT ELEVATION:	8.0 NGVD	
HYDROLOGIC UNITS:	Upper Floridan	
% RECOVERY	85 %	
CORED INTERVAL	1008 - 1022 ASR-3 ✓	

DEPTH (feet below pad)			DEPTH INTERVAL	DESCRIPTION	DRILLING COMMENTS
1008	to	1017	8	Limestone, white to medium gray, moderately indurated boundstones to wackstones, locally grades to packstone and grainstone. Contains phosphate nodules. Some bioclasts are represented as moldic porosity, and high secondary porosity and permeability are present (intergranular, interparticle and moldic). Locally the rock is recrystalized. Well indurated, and contains coarse spar cement (reducing). Biotics include reef fauna assemblage (diverse mollusk, foram, bryozoan, corals).	Penetration rate = 5 minute/foot. Weight on bit = 2-4 K. RPM of kelly = 30. Pump pressure held at a constant of 70 psi.
1017	to	1022	5	NO RECOVERY	Penetration rate = 30 seconds/foot. Weight on bit = 0 K. RPM of kelly = 30. Pump pressure held at a constant of 85 psi.

Description by M.R.S

MONTGOMERY WATSON

WELL # FMW-1 CORE DESCRIPTION

DATE(S): 1/19/98

CITY OF FORT LAUDERDALE - FIVEASH WTP ASR WELL

JOB NUMBER 1324007
COST CODE 28090290

CONTRACTOR: Youngquist

TOTAL DEPTH:	1102	feet
COUNTY:	Broward	
OWNER:	City of Fort Lauderdale	
DRILLING METHOD:	Diamond Drilling	
DRILLER(S):	Jay Swartzentruber	
DATUM POINT:	Pad level	
DATUM POINT ELEVATION:	8.0 NGVD	
HYDROLOGIC UNITS:	Upper Floridan	
% RECOVERY	75 %	
CORED INTERVAL	1090-1102 FMW-2 ✓	

DEPTH (feet below pad)			DEPTH INTERVAL	DESCRIPTION	DRILLING COMMENTS
1090	to	1097.5	7.5	LIMESTONE: Color: very pale orange, Texture: packstone, Grains: minor quartz sand - mollusca and foraminifera. Cement/Matrix: calcite with recrystallized limemud matrix, poorly cemented. Porosity: moderate. Permeability: moderate. Hardness: moderately soft. Fossils: abundant forams, all are recrystallized and filled with cement.	Penetration rate = 5 minute/foot. Weight on bit = 2-4 K. RPM of kelly = 30. Pump pressure held at a constant of 70 psi.
1097.5	to	1100	2.5	NO RECOVERY	Penetration rate = 30 seconds/foot. Weight on bit = 0 K. RPM of kelly = 30. Pump pressure held at a constant of 85 psi.

Description by M.R.S

MONTGOMERY WATSON

WELL # ASR-1 CORE DESCRIPTION

DATE(S): 1/19/98

CITY OF FORT LAUDERDALE - FIVEASH WTP ASR WELL

JOB NUMBER 1324007
COST CODE 28090290

CONTRACTOR: Youngquist

TOTAL DEPTH:	1136	feet
COUNTY:	Broward	
OWNER:	City of Fort Lauderdale	
DRILLING METHOD:	Carbide Aggressive Drilling	
DRILLER(S):	Ronnie Thames	
DATUM POINT:	Pad level	
DATUM POINT ELEVATION:	8.0 NGVD	
HYDROLOGIC UNITS:	Upper Floridan	
% RECOVERY	40 %	
CORED INTERVAL	1126 - 1136 ASR-4	

DEPTH (feet below pad)			DEPTH INTERVAL	DESCRIPTION	DRILLING COMMENTS
1126	to	1130	4	LIMESTONE: Color: very pale orange, Texture: wackestone, Grains: minor quartz sand and foraminifera. Cement/Matrix: calcite with recrystallized limemud matrix, poorly cemented. Porosity: moderate. Permeability: moderate. Hardness: moderately soft. Fossils: abundant forams, all are recrystallized and filled with cement.	Penetration rate = 5 minute/foot. Weight on bit = 2-4 K. RPM of kelly = 30. Pump pressure held at a constant of 70 psi.
1130	to	1136	6	NO RECOVERY	Penetration rate = 30 seconds/foot. Weight on bit = 0 K. RPM of kelly = 30. Pump pressure held at a constant of 85 psi.

Description by M.R.S

MONTGOMERY WATSON

WELL # FMW-1 CORE DESCRIPTION

DATE(S): 1/19/98

CITY OF FORT LAUDERDALE - FIVEASH WTP ASR WELL

JOB NUMBER 1324007
COST CODE 28090290

CONTRACTOR: Youngquist

TOTAL DEPTH:	1005	feet
COUNTY:	Broward	
OWNER:	City of Fort Lauderdale	
DRILLING METHOD:	Diamond Drilling	
DRILLER(S):	Jay Swartzentruber	
DATUM POINT:	Pad level	
DATUM POINT ELEVATION:	8.0 NGVD	
HYDROLOGIC UNITS:	Upper Floridan	
% RECOVERY	55 %	
CORED INTERVAL	993-1005 FMW-2 ✓	

DEPTH (feet below pad)			DEPTH INTERVAL	DESCRIPTION	DRILLING COMMENTS
993	to	995	2.0	SANDY LIMESTONE: Color: white matrix with clear to black grains, Matrix is recrystalized lime mud, Grains: sand size grains of quarts and phosphate, Fossils: porities - finger to stag horn, Porosity is interparticulate, Permeability is low. Unit is poorly indurated. Unit contains large rip-ups of above unit (Walthers Law).	Penetration rate = 5 minute/foot. Weight on bit = 2-4 K. RPM of kelly = 30. Pump pressure held at a constant of 70 psi.
995	to	998.5	3.5	LIMESTONE. white to medium gray, moderately indurated boundstones to wackstones, locally grades to packstone and grainstone. Contains phosphate nodules. Some bioclasts are represented as moldic porosity, and high secondary porosity and permeability are present (intergranular, interparticle and moldic). Locally the rock is recrystalized. Well indurated, and contains coarse spar cement (reducing). Biotics include reef fauna assemblage (diverse mollusk, foram, bryozoan, corals).	Penetration rate = 5 minute/foot. Weight on bit = 2-4 K. RPM of kelly = 30. Pump pressure held at a constant of 70 psi.
998.5	to	1003	4.5	NO RECOVERY	Penetration rate = 30 seconds/foot. Weight on bit = 0 K. RPM of kelly = 30. Pump pressure held at a constant of 85 psi.

Description by M.R.S

MONTGOMERY WATSON

WELL # FMW-1 CORE DESCRIPTION

DATE(S): 1/19/98

CITY OF FORT LAUDERDALE - FIVEASH WTP ASR WELL

JOB NUMBER 1324007
COST CODE 28090290

CONTRACTOR: Youngquist

TOTAL DEPTH:	974 feet
COUNTY:	Broward
OWNER:	City of Fort Lauderdale
DRILLING METHOD:	Diamond Drilling
DRILLER(S):	Jay Swartzentruber
DATUM POINT:	Pad level
DATUM POINT ELEVATION:	8.0 NGVD
HYDROLOGIC UNITS:	Upper Floridan
% RECOVERY	55 %
CORED INTERVAL	963-974 FMW-1 ✓

DEPTH (feet below pad)			DEPTH INTERVAL	DESCRIPTION	DRILLING COMMENTS
963	to	963.5	0.5	SANDY LIMESTONE: Color: white matrix with clear to black grains, Matrix is recrystalized lime mud, Grains: sand size grains of quarts and phosphate, Fossils: porities - finger to stag horn, Porosity is interparticulate, Permeability is low. Unit is poorly indurated.	Penetration rate = 5 minute/foot. Weight on bit = 2-4 K. RPM of kelly = 30. Pump pressure held at a constant of 70 psi.
963.5	to	963.8	0.3	LIMESTONE: Color: very pale orange, Framestone - colonial antillophyllia, septa have been reduced by dissolution, porosity is integranular, solution enhanced and sediment filled. Permebility is low, moderately hard.	Penetration rate = 2 minuet/foot. Weight on bit = 2 K. RPM of kelly = 30. Pump pressure held at a constant of 85 psi.
963.8	to	966	2.2	LIMESTONE: Grainstone, Color: white, unit is recrystalized. Porosity is moderate and highly altered - precipitation of dog-tooth is present, Permeability: is low to moderate, Moderately hard. unit contains mollusca - cnidarians -kuphus - and bryzoans.	Penetration rate = 3 minuets/foot. Weight on bit = 2 K. RPM of kelly = 30. Pump pressure held at a constant of 85 psi.
966	to	967	1.0	LIMESTONE: Color: very pale orange, Texture: wackestone. Grains: minor quartz sand and foraminifera. Cement/Matrix: calcite with recrystallized limemud matrix, poorly cemented. Porosity: moderate. Permeability: moderate. Hardness: moderately soft. Fossils: abundant mollusca, all are recrystallized and filled with cement.	Penetration rate = 2 minuets/foot. Weight on bit = 2 K. RPM of kelly = 30. Pump pressure held at a constant of 85 psi.

Description by M.R.S

967	to	968.5	1.5	LIMESTONE: Color: very gray to tan, Texture: packstone, Grains: minor quartz sand, lithic fragments, and mollusca . Cement/Matrix: calcite with recrystallized limemud matrix, poorly cemented. Porosity: low - moldic. Permeability: low. Hardness: very hard. Fossils: abundant mollusca, kuphus all are recrystallized some filled with sediment.	Penetration rate = 4-5 minuets/foot. Weight on bit = 2 K. RPM of kelly = 30. Pump pressure held at a constant of 85 psi.
968.5	to	973	4.5	NO RECOVERY	Penetration rate = 30 seconds/foot. Weight on bit = 0 K. RPM of kelly = 30. Pump pressure held at a constant of 85 psi.

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

May 18, 1998
File Number 98-050

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

Attention: Mr. JAY SWARTZENTRUBER
Drilling Superintendent

RECEIVED MAY 20 1998

Subject: Laboratory Test Results on Rock Core Specimens, Fort Lauderdale Five-Ash ASR Well and Floridan Monitor Well

Gentlemen:

Permeability, unconfined compression and specific gravity tests have been completed on seven rock core samples provided by your firm from the Fort Lauderdale Five-Ash ASR Well and Floridan Monitor Well. 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 the constant-head (Method A) and falling-head with increasing tailwater level (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, each of the requested tests (i.e., vertical permeability test, horizontal permeability test and unconfined compression test) could not 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 7.6 to 15.3 cm. After completing the vertical permeability tests, horizontal permeability specimens were obtained by coring 5.1 cm diameter cylinders from the vertical specimens. The horizontal specimens were then trimmed to lengths of 6.6 to 7.8 cm to provide flat, parallel ends. Since the vertical permeability test specimens were cored upon completion of testing to obtain horizontal permeability test specimens, the final moisture contents of the vertical specimens were not measured. The dry densities and degrees of saturation of the vertical permeability specimens, therefore, were estimated using the final moisture contents from the corresponding horizontal permeability specimens.

The permeability test specimens were 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 back-pressures of 80 to 170 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 hydraulic conductivity 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 hydraulic

conductivity 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 specimens from the corresponding horizontal permeability 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

Unconfined compression tests were performed on three samples. The tests were performed on specimens cored to diameters of 3.3 to 5.1 cm and trimmed to lengths of 7.5 to 10.4 cm to provide a length to diameter ratio of approximately 2, and then capped with a sulfur capping compound. The specimens were loaded at a 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., P.E.
Geotechnical Engineer

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

SA/TSI/jo

cc: Montgomery Watson
M. Randal Skinner
(FAX 561-586-8834)

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Table 1

PERMEABILITY TEST RESULTS
FORT LAUDERDALE FIVE-ASH ASR WELL AND FLORIDAN MONITOR WELL

Core Depth (feet)	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			Hydraulic Conductivity, k_{20} (cm/sec)
				Length (cm)	Diameter (cm)	w_c (%)	γ_d (lb/ft^3)	n					w_c (%)	γ_d (lb/ft^3)	S (%)	
ASR-3 1014	Vertical Horizontal	A A	2.72	8.86 7.84	10.04 5.11	9.1 9.1	128.8 128.7	0.24 0.24	20 20	70 80	95 89*	0.2 10.5	9.9† 9.9	128.8 128.7	85 85	4.7×10^{-3} 5.1×10^{-5}
ASR-6 1238	Vertical Horizontal	C C	2.69	8.85 6.59	8.71 4.98	25.1 25.1	98.5 99.8	0.41 0.41	20 20	80 80	98 96	2.1 2.7	25.1† 25.1	98.5 99.8	96 99	1.2×10^{-4} 9.6×10^{-5}
ASR-7 1285	Vertical Horizontal	C C	2.70	15.32 6.58	9.32 4.95	25.7 25.7	97.7 97.2	0.42 0.42	20 20	80 80	85* 95	1.1 2.8	25.7† 25.7	97.7 97.2	96 95	9.4×10^{-4} 1.6×10^{-3}
FMW-1 965	Vertical Horizontal	A A	2.71	8.83 7.05	9.97 5.10	13.7 13.8	118.6 120.1	0.30 0.29	20 20	170 80	91* 97	7.5 14.8	13.8† 13.8	118.6 120.1	88 91	5.9×10^{-5} 3.6×10^{-5}
FMW-2 998	Vertical Horizontal	C C	2.69	7.64 7.19	9.78 5.04	22.1 22.1	102.1 98.9	0.39 0.41	20 20	80 80	92* 98	2.1 2.4	22.1† 22.1	102.1 98.9	92 85	5.1×10^{-4} 1.5×10^{-3}
FMW-2 999	Vertical Horizontal	C C	2.70	12.53 7.23	9.69 4.97	22.1 22.1	101.6 98.3	0.40 0.42	20 20	80 80	95 100	1.3 2.5	22.1† 22.1	101.6 98.3	91 83	1.2×10^{-3} 1.2×10^{-3}
FMW-3 1095	Vertical Horizontal	C C	2.69	9.78 7.48	9.93 4.97	25.6 26.1	90.8 90.2	0.46 0.46	20 20	80 80	91* 97	1.7 2.5	26.1† 26.1	90.8 90.2	83 81	1.4×10^{-3} 1.8×10^{-3}

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; S = Calculated degree of saturation using measured specific gravity; and k_{20} = Hydraulic conductivity at 20°C.

* 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 test specimen. The final moisture content of the vertical test specimen was not measured, and was assumed to be the same as the horizontal test specimen.

Table 2

UNCONFINED COMPRESSION TEST RESULTS
FORT LAUDERDALE FIVE-ASH ASR WELL AND FLORIDAN MONITOR WELL

Core Depth (feet)	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*	
ASR-3 1014	7.48	3.27	2.29	1.1	130.3	.0.0076	4.1	2057	2089	7.0×10^5
ASR-6 1238	9.95	5.10	1.95	11.8	100.5	0.0076	4.6	565	563	2.2×10^5
FMW-3 1095	10.43	5.07	2.06	13.8	100.3	0.0076	4.0	343	344	1.3×10^5

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 2938-86.
** Young's modulus calculated from the slope of the straight-line portion of the stress-strain curve.

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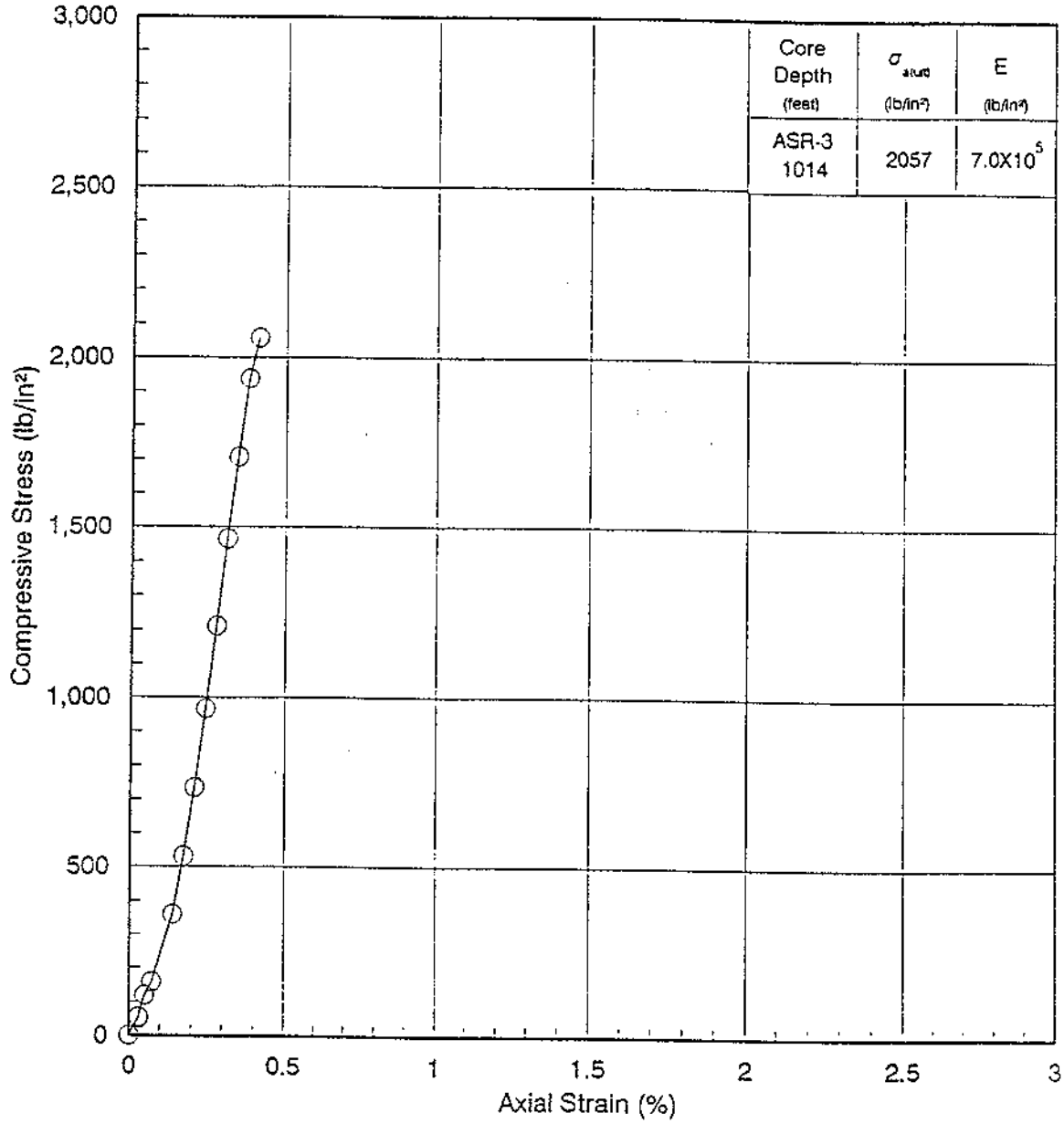


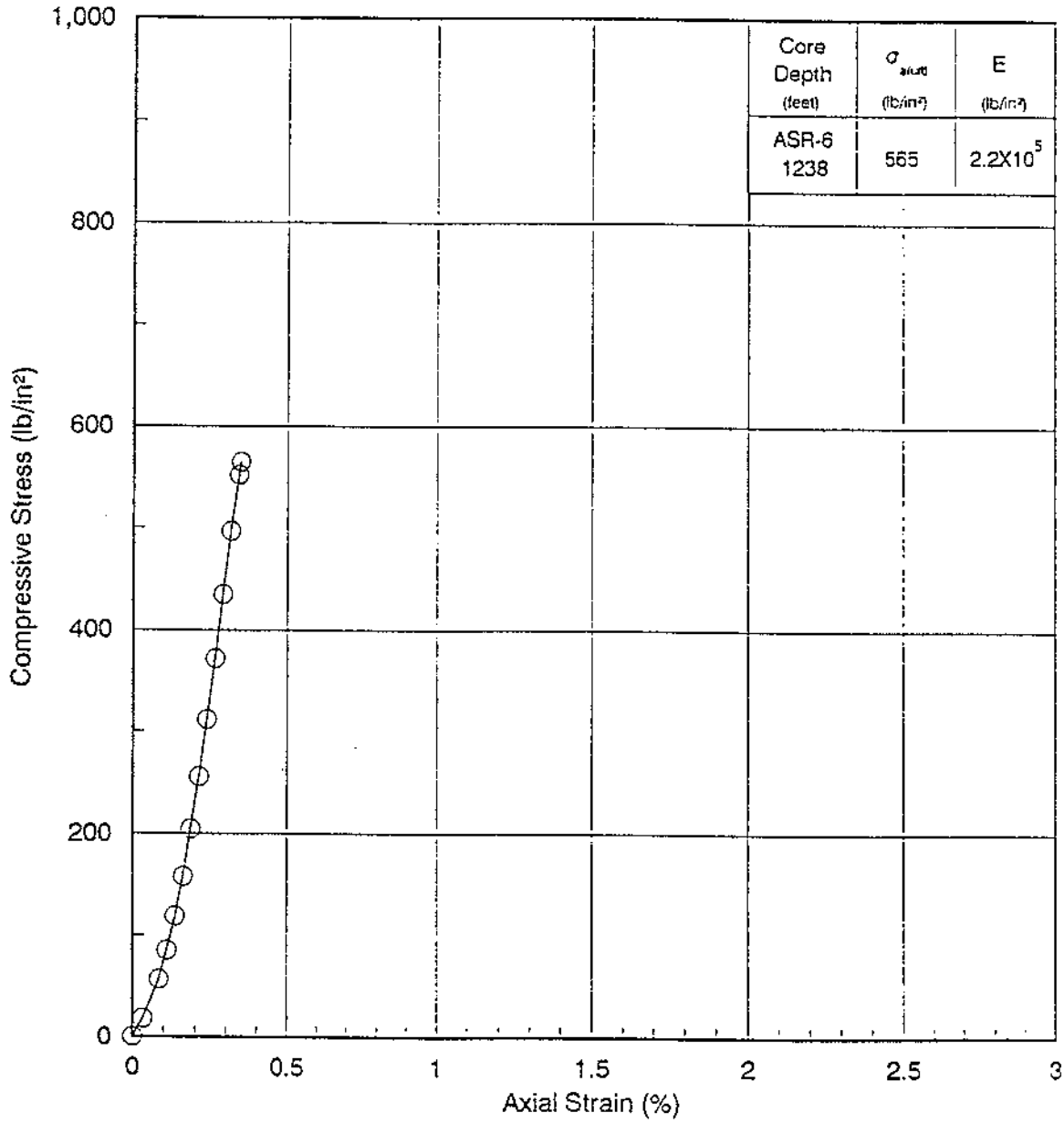
UNCONFINED COMPRESSION TEST

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

FORT LAUDERDALE FIVE-ASH ASR WELL AND FLORIDAN MONITOR WELL

YOUNGQUIST BROTHERS, INC.

DRAWN BY: SA	CHECKED BY: SA	DATE: 05-18-98
FILE NO.: 98-050	APPROVED BY:	FIGURE: 1



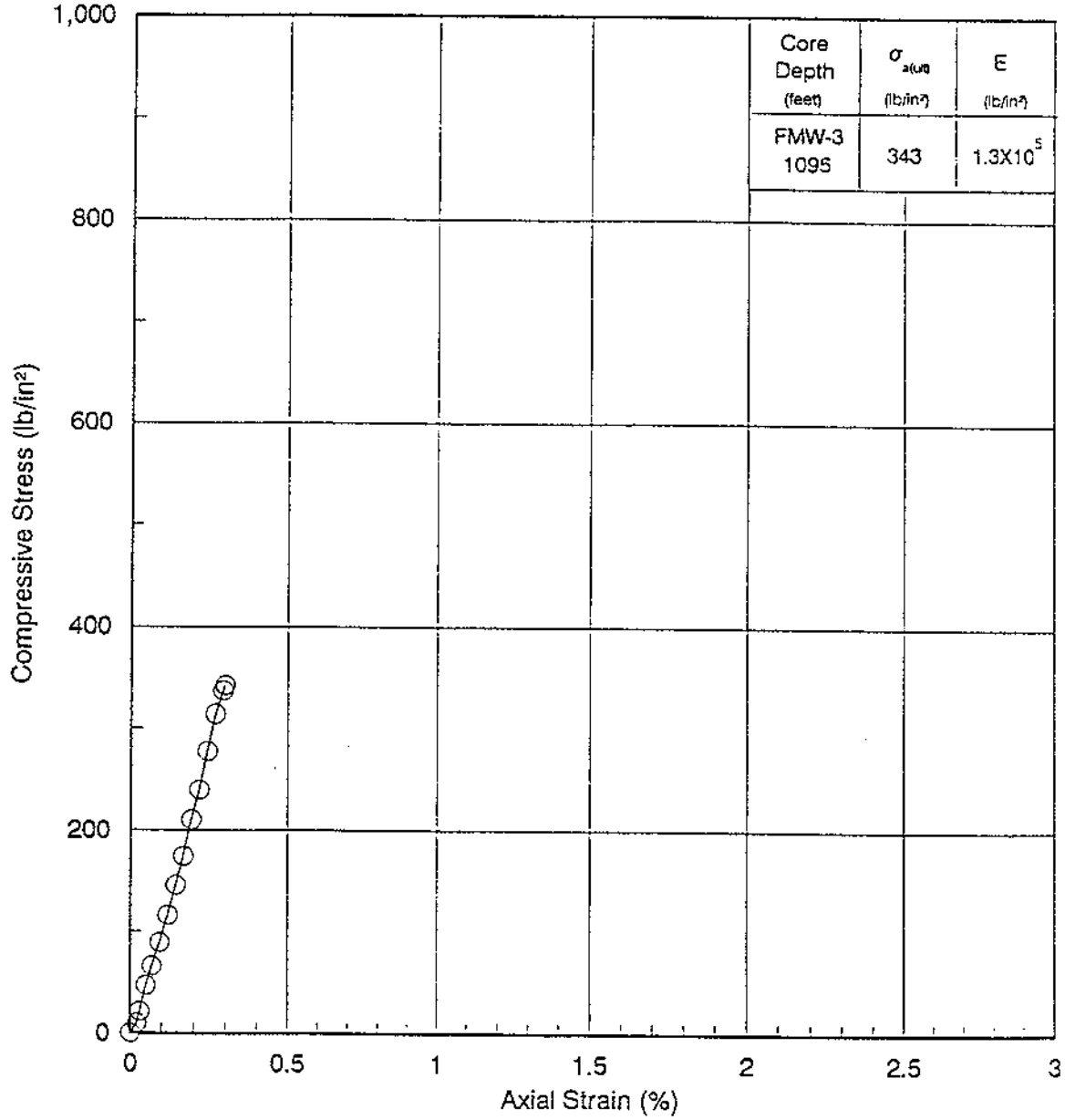
UNCONFINED COMPRESSION TEST

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

FORT LAUDERDALE FIVE-ASH ASR WELL
AND FLORIDAN MONITOR WELL

YOUNGQUIST BROTHERS, INC.

DRAWN BY: SA	CHECKED BY: SA	DATE: 05-18-98
FILE NO.: 98-050	APPROVED BY:	FIGURE 2



UNCONFINED COMPRESSION TEST

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

FORT LAUDERDALE FIVE-ASH ASR WELL AND FLORIDAN MONITOR WELL

YOUNGQUIST BROTHERS, INC.

DRAWN BY: SA	CHECKED BY: SA	DATE: 05-18-98
FILE NO.: 98-050	APPROVED BY:	FIGURE: 3

Appendix H

Pressure Test Data for ASR-1

MONTGOMERY WATSON

ASR-1 PRESSURE TEST DATA

DATE(S): 12/19/97

CITY OF FORT LAUDERDALE WTP ASR WELL SYSTEM

JOBNUMBER 1324007.28090290

CONTRACTOR: Youngquist Brothers, Inc.

PROJECT MANAGER: Anne Murray

COUNTY: Broward
OWNER: City of Ft. Lauderdale

DESCRIPTION OF OPERATIONS: Pressure Test 16-inch casing

START TIME: 715
FINISH TIME: 815
CASING SIZE: 16-inch
GAGE SERIAL NUMBER: BA0483

INITIAL PRESSURE: 173 psi

TIME	TOTAL MINUTES	PRESSURE	COMMENTS
7:15	0:00	173	
7:25	0:10	172.5	
7:32	0:17	172	
7:35	0:20	172	
7:40	0:25	171.5	
7:48	0:33	171	
7:50	0:35	171	
7:55	0:40	170.5	
8:00	0:45	170	
8:05	0:50	169.75	
8:11	0:56	169	
8:15	1:00	168	
8:20		168	Began bleeding pressure
		60	5.0 gal recovered
8:23		0	8.0 gal recovered

Observers' Initials NAJ

Certificate of Calibration

Customer: YOUNGQUIST BROTHERS, INC.
Certificate # 0000046029
Manufacturer: MCDANIEL
Model Number: 300 PSI
Nomenclature: PRESSURE TEST GAUGE
Serial/I.D. # BA0483
Specifications: +/-.25%
Cal. Procedure: MP03/C1-NAV
KELI Control # BAR-37617

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. or derived by the ratio type of self-calibration techniques and is guaranteed to meet published specifications. The metrology procedures utilized satisfy the requirements set forth in ANSI/NCSL Z540-1.

In Tolerance When Received? Y Cal. Tech:055 Relative Humidity: 50% Temperature: 73 Deg. F

In-House [Y] Cal. Cycle: 12 Mos. Calibration Date: 11/07/1997 Calibration Due: 11/07/1998

Remarks: ROUTINE CALIBRATION/CERTIFICATION/PREVENTIVE MAINTENANCE.

Standards Used

I.D. #		Cal. Date	Cal. Due
331	AMETEK T-150 DEAD WEIGHT TESTER	07/22/1997	07/22/1999

Quality Assurance

[redacted]

YOUNGQUIST BROTHERS, INC.

Certificate Of Test # 154480

KELI Control # BAR-37617

Manufacturer: MCDANIEL
Model: 300 PSI

Serial / I.D: BA0483
Description: PRESSURE TEST GAUGE

RANGE	APPLIED	READING PRE-CAL	READING POST-CAL	LOW LIMIT	HIGH LIMIT	SPECIFICATIONS
300 PSI	50	50.25	50.25	49.25	50.75	+/-.25% of FS
	100	100.00	100.00	99.25	100.75	
	150	150.00	150.00	149.25	150.75	
	200	200.00	200.00	199.25	200.75	
	300	300.00	300.00	299.25	300.75	

In tolerance when received? *YES*

Temperature: *73* Deg. F R.H. *50* %

Remarks: *ROUTINE CALIBRATION /CERTIFICATION AND PREVENTIVE MAINTENANCE.*

ID #	STANDARDS USED	CAL. DATE	CAL. DUE
331	*AMETEK T-150 DEAD WEIGHT TESTER*	*07/22/97*	*07/22/99*

Procedure Used: *MP03/C1-NAV*

Accuracy: MANUFACTURERS

The accuracy & 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.

Calibration Date: *11/07/97*

Cal. Tech: *055*

Calibration Due: *11/07/98*

Pressure Test Data for FMW-1

MONTGOMERY WATSON

FMW-1 PRESSURE TEST DATA

DATE(S): 1/29/98

CITY OF FORT LAUDERDALE WTP ASR WELL SYSTEM

JOBNUMBER 1324007.28090290

CONTRACTOR: Youngquist Brothers, Inc.

PROJECT MANAGER: Anne Murray

COUNTY: Broward

OWNER: City of Ft. Lauderdale

DESCRIPTION OF OPERATIONS: Pressure Test 6-inch casing
3-inch packer at 1,041 ft bpl -- 230 psi

START TIME: 5:45

FINISH TIME: 6:45

INITIAL PRESSURE: 125 psi

CASING SIZE: 6-inch

GAGE SERIAL NUMBER: BA0483

TIME	TOTAL MINUTES	PRESSURE	COMMENTS
05:45	0:00	125	
05:50	0:05	125	
05:55	0:10	125	
06:00	0:15	125	
06:05	0:20	125	
06:20	0:35	125.5	
06:25	0:40	125.5	
06:33	0:48	125.5	
06:40	0:55	126	
06:45	1:00	126	End test
06:48	1:03	126	Bleeding off pressure into 5-gal bucket
06:49	1:04	0	~3/4 gal water recovered
			packer pressure still 230 psi

Observers' Initials NAJ

KELI

Kimball Electronic Laboratory, Inc.

Precision Measurement Equipment Specialists

Certificate of Calibration

Customer:	YOUNGQUIST BROTHERS, INC.
Certificate #	0000047881
Manufacturer:	MCDANIEL
Model Number:	300 PSI
Nomenclature:	PRESSURE TEST GAUGE
Serial/I.D. #	BA0483
Specifications:	+/-.25%
Cal. Procedure:	MP03/C1-NAV
KELI Control #	BAR-37617

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. or derived by the ratio type of self-calibration techniques and is guaranteed to meet published specifications. The metrology procedures utilized satisfy the requirements set forth in ANSI/NCSL Z540-1.

In Tolerance When Received? Y Cal. Tech:048 Relative Humidity: 52% Temperature: 72 Deg. F

In-House [Y] Cal. Cycle: 12 Mos. Calibration Date: 01/08/1998 Calibration Due: 01/08/1999

Remarks: ROUTINE CALIBRATION/CERTIFICATION/PREVENTIVE MAINTENANCE.

I.D. #	Standards Used	Cal. Date	Cal. Due
331	AMETEK T-150 DEAD WEIGHT TESTER	07/22/1997	07/22/1999

Quality Assurance

mlcert 4 97

8081 West 21st Lane, Hialeah, Fl. 33016 • Ph (305) 822-5792 • Fax (305) 362-3125

Kimball Electronic Laboratory, Inc.

Precision Measurement Equipment Specialists

YOUNGQUIST BROTHERS, INC.

Certificate Of Test # 157214

KELI Control # BAR-37617

Manufacturer MCDANIEL
Model: 300 PSI
Serial / I.D: BA0483
Description: PRESSURE TEST GAUGE

RANGE	APPLIED	READING PRE-CAL	READING POST-CAL	LOW LIMIT	HIGH LIMIT	SPECIFICATIONS
300 PSI	50	50.05	50.05	49.25	50.75	+/-.25% of Full Scale
	100	100.10	100.10	99.25	100.75	
	150	150.00	150.00	149.25	150.75	
	200	200.00	200.00	199.25	200.75	
	300	300.10	300.10	299.25	300.75	

In tolerance when received? *YES* Temperature: *72* Deg. F R.H. *52*
Remarks: *PERFORMED ROUTINE CERTIFICATION AND PREVENTIVE MAINTENANCE*

I.D.#	STANDARDS USED	CAL. DATE	CAL. DUE
331	*AMETEK T-150 DEAD WEIGHT TESTER*	*July 1997*	*July 1999*

Procedure Used: *MP03/C1-NAV* *Accuracy: MANUFACTURERS*

The accuracy & 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.

Calibration Date: *01/08/98* Cal. Tech: *048*
Calibration Due: *01/08/99*

Approved By

8081 West 21st Lane, Hialeah, FL 33016 • Ph (305) 822-5792 • Fax (305) 362-3125

KELI
Kimball Electronic Laboratory, Inc.
Precision Measurement Equipment Specialists

YOUNGQUIST BROTHERS, INC.

Certificate Of Test # 157214

KELI Control # BAR-37617

Manufacturer MCDANIEL
Model: 300 PSI
Serial / I.D: BA0483
Description: PRESSURE TEST GAUGE

RANGE	APPLIED	READING PRE-CAL	READING POST-CAL	LOW LIMIT	HIGH LIMIT	SPECIFICATIONS
300 PSI	50	50.05	50.05	49.25	50.75	+/-.25% of Full Scale
	100	100.10	100.10	99.25	100.75	
	150	150.00	150.00	149.25	150.75	
	200	200.00	200.00	199.25	200.75	
	300	300.10	300.10	299.25	300.75	

In tolerance when received? *YES* Temperature: *72* Deg. F R.H. *52*
Remarks: *PERFORMED ROUTINE CERTIFICATION AND PREVENTIVE MAINTENANCE*

I.D.#	STANDARDS USED	CAL DATE	CAL DUE
331	*AMETEK T-150 DEAD WEIGHT TESTER*	*July 1997*	*July 1999*

Procedure Used: *MP03/C1-NAV* *Accuracy: MANUFACTURERS*

The accuracy & 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.

Calibration Date: *01/08/98* Cal. Tech: *048*
Calibration Due: *01/08/99*

Approved By

8081 West 21st Lane, Hialeah, Fl. 33016 • Ph (305) 822-5792 • Fax (305) 362-3125

Appendix I

Video Survey Descriptions For ASR-1

MONTGOMERY WATSON

ASR-1 VIDEO SURVEY

DATE(S): 12/24/97

FIVEASH ASR WELL SYSTEM

JOB NUMBER: 1324007.28090290

CONTRACTOR: Youngquist Brothers, Inc.

PROJECT MANAGER: Anne Murray

COUNTY: Broward
OWNER: ty of Fort Lauderdale

VIDEO CONTRACTOR: FGL
TOTAL DEPTH: 1,272

DESCRIPTION OF OPERATIONS: Video Log ASR-1

DEPTH IN FEET		REEL COUNTER		OBSERVATIONS
From	To	From	To	
70				Weld
112				Weld
155				Weld
194				Weld
233				Weld
272				Weld
313				Weld
349				Weld
392				Weld
405				Very silty, stop at 07:52
				Resume log at 08:30
432				Weld
474				Weld
516				Weld
556				Weld
598				Weld
641				Weld
683				Weld
725				Weld
753				Stop at 08:45 -- getting silty

DEPTH IN FEET		REEL COUNTER		OBSERVATIONS
From	To	From	To	
753				Resume at 09:20 -- Clear
767				Weld -- vertical striations
809				Weld
851				Weld
1,020				Weld
1,057				Bottom of casing
1,060				Cavernous washout
1,066	1,082			Boulders in hole -- Cement
1,082				Porous LS, oblate hole, end boulders
1,110				Hole closer to gauge, still porous LS
1,118	1,122			Popouts
1,122				Same as above
1,129				Bedding plane?
1,139	1,141			Loose zone to 1,141
1,141				Porous LS, becomes gradually less porous
1,152				Much less porosity
1,155				Porous LS
1,158	1,168			Very porous LS
1,165				Cavernous, porous to 1,168
1,168				Porous
1,185				Lower porosity -- gauge hole
1,200				Walls mostly smooth
1,211	1,214			Fractured to 1,214
1,216				Smoother hole w/ popouts
1,227				Low porosity
1,272				Stop log -- Bottom of hole is silted up, end log at 10:00

Vide Survey Descriptions for FMW-1

MONTGOMERY WATSON

FMW-1 VIDEO SURVEY

DATE(S): 3/7/98

FIVEASH ASR WELL SYSTEM

JOB NUMBER: 1324007.28090290

CONTRACTOR: Youngquist Brothers, Inc.

PROJECT MANAGER: Anne Murray

COUNTY: Broward
OWNER: ty of Fort Lauderdale

VIDEO CONTRACTOR: FGL
TOTAL DEPTH: 1,166

DESCRIPTION OF OPERATIONS: Video Log FMW-1

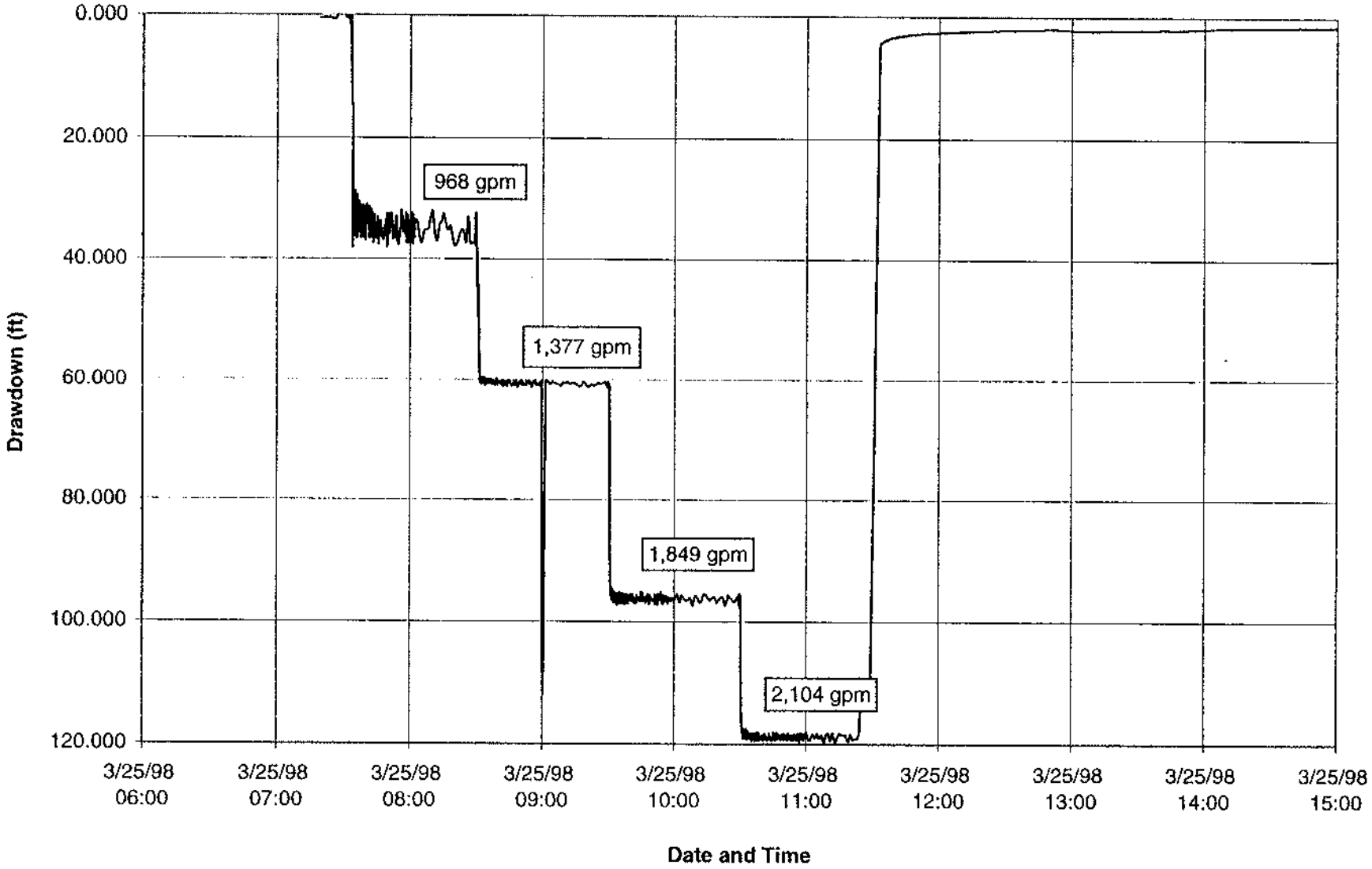
DEPTH IN FEET		REEL COUNTER		OBSERVATIONS
From	To	From	To	
34				Weld
77				Weld
121				Weld
163				Weld
205				Weld
248				Weld
292				Weld
336				Weld
379				Weld
423				Weld
467				Weld
511				Weld
555				Weld
599				Weld
643				Weld
686				Weld
729				Weld
772				Weld
816				Weld
859				Weld

DEPTH IN FEET		REEL COUNTER		OBSERVATIONS
From	To	From	To	
892				Weld
935				Weld
979				Weld
1,021				Weld
1,053				Weld
1,053	1,105			Smooth borehole -- some mudcake, v. tight formation
1,105				Bedding plane -- more mudcake
1,113				Bedding plane -- possible flow zone
1,122				Bedding plane -- vugs
1,129	1,131			Vugs
1,151				Bedding plane -- rougher borehole
1,160				Lost visibility - no flow
1,166				Stopped lowering camera -- material on light head -- TD

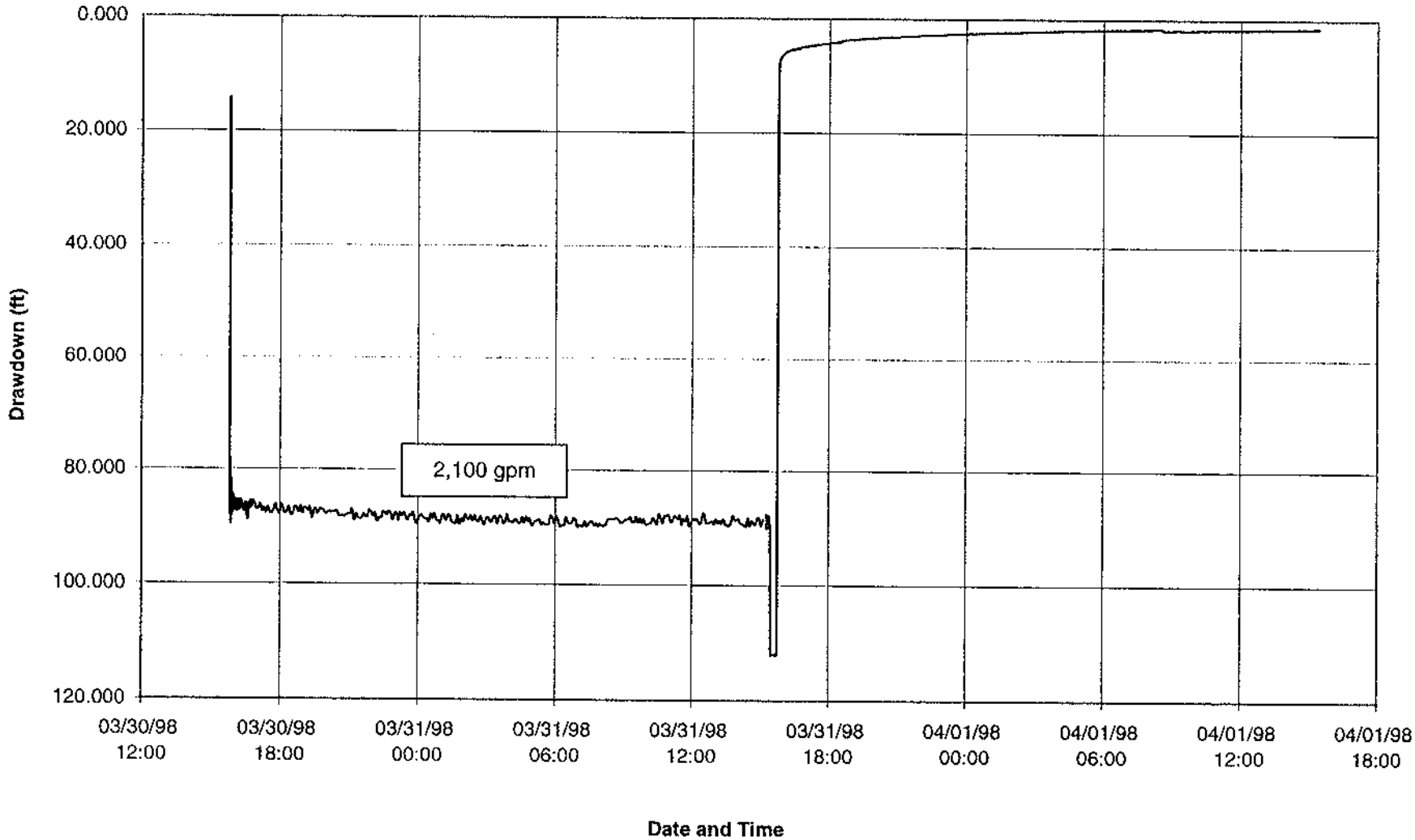
Appendix J

Water Level Pumping Data Tests for ASR-1

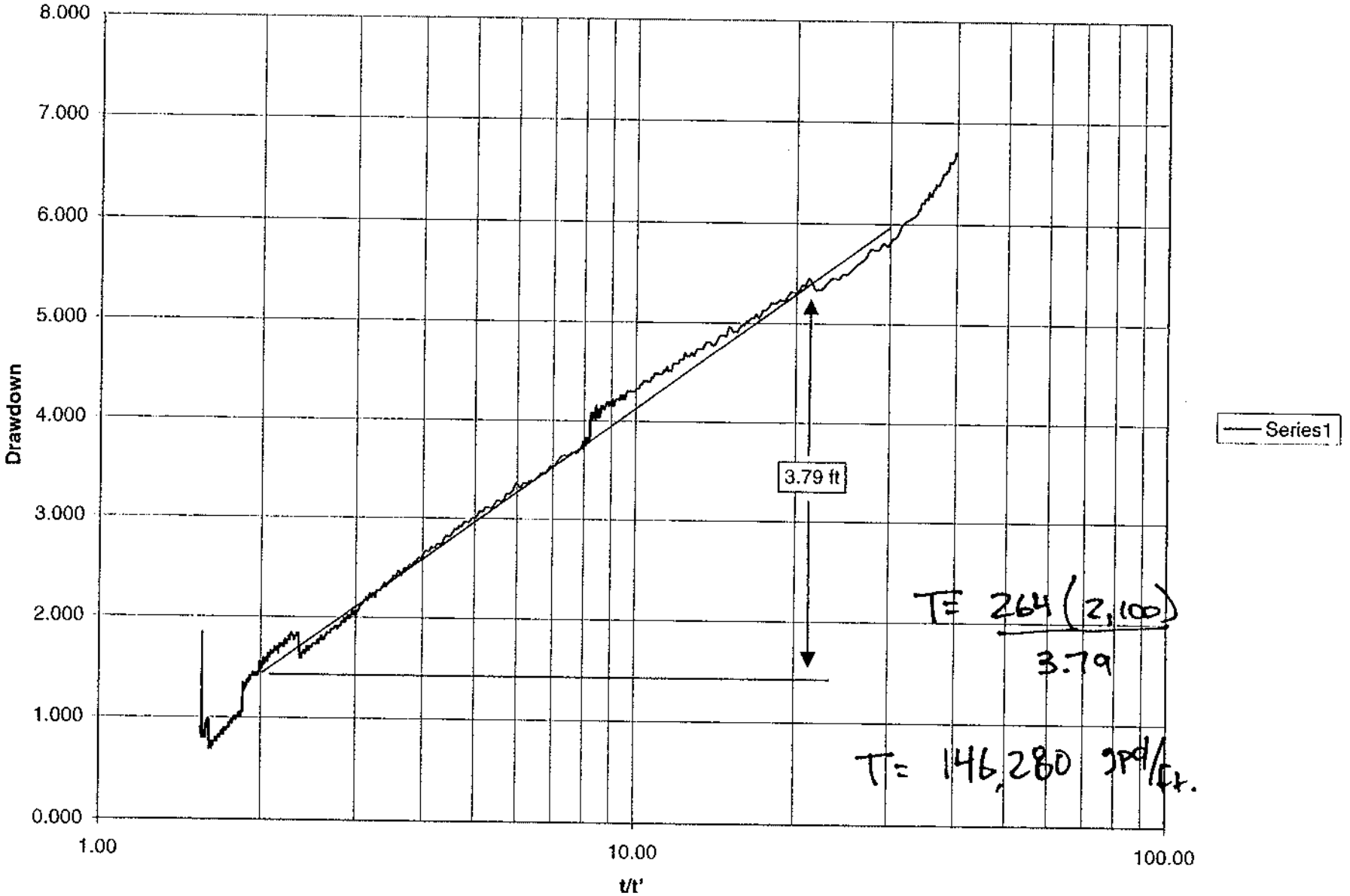
ASR-1 Step Rate Pump Test Drawdown



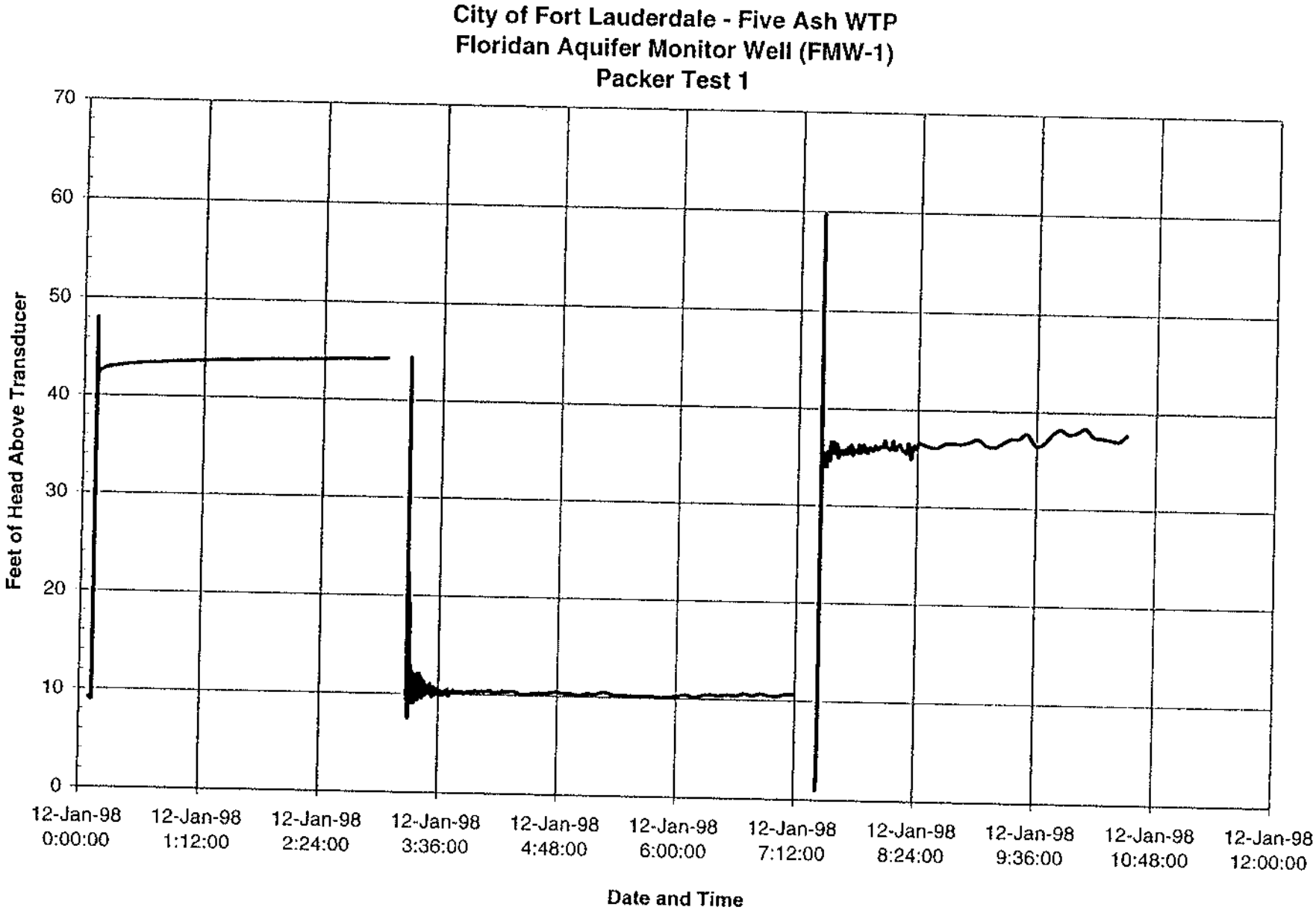
ASR-1 Constant-Rate Pumping Test

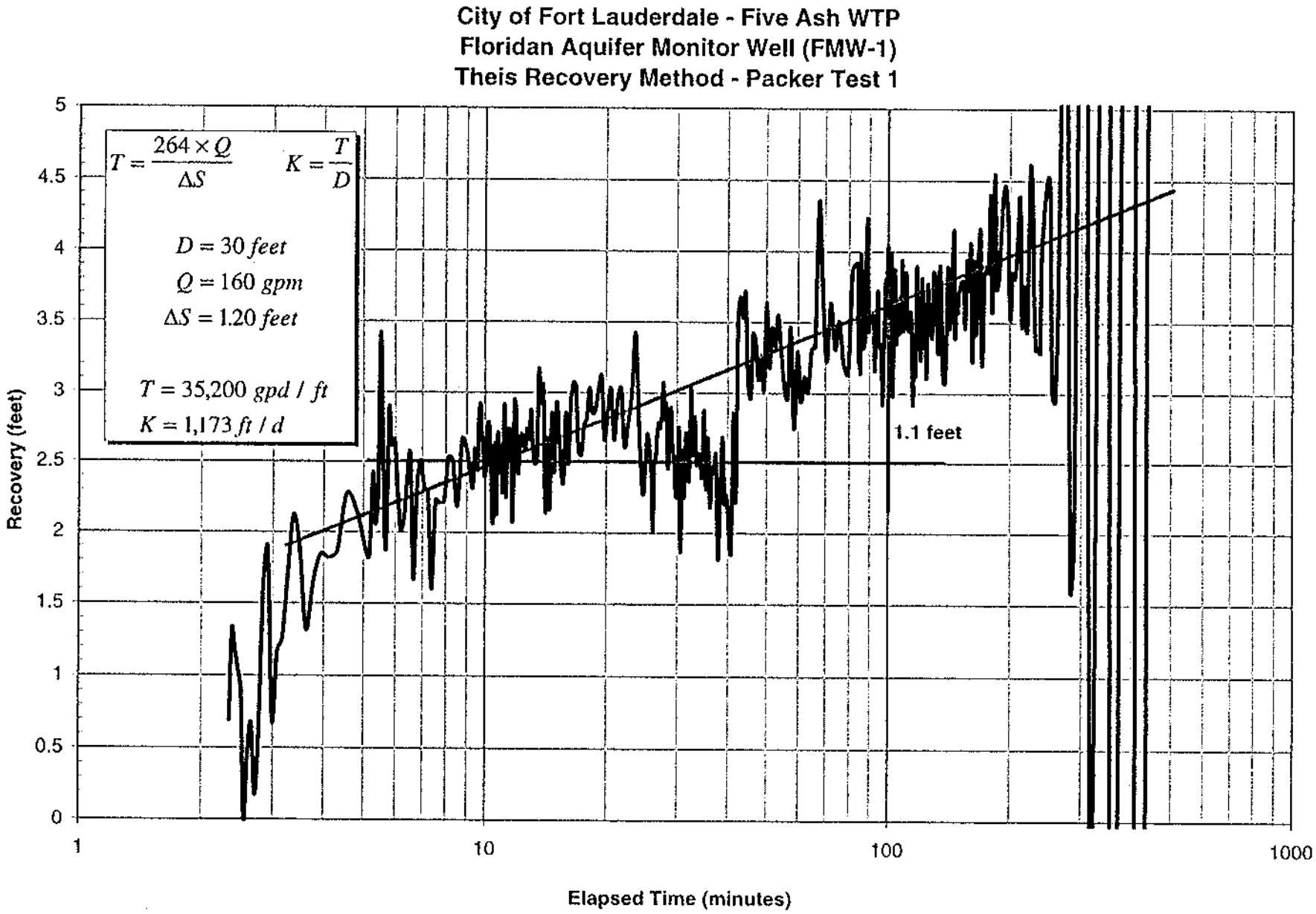


RSK-1 Pump Test
Pumped Well Recovery Data
Q= 2,100 gpm

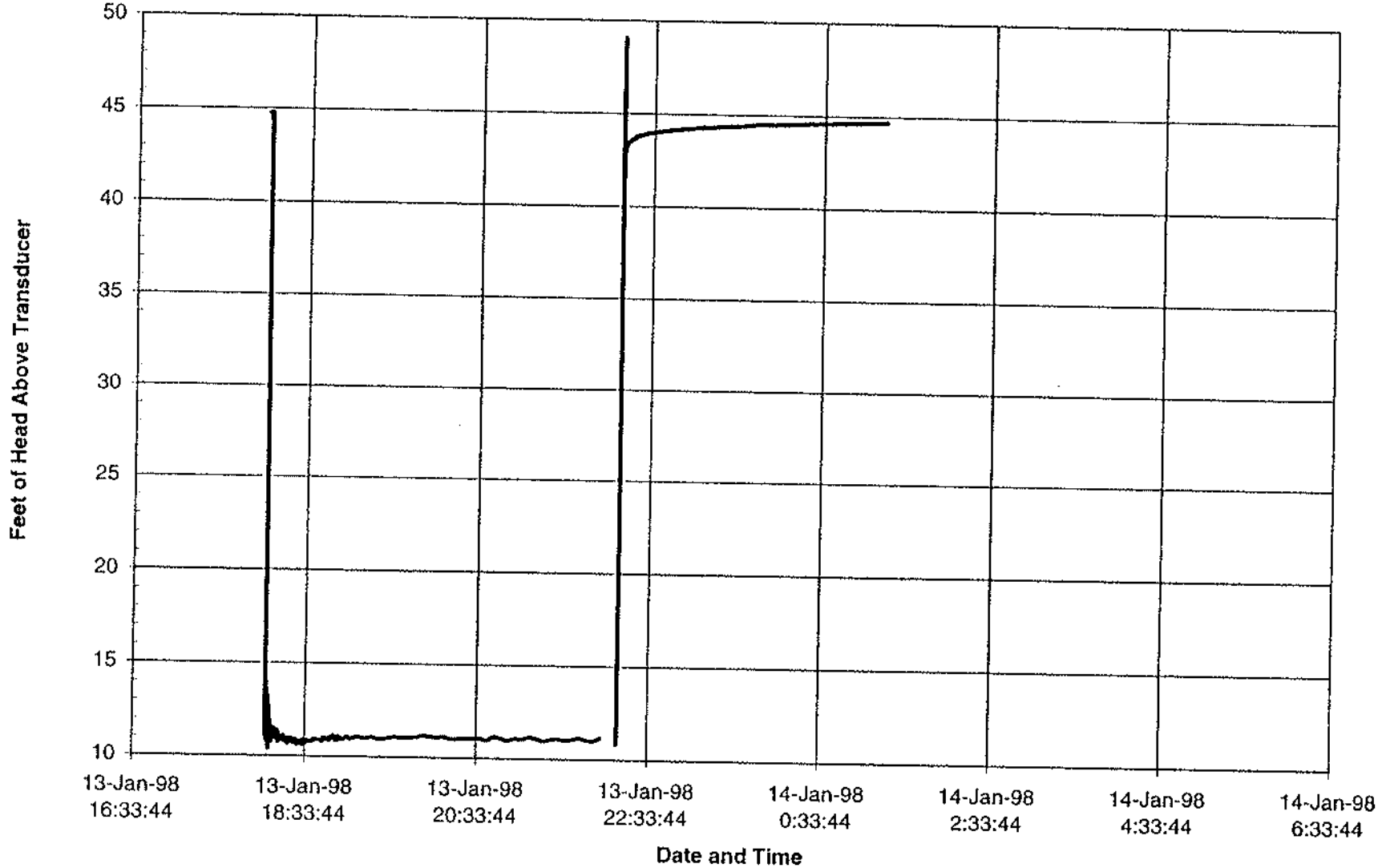


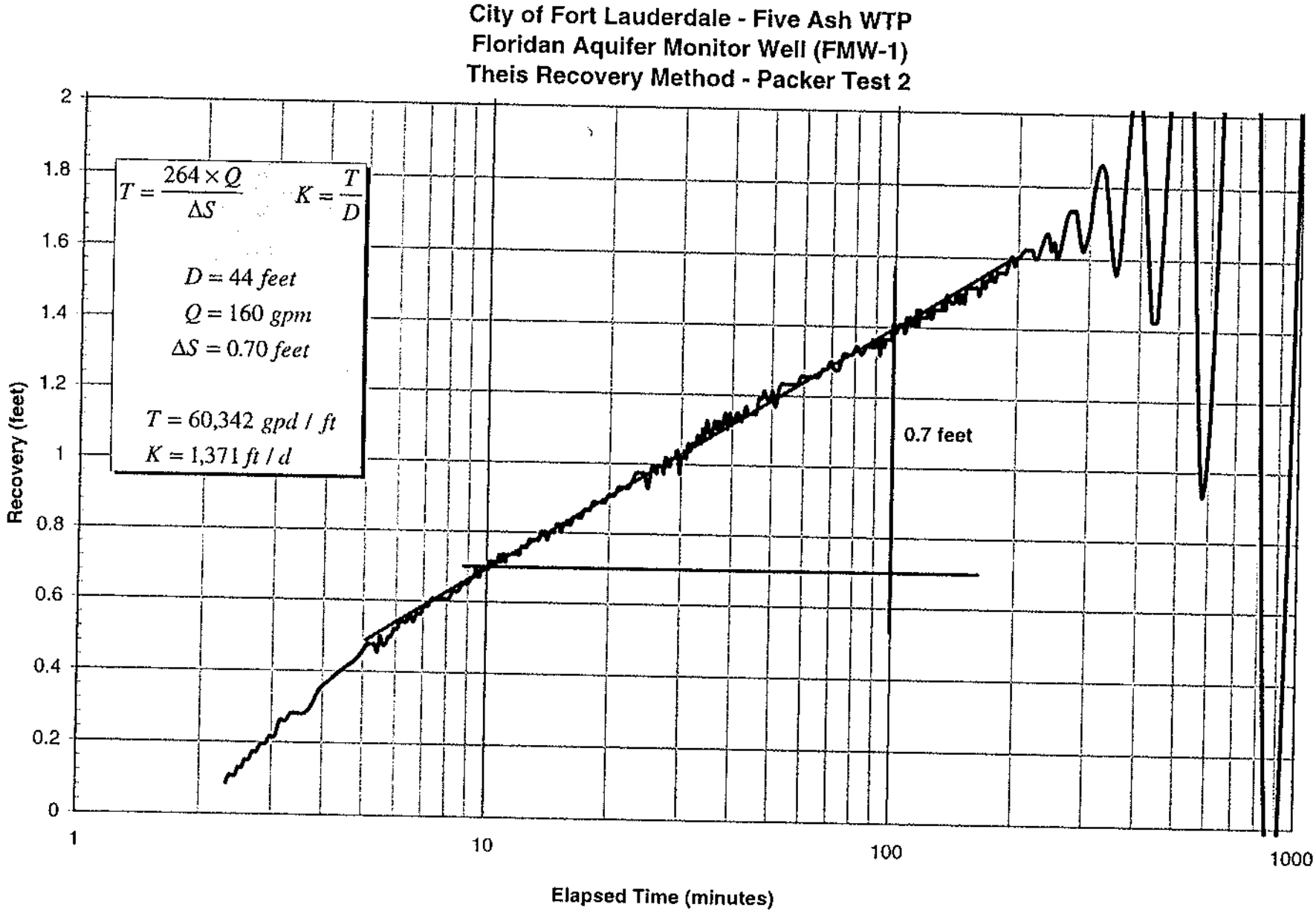
Water Level Pumping Data Tests for FMW-1


City of Fort Lauderdale - Five Ash WTP
Floridan Aquifer Monitor Well (FMW-1)
Packer Test 1
Feet of Head Above Transducer
70
60
50
40
30
20
10
0
12-Jan-98 0:00:00
12-Jan-98 1:12:00
12-Jan-98 2:24:00
12-Jan-98 3:36:00
12-Jan-98 4:48:00
12-Jan-98 6:00:00
12-Jan-98 7:12:00
12-Jan-98 8:24:00
12-Jan-98 9:36:00
12-Jan-98 10:48:00
12-Jan-98 12:00:00
Date and Time

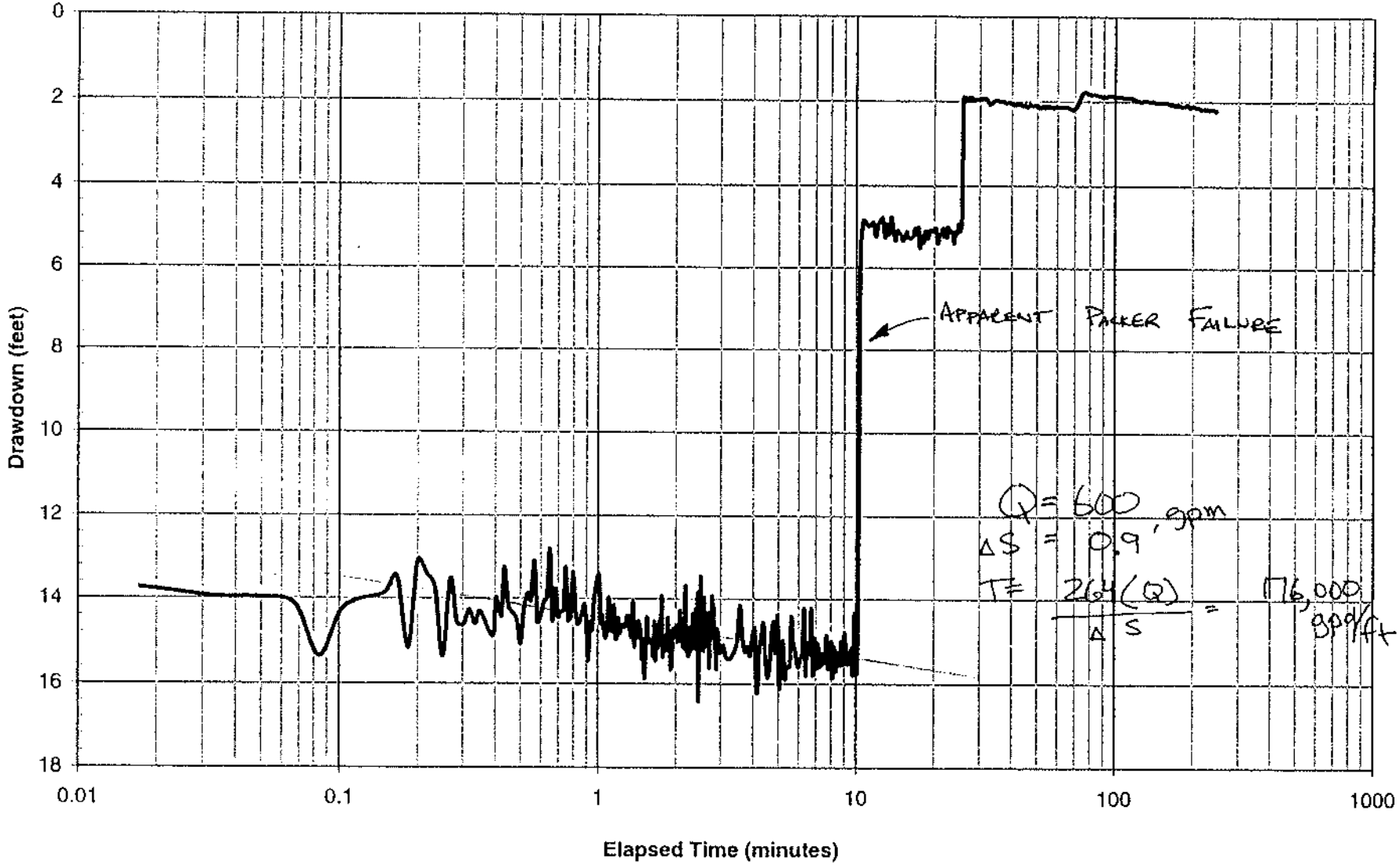

City of Fort Lauderdale - Five Ash WTP
Floridan Aquifer Monitor Well (FMW-1)
Theis Recovery Method - Packer Test 1
$T = \frac{264 \times Q}{\Delta S}$
$K = \frac{T}{D}$
$D = 30\ feet$
$Q = 160\ gpm$
$\Delta S = 1.20\ feet$
$T = 35{,}200\ gpd / ft$
$K = 1{,}173\ ft / d$
1.1 feet
Recovery (feet)
Elapsed Time (minutes)
0
0.5
1
1.5
2
2.5
3
3.5
4
4.5
5
1
10
100
1000

City of Fort Lauderdale - Five Ash WTP
Floridan Aquifer Monitor Well (FMW-1)
Packer Test 2

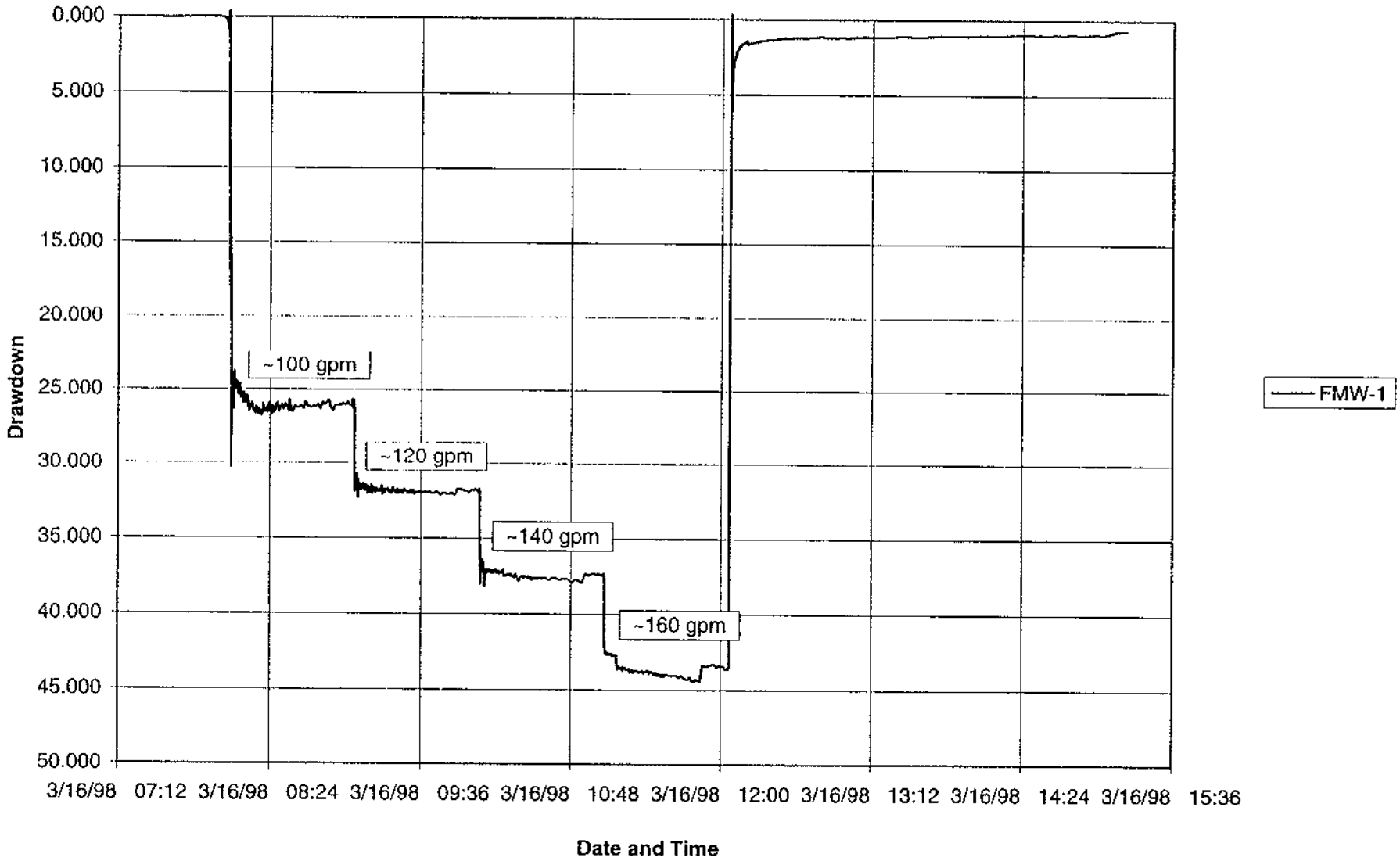



City of Fort Lauderdale - Five Ash WTP
Floridan Aquifer Monitor Well (FMW-1)
Theis Recovery Method - Packer Test 2
$T = \frac{264 \times Q}{\Delta S}$
$K = \frac{T}{D}$
$D = 44\ feet$
$Q = 160\ gpm$
$\Delta S = 0.70\ feet$
$T = 60{,}342\ gpd / ft$
$K = 1{,}371\ ft / d$
0.7 feet
Recovery (feet)
Elapsed Time (minutes)
0
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
1.8
2
1
10
100
1000

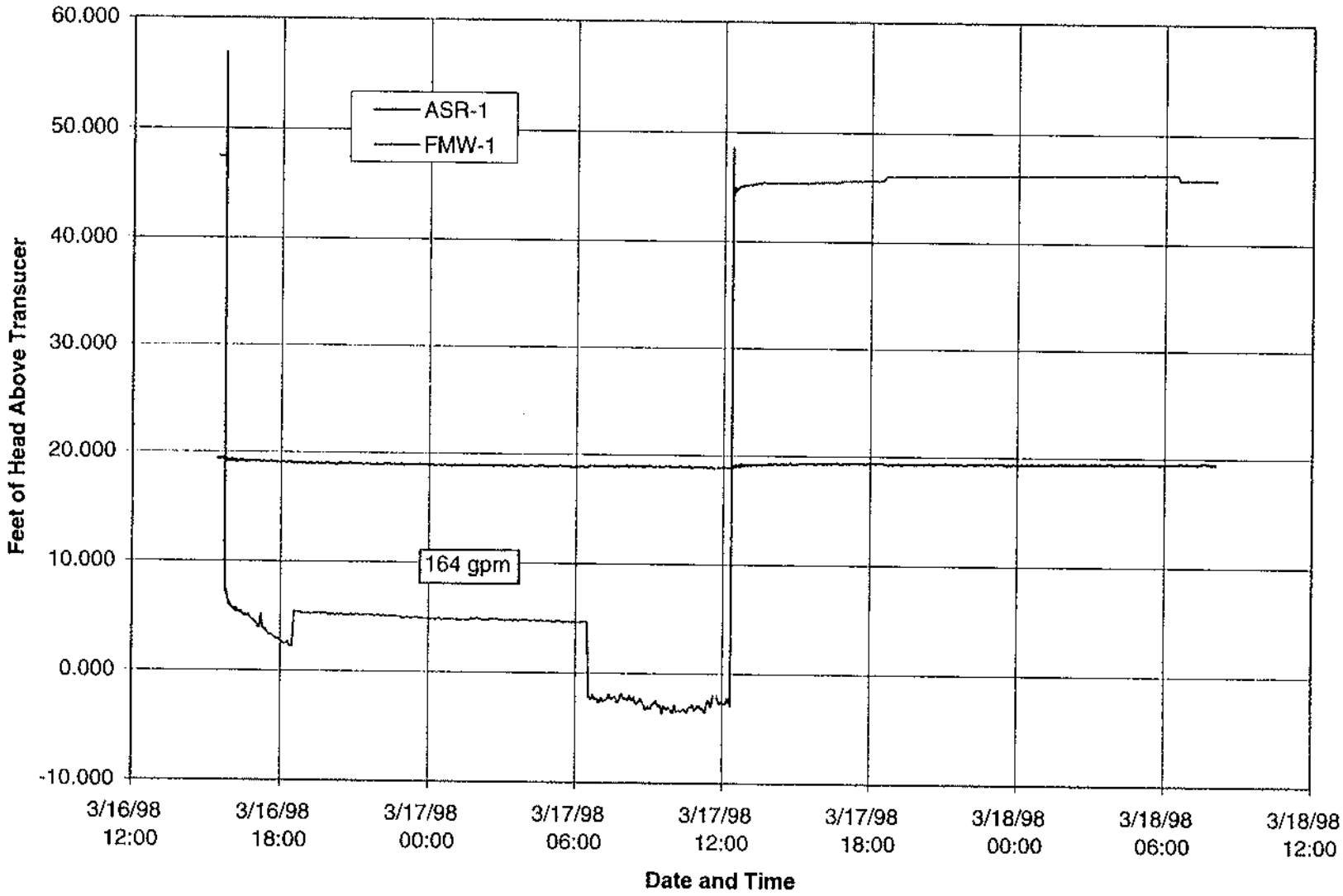
City of Fort Lauderdale - Five Ash WTP
Floridan Aquifer Monitor Well (FMW-1)
Drawdown - Packer Test 3



FMW-1 Step-Rate Pump Test



FMW-1 Constant-Rate Pump Test



Appendix K

Water Quality Analyses for FMW-1

Bob Terrastro.

Sanders Laboratories
Environmental Testing Services

Date *16-Apr-98*

INTAKE #: 512936

Project Name:	Five Ash/Drinking Water
Project Location:	FMN - 1
Sample Supply:	Water
Collector:	Tim Case
Sample Received Date/Time:	3/17/98 15:00

RECEIVED

APR 30 1998

RECEIVED APR 17 1998

Youngquist Brothers, Inc.
15465 Pine Ridge Road

Fort Myers, FL 33908-

MONTGOMERY WATSON

Parameter ID	Analysis	Sample ID	Result	Unit	Method	Analysis Date/Time	D. L.	LabID	Analyst
	Inorganic Analysis								
	62-550.310(1)								
	PWS030								
1005	Arsenic (0.05)	N981883	<0.0022	mg/L	EPA 206.2	3/20/98	0.0022	84352	ua
1010	Barium (2)	N981883	1.506	mg/L	EPA 208.2	3/26/98	0.200	84352	ua
1015	Cadmium (0.005)	N981883	<0.003	mg/L	EPA 213.1	3/19/98	0.003	84352	ua
1020	Chromium (0.1)	N981883	<0.020	mg/L	EPA 218.1	3/19/98	0.020	84352	ua
1024	Cyanide (0.2)	N981883	<0.006	mg/L	SM 4500CNE	3/21/98	0.006	84352	ua
5	Fluoride (4)	N981883	1.44	mg/L	EPA 340.2	3/19/98	0.2	84352	ua
1030	Lead (0.015)	N981883	<0.001	mg/L	EPA 239.2	3/19/98	0.001	84352	ua
1035	Mercury (0.002)	N981883	<0.001	mg/L	EPA 245.1	3/21/98	0.001	84352	ua
1036	Nickel (0.1)	N981883	<0.010	mg/L	EPA 249.1	3/20/98	0.010	84352	ua
1040	Nitrate (10)	N981883	<0.01	mg/L	EPA 353.2	3/26/98	0.01	84352	ua
1041	Nitrite (1)	N981883	<0.01	mg/L	EPA 354.1	3/17/98	0.01	84352	ua
1045	Selenium (0.05)	N981883	<0.004	mg/L	EPA 270.2	3/23/98	0.004	84352	ua
1052	Sodium (160)	N981883	1,827	mg/L	EPA 273.1	3/24/98	0.003	84352	ua
1074	Antimony (0.006)	N981883	<0.0017	mg/L	EPA 200.9	3/23/98	0.0017	84352	ua
1075	Beryllium (0.004)	N981883	<0.0003	mg/L	EPA 200.7	3/24/98	0.0003	84352	ua
1085	Thallium (0.002)	N981883	<0.0006	mg/L	EPA 200.9	3/23/98	0.0006	84352	ua
	Secondary Chemical Analysis								
	62-550.320								
	PWS031								
1002	Aluminum (0.2)	N981883	<0.2	mg/L	EPA 202.1	3/23/98	0.2	84352	ua
1017	Chloride (250)	N981883	3,524	mg/L	SM4500Cl-B	3/24/98	5	84352	ua
1022	Copper (1.0)	N981883	0.011	mg/L	EPA 220.2	3/20/98	0.001	84352	ua
1025	Fluoride (2.0)	N981883	1.44	mg/L	EPA 340.2	3/19/98	0.2	84352	ua
1028	Iron (0.3)	N981883	0.156	mg/L	EPA 236.1	3/23/98	0.015	84352	ua
2	Manganese (0.05)	N981883	0.014	mg/L	EPA 243.1	3/23/98	0.005	84352	ua

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

1050 Endeavor Ct. • Nokomis, FL 34275 • Phone: (941) 488-8103 • (800) 255-3108 • Fax: (941) 484-6774

Parameter ID	Analysis	Sample ID	Result	Unit	Method	Analysis Date/Time	D. L.	LabID	Analyst
1050	Silver (0.1)	N981883	<0.010	mg/L	EPA 272.1	3/24/98	0.010	84352	ua
1055	Sulfate (250)	N981883	725	mg/L	EPA 375.4	3/21/98	5	84352	ua
1	Zinc (5.0)	N981883	<0.005	mg/L	EPA 289.1	3/21/98	0.005	84352	ua
[illegible]5	Color (15.0)	N981883	17	PtCo units	EPA 110.3	3/17/98	1	84352	ua
1920	Odor (3.0)	N981883	50	TON	EPA 140.1	3/17/98	1	84352	ua
1925	pH (6.5-8.5)	N981883	7.61	std units	EPA 150.1	3/17/98	n/a	84352	ua
1930	Total Dissolved Solids (500)	N981883	7,880	mg/L	EPA 160.1	3/17/98	7	84352	ua
2905	Foaming Agents (1.5)	N981883	0.04	mg/L	SM 5540C	3/19/98	0.02	84352	ua

Trihalomethane Analysis

62-550.310(2)(a)

PWS027

FMW-1

2950	Total THM's (0.10)	N981883	0.0017	mg/L	EPA 524.2	3/19/98	0.00036	83331	ua

Volatile Organic Analysis

62-550.310(2)(b)

PWS028

2378	1,2,4-Trichlorobenzene (70)	N981883	<0.22	ug/L	EPA 524.2	3/19/98	0.22	83331	ua
2380	Cis-1,2-Dichloroethylene (70)	N981883	<0.03	ug/L	EPA 524.2	3/19/98	0.03	83331	ua
2955	Xylenes (Total) (10,000)	N981883	<0.24	ug/L	EPA 524.2	3/19/98	0.24	83331	ua
2964	Dichloromethane (5)	N981883	<0.05	ug/L	EPA 524.2	3/19/98	0.05	83331	ua
2968	O-Dichlorobenzene (600)	N981883	<0.05	ug/L	EPA 524.2	3/19/98	0.05	83331	ua
[illegible]9	Para-Dichlorobenzene (75)	N981883	<0.02	ug/L	EPA 524.2	3/19/98	0.02	83331	ua
[illegible]6	Vinyl Chloride (1)	N981883	<0.29	ug/L	EPA 524.2	3/19/98	0.29	83331	ua
2977	1,1-Dichloroethylene (7)	N981883	<0.02	ug/L	EPA 524.2	3/19/98	0.02	83331	ua
2979	Trans-1,2-Dichloroethylene(100)	N981883	<0.12	ug/L	EPA 524.2	3/19/98	0.12	83331	ua
2980	1,2-Dichloroethane (3)	N981883	<0.02	ug/L	EPA 524.2	3/19/98	0.02	83331	ua
2981	1,1,1-Trichloroethane (200)	N981883	<0.21	ug/L	EPA 524.2	3/19/98	0.21	83331	ua
2982	Carbon Tetrachloride (3)	N981883	<0.29	ug/L	EPA 524.2	3/19/98	0.29	83331	ua
2983	1,2-Dichloropropane (5)	N981883	<0.33	ug/L	EPA 524.2	3/19/98	0.33	83331	ua
2984	Trichloroethylene (3)	N981883	<0.02	ug/L	EPA 524.2	3/19/98	0.02	83331	ua
2985	1,1,2-Trichloroethane (5)	N981883	<0.23	ug/L	EPA 524.2	3/19/98	0.23	83331	ua
2987	Tetrachloroethylene (3)	N981883	<0.21	ug/L	EPA 524.2	3/19/98	0.21	83331	ua
2989	Monochlorobenzene (100)	N981883	<0.23	ug/L	EPA 524.2	3/19/98	0.23	83331	ua
2990	Benzene (1)	N981883	<0.05	ug/L	EPA 524.2	3/19/98	0.05	83331	ua
2991	Toluene (1000)	N981883	<0.41	ug/L	EPA 524.2	3/19/98	0.41	83331	ua
2992	Ethylbenzene (700)	N981883	<0.47	ug/L	EPA 524.2	3/19/98	0.47	83331	ua
2996	Styrene (100)	N981883	<0.2	ug/L	EPA 524.2	3/19/98	0.2	83331	ua

	Dioxin - 2,3,7,8-TCDD	N981883	<5.4	pg/L	EPA 1613	4/9/98	5.4	87424	ua

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

Pesticide/PCB Chemical Analysis

62-550.310(2)(c)

PWS029

FMW - 1

Parameter ID	Analysis	Sample ID	Result	Unit	Method	Analysis Date/Time	D.L.	LabID	Analyst
2005	Endrin (2)	N981883	<0.002	ug/L	EPA 508	3/26/98	0.002	83331	ua
2010	Lindane (0.2)	N981883	<0.002	ug/L	EPA 508	3/26/98	0.002	83331	ua
2015	Methoxychlor (40)	N981883	<0.052	ug/L	EPA 508	3/26/98	0.052	83331	ua
2020	Toxaphene (3)	N981883	<0.309	ug/L	EPA 508	3/26/98	0.309	83331	ua
2031	Dalapon (200)	N981883	<0.035	ug/L	EPA 515.1	4/10/98	0.035	83331	ua
2032	Diquat (20)	N981883	<0.26	ug/L	EPA 549.1	3/30/98	0.26	83331	ua
2033	Endothall (100)	N981883	<15.4	ug/L	EPA 548	4/1/98	15.4	83331	ua
2034	Glyphosate (700)	N981883	<9.44	ug/L	EPA 547	3/31/98	9.44	83331	ua
2035	Di(2-ethylhexyl) adipate (400)	N981883	<0.71	ug/L	EPA 525.2	4/5/98	0.71	83331	ua
2036	Oxamyl (Vydate) (200)	N981883	<2.57	ug/L	EPA 531.1	3/26/98	2.57	83331	ua
2037	Simazine (4)	N981883	<0.078	ug/L	EPA 507	3/26/98	0.078	83331	ua
2039	Di(2-ethylhexyl) phthalate (6)	N981883	<1.15	ug/L	EPA 525.2	4/5/98	1.15	83331	ua
2040	Picloram (500)	N981883	<0.029	ug/L	EPA 515.1	4/10/98	0.029	83331	ua
2041	Dinoseb (7)	N981883	<0.055	ug/L	EPA 515.1	4/10/98	0.055	83331	ua
2042	Hexachlorocyclopentadiene(50)	N981883	<0.01	ug/L	EPA 508	3/26/98	0.01	83331	ua
2046	Carbofuran (40)	N981883	<7.04	ug/L	EPA 531.1	3/26/98	7.04	83331	ua
2050	Atrazine (3)	N981883	<0.035	ug/L	EPA 507	3/26/98	0.035	83331	ua
2051	Alachlor (2)	N981883	<0.012	ug/L	EPA 507	3/26/98	0.012	83331	ua
2065	Heptachlor (0.4)	N981883	<0.004	ug/L	EPA 508	3/26/98	0.004	83331	ua
2067	Heptachlor Epoxide (0.2)	N981883	<0.002	ug/L	EPA 508	3/26/98	0.002	83331	ua
2105	2,4-D (70)	N981883	<0.026	ug/L	EPA 515.1	4/10/98	0.026	83331	ua
2110	2,4,5-TP (Silvex) (50)	N981883	<0.017	ug/L	EPA 515.1	4/10/98	0.017	83331	ua
2274	Hexachlorobenzene (1)	N981883	<0.008	ug/L	EPA 508	3/26/98	0.008	83331	ua
2306	Benzo(a)pyrene (.2)	N981883	<0.013	ug/L	EPA 550	4/3/98	0.013	83331	ua
2326	Pentachlorophenol (1)	N981883	<0.007	ug/L	EPA 515.1	4/10/98	0.007	83331	ua
2383	PCB (0.5)	N981883	<0.1	ug/L	EPA 508	3/26/98	0.1	83331	ua
2931	Dibromochloropropane (.2)	N981883	<0.004	ug/L	EPA 504	3/30/98	0.004	83331	ua
2946	Ethylene Dibromide (0.02)	N981883	<0.006	ug/L	EPA 504	3/30/98	0.006	83331	ua
2959	Chlordane (2)	N981883	<0.446	ug/L	EPA 508	3/26/98	0.446	83331	ua

Unregulated Group I Analysis

62-550.405

PWS035

2021	Carbaryl	N981883	<3.89	ug/L	EPA 531.1	3/26/98	3.89	83331	ua
2022	Methomyl	N981883	<3.2	ug/L	EPA 531.1	3/26/98	3.2	83331	ua
2043	Aldicarb Sulfoxide	N981883	<1.88	ug/L	EPA 531.1	3/26/98	1.88	83331	ua
2044	Aldicarb Sulfone	N981883	<5.57	ug/L	EPA 531.1	3/26/98	5.57	83331	ua
2045	Metolachlor	N981883	<0.108	ug/L	EPA 507	3/26/98	0.108	83331	ua
2047	Aldicarb	N981883	<5.95	ug/L	EPA 531.1	3/26/98	5.95	83331	ua
2066	3-Hydroxycarbofuran	N981883	<3.35	ug/L	EPA 531.1	3/26/98	3.35	83331	ua

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

Parameter ID	Analysis	Sample ID	Result	Unit	Method	Analysis Date/Time	D. L.	LabID	Analyst
2077	Propachlor	N981883	<5	ug/L	EPA 508	3/26/98	5	83331	ua
2356	Aldrin	N981883	<0.005	ug/L	EPA 508	3/26/98	0.005	83331	ua
	Dieldrin	N981883	<0.02	ug/L	EPA 508	3/26/98	0.02	83331	ua
2440	Dicamba	N981883	<0.005	ug/L	EPA 515.1	4/10/98	0.005	83331	ua
2595	Metribuzin	N981883	<0.024	ug/L	EPA 507	3/26/98	0.024	83331	ua
2076	Butachlor	N981883	<0.021	ug/L	EPA 507	3/26/98	0.021	83331	ua

Unregulated Group II Analysis

62-550.410

PWS034

FMW - 1

2210	Chloromethane	N981883	<0.35	ug/L	EPA 524.2	3/19/98	0.35	83331	ua
2212	Dichlorodifluoromethane	N981883	<0.26	ug/L	EPA 524.2	3/19/98	0.26	83331	ua
2214	Bromomethane	N981883	<0.29	ug/L	EPA 524.2	3/19/98	0.29	83331	ua
2216	Chloroethane	N981883	<0.29	ug/L	EPA 524.2	3/19/98	0.29	83331	ua
2218	Trichlorofluoromethane	N981883	<0.28	ug/L	EPA 524.2	3/19/98	0.28	83331	ua
2251	Methyl-Tert-Butyl-Ether	N981883	<0.27	ug/L	EPA 524.2	3/19/98	0.27	83331	ua
2408	Dibromomethane	N981883	<0.03	ug/L	EPA 524.2	3/19/98	0.03	83331	ua
2410	1,1-Dichloropropylene	N981883	<0.06	ug/L	EPA 524.2	3/19/98	0.06	83331	ua
2412	1,3-Dichloropropane	N981883	<0.05	ug/L	EPA 524.2	3/19/98	0.05	83331	ua
2413	1,3-Dichloropropene	N981883	<0.21	ug/L	EPA 524.2	3/19/98	0.21	83331	ua
2414	1,2,3-Trichloropropane	N981883	<0.39	ug/L	EPA 524.2	3/19/98	0.39	83331	ua
2416	2,2-Dichloropropane	N981883	<0.38	ug/L	EPA 524.2	3/19/98	0.38	83331	ua
[illegible]1	Chloroform	N981883	1.7	ug/L	EPA 524.2	3/19/98	0.16	83331	ua
[illegible]2	Bromoform	N981883	<0.31	ug/L	EPA 524.2	3/19/98	0.31	83331	ua
2943	Bromodichloromethane	N981883	<0.36	ug/L	EPA 524.2	3/19/98	0.36	83331	ua
2944	Dibromochloromethane	N981883	<0.27	ug/L	EPA 524.2	3/19/98	0.27	83331	ua
2965	O-Chlorotoluene	N981883	<0.33	ug/L	EPA 524.2	3/19/98	0.33	83331	ua
2966	P-Chlorotoluene	N981883	<0.29	ug/L	EPA 524.2	3/19/98	0.29	83331	ua
2967	M-Dichlorobenzene	N981883	<0.2	ug/L	EPA 524.2	3/19/98	0.2	83331	ua
2978	1,1-Dichloroethane	N981883	<0.1	ug/L	EPA 524.2	3/19/98	0.1	83331	ua
2986	1,1,1,2-Tetrachloroethane	N981883	<0.13	ug/L	EPA 524.2	3/19/98	0.13	83331	ua
2988	1,1,2,2-Tetrachloroethane	N981883	<0.33	ug/L	EPA 524.2	3/19/98	0.33	83331	ua
2993	Bromobenzene	N981883	<0.05	ug/L	EPA 524.2	3/19/98	0.05	83331	ua

Unregulated Group III Analysis

62-550.415

PWS036 & 037

2262	Isophorone	N981883	<7.26	ug/L	EPA 625	3/23/98	7.26	83331	ua
2270	2,4-Dinitrotoluene	N981883	<4.78	ug/L	EPA 625	3/23/98	4.78	83331	ua
2282	Dimethylphthalate	N981883	<9.47	ug/L	EPA 625	3/23/98	9.47	83331	ua
2284	Diethylphthalate	N981883	<4.3	ug/L	EPA 625	3/23/98	4.3	83331	ua
2290	Di-n-Butylphthalate	N981883	<4.01	ug/L	EPA 625	3/23/98	4.01	83331	ua
2294	Butyl benzyl phthalate	N981883	<2.55	ug/L	EPA 625	3/23/98	2.55	83331	ua
)	Di-n-octylphthalate	N981883	<2.43	ug/L	EPA 625	3/23/98	2.43	83331	ua

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

Parameter ID	Analysis	Sample ID	Result	Unit	Method	Analysis Date/Time	D.L.	LabID	Analyst
9108	2-Chlorophenol	N981883	<4.1	ug/L	EPA 625	3/23/98	4.1	83331	ua
9112	2-Methyl-4,6-dinitophenol	N981883	<4	ug/L	EPA 625	3/23/98	4	83331	ua
9	Phenol	N981883	<2.6	ug/L	EPA 625	3/23/98	2.6	83331	ua
91	2,4,6-Trichlorophenol	N981883	<4.66	ug/L	EPA 625	3/23/98	4.66	83331	ua

Fmw - 1

Total Coliform	N981883	6	col/100ml	SM9222B	3/17/98	15:20 1	84352	ua
Fecal Coliform	N981883	4	col/100ml	SM9222D	3/17/98	15:20 1	84352	ua
Fecal Strep	N981883	1	col/100ml	SM9230C	3/17/98	15:20 1	84352	ua

PA 608 - Organochlorine Pesticides and PC

A-BHC	N981883	<0.01	ug/L	EPA 8080	3/23/98	0.01	E84207	ua
B-BHC	N981883	<0.01	ug/L	EPA 8080	3/23/98	0.01	E84207	ua
D-BHC	N981883	<0.01	ug/L	EPA 8080	3/23/98	0.01	E84207	ua
G-BHC (Lindane)	N981883	<0.01	ug/L	EPA 8080	3/23/98	0.01	E84207	ua
Heptachlor	N981883	<0.05	ug/L	EPA 8080	3/23/98	0.05	E84207	ua
Aldrin	N981883	<0.01	ug/L	EPA 8080	3/23/98	0.01	E84207	ua
Heptachlor Epoxide	N981883	<0.01	ug/L	EPA 8080	3/23/98	0.01	E84207	ua
Endosulfan I	N981883	<0.01	ug/L	EPA 8080	3/23/98	0.01	E84207	ua
4,4-DDE	N981883	<0.01	ug/L	EPA 8080	3/23/98	0.01	E84207	ua
Dieldrin	N981883	<0.01	ug/L	EPA 8080	3/23/98	0.01	E84207	ua
Endrin	N981883	<0.01	ug/L	EPA 8080	3/23/98	0.01	E84207	ua
4,4-DDD	N981883	<0.01	ug/L	EPA 8080	3/23/98	0.01	E84207	ua
Endosulfan II	N981883	<0.01	ug/L	EPA 8080	3/23/98	0.01	E84207	ua
4,4-DDT	N981883	<0.07	ug/L	EPA 8080	3/23/98	0.07	E84207	ua
Endrin Aldehyde	N981883	<0.01	ug/L	EPA 8080	3/23/98	0.01	E84207	ua
Endosulfan Sulfate	N981883	<0.01	ug/L	EPA 8080	3/23/98	0.01	E84207	ua
Chlordane	N981883	<0.99	ug/L	EPA 8080	3/23/98	0.99	E84207	ua
Toxaphene	N981883	<1.2	ug/L	EPA 8080	3/23/98	1.2	E84207	ua
PCB-1016	N981883	<0.44	ug/L	EPA 8080	3/23/98	0.44	E84207	ua
PCB-1221	N981883	<1.1	ug/L	EPA 8080	3/23/98	1.1	E84207	ua
PCB-1232	N981883	<0.70	ug/L	EPA 8080	3/23/98	0.70	E84207	ua

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

Parameter ID	Analysis	Sample ID	Result	Unit	Method	Analysis Date/Time	D.L.	LabID	Analyst
	PCB-1242	N981883	<0.59	ug/L	EPA 8080	3/23/98	0.59	E84207	ua
	PCB-1248	N981883	<0.55	ug/L	EPA 8080	3/23/98	0.55	E84207	ua
	PCB-1254	N981883	<0.44	ug/L	EPA 8080	3/23/98	0.44	E84207	ua
	PCB-1260	N981883	<0.65	ug/L	EPA 8080	3/23/98	0.65	E84207	ua
	Methoxychlor	N981883	<0.1	ug/L	EPA 8080	3/23/98	0.1	E84207	ua

EPA 624 - Purgeable Organics

FMW-1

	Chloromethane	N981883	<0.52	ug/L	EPA 8240	3/18/98	0.52	E84207	ua
	Vinyl Chloride	N981883	<0.47	ug/L	EPA 8240	3/18/98	0.47	E84207	ua
	Bromomethane	N981883	<1.0	ug/L	EPA 8240	3/18/98	1.0	E84207	ua
	Chloroethane	N981883	<0.53	ug/L	EPA 8240	3/18/98	0.53	E84207	ua
	Trichlorofluoromethane	N981883	<1.3	ug/L	EPA 8240	3/18/98	1.3	E84207	ua
	1,1-Dichloroethene	N981883	<0.60	ug/L	EPA 8240	3/18/98	0.60	E84207	ua
	Methylene Chloride	N981883	<1.0	ug/L	EPA 8240	3/18/98	1.0	E84207	ua
	Trans-1,2-Dichloroethene	N981883	<0.38	ug/L	EPA 8240	3/18/98	0.38	E84207	ua
	1,1-Dichloroethane	N981883	<0.74	ug/L	EPA 8240	3/18/98	0.74	E84207	ua
	Chloroform	N981883	1.1	ug/L	EPA 8240	3/18/98	1.0	E84207	ua
	1,1,1-Trichloroethane	N981883	<0.36	ug/L	EPA 8240	3/18/98	0.36	E84207	ua
	Carbon Tetrachloride	N981883	<0.42	ug/L	EPA 8240	3/18/98	0.42	E84207	ua
	1,2-Dichloroethane	N981883	<0.27	ug/L	EPA 8240	3/18/98	0.27	E84207	ua
	Benzene	N981883	<0.34	ug/L	EPA 8240	3/18/98	0.34	E84207	ua
	Trichloroethene	N981883	<0.83	ug/L	EPA 8240	3/18/98	0.83	E84207	ua
	1,2-Dichloropropane	N981883	<0.36	ug/L	EPA 8240	3/18/98	0.36	E84207	ua
	Bromodichloromethane	N981883	<0.26	ug/L	EPA 8240	3/18/98	0.26	E84207	ua
	2-Chloroethylvinyl Ether	N981883	<0.59	ug/L	EPA 8240	3/18/98	0.59	E84207	ua
	Cis-1,3-dichloropropene	N981883	<0.29	ug/L	EPA 8240	3/18/98	0.29	E84207	ua
	Toluene	N981883	<0.38	ug/L	EPA 8240	3/18/98	0.38	E84207	ua
	Trans-1,3-Dichloropropene	N981883	<0.89	ug/L	EPA 8240	3/18/98	0.89	E84207	ua
	1,1,2-Trichloroethane	N981883	<0.48	ug/L	EPA 8240	3/18/98	0.48	E84207	ua
	Tetrachloroethene	N981883	<0.36	ug/L	EPA 8240	3/18/98	0.36	E84207	ua
	Dibromochloromethane	N981883	<0.63	ug/L	EPA 8240	3/18/98	0.63	E84207	ua
	Chlorobenzene	N981883	<0.34	ug/L	EPA 8240	3/18/98	0.34	E84207	ua
	Ethylbenzene	N981883	<0.41	ug/L	EPA 8240	3/18/98	0.41	E84207	ua
	Bromoform	N981883	<0.66	ug/L	EPA 8240	3/18/98	0.66	E84207	ua
	1,1,2,2-Tetrachloroethane	N981883	<0.31	ug/L	EPA 8240	3/18/98	0.31	E84207	ua
	1,3-Dichlorobenzene	N981883	<0.77	ug/L	EPA 8240	3/18/98	0.77	E84207	ua
	1,4-Dichlorobenzene	N981883	<0.50	ug/L	EPA 8240	3/18/98	0.50	E84207	ua
	1,2-Dichlorobenzene	N981883	<0.42	ug/L	EPA 8240	3/18/98	0.42	E84207	ua

EPA 625 - Semivolatile Organics

Parameter ID	Analysis	Sample ID	Result	Unit	Method	Analysis Date/Time	D. L.	LabID	Analyst
	N-Nitrosodimethylamine	N981883	<1.0	ug/L	EPA 8270	3/21/98	1.0	E84207	ua
	Phenol	N981883	<1.3	ug/L	EPA 8270	3/21/98	1.3	E84207	ua
	Bis(2-Chloroethyl)Ether	N981883	<0.50	ug/L	EPA 8270	3/21/98	0.50	E84207	ua
	2-Chlorophenol	N981883	<0.42	ug/L	EPA 8270	3/21/98	0.42	E84207	ua
	1,3-Dichlorobenzene	N981883	<0.50	ug/L	EPA 8270	3/21/98	0.50	E84207	ua
	1,4-Dichlorobenzene	N981883	<0.55	ug/L	EPA 8270	3/21/98	0.55	E84207	ua
	1,2-Dichlorobenzene	N981883	<1.0	ug/L	EPA 8270	3/21/98	1.0	E84207	ua
	Bis(2-Chloroisopropyl)ether	N981883	<0.35	ug/L	EPA 8270	3/21/98	0.35	E84207	ua
	N-Nitroso-di-n-propylamine	N981883	<0.34	ug/L	EPA 8270	3/21/98	0.34	E84207	ua
	Hexachloroethane	N981883	<0.71	ug/L	EPA 8270	3/21/98	0.71	E84207	ua
	Nitrobenzene	N981883	<2.8	ug/L	EPA 8270	3/21/98	2.8	E84207	ua
	2-Nitrophenol	N981883	<0.63	ug/L	EPA 8270	3/21/98	0.63	E84207	ua
	2,4-Dimethylphenol	N981883	<0.85	ug/L	EPA 8270	3/21/98	0.85	E84207	ua
	Bis(2-Chloroethoxy)Methane	N981883	<0.28	ug/L	EPA 8270	3/21/98	0.28	E84207	ua
	2,4-Dichlorophenol	N981883	<0.22	ug/L	EPA 8270	3/21/98	0.22	E84207	ua
	1,2,4-Trichlorobenzene	N981883	<0.43	ug/L	EPA 8270	3/21/98	0.43	E84207	ua
	Naphthalene	N981883	<0.59	ug/L	EPA 8270	3/21/98	0.59	E84207	ua
	Hexachlorobutadiene	N981883	<0.67	ug/L	EPA 8270	3/21/98	0.67	E84207	ua
	4-Chloro-3-Methylphenol	N981883	<0.52	ug/L	EPA 8270	3/21/98	0.52	E84207	ua
	2-Methylnaphthalene	N981883	<0.52	ug/L	EPA 8270	3/21/98	0.52	E84207	ua
	1-Methylnaphthalene	N981883	<0.48	ug/L	EPA 8270	3/21/98	0.48	E84207	ua
	Hexachlorocyclopentadiene	N981883	<1.6	ug/L	EPA 8270	3/21/98	1.6	E84207	ua
	2,4,6-Trichlorophenol	N981883	<0.70	ug/L	EPA 8270	3/21/98	0.70	E84207	ua
	2-Chloronaphthalene	N981883	<0.48	ug/L	EPA 8270	3/21/98	0.48	E84207	ua
	Dimethylphthalate	N981883	<0.22	ug/L	EPA 8270	3/21/98	0.22	E84207	ua
	Acenaphthene	N981883	<0.39	ug/L	EPA 8270	3/21/98	0.39	E84207	ua
	Acenaphthylene	N981883	<0.39	ug/L	EPA 8270	3/21/98	0.39	E84207	ua
	2,4-Dinitrophenol	N981883	<1.4	ug/L	EPA 8270	3/21/98	1.4	E84207	ua
	4-Nitrophenol	N981883	<0.97	ug/L	EPA 8270	3/21/98	0.97	E84207	ua
	2,4-Dinitrotoluene	N981883	<0.50	ug/L	EPA 8270	3/21/98	0.50	E84207	ua
	2,6-Dinitrotoluene	N981883	<0.68	ug/L	EPA 8270	3/21/98	0.68	E84207	ua
	Diethylphthalate	N981883	0.97	ug/L	EPA 8270	3/21/98	0.28	E84207	ua
	4-Chlorophenyl-phenyl ether	N981883	<0.37	ug/L	EPA 8270	3/21/98	0.37	E84207	ua
	Fluorene	N981883	<0.31	ug/L	EPA 8270	3/21/98	0.31	E84207	ua
	4,6-Dinitro-2-Methylphenol	N981883	<0.21	ug/L	EPA 8270	3/21/98	0.21	E84207	ua
	N-Nitrosodiphenylamine	N981883	<0.52	ug/L	EPA 8270	3/21/98	0.52	E84207	ua
	4-Bromophenyl-phenyl ether	N981883	<0.31	ug/L	EPA 8270	3/21/98	0.31	E84207	ua
	Hexachlorobenzene	N981883	<0.48	ug/L	EPA 8270	3/21/98	0.48	E84207	ua
	B-BHC	N981883	<0.01	ug/L	EPA 8080	3/23/98	0.01	E84207	ua
	Pentachlorophenol	N981883	<0.21	ug/L	EPA 8270	3/21/98	0.21	E84207	ua
	Phenanthrene	N981883	<0.45	ug/L	EPA 8270	3/21/98	0.45	E84207	ua
	Anthracene	N981883	<0.28	ug/L	EPA 8270	3/21/98	0.28	E84207	ua
	D-BHC	N981883	<0.01	ug/L	EPA 8080	3/23/98	0.01	E84207	ua
	Heptachlor	N981883	<0.05	ug/L	EPA 8080	3/23/98	0.05	E84207	ua

Parameter ID	Analysis	Sample ID	Result	Unit	Method	Analysis Date/Time	D. L.	LabID	Analyst
	Di-n-Butylphthalate	N981883	<0.22	ug/L	EPA 8270	3/21/98	0.22	E84207	ua
	Aldrin	N981883	<0.01	ug/L	EPA 8080	3/23/98	0.01	E84207	ua
	Heptachlor Epoxide	N981883	<0.01	ug/L	EPA 8080	3/23/98	0.01	E84207	ua
	Fluoranthene	N981883	<0.56	ug/L	EPA 8270	3/21/98	0.56	E84207	ua
	Benzidine	N981883	<2.8	ug/L	EPA 8270	3/21/98	2.8	E84207	ua
	Pyrene	N981883	<0.51	ug/L	EPA 8270	3/21/98	0.51	E84207	ua
	Endosulfan I	N981883	<0.01	ug/L	EPA 8080	3/23/98	0.01	E84207	ua
	4,4-DDE	N981883	<0.01	ug/L	EPA 8080	3/23/98	0.01	E84207	ua
	Dieldrin	N981883	<0.01	ug/L	EPA 8080	3/23/98	0.01	E84207	ua
	Endrin	N981883	<0.01	ug/L	EPA 8080	3/23/98	0.01	E84207	ua
	4,4-DDD	N981883	<0.01	ug/L	EPA 8080	3/23/98	0.01	E84207	ua
	Endosulfan II	N981883	<0.01	ug/L	EPA 8080	3/23/98	0.01	E84207	ua
	Butylbenzylphthalate	N981883	<0.20	ug/L	EPA 8270	3/21/98	0.20	E84207	ua
	4,4-DDT	N981883	<0.08	ug/L	EPA 8080	3/23/98	0.08	E84207	ua
	Endosulfan Sulfate	N981883	<0.07	ug/L	EPA 8080	3/23/98	0.07	E84207	ua
	3,3-Dichlorobenzidine	N981883	<0.53	ug/L	EPA 8270	3/21/98	0.53	E84207	ua
	Benzo(a)Anthracene	N981883	<0.58	ug/L	EPA 8270	3/21/98	0.58	E84207	ua
	Bis(2-Ethylhexyl)Phthalate	N981883	<0.81	ug/L	EPA 8270	3/21/98	0.81	E84207	ua
	Chrysene	N981883	<0.56	ug/L	EPA 8270	3/21/98	0.56	E84207	ua
	Di-n-octylophthalate	N981883	<1.0	ug/L	EPA 8270	3/21/98	1.0	E84207	ua
	Benzo(d)Fluoranthene	N981883	<2.1	ug/L	EPA 8270	3/21/98	2.1	E84207	ua
	Benzo(k)Fluoranthene	N981883	<1.1	ug/L	EPA 8270	3/21/98	1.1	E84207	ua
	Benzo(a)Pyrene	N981883	<0.43	ug/L	EPA 8270	3/21/98	0.43	E84207	ua
	Indeno(1,2,3-cd)Pyrene	N981883	<0.38	ug/L	EPA 8270	3/21/98	0.38	E84207	ua
	Dibenzo(a,h)Anthracene	N981883	<0.36	ug/L	EPA 8270	3/21/98	0.36	E84207	ua
	Benzo(g,h,i)Perylene	N981883	<0.59	ug/L	EPA 8270	3/21/98	0.59	E84207	ua
	Chlordane	N981883	<0.99	ug/L	EPA 8080	3/23/98	0.99	E84207	ua
	Endrin Aldehyde	N981883	<0.01	ug/L	EPA 8080	3/23/98	0.01	E84207	ua
	Isophorone	N981883	<0.20	ug/L	EPA 8270	3/21/98	0.20	E84207	ua
	Toxaphene	N981883	<1.2	ug/L	EPA 8080	3/23/98	1.2	E84207	ua
	PCB 1016	N981883	<0.44	ug/L	EPA 8080	3/23/98	0.44	E84207	ua
	PCB 1221	N981883	<1.1	ug/L	EPA 8080	3/23/98	1.1	E84207	ua
	PCB 1232	N981883	<0.70	ug/L	EPA 8080	3/23/98	0.70	E84207	ua
	PCB 1242	N981883	<0.59	ug/L	EPA 8080	3/23/98	0.59	E84207	ua
	PCB 1248	N981883	<0.55	ug/L	EPA 8080	3/23/98	0.55	E84207	ua
	PCB 1254	N981883	<0.44	ug/L	EPA 8080	3/23/98	0.44	E84207	ua
	PCB 1260	N981883	<0.65	ug/L	EPA 8080	3/23/98	0.65	E84207	ua

FMW-1

	Asbestos	N981883	<1.882	mg/L	EPA 100.2	4/10/98	1.882	25304	ua

Radiochemical Analysis

62-550.310(5)

PWS033

Fmw - 1

Parameter ID	Analysis	Sample ID	Result	Unit	Method	Analysis Date/Time	D. L.	LabID	Analyst
4000	Gross Alpha	N981883	30.7	pCi/L	EPA 900.1	3/25/98	+/-14.0	83141	ua
4020	Radium 226	N981883	3.4	pCi/L	EPA 903.1	3/25/98	+/-0.4	83141	ua
4030	Radium 228	N981883	1.0	pCi/L	Brks/Bichrd	3/25/98	+/-0.7	83141	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)

28090290/
10.1.7

Sanders Laboratories
Environmental Testing Services

INTAKE #: 511442

Project Name:	Youngquist/FMW Well 1
Project Location:	Five Ash, Broward County
Job ID:	
Sample Supply:	Ground Water FMW-1
Collector:	Client
Sample Received Date/Time:	1/15/98 15:10

Date: *20-Jan-98*

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

Lab ID	Sample ID	Type	Sample Date/Time
N980177	well 1	GRB	1/15/98 8:30

Analysis	Method	Result	D. L.	Unit	Analysis Date/Time	LabID:
Chloride	SM 4500 CI-B	3,549	5	mg/L	1/16/98	E84380
Conductivity	EPA 120.1	9,345	1.0	umhos/cm	1/15/98	E84380
pH, Lab	EPA 150.1	7.35	n/a	std units	1/15/98	E84380
Total Dissolved Solids	EPA 160.1	6,840	7	mg/L	1/15/98	E84380
Sulfate	EPA 375.4	715	5	mg/L	1/15/98	E84380
Calcium	EPA 215.1	200	0.022	mg/L	1/16/98	E84380
Potassium	EPA 258.1	59.8	0.003	mg/L	1/19/98	E84380
Bicarbonate, HCO3	4500-CO2-D	0.273		mg/L	1/16/98	E84380
Sodium	EPA 273.1	1,925	0.003	mg/L	1/19/98	E84380
Magnesium	EPA 242.1	257	0.0008	mg/L	1/16/98	E84380

Approved by:

Debra A. Sanders

Debra Sanders
Laboratory Director

Comments:

RECEIVED JAN 2 2 1998

RECEIVED FEB 17 1998 MONTGOMERY WATSON

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

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Laboratories
Environmental Testing Services

Page ___ of ___

Client: Youngquist Brothers Well Drilling
Address:
Phone: ___ Fax: ___

Report To: Mike
Bill To:
P.O. #:
Project Name: Five Ash SAMW
Project Location: Five Ash AWTP

Sample Supply: Drinking Water
Customer Type:
Field Report #:
Kit #:
REQUESTED DUE DATE: 4/1/93

Sampled By (PRINT): Tim Case
Sampler Signature:

ITEM #	SAMPLE DESCRIPTION / LOCATION	JOB #	Sample DATE	Sample TIME	Sample TYPE	NO. OF CONTAINERS	PRESERVATIVES UNPRESERVED	H_2SO_4	HNO_3	HCL	ANALYSES REQUEST: Pesticides+Herbicides	Asbestos	THMs, VOCs	Dioxin	Pest's+PCB's	Inorganics I	Total+Fecal	Fecal-Strep	608/624/625	GA's/Rad 226/8	LAB NUMBER
1	AS/Monitoring Well (FAMW)		3/17/93	1000	G						X		X		X		X				93 1483

OUT / DATE	SHIPMENT METHOD RETURNED / DATE	VIA	COOLER #

ITEM #	RELINQUISHED BY / AFFILIATION	DATE	TIME	ACCEPTED BY / AFFILIATION	DATE	TIME
		3/17/93	1500	Allison Lewis	3/17	1500

COMMENTS:
Cond. 9530
PH. 7.61

1050 Endeavor Ct., Nokomis, FL 34275-3623 • (941) 488-8103 • FAX 484-6774
16880 Gator Road, Fort Myers, FL 33912 • (941) 590-0337 • FAX (941) 590-0536

Sanders Laboratories
Environmental Testing Services

CHAIN-OF-CUSTODY RECORD

FORM # 5779 C

Page ____ of ____

Client Young Quist Brothers
Address
Phone ____ Fax ____

Report To:
Bill To:
P.O. #
Project Name Five Ash
Project Location: Broward

Sample Supply: GW / ~~DW~~
Customer Type:
Field Report #:
Kit #
REQUESTED DUE DATE: 1-17-98

Sampled By (PRINT) Client
Sampler Signature

ITEM #	SAMPLE DESCRIPTION / LOCATION	JOB #	Sample DATE	Sample TIME	Sample TYPE	NO. OF CONTAINERS	PRESERVATIVES: UNPRESERVED	H_2SO_4	HNO_3	HCL	ANALYSES REQUEST: U. Coord	PH	TDS	Sulfate	Calcium	Potassium	Bicarb	Sodium	Magnesium	LAB NUMBER
1	Five Ash Mw Well 2		1-15-98	0830	G	4					X	X	X	X	X	X	X	X		M80177

OUT / DATE	SHIPMENT METHOD RETURNED / DATE	VIA

COOLER #

COMMENTS:
6014M

ITEM #	RELINQUISHED BY / AFFILIATION	DATE	TIME	ACCEPTED BY / AFFILIATION	DATE	TIME
		1/15/98	1510	CA Bach	1/15/98	1510

625 UNIT 1, 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

Water Quality Analyses for SMW-1

INTAKE #: 511421

Sanders Laboratories
Environmental Testing Services

Project Name: Youngquist/ASR Well
Project Location: Five Ash, Broward County
Sample Supply: Ground Water
Collector: Tim Case
Sample Received Date/Time: 1/15/98 8:00

Date: *09-Feb-98*

Floridan Aquifer Monitor Well

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

Parameter ID	Analysis	Sample ID	Result	Unit	Method	Analysis Date/Time	D. L.	LabID	Analys
	Dioxin Screen	N980148	<5.0	pg/L	EPA 1613A	2/3/98	5.0	87424	ua

Trihalomethane Analysis

62-550.310(2)(a)

PWS027

2950	Total THM's (0.10)	N980148	<0.0004	mg/L	EPA 524.2	1/19/98	0.0004	83331	ua

Volatile Organic Analysis

62-550.310(2)(b)

PWS028

2378	1,2,4-Trichlorobenzene (70)	N980148	<0.22	ug/L	EPA 524.2	1/19/98	0.22	83331	ua
2380	Cis-1,2-Dichloroethylene (70)	N980148	<0.03	ug/L	EPA 524.2	1/19/98	0.03	83331	ua
2955	Xylenes (Total) (10,000)	N980148	<0.24	ug/L	EPA 524.2	1/19/98	0.24	83331	ua
2964	Dichloromethane (5)	N980148	<0.31	ug/L	EPA 524.2	1/19/98	0.31	83331	ua
2968	O-Dichlorobenzene (600)	N980148	<0.05	ug/L	EPA 524.2	1/19/98	0.05	83331	ua
2969	Para-Dichlorobenzene (75)	N980148	<0.02	ug/L	EPA 524.2	1/19/98	0.02	83331	ua
2976	Vinyl Chloride (1)	N980148	<0.29	ug/L	EPA 524.2	1/19/98	0.29	83331	ua
2977	1,1-Dichloroethylene (7)	N980148	<0.02	ug/L	EPA 524.2	1/19/98	0.02	83331	ua
2979	Trans-1,2-Dichloroethylene(10	N980148	<0.12	ug/L	EPA 524.2	1/19/98	0.12	83331	ua
2980	1,2-Dichloroethane (3)	N980148	<0.02	ug/L	EPA 524.2	1/19/98	0.02	83331	ua
2981	1,1,1-Trichloroethane (200)	N980148	<0.21	ug/L	EPA 524.2	1/19/98	0.21	83331	ua

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

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Parameter ID	Analysis	Sample ID	Result	Unit	Method	Analysis Date/Time	D. L.	LabID	Analyst
2982	Carbon Tetrachloride (3)	N980148	<0.29	ug/L	EPA 524.2	1/19/98	0.29	83331	ua
2983	1,2-Dichloropropane (5)	N980148	<0.33	ug/L	EPA 524.2	1/19/98	0.33	83331	ua
29[illegible]	Trichloroethylene (3)	N980148	<0.02	ug/L	EPA 524.2	1/19/98	0.02	83331	ua
2985	1,1,2-Trichloroethane (5)	N980148	<0.23	ug/L	EPA 524.2	1/19/98	0.23	83331	ua
2987	Tetrachloroethylene (3)	N980148	<0.21	ug/L	EPA 524.2	1/19/98	0.21	83331	ua
2989	Monochlorobenzene (100)	N980148	<0.23	ug/L	EPA 524.2	1/19/98	0.23	83331	ua
2990	Benzene (1)	N980148	<0.05	ug/L	EPA 524.2	1/19/98	0.05	83331	ua
2991	Toluene (1000)	N980148	<0.41	ug/L	EPA 524.2	1/19/98	0.41	83331	ua
2992	Ethylbenzene (700)	N980148	<0.47	ug/L	EPA 524.2	1/19/98	0.47	83331	ua
2996	Styrene (100)	N980148	<0.2	ug/L	EPA 524.2	1/19/98	0.2	83331	ua

Pesticide/PCB Chemical Analysis

62-550.310(2)(c)

PWS029

2005	Endrin (2)	N980148	<0.002	ug/L	EPA 508	1/22/98	0.002	83331	ua
2010	Lindane (0.2)	N980148	<0.002	ug/L	EPA 508	1/22/98	0.002	83331	ua
2015	Methoxychlor (40)	N980148	<0.052	ug/L	EPA 508	1/22/98	0.052	83331	ua
2020	Toxaphene (3)	N980148	<0.309	ug/L	EPA 508	1/22/98	0.309	83331	ua
20[illegible]	Dalapon (200)	N980148	<0.036	ug/L	EPA 515.1	1/26/98	0.036	83331	ua
20[illegible]	Diquat (20)	N980148	<0.26	ug/L	EPA 549.1	1/29/98	0.26	83331	ua
2033	Endothall (100)	N980148	<15.4	ug/L	EPA 548	1/27/98	15.4	83331	ua
2034	Glyphosate (700)	N980148	<9.44	ug/L	EPA 547	1/29/98	9.44	83331	ua
2035	Di(2-ethylhexyl) adipate (400)	N980148	<0.71	ug/L	EPA 525.2	1/26/98	0.71	83331	ua
2036	Oxamyl (Vydate) (200)	N980148	<2.57	ug/L	EPA 531.1	2/3/98	2.57	83331	ua
2037	Simazine (4)	N980148	<0.078	ug/L	EPA 507	1/22/98	0.078	83331	ua
2039	Di(2-ethylhexyl) phthalate (6)	N980148	<1.15	ug/L	EPA 525.2	1/26/98	1.15	83331	ua
2040	Picloram (500)	N980148	<0.029	ug/L	EPA 515.1	1/26/98	0.029	83331	ua
2041	Dinoseb (7)	N980148	<0.055	ug/L	EPA 515.1	1/26/98	0.055	83331	ua
2042	Hexachlorocyclopentadiene(50	N980148	<0.01	ug/L	EPA 508	1/22/98	0.01	83331	ua
2046	Carbofuran (40)	N980148	<7.04	ug/L	EPA 531.1	2/3/98	7.04	83331	ua
2050	Atrazine (3)	N980148	<0.035	ug/L	EPA 507	1/22/98	0.035	83331	ua
2051	Alachlor (2)	N980148	<0.012	ug/L	EPA 507	1/22/98	0.012	83331	ua
2065	Heptachlor (0.4)	N980148	<0.004	ug/L	EPA 508	1/22/98	0.004	83331	ua
2067	Heptachlor Epoxide (0.2)	N980148	<0.002	ug/L	EPA 508	1/22/98	0.002	83331	ua
2105	2,4-D (70)	N980148	<0.026	ug/L	EPA 515.1	1/26/98	0.026	83331	ua

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

Parameter ID	Analysis	Sample ID	Result	Unit	Method	Analysis Date/Time	D. L.	LabID	Analyst
2110	2,4,5-TP (Silvex) (50)	N980148	<0.017	ug/L	EPA 515.1	1/26/98	0.017	83331	ua
2274	Hexachlorobenzene (1)	N980148	<0.008	ug/L	EPA 508	1/22/98	0.008	83331	ua
2.	Benzo(a)pyrene (.2)	N980148	<0.013	ug/L	EPA 550	1/28/98	0.013	83331	ua
2326	Pentachlorophenol (1)	N980148	<0.007	ug/L	EPA 515.1	1/26/98	0.007	83331	ua
2383	PCB (0.5)	N980148	<0.1	ug/L	EPA 508	1/22/98	0.1	83331	ua
2931	Dibromochloropropane (.2)	N980148	<0.004	ug/L	EPA 504	1/20/98	0.004	83331	ua
2946	Ethylene Dibromide (0.02)	N980148	<0.006	ug/L	EPA 504	1/20/98	0.006	83331	ua
2959	Chlordane (2)	N980148	<0.446	ug/L	EPA 508	1/22/98	0.446	83331	ua

Unregulated Group I Analysis

62-550.405

PWS035

2021	Carbaryl	N980148	<3.89	ug/L	EPA 531.1	2/3/98	3.89	83331	ua
2022	Methomyl	N980148	<3.2	ug/L	EPA 531.1	2/3/98	3.2	83331	ua
2043	Aldicarb Sulfoxide	N980148	<1.88	ug/L	EPA 531.1	2/3/98	1.88	83331	ua
2044	Aldicarb Sulfone	N980148	<5.57	ug/L	EPA 531.1	2/3/98	5.57	83331	ua
2045	Metolachlor	N980148	<0.108	ug/L	EPA 507	1/22/98	0.108	83331	ua
2047	Aldicarb	N980148	<5.95	ug/L	EPA 531.1	2/3/98	5.95	83331	ua
2066	3-Hydroxycarbofuran	N980148	<3.35	ug/L	EPA 531.1	2/3/98	3.35	83331	ua
2(	Propachlor	N980148	<5	ug/L	EPA 508	1/22/98	5	83331	ua
2356	Aldrin	N980148	<0.005	ug/L	EPA 508	1/22/98	0.005	83331	ua
2364	Dieldrin	N980148	<0.02	ug/L	EPA 508	1/22/98	0.02	83331	ua
2440	Dicamba	N980148	<0.005	ug/L	EPA 515.1	1/26/98	0.005	83331	ua
2595	Metribuzin	N980148	<0.024	ug/L	EPA 507	1/22/98	0.024	83331	ua
2076	Butachlor	N980148	<0.021	ug/L	EPA 507	1/22/98	0.021	83331	ua

Unregulated Group II Analysis

62-550.410

PWS034

2210	Chloromethane	N980148	<0.35	ug/L	EPA 524.2	1/19/98	0.35	83331	ua
2212	Dichlorodiflouromethane	N980148	<0.26	ug/L	EPA 524.2	1/19/98	0.26	83331	ua
2214	Bromomethane	N980148	<0.29	ug/L	EPA 524.2	1/19/98	0.29	83331	ua
2216	Chloroethane	N980148	<0.29	ug/L	EPA 524.2	1/19/98	0.29	83331	ua
2218	Trichlorofluoromethane	N980148	<0.28	ug/L	EPA 524.2	1/19/98	0.28	83331	ua
2251	Methyl-Tert-Butyl-Ether	N980148	<0.27	ug/L	EPA 524.2	1/19/98	0.27	83331	ua
2408	Dibromomethane	N980148	<0.03	ug/L	EPA 524.2	1/19/98	0.03	83331	ua

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

Parameter ID	Analysis	Sample ID	Result	Unit	Method	Analysis Date/Time	D. L.	LabID	Analyst
2410	1,1-Dichloropropylene	N980148	<0.06	ug/L	EPA 524.2	1/19/98	0.06	83331	ua
2412	1,3-Dichloropropane	N980148	<0.05	ug/L	EPA 524.2	1/19/98	0.05	83331	ua
24 .	1,3-Dichloropropene	N980148	<0.21	ug/L	EPA 524.2	1/19/98	0.21	83331	ua
2414	1,2,3-Trichloropropane	N980148	<0.39	ug/L	EPA 524.2	1/19/98	0.39	83331	ua
2416	2,2-Dichloropropane	N980148	<0.38	ug/L	EPA 524.2	1/19/98	0.38	83331	ua
2941	Chloroform	N980148	<0.16	ug/L	EPA 524.2	1/19/98	0.16	83331	ua
2942	Bromoform	N980148	<0.31	ug/L	EPA 524.2	1/19/98	0.31	83331	ua
2943	Bromodichloromethane	N980148	<0.36	ug/L	EPA 524.2	1/19/98	0.36	83331	ua
2944	Dibromochloromethane	N980148	<0.27	ug/L	EPA 524.2	1/19/98	0.27	83331	ua
2965	O-Chlorotoluene	N980148	<0.33	ug/L	EPA 524.2	1/19/98	0.33	83331	ua
2966	P-Chlorotoluene	N980148	<0.29	ug/L	EPA 524.2	1/19/98	0.29	83331	ua
2967	M-Dichlorobenzene	N980148	<0.2	ug/L	EPA 524.2	1/19/98	0.2	83331	ua
2978	1,1-Dichloroethane	N980148	<0.1	ug/L	EPA 524.2	1/19/98	0.1	83331	ua
2986	1,1,1,2-Tetrachloroethane	N980148	<0.13	ug/L	EPA 524.2	1/19/98	0.13	83331	ua
2988	1,1,2,2-Tetrachloroethane	N980148	<0.33	ug/L	EPA 524.2	1/19/98	0.33	83331	ua
2993	Bromobenzene	N980148	<0.05	ug/L	EPA 524.2	1/19/98	0.05	83331	ua

Unregulated Group III Analysis

62-550.415

PWS036 & 037

2262	Isophorone	N980148	<7.26 ug/L	EPA 625	2/3/98	7.26	83331	ua
2270	2,4-Dinitrotoluene	N980148	<4.78 ug/L	EPA 625	2/3/98	4.78	83331	ua
2282	Dimethylphthalate	N980148	<9.47 ug/L	EPA 625	2/3/98	9.47	83331	ua
2284	Diethylphthalate	N980148	<4.3 ug/L	EPA 625	2/3/98	4.3	83331	ua
2290	Di-n-Butylphthalate	N980148	<4.01 ug/L	EPA 625	2/3/98	4.01	83331	ua
2294	Butyl benzyl phthalate	N980148	<2.55 ug/L	EPA 625	2/3/98	2.55	83331	ua
9089	Di-n-octylphthalate	N980148	<2.43 ug/L	EPA 625	2/3/98	2.43	83331	ua
9108	2-Chlorophenol	N980148	<4.1 ug/L	EPA 625	2/3/98	4.1	83331	ua
9112	2-Methyl-4,6-dinitophenol	N980148	<4.0 ug/L	EPA 625	2/3/98	4.0	83331	ua
9115	Phenol	N980148	<2.6 ug/L	EPA 625	2/3/98	2.6	83331	ua
9116	2,4,6-Trichlorophenol	N980148	<4.66 ug/L	EPA 625	2/3/98	4.66	83331	ua

Radiochemical Analysis

62-550.310(5)

PWS033

4000	Gross Alpha	N980148	10.7 pCi/L	EPA 900.1	1/21/98	+\-3.0	83141	ua

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

Parameter ID	Analysis	Sample ID	Result	Unit	Method	Analysis Date/Time	D. L.	LabID	Analyst
4020	Radium 226	N980148	3.4	pCi/L	EPA 903.1	1/27/98	+\-0.3	83141	ua
4030	Radium 228	N980148	<1.0	pCi/L	Brks/Bichrd	1/27/98	+\-0.6	83141	ua

Inorganic Analysis

62-550.310(1)

PWS030

1005	✓ Arsenic (0.05)	N980148	<0.0022	mg/L	EPA 206.2	1/15/98	0.0022	84352	ua
1010	Barium (2)	N980148	1.12	mg/L	EPA 208.2	1/19/98	0.200	84352	ua
1015	Cadmium (0.005)	N980148	<0.003	mg/L	EPA 213.1	1/27/98	0.003	84352	ua
1020	Chromium (0.1)	N980148	<0.020	mg/L	EPA 218.1	1/27/98	0.020	84352	ua
1024	Cyanide (0.2)	N980148	<0.006	mg/L	SM 4500CN	1/19/98	0.006	83331	ua
1025	Fluoride (4)	N980148	0.36	mg/L	EPA 340.2	1/16/98	0.2	84352	ua
1030	Lead (0.015)	N980148	0.004	mg/L	EPA 239.2	1/16/98	0.001	84352	ua
1035	Mercury (0.002)	N980148	<0.001	mg/L	EPA 245.1	1/16/98	0.001	84352	ua
1036	Nickel (0.1)	N980148	<0.010	mg/L	EPA 249.1	1/28/98	0.010	84352	ua
1040	Nitrate (10)	N980148	<0.01	mg/L	EPA 353.2	1/16/98	0.01	84352	ua
1041	Nitrite (1)	N980148	<0.01	mg/L	EPA 354.1	1/15/98	0.01	84352	ua
1045	Selenium (0.05)	N980148	<0.004	mg/L	EPA 270.2	1/20/98	0.004	84352	ua
1052	Sodium (160)	N980148	15.9	mg/L	EPA 273.1	1/19/98	0.003	84352	ua
1c	✓ Antimony (0.006)	N980148	<0.0017	mg/L	EPA 204.2	1/26/98	0.0017	83331	ua
1075	✓ Beryllium (0.004)	N980148	<0.0003	mg/L	EPA 200.9	1/21/98	0.0003	83331	ua
1085	Thallium (0.002)	N980148	<0.0006	mg/L	EPA 200.7	1/26/98	0.0006	83331	ua

Secondary Chemical Analysis

62-550.320

PWS031

1002	Aluminum (0.2)	N980148	3.44	mg/L	EPA 200.9	1/19/98	0.2	84352	ua
1017	Chloride (250)	N980148	24	mg/L	SM4500Cl-B	1/20/98	5	84352	ua
1022	Copper (1.0)	N980148	0.008	mg/L	EPA 220.2	1/28/98	0.001	84352	ua
1025	Fluoride (4.0)	N980148	0.36	mg/L	EPA 340.2	1/16/98	0.2	84352	ua
1028	Iron (0.3)	N980148	0.642	mg/L	EPA 236.1	1/19/98	0.015	84352	ua
1032	Manganese (0.05)	N980148	0.049	mg/L	EPA 243.1	1/28/98	0.005	84352	ua
1050	Silver (0.1)	N980148	<0.010	mg/L	EPA 272.1	1/20/98	0.010	84352	ua
1055	Sulfate (250)	N980148	21	mg/L	EPA 375.4	1/15/98	5	84352	ua
1095	Zinc (5.0)	N980148	0.011	mg/L	EPA 289.1	1/27/98	0.005	84352	ua
1905	Color (15.0)	N980148	3	PtCo units	EPA 110.3	1/15/98	1	84352	ua

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

Parameter ID	Analysis	Sample ID	Result	Unit	Method	Analysis Date/Time	D. L.	LabID	Analyst
1920	Odor (3.0)	N980148	1.0	TON	EPA 140.1	1/15/98	1	84352	ua
1925	pH (6.5-8.5)	N980148	7.74	std units	EPA 150.1	1/16/98	n/a	84352	ua
193\	Total Dissolved Solids (500)	N980148	279	mg/L	EPA 160.1	1/15/98	7	84352	ua
2905	Foaming Agents (1.5)	N980148	<0.02	mg/L	SM 5540C	1/19/98	0.02	83331	ua
	Total Coliform	N980148B	<1	col/100ml	SM9222B	1/22/98 14:00	1	84352	ua
	Fecal Coliform	N980148B	<1	col/100ml	SM9222D	1/22/98 14:00	1	84352	ua

App d by:

Debra Sanders
Laboratory Director

Approved by:

Patrick N. Sterling
Laboratory Manager

Comments:

TRANSMISSION ELECTRON MICROSCOPY ANALYSIS

Project: Youngquist Bros. Five Ash Date: 1/30/98

Method Used: ANALYTICAL METHOD FOR DETERMINATION OF ASBESTOS IN WATER 100.2

Sample Date: 1/15/98
SAMPLE TIME: 08:00

SAMPLE ID NO.	**N980148A**
TYPE OF Matrix	Water
DETECTION LIMIT MSL	0.1882
RESULT	<0.1882
IS ASBESTOS PRESENT?	NO

Sanders Laboratories

Environmental Testing Services

FORM # [illegible]

Page____ of ____

Client: Youngquist Brothers

Address:

Phone: Fax:

Report To:

Bill To:

P.O. #:

Project Name: Fire ASR

Project Location: Broward

Sample Supply: GW/[illegible]

Customer Type:

Field Report #:

Kit #:

REQUESTED DUE DATE: 1/27/98

Sampled By (PRINT): [illegible]

Sampler Signature: [signature]

ITEM #	SAMPLE DESCRIPTION / LOCATION	JOB #	Sample DATE	TIME	TYPE	NO. OF CONTAINERS	UNPRESERVED	H_2SO_4	HNO_3	HCL		Asbestos	Dioxin	[illegible]	[illegible] PCB	[illegible]	[illegible]	[illegible]	[illegible]	MBAS	[illegible]	[illegible]	Total/Fecal	LAB NUMBER
1	Young Bros ASR WELL		1/15/98	900	G							X	X	X	X	X	X	X	X	X	X	X	X	[illegible]-0148
																							X	[illegible]-0148A

SHIPMENT METHOD OUT/DATE	RETURNED/DATE	VIA	ITEM #	RELINQUISHED BY/AFFILIATION	DATE	TIME	ACCEPTED BY/AFFILIATION	DATE	TIME
				[signature]	~~1/15/98~~ 1/15/98	~~1400~~ 1400	[signature]	1/15/98	1400

COOLER #

COMMENTS:

*Quote ASR Well
$2547 (Includes Sampling)
$25 Total Col ×2
$25 Fecal Coli ×2

Appendix L

Certificate of Completion

City of Fort Lauderdale

Fiveash Water Treatment Plant
Aquifer Storage and Recovery System
Fort Lauderdale Project No. 8880/ P-9771

Well Construction Report

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.

(to be replaced with signed/sealed copy upon system completion).

_____ _____
Project Engineer Date

_____ _____
Project Hydrogeologist Date

Appendix M

Injectate Water Quality Analysis

CITY OF FORT LAUDERDALE
PUBLIC SERVICES
ENVIRONMENTAL LABORATORY
LAB CERTIFICATION NO:
DHRS #56034 & E56084
DER COM QAP #87247G

SAMPLE ID NUMBER:98-1165-RCI
SAMPLE DATE:06/22/98
SAMPLER:JC
ANALYST:JB,EM,KH,TB

SAMPLE LOCATION: Fiveash Raw Composite I

PARAMETER ID	NAME (MCL mg/L)	ANALYTICAL METHOD	ANALYSIS DATE	RESULT mg/L*	DET. LT. mg/L*
	INORGANIC ANALYSIS 62-550.310(1) (PWS030)				
0100	Turbidity (NTU)	EPA180.1	06/22/98	2.82	0.1
1005	Arsenic (.05)	SM3113-B	07/17/98	<0.001	0.001
1010	Barium (2)	SM3113-B	07/16/98	0.036	0.008
1015	Cadmium (.005)	SM3113-B	07/17/98	<0.0001	0.0001
1020	Chromium (0.1)	SM3113-B	07/20/98	<0.001	0.001
1024	Cyanide (0.2)	SM4500CN-E	06/30/98	<0.005	0.005
1025	Fluoride (4)	SM4500F-C	06/24/98	0.328	0.1
1030	Lead (0.015)	SM3113-B	07/15/98	0.0028	0.001
1035	Mercury (0.002)	EPA245.1	07/17/98	<0.0002	0.0002
1036	Nickel (0.1)	SM3111-B	07/16/98	<0.001	0.001
1040	Nitrate (10)	EPA353.2	06/25/98	<0.01	0.01
1041	Nitrite (1)	EPA354.1	06/22/98	<0.01	0.01
1045	Selenium (0.05)	SM3113-B	07/17/98	<0.001	0.001
1052	Sodium (160)	SM3111-B	07/23/98	34.4	0.002
1074	Antimony (0.006)	SM3113-B	07/15/98	<0.005	0.005
1075	Beryllium (0.004)	SM3113-B	07/21/98	<0.0005	0.0005
1085	Thallium (0.002)	EPA200.9	07/22/98	<0.002	0.002
	SECONDARY CHEMICAL ANALYSIS 62-550.320 (PWS031)				
1002	Aluminum (0.2)	SM3113-B	07/27/98	0.024	0.005
1017	Chloride (250)	SM4500Cl-D	06/23/98	48	2
1022	Copper (1)	SM3113-B	07/22/98	0.019	0.001
1025	Fluoride (2.0)	SM4500F-C	06/24/98	0.328	0.1
1028	Iron (0.3)	SM3111-B	07/30/98	0.78	0.02
1032	Manganese (0.05)	SM3111-B	07/31/98	<0.01	0.01
1050	Silver (0.1)	SM3113-B	07/23/98	<0.0002	0.0002
1055	Sulfate (250)	EPA375.4	06/25/98	15	1
1095	Zinc (5)	SM3111-B	07/30/98	0.009	0.001
1905	Color (15 Color Uts.)	SM2120-B	06/22/98	58	1
1920	Odor (3 TON)	SM2150-B	06/22/98	2	1
1925	pH (6.5-8.5)	EPA150.1	06/22/98	7.35	0.1
1930	Total Dissolved Solids (300)	SM2540-C	06/24/98	506	10
2905	Foaming Agents (0.5)	SM5540-C	06/23/98	<0.025	0.025

* Except denoted

CITY OF FORT LAUDERDALE
PUBLIC SERVICES
ENVIRONMENTAL LABORATORY
LAB CERTIFICATION NO:
DHRS #56034 & E56084
DER COM QAP #87247G

SAMPLE ID NUMBER:98-1165-RC1
SAMPLE DATE:06/22/98
EXTRACTION DATE:6/24-7/6/98
SAMPLER:JC
ANALYST:PB,ML,*

SAMPLE LOCATION: Fiveash Raw Composite I

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

PARAMETER ID	NAME (MCL ug/L)	ANALYTICAL METHOD	ANALYSIS DATE	RESULT ug/L	DET. LT. ug/L
2005	Endrin (2)	EPA508	06/25/98	<0.1	0.1
2010	Lindane (.2)	EPA508	06/25/98	<0.1	0.1
2015	Methoxychlor (40)	EPA508	06/25/98	<0.8	0.8
2020	Toxaphene (40)	EPA525.2	07/07/98	<3.0	3.0
2031	Dalapon (200)	EPA515.1	07/01/98	<0.9	0.9
2032	Diquat (20)	EPA549.1	06/27/98	<0.5 *	0.5
2033	Endothal (100)	EPA548.1	06/27/98	<10.0 *	10.0
2034	Glyphosate (700)	EPA547.1	06/27/98	<10.0 *	10.0
2035	Di(2-ethylhexyl)adipate (400)	EPA525.2	07/07/98	<2.0	2.0
2036	Oxamyl (Vydate) (200)	EPA531.1	06/30/98	<50.0 *	50.0
2037	Simazine (4)	EPA525.2	07/07/98	<1.0	1.0
2039	Di(2-ethylhexyl)-phthalate (6)	EPA525.2	07/07/98	<2.3	2.3
2040	Picloram (500)	EPA515.1	07/01/98	<0.2	0.2
2041	Dinoseb (7)	EPA515.1	07/01/98	<0.4	0.4
2042	Hexachlorocyclopentadiene (50)	EPA525.2	07/07/98	<1.0	1.0
2046	Carbofuran (40)	EPA531.1	06/30/98	<10.0 *	10.0
2050	Atrazine (3)	EPA507	06/25/98	<2.0	2.0
2051	Alachlor (2)	EPA507	06/25/98	<0.4	0.4
2063	Dioxin (0.00003) (Screen)	EPA525.2	07/07/98	<0.00003	0.00003
2065	Heptachlor (.4)	EPA508	06/25/98	<0.1	0.1
2067	Heptachlor epoxide (.2)	EPA508	06/25/98	<0.1	0.1
2105	2,4-D (70)	EPA515.1	07/01/98	<0.9	0.9
2110	2,4,5-TP (Silvex) (50)	EPA515.1	07/01/98	<0.2	0.2
2274	Hexachlorobenzene (1)	EPA525.2	07/07/98	<0.2	0.2
2306	Benzo(a)pyrene (.2)	EPA525.2	07/07/98	<0.2	0.2
2326	Pentachlorophenol (1)	EPA515.1	07/01/98	<0.1	0.1
2383	PCBs (.5)	EPA508	07/05/98	<0.2	0.2
2931	Dibromochloropropane(.2)	EPA504.1	07/06/98	<0.007	0.007
2946	Ethylene dibromide (.02)	EPA504.1	07/06/98	<0.009	0.009
2959	Chlordane (2)	EPA508	06/26/98	<0.7	0.7

COMMENTS:

* Analyzed by contract lab, Precision Lab, see separate reports. Reagent blank results all below detection limits.

CITY OF FORT LAUDERDALE
PUBLIC SERVICES
ENVIRONMENTAL LABORATORY
LAB CERTIFICATION NO:
DHRS #56034 & E56084
DER COM QAP #87247G

SAMPLE ID NUMBER:98-1165-RC1
SAMPLE DATE:06/22/98
SAMPLER:JC
ANALYST:RB

SAMPLE LOCATION: Fiveash Raw Composite I

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

PARAMETER ID	NAME	ANALYTICAL METHOD	ANALYSIS DATE	RESULT mg/L	DET. LT. mg/L	MCL mg/L
2950	Total THMs	EPA502.2	06/24/98	<0.001	0.001	0.1

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

PARAMETER ID	MAME	ANALYTICAL METHOD	ANALYSIS DATE	RESULT ug/L	DET. LT. ug/L	MCL ug/L
2378	1,2,4-Trichlorobenzene	EPA502.2	06/24/98	<3.0	3.0	70
2380	Cis-1,2-Dichloroethylene	EPA502.2	06/24/98	<3.0	3.0	70
55	Xylenes (total)	EPA502.2	06/24/98	<3.0	3.0	10000
2964	Dichloromethane	EPA502.2	06/24/98	<3.0	3.0	5
2968	o-Dichlorobenzene	EPA502.2	06/24/98	<3.0	3.0	600
2969	para-Dichlorobenzene	EPA502.2	06/24/98	<3.0	3.0	75
2976	Vinyl Chloride	EPA502.2	06/24/98	<1.0	1.0	1
2977	1,1-Dichloroethylene	EPA502.2	06/24/98	<3.0	3.0	7
2979	trans-1,2-Dichloroethylene	EPA502.2	06/24/98	<3.0	3.0	100
2980	1,2-Dichloroethane	EPA502.2	06/24/98	<3.0	3.0	3
2981	1,1,1-Trichloroethane	EPA502.2	06/24/98	<3.0	3.0	200
2982	Carbon tetrachloride	EPA502.2	06/24/98	<3.0	3.0	3
2983	1,2-Dichloropropane	EPA502.2	06/24/98	<3.0	3.0	5
2984	Trichloroethylene	EPA502.2	06/24/98	<3.0	3.0	3
2985	1,1,2-Trichloroethane	EPA502.2	06/24/98	<3.0	3.0	5
2987	Tetrachloroethylene	EPA502.2	06/24/98	<3.0	3.0	3
2989	Monochlorobenzene	EPA502.2	06/24/98	<3.0	3.0	100
2990	Benzene	EPA502.2	06/24/98	<1.0	1.0	1
2991	Toluene	EPA502.2	06/24/98	<3.0	3.0	1000
2992	Ethylbenzene	EPA502.2	06/24/98	<3.0	3.0	700
2996	Styrene	EPA502.2	06/24/98	<3.0	3.0	100

COMMENTS:

Trip and reagent blank results all below detection limits.

CITY OF FORT LAUDERDALE
PUBLIC SERVICES
ENVIRONMENTAL LABORATORY
LAB CERTIFICATION NO:
DHRS #56034 & E56084
DER COM QAP #87247G

SAMPLE ID NUMBER:98-1165-RC1
SAMPLE DATE:06/22/98
SAMPLER:JC
ANALYST:RB

SAMPLE LOCATION: Fiveash Raw Composite I

PARAMETER ID	NAME	ANALYTICAL METHOD	ANALYSIS DATE	RESULT ug/L	DET. LT. ug/L
	UNREGULATED GROUP II PURGEABLE ANALYSIS 62-550.410 (PWS034)				
2210	Chloromethane	EPA502.2	06/24/98	<3.0	3.0
2212	Dichlorodifluoromethane	EPA502.2	06/24/98	<3.0	3.0
2214	Bromomethane	EPA502.2	06/24/98	<3.0	3.0
2216	Chloroethane	EPA502.2	06/24/98	<3.0	3.0
2218	Trichlorofluoromethane	EPA502.2	06/24/98	<3.0	3.0
2251	Methyl-tert-butyl-ether	EPA502.2	06/24/98	<3.0	3.0
2408	Dibromomethane	EPA502.2	06/24/98	<3.0	3.0
2410	1,1-Dichloropropene	EPA502.2	06/24/98	<3.0	3.0
2412	1,3-Dichloropropane	EPA502.2	06/24/98	<3.0	3.0
2413	1,3-Dichloropropene	EPA502.2	06/24/98	<3.0	3.0
2414	1,2,3-Trichloropropane	EPA502.2	06/24/98	<3.0	3.0
2416	2,2-Dichloropropane	EPA502.2	06/24/98	<3.0	3.0
2941	Chloroform	EPA502.2	06/24/98	<1.0	1.0
2942	Bromoform	EPA502.2	06/24/98	<1.0	1.0
2943	Bromodichloromethane	EPA502.2	06/24/98	<1.0	1.0
2944	Dibromochloromethane	EPA502.2	06/24/98	<1.0	1.0
2965	o-Chlorotoluene	EPA502.2	06/24/98	<3.0	3.0
2966	p-Chlorotoluene	EPA502.2	06/24/98	<3.0	3.0
2967	m-Dichlorobenzene	EPA502.2	06/24/98	<3.0	3.0
2978	1,1-Dichloroethane	EPA502.2	06/24/98	<3.0	3.0
2986	1,1,1,2-Tetrachloroethane	EPA502.2	06/24/98	<3.0	3.0
2988	1,1,2,2-Tetrachloroethane	EPA502.2	06/24/98	<3.0	3.0
2993	Bromobenzene	EPA502.2	06/24/98	<3.0	3.0

COMMENTS:

Trip and reagent blank results all below detection limits.

CITY OF FORT LAUDERDALE
PUBLIC SERVICES
ENVIRONMENTAL LABORATORY
LAB CERTIFICATION NO:
DHRS #56034 & E56084
DER COM QAP #87247G

SAMPLE ID NUMBER:98-1165-RC2
SAMPLE DATE:06/22/98
SAMPLER:JC
ANALYST:JB,EM,KH,TB

SAMPLE LOCATION: Fiveash Raw Composite II

PARAMETER ID	NAME (MCL mg/L)	ANALYTICAL METHOD	ANALYSIS DATE	RESULT mg/L*	DET. LT. mg/L*
	INORGANIC ANALYSIS 62-550.310(1) (PWS030)				
0100	Turbidity (NTU)	EPA180.1	06/22/98	1.44	0.1
1005	Arsenic (.05)	SM3113-B	07/17/98	0.0014	0.001
1010	Barium (2)	SM3113-B	07/16/98	0.033	0.008
1015	Cadmium (.005)	SM3113-B	07/17/98	<0.0001	0.0001
1020	Chromium (0.1)	SM3113-B	07/20/98	<0.001	0.001
1024	Cyanide (0.2)	SM4500CN-E	06/29/98	<0.005	0.005
1025	Fluoride (4)	SM4500F-C	06/24/98	0.312	0.1
1030	Lead (0.015)	SM3113-B	07/15/98	0.0029	0.001
1035	Mercury (0.002)	EPA245.1	07/17/98	<0.0002	0.0002
1036	Nickel (0.1)	SM3111-B	07/16/98	<0.001	0.001
1040	Nitrate (10)	EPA353.2	06/25/98	<0.01	0.01
1041	Nitrite (1)	EPA354.1	06/22/98	<0.01	0.01
1045	Selenium (0.05)	SM3113-B	07/17/98	<0.001	0.001
1052	Sodium (160)	SM3111-B	07/23/98	34.3	0.002
1074	Antimony (0.006)	SM3113-B	07/15/98	<0.005	0.005
1075	Beryllium (0.004)	SM3113-B	07/21/98	<0.0005	0.0005
1085	Thallium (0.002)	EPA200.9	07/22/98	<0.002	0.002
	SECONDARY CHEMICAL ANALYSIS 62-550.320 (PWS031)				
1002	Aluminum (0.2)	SM3113-B	07/27/98	0.016	0.005
1017	Chloride (250)	SM4500Cl-D	06/23/98	56	2
1022	Copper (1)	SM3113-B	07/22/98	0.0065	0.001
1025	Fluoride (2.0)	SM4500F-C	06/24/98	0.312	0.1
1028	Iron (0.3)	SM3111-B	07/30/98	0.71	0.02
1032	Manganese (0.05)	SM3111-B	07/31/98	<0.01	0.01
1050	Silver (0.1)	SM3113-B	07/23/98	<0.0002	0.0002
1055	Sulfate (250)	EPA375.4	06/25/98	9	1
1095	Zinc (5)	SM3111-B	07/30/98	0.008	0.001
1905	Color (15 Color Uts.)	SM2120-B	06/22/98	56	1
1920	Odor (3 TON)	SM2150-B	06/22/98	3	1
1925	pH (6.5-8.5)	EPA150.1	06/22/98	7.4	0.1
1930	Total Dissolved Solids (300)	SM2540-C	06/24/98	564	10
2905	Foaming Agents (0.5)	SM5540-C	06/23/98	0.054	0.025

* Except denoted

CITY OF FORT LAUDERDALE
PUBLIC SERVICES
ENVIRONMENTAL LABORATORY
LAB CERTIFICATION NO:
DHRS #56034 & E56084
DER COM QAP #87247G

SAMPLE ID NUMBER:98-1165-RC2
SAMPLE DATE:06/22/98
EXTRACTION DATE:6/24-7/6/98
SAMPLER:JC
ANALYST:PB,ML,*

SAMPLE LOCATION: Fiveash Raw Composite II

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

PARAMETER ID	NAME (MCL ug/L)	ANALYTICAL METHOD	ANALYSIS DATE	RESULT ug/L	DET. LT. ug/L
2005	Endrin (2)	EPA508	06/25/98	<0.1	0.1
2010	Lindane (.2)	EPA508	06/25/98	<0.1	0.1
2015	Methoxychlor (40)	EPA508	06/25/98	<0.8	0.8
2020	Toxaphene (40)	EPA525.2	07/07/98	<3.0	3.0
2031	Dalapon (200)	EPA515.1	07/01/98	<0.9	0.9
2032	Diquat (20)	EPA549.1	06/30/98	<0.5 *	0.5
2033	Endothal (100)	EPA548.1	06/27/98	<10.0 *	10.0
2034	Glyphosate (700)	EPA547.1	06/27/98	<10.0 *	10.0
2035	Di(2-ethylhexyl)adipate (400)	EPA525.2	07/07/98	<2.0	2.0
2036	Oxamyl (Vydate) (200)	EPA531.1	06/30/98	<50.0 *	50.0
2037	Simazine (4)	EPA525.2	07/07/98	<1.0	1.0
39	Di(2-ethylhexyl)-phthalate (6)	EPA525.2	07/07/98	<2.3	2.3
2040	Picloram (500)	EPA515.1	07/01/98	<0.2	0.2
2041	Dinoseb (7)	EPA515.1	07/01/98	<0.4	0.4
2042	Hexachlorocyclopentadiene (50)	EPA525.2	07/07/98	<1.0	1.0
2046	Carbofuran (40)	EPA531.1	06/30/98	<10.0 *	10.0
2050	Atrazine (3)	EPA507	06/25/98	<2.0	2.0
2051	Alachlor (2)	EPA507	06/25/98	<0.4	0.4
2063	Dioxin (0.00003) (Screen)	EPA525.2	07/07/98	<0.00003	0.00003
2065	Heptachlor (.4)	EPA508	06/25/98	<0.1	0.1
2067	Heptachlor epoxide (.2)	EPA508	06/25/98	<0.1	0.1
2105	2,4-D (70)	EPA515.1	07/01/98	<0.9	0.9
2110	2,4,5-TP (Silvex) (50)	EPA515.1	07/01/98	<0.2	0.2
2274	Hexachlorobenzene (1)	EPA525.2	07/07/98	<0.2	0.2
2306	Benzo(a)pyrene (.2)	EPA525.2	07/07/98	<0.2	0.2
2326	Pentachlorophenol (1)	EPA515.1	07/01/98	<0.1	0.1
2383	PCBs (.5)	EPA508	07/05/98	<0.2	0.2
2931	Dibromochloropropane(.2)	EPA504.1	07/06/98	<0.007	0.007
2946	Ethylene dibromide (.02)	EPA504.1	07/06/98	<0.009	0.009
2959	Chlordane (2)	EPA508	06/26/98	<0.7	0.7

COMMENTS:

* Analyzed by contract lab, Precision Lab, see separate reports.
Reagent blank results all below detection limits.

CITY OF FORT LAUDERDALE
PUBLIC SERVICES
ENVIRONMENTAL LABORATORY
LAB CERTIFICATION NO:
DHRS #56034 & E56084
DER COM QAP #87247G

SAMPLE ID NUMBER:98-1165-RC2
SAMPLE DATE:06/22/98
SAMPLER:JC
ANALYST:RB

SAMPLE LOCATION: Fiveash Raw Composite II

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

PARAMETER ID	NAME	ANALYTICAL METHOD	ANALYSIS DATE	RESULT mg/L	DET. LT. mg/L	MCL mg/L
2950	Total THMs	EPA502.2	06/25/98	<0.001	0.001	0.1

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

PARAMETER ID	MAME	ANALYTICAL METHOD	ANALYSIS DATE	RESULT ug/L	DET. LT. ug/L	MCL ug/L
2378	1,2,4-Trichlorobenzene	EPA502.2	06/25/98	<3.0	3.0	70
2380	Cis-1,2-Dichloroethylene	EPA502.2	06/25/98	<3.0	3.0	70
2955	Xylenes (total)	EPA502.2	06/25/98	<3.0	3.0	10000
2964	Dichloromethane	EPA502.2	06/25/98	<3.0	3.0	5
2968	o-Dichlorobenzene	EPA502.2	06/25/98	<3.0	3.0	600
2969	para-Dichlorobenzene	EPA502.2	06/25/98	<3.0	3.0	75
2976	Vinyl Chloride	EPA502.2	06/25/98	<1.0	1.0	1
2977	1,1-Dichloroethylene	EPA502.2	06/25/98	<3.0	3.0	7
2979	trans-1,2-Dichloroethylene	EPA502.2	06/25/98	<3.0	3.0	100
2980	1,2-Dichloroethane	EPA502.2	06/25/98	<3.0	3.0	3
2981	1,1,1-Trichloroethane	EPA502.2	06/25/98	<3.0	3.0	200
2982	Carbon tetrachloride	EPA502.2	06/25/98	<3.0	3.0	3
2983	1,2-Dichloropropane	EPA502.2	06/25/98	<3.0	3.0	5
2984	Trichloroethylene	EPA502.2	06/25/98	<3.0	3.0	3
2985	1,1,2-Trichloroethane	EPA502.2	06/25/98	<3.0	3.0	5
2987	Tetrachloroethylene	EPA502.2	06/25/98	<3.0	3.0	3
2989	Monochlorobenzene	EPA502.2	06/25/98	<3.0	3.0	100
2990	Benzene	EPA502.2	06/25/98	<1.0	1.0	1
2991	Toluene	EPA502.2	06/25/98	<3.0	3.0	1000
2992	Ethylbenzene	EPA502.2	06/25/98	<3.0	3.0	700
2996	Styrene	EPA502.2	06/25/98	<3.0	3.0	100

COMMENTS:

Trip and reagent blank results all below detection limits.

CITY OF FORT LAUDERDALE
PUBLIC SERVICES
ENVIRONMENTAL LABORATORY
LAB CERTIFICATION NO:
DHRS #56034 & E56084
DER COM QAP #87247G

SAMPLE ID NUMBER:98-1165-RC2
SAMPLE DATE:06/22/98
SAMPLER:JC
ANALYST:RB

SAMPLE LOCATION: Fiveash Raw Composite II

PARAMETER ID	NAME	ANALYTICAL METHOD	ANALYSIS DATE	RESULT ug/L	DET. LT. ug/L
	UNREGULATED GROUP II PURGEABLE ANALYSIS 62-550.410 (PWS034)				
2210	Chloromethane	EPA502.2	06/25/98	<3.0	3.0
2212	Dichlorodifluoromethane	EPA502.2	06/25/98	<3.0	3.0
2214	Bromomethane	EPA502.2	06/25/98	<3.0	3.0
2216	Chloroethane	EPA502.2	06/25/98	<3.0	3.0
2218	Trichlorofluoromethane	EPA502.2	06/25/98	<3.0	3.0
2251	Methyl-tert-butyl-ether	EPA502.2	06/25/98	<3.0	3.0
2408	Dibromomethane	EPA502.2	06/25/98	<3.0	3.0
2410	1,1-Dichloropropene	EPA502.2	06/25/98	<3.0	3.0
12	1,3-Dichloropropane	EPA502.2	06/25/98	<3.0	3.0
2413	1,3-Dichloropropene	EPA502.2	06/25/98	<3.0	3.0
2414	1,2,3-Trichloropropane	EPA502.2	06/25/98	<3.0	3.0
2416	2,2-Dichloropropane	EPA502.2	06/25/98	<3.0	3.0
2941	Chloroform	EPA502.2	06/25/98	<3.0	3.0
2942	Bromoform	EPA502.2	06/25/98	<1.0	1.0
2943	Bromodichloromethane	EPA502.2	06/25/98	<1.0	1.0
2944	Dibromochloromethane	EPA502.2	06/25/98	<1.0	1.0
2965	o-Chlorotoluene	EPA502.2	06/25/98	<1.0	1.0
2966	p-Chlorotoluene	EPA502.2	06/25/98	<3.0	3.0
2967	m-Dichlorobenzene	EPA502.2	06/25/98	<3.0	3.0
2978	1,1-Dichloroethane	EPA502.2	06/25/98	<3.0	3.0
2986	1,1,1,2-Tetrachloroethane	EPA502.2	06/25/98	<3.0	3.0
2988	1,1,2,2-Tetrachloroethane	EPA502.2	06/25/98	<3.0	3.0
2993	Bromobenzene	EPA502.2	06/25/98	<3.0	3.0

COMMENTS:

Trip and reagent blank results all below detection limits.

CITY OF FORT LAUDERDALE
PUBLIC SERVICES DEPARTMENT

CHAIN OF CUSTODY RECORD

SAMPLE ID NUMBER
98-1165

Sample/Project Site: Fluoride Finished + Wells — Annual

Sample Type: ☐ Comp ☒ Grab

Matrix: ☐ Water ☐ Solid

Sampled By: James Crawford (Print) James B Crawford (Sign)

ITEM #	Sampling Date	Sampling Time	Sample Location/Description	TOTAL # CONTAINERS	Analyses Required
					# of containers submitted for each analysis
1	6/22	0700 - 1030	Fluoride Finished		
2	↓	↓	Fluoride Comp 1		
3	↓	↓	Fluoride Comp 2		
4					
5					
6					
7					

Comments:
Comp 1 – 25, 26, 27, 28, 30, 36, 39, 40, 41
Comp 2 – 42, 43, 44, 45, 46, 47, 48, 49

Relinquished By: (Print)	(Sign)	Date/Time	Relinquished By: (Print)	(Sign)	Date/Time
James Crawford	James B Crawford	6/23/98 1311			

Received By: (Print)	(Sign)	Date/Time	Received By: (Print)	(Sign)	Date/Time
Robin Byrd	Robin Byrd	6/22/98 1:11 PM			

FORM AW-334 Rev. 3/96

Appendix N

Cycle Testing Reports