City of Sunrise

Drilling and Testing Report

Sawgrass Water Treatment Pla
Concentrate Disposal System

Report and Appendix I

August, 1999

CITY OF
SUNRISE
FLORIDA

MONTGOMERY WATSON

August 31, 1999

Jose L. Calas P.E.
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Program Manager
Underground Injection Control Division
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West Palm Beach, Florida 33401

SUBJECT: City of Sunrise Concentrate Injection Well CW-1
and Monitor Well DZMW-1
Construction Permit Application No. 0129008-001-UC
Drilling and Testing Report

Dear Mr. Calas:

On behalf of the City of Sunrise, Montgomery Watson Americas, Inc. is pleased to submit the attached report entitled " Sunrise Concentrate Injection Well CW-1 and Monitor Well DZMW-1 Drilling and Testing Report" for your review and comment.

This report is submitted pursuant to Specific Condition 5j of the construction permit. The report details information required in the above-referenced permit relative to the drilling and testing of the wells. It also presents the data collected during construction of the injection and monitor wells.

Please contact Helen Madeksho-Hickman at 561-586-8830 if you have any questions or comments regarding this submittal.

Sincerely,
MONTGOMERY WATSON

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CITY OF SUNRISE FLORIDA

Sawgrass Water Treatment Plant Concentrate Disposal System

Report and Appendix I

Submitted by
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August 1999

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 Concentrate Injection Well CW-1 and monitor well DZMW-1. Those who played particularly significant roles in this achievement were:

City of Sunrise Commission

Hon. Steve Feren – Mayor
Hon. Joe Scutto – Deputy Mayor
Hon. Francine Klauber – Assistant Deputy Mayor
Hon. Irwin Harlam – Commissioner
Hon. Roger Wishner - Commissioner

City of Sunrise Staff

Pat Salerno – City Manager
Jeff Olsen – City Attorney
Tom Kassawara - City Engineer
Don Bayler – Acting Utilities Director
Chris Helfrich P.E. –Assistant Utilities Director – Engineering
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Robert Romanitch – Purchasing Agent

Florida Department of Environmental Protection (FDEP)

Jose L. Calas P.E.
J.P. Listick

Technical Advisory Committee

Steven D. Anderson – South Florida Water Management District
Cathy Conrardy P.G. – FDEP Tallahassee
Richard Deuerling P.G. – FDEP Tallahassee
Nancy Marsh – U.S. E.P.A. Region IV Atlanta
Ron Reese – U.S. Geological Survey, Miami

Contractor (Drilling) – Youngquist Brothers, Inc.

Jim Brantley – President of Drilling Operations
Bill Musselwhite – Contracts Administrator
Troy Moore – Drilling Superintendant
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Executive Summary

This report provides the results of drilling and testing for one Class I Industrial Injection well (CW-1), and a dual-zone monitor well (DZMW-1) for the City of Sunrise. The injection well system was drilled to dispose of membrane softening process concentrate from the City of Sunrise Sawgrass Water Treatment Plant (WTP). The construction of the water treatment plant at the City of Sunrise Utilities Complex, located between International Parkway and Sawgrass Corporate Parkway, on NW 8th Street in the City of Sunrise. The wells were constructed in accordance with Florida Department of Environmental Protection (FDEP) Construction Permit 0129008-001-UC (**Appendix A**).

The Construction Permit authorized the construction of one 20-inch outside diameter (OD) lined injection well with the design capacity to dispose of up to 12.6 million gallons of membrane softening process concentrate per day. The dual zone monitoring well DZMW-1, constructed within 70 feet of CW-1, was designed to provide water quality monitoring within and below the Underground Source of Drinking Water (USDW), respectively. This report provides the details of drilling and testing to support the issuance of an operating permit for the injection well system.

Construction of CW-1 began on August 24, 1998. Both the injection and the dual-zone monitoring wells were completed and tested by March 20, 1999. Data was collected continuously throughout drilling and testing activities to fulfill the requirements of the FDEP Construction Permit.

The following information is summarized in the report:

- Construction details
- Geophysical logging results
- Formation testing program
- Formation testing results
- Documentation of mechanical integrity
- Mechanical integrity testing results

These data were used to provide reasonable assurances for the following:

- Confinement between the injection zone and the base of the Underground Source of Drinking Water (USDW)
- Justification for the upper and lower monitor zone intervals
- Identification of the depth of the USDW and the active injection zone of the City of Sunrise Waste Water Treatment Plant injection well system (located adjacent to the WTP site)
- Verification of the presence of an adequate injection zone for the disposal of membrane softening concentrate and wastewater effluent

CONSTRUCTION DETAILS

Injection well CW-1 and dual zone monitoring well DZMW-1 are located in the southwest corner of the WTP site. A concrete construction pad with a 2-foot high retaining wall was constructed around the wells to contain any fluid spills during construction. Four 20-foot deep pad monitor wells were installed prior to the start of drilling activities to monitor chloride concentrations in the surficial aquifer during drilling.

Drilling activities were conducted on a 24 hour per day, 7 day per week schedule. Injection well construction was completed on November 21, 1998, and the monitor well DZMW-1 was completed December 10, 1998. The injection well was drilled using the mud rotary method to a depth of 1,056 feet below pad level (bpl) and the reverse air drilling method was used to drill from 1,056 feet bpl to the total depth of the well at 3,400 feet bpl. The DZMW-1 was drilled using the mud rotary method to a depth of 1,620 feet bpl and the reverse air drilling method was used to drill from 1,620 feet bpl to the total depth of the well at 1,980 feet bpl. Casings were centralized in reamed boreholes and cemented in place. Details of the casing materials and sizes are listed in **Table E-1**.

Table E-1
Well Casing Summary

Casing Name and Setting Depth	Outside Diameter (inches)	Wall Thickness (inches)	Casing Type	Grade	Joint Connection
INJECTION WELL CW-1					
Conductor 190 feet	54	0.375	Spiral Welded Steel	ASTM A 139 Grade B	Welded
Surface 1,030 feet	44	0.375	Spiral Welded Steel	ASTM A 139 Grade B	Welded
Intermediate 2,021 feet	34	0.375	Spiral Welded Steel	ASTM A 139 Grade B	Welded
Final 3,040 feet	24	0.500	Rolled Steel Seamless	ASTM A 53 Grade B	Welded
Tubing 3,030 feet	20	0.500	Rolled Steel Seamless	ASTM A 53 Grade B	Welded
DUAL MONITOR WELL DZMW-1					
Conductor 190 feet	20	0.375	Spiral Welded Steel	ASTM A 53 Grade B	Welded
Final Upper 1,620 feet	14	0.375	Spiral Welded/ Rolled Steel	ASTM A 53 Grade B	Welded
Final Lower 1,950 feet	6.625	0.562	Rolled Steel Seamless	ASTM A 53 Grade B	Welded

The factory-beveled ends of all casings were arc welded by certified pipeline welders to standard pipeline certifications. Caliper logs were run inside the reamed hole to determine hole volumes for cement calculations. The complete annular space between each successive casing in CW-1 and DZMW-1 was then filled with cement.

GEOPHYSICAL LOGGING PROGRAM

The geophysical logging program was used to determine formation characteristics, borehole water quality changes, identify flow zones, verify cement, and test for mechanical integrity. Geophysical logs were conducted in the pilot borehole in accordance with Specific Condition 3(f) of the FDEP Construction Permit. The following is a brief description of the geophysical logs performed at different drilling phases in the wells:

- **Caliper**: measures the diameter of the borehole, identifies fractures and solution features, implies the mechanical strength of the formation material
- **Dual Induction/Spontaneous Potential (SP)**: measures the electrical properties of the formation as they are affected by porosity and water quality
- **Borehole Compensated Sonic (BHCS) with Variable Display Log (VDL)**: measures the acoustic properties of the formation material indicating the mechanical strength and porosity of the formation
- **Gamma Ray**: measures the natural gamma radiation produced by the formation material resulting in a formation signature
- **Temperature and Fluid Resistivity**: measures the temperature and resistivity of the fluid filling the borehole
- **Flowmeter Survey**: measures the rate of fluid movement in the borehole and detects the entry of water into the borehole as the well is pumped
- **Digital Borehole Televiewer**: produces a borehole ultrasonic image output from measurement of the acoustic properties 360 degrees around the borehole wall

Detailed geophysical log information was predominantly collected from the logging program conducted in CW-1. The CW-1 logging interpretations then were verified above 1,980 feet bpl with the logs run in DZMW-1.

FORMATION TESTING PROGRAM

Lithology

The following table summarizes a lithologic interpretation of the site:

Table E-2
Lithology Summary

Depth Interval (feet)	Lithology	Formation Name, and Age	Hydrogeologic Unit
0′ - 190′	Undifferentiated limestone, sand, clay, and shell material	Plio-Pleistocene	Biscayne Aquifer
190′ – 1,005′	Light green to dark olive clays interbedded with limestone	Miocene-aged Hawthorn Group	Upper Confining Unit
1,005′ – 1,110′	White to medium gray, well indurated, highly fossiliferous packstones and grainstones with high porosity and permeability.	Oligocene-aged Suwannee Limestone	Upper Floridan Aquifer
1,110′ - 1,460′	Moderately soft, highly fossili-ferous, pelletal, white to very pale orange wackestones and pack-stones. 15% to 40% intergranular porosity.	Eocene-aged Ocala Limestone	(770 feet to 1,650′)
1,460′ - 2,400′	Limestones and dolomites, consisting of moderately soft, poorly to well indurated pelletal wackestones and packstones. Dolostone is found in the section, but is restricted to the base of the formation.	Eocene-aged Avon Park Formation	Middle Confining Unit (1,740′ – 3,030)
2,400′ -3,400′ (total depth of CW-1)	Wackestones and packstones similar to Avon Park Formation but up to 75 percent dolostone, appearing as alternating layers with limestone. From 3,100 feet to 3,200 feet bpl, formation extensive -ly fractured and dissolved. Cavernous interval known as the "Boulder Zone".	Oldsmar Formation	Lower Floridan Aquifer (Boulder Zone 3,100′ to 3,200′)

Monitor Well DZMW-1 was completed in the Avon Park Formation to a depth of 1,980 feet bpl. Drilling at the site did not identify the top of the Cedar Keys Formation, which is designated as the base of the Lower Floridan Aquifer. The "Boulder Zone" is included in the Lower Floridan and was identified at the site as occurring between the depths of 3,100 feet and 3,200 feet bpl. The "Boulder Zone" was the targeted injection zone and is generally accepted as the identifiable base of the Oldsmar Formation.

Cores

Cores were collected in accordance with Specific Condition 3(j)(4) of the Construction Permit. Seven cores were collected in CW-1 to enhance detailed lithologic information for the interval from approximately 1,743 feet to 3,044 feet bpl. Cores were collected to evaluate the porosity, permeability, and mechanical properties of the formation materials over selected intervals. This information was used to support the existence of confinement between the base of the USDW and the injection zone. Selected intervals from each core were analyzed for horizontal and vertical permeability (HP and VP), porosity (P), compressive strength, specific gravity (SG), and the modulus of elasticity as required by Specific Condition 3(j)(4) of the Construction Permit.

The results of that analysis are listed in **Table E-3.** The core information assisted in determining the hydrologic character of the middle confining unit.

Table E-3
Summary of CW-1 Core Data Analysis

Core	Sample	Depth	VP	HP	P	SG
		(feet)	(cm/sec)	(cm/sec)	%	
1	1	1,745	$3.6x10^{-3}$	$4.4 x10^{-3}$	40	2.75
2	1	1,955	$2.8 x10^{-3}$	$6.2 x10^{-3}$	42	2.72
	2	1,959	$4.3 x10^{-4}$	$1.1 x10^{-3}$	43	2.71
	3	1,964	$4.0 x10^{-5}$	$3.0 x10^{-5}$	40	2.70
3	1	2,040	$4.0 x10^{-4}$	$5.6 x10^{-4}$	38	2.72
4	1	2,078	$1.9 x10^{-5}$	$2.1 x10^{-5}$	36	2.71
	2	2,079	No Test	No Test	NT	2.73
	3	2,080	$1.2 x10^{-4}$	$1.8 x10^{-4}$	41	2.72
6	1	2,205	$6.1 x10^{-5}$	$2.9 x10^{-5}$	41	2.74
	2	2,206	$3.3 x10^{-5}$	$4.3 x10^{-5}$	32	2.74
7	1	2,298	$1.6 x10^{-8}$	$6.3 x10^{-8}$	3	2.84
	2	2,301	$1.0 x10^{-8}$	$1.4 x10^{-8}$	7	2.86
8	1	3,025	$1.1 x10^{-9}$	$8.1 x10^{-9}$	6	2.87
	2	3,027	$8.4 x10^{-5}$	No Test	28	2.73
	3	3,034	$2.3 x10^{-5}$	$8.4 x10^{-5}$	27	2.73

Descriptions and laboratory analysis verified that porosity and permeability for each of the samples was low ($1.0 x10^{-5}$ – $1.0x10^{-9}$) to moderate ($1.0x10^{-3}$ - $1.2 x10^{-4}$).

Packer Testing

Packer tests were performed at selected intervals in the CW-1 pilot hole between 1,620 feet and 2,348 feet bpl to better understand the relationship between confining and producing zones within the CW-1 pilot borehole. From the packer tests, aquifer parameters such as hydraulic conductivity, transmissivity and specific capacity were derived. Water quality samples were collected to provide data on the formation water quality in the packer intervals. Water quality data from the packer tests was used to determine the location of the base of the USDW and verify the proposed dual monitor zone.

The packer testing program consisted of five straddle packer tests, and one single packer test. The aquifer parameter tests are summarized in **Table E-4.**

Table E-4
Summary of Packer Tests Performed in CW-1

Interval	Type	Test Number	Pumping Rate	Drawdown	Transmissivity
2,060-2,090	Straddle	1	9 gpm	122 feet	109 gpd/ft
1,950-1,980	Straddle	2	79 gpm	65 feet	6,485 gpd/ft
1,920-1,950	Straddle	3	77 gpm	95 feet	3,705 gpd/ft
1,780-1,810	Straddle	4	67 gpm	129 feet	1,755 gpd/ft
1,620-1,700	Single	5	330 gpm	85 feet	6,453 gpd/ft
2,320-2,348	Straddle	6	2.5 gpm	85 feet	31 gpd/ft

** Transmissivity values calculated using the Theis Recovery Method in CW-1.*

The base of the USDW was tentatively identified between 1,900 and 1,920 feet bpl based on water quality analyses of samples collected during packer testing. Sample results are shown in **Table E-5.**

Table E-5
Summary of CW-1 Packer Test Water Samples

Depth	Specific Conductance	TDS	Cl^-	SO^4	NH^3	TKN	TP	PH	Ca	Mg	K	Na
(feet)	(umhos/cm)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(std unit)	(mg/L)	(mg/L)	(mg/L)	(mg/L)
1,620-1,700	6,120	3,580	1,750	656	0.67	0.52	<0.02	7.18	46	103	59.5	653
1,780-1,810	7,545	3,960	2,399	637	1.09	0.49	0.02	6.66	67.6	173	85.1	928
1,920-1,950	17,040	10,533	7,698	533	1.3	1.2	0.04	7.44	182	380	159	3,702
1,950-1,980	18,320	11,300	8,847	939	6.0	5.73	0.02	7.45	141	408	271	4,247
2,060-2,090	45,250	22,800	15,120	2,656	0.48	0.48	0.03	7.39	274	808	727	7,327
2,320-2,348	36,200	25,950	21,115	2,679	0.64	0.64	<0.02	7.32	273	1,449	963	10,862

Drill Stem Testing

Drill stem water samples were collected every 40 feet of pilot hole as it was advanced below a depth of 2,160 feet, as required by the permit. They were collected in accordance with Specific Condition 3(k) of the Construction Permit. These data were used to help identify the upper limit of effluent from the WWTP injection well system, and aid in the location of confining intervals. **Table E-6** summarizes the results from the collected drill stem water samples.

Table E-6
Summary of CW-1 Drill Stem Water Samples

Depth (feet)	Specific Conductance (umhos/cm)	TDS (mg/L)	Cl^- (mg/L)	NH^3 (mg/L)	TKN (mg/L)	TPO_4 (mg/L)
2160	33,300	3,898	11,800	2.18	3.82	0.00
2223	28,180	18,361	9,600	3.48	4.09	0.53
2240	31,350	20,548	11,000	3.42	3.99	0.00
2295	28,830	18,901	10,300	4.72	4.74	0.36
2320	12,080	7,342	3,950	1.82	3.49	0.36
2370	13,610	8,239	4,750	2.15	3.67	0.38
2400	14,410	8,060	4,250	1.92	3.66	0.00
2440	15,160	8,293	5,150	2.45	3.56	0.00
2480	14,100	8,340	4,550	2.41	3.65	0.33
2520	15,010	9,094	5,000	2.71	2.95	0.42
2560	16,010	9,999	5,150	2.76	3.07	0.31
2600	15,200	9,149	5,300	1.94	3.01	0.35
2640	17,240	10,866	5,850	2.18	3.69	0.35
2680	18,930	12,004	6,600	1.79	3.36	0.40
2726	18,740	11,705	6,300	2.76	3.54	0.35
2760	17,710	10,845	6,050	4.19	4.53	0.37
2800	19,000	12,128	5,900	2.60	3.19	0.36
2840	19,080	11,959	6,000	2.49	3.64	0.00
2880	18,790	11,758	6,050	2.90	3.60	0.00
2920	19,000	11,729	6,200	2.47	3.37	0.00
2960	19,140	12,090	6,350	2.58	3.59	0.00
3000	19,050	11,808	6,250	3.11	3.41	0.00
3040	19,520	12,297	6,400	2.57	3.41	0.33

Water quality data collected from drill stem tests between 2,160 feet bpl and 3,040 feet bpl and packer test samples helped define the location of the active injection zone. The data indicates that effluent is present in the formation below the dolomite confining layer at 2,300 feet bpl at the Sawgrass Site. This is due to the IW-1 and IW-2 injection wells injecting into an interval higher (2,600 feet bpl), than the interval selected for IW-3, and CW-1.

Injection and Monitor Zone Water Quality

Water samples were also collected from the injection zone of CW-1 and the shallow monitoring interval of DZMW-1 at the completion of each well. The samples were analyzed for primary and secondary water quality standards and minimum criteria. The samples were collected to establish background water quality for both wells to facilitate the monitoring of water quality over time. Since the injection zone of CW-1 is already an active injection zone from over 14 years of effluent injection into the City of Sunrise WWTP Injection Well System, the injection zone sample represents an "as-is" water quality rather than a true background condition.

Injection Test

An injection test was performed as required by FDEP in accordance with Specific condition 5(h) of the permit. The main objectives of the injection test were to determine if the injection zone could accept the quantity of fluids for which it was designed. The injection test was conducted for a period of 24 hours at an average rate of 6,070 gpm, the maximum amount that could be pumped from the WWTP, since the WTP in not yet producing concentrate. The injection test was preceded by a 24-hour static background period and followed by 48 hours of static recovery. Water levels and wellhead pressures were monitored in CW-1 and in DZMW-1 and IW-3 during the background, injection, and recovery phases of the injection test.

Water quality samples were collected and analyzed for primary and secondary drinking water parameters and other selected constituents listed in Chapter 62-550, FAC. This analysis provided existing background water quality for the injection zone.

Monitor Zone Pump Test

Following construction completion of DZMW-1, a step-rate pumping test and a constant rate pumping test were performed to determine the production characteristics of the monitoring interval between 1,620 feet and 1,700 feet bpl, and between 1,950 and 1,980 feet bpl. The results are summarized in **Table E-7a and E-7b**.

Table E-7a
Summary of Pumping Test Results for Upper Monitor Zone

Pumping Test	Pumping Rate (gpm)	Drawdown (feet)	Specific Capacity (gpm/ft)
Constant Rate	113	36	3.1
Step Rate 1	67	21	3.2
Step Rate 2	92	28	3.3
Step Rate 3	106	34	3.1
Step Rate 4	113	37	3.1

Table E-7b
Summary of Pumping Test Results for Lower Monitor Zone

Pumping Test	Pumping Rate (gpm)	Drawdown (feet)	Specific Capacity (gpm/ft)
Constant Rate	63	34	1.9
Step Rate 1	70	15	4.7
Step Rate 2	93	24	3.9
Step Rate 3	105	32	3.3
Step Rate 4	112	34	3.3

To satisfy Specific Condition 6.b.13. of permit number 0129008-UC, water samples were collected from the upper and lower monitor intervals by Sanders Environmental Laboratory of Fort Myers, Florida. The samples were analyzed for primary and secondary drinking water quality standards along with minimum criteria as listed in Chapter 62-550 FAC. The laboratory results show no parameters measured above expected ranges. All of the other parameters were measured below the detectable limit. This water quality data will serve as a baseline for all future upper monitor zone water quality comparisons.

MECHANICAL INTEGRITY TESTING AND RESULTS

Mechanical Integrity testing was performed in CW-1 and DZMW-1 to verify the internal and external well integrity. The mechanical integrity testing program was conducted to comply with FDEP Chapter 62-528.300 (6), (b)2, and (c) of the Florida Administrative Code as prescribed in the City's Construction and Testing Permit Special Condition 3(i).

The testing included:

- Hydrostatic Pressure test (CW-1 and DZMW-1)
- Cement Bond log (CW-1)
- Sector Bond Log (DZMW-1)
- Oxygen Activation Log (DZMW-1)
- Temperature and video survey (CW-1 and DZMW-1)
- Radioactive Tracer Survey (CW-1)

The pressure test was used to detect potential leaks in the final casing. The Cement Bond Log and Sector Bond Log were run to determin the quality of the cement seal of the annular space behind the final casing. The Oxygen Activation Log was run to determine if any un-cemented intervals behind the monitor tubing. A Temperature Log was used to record changes in water temperature within the casing as an indication of any potential fluid movement into the casing from the outside of the casing. The Radioactive Tracer Survey (RTS) was run to determined if water pumped into the injection zone could readily migrate upwards adjacent to the well bore.

Pressure Tests in Injection Well CW-1 and Monitor Well DZMW-1

The pressure test on the final casing string of CW-1 was performed on November 9, 1998, and was successfully completed within the 5 percent tolerance established by the FDEP. The pressure test on the injection tubing of CW-1 was performed on November 17, 1998, and was successfully completed within the 5 percent tolerance established by the FDEP. The pressure test of the monitor casing of DZMW-1 was performed on December 10, 1998, through use of an inflatable packer set in the monitor casing at a depth of 1,945 feet bpl. The pressure test for DZMW-1 was successfully completed within the 5 percent tolerance established by the FDEP.

Cement Bond Log in Injection Well CW-1

A cement bond log (CBL) was run in the final casing of CW-1 to detect potential voids in the grout sheath around the casing by measuring the acoustic properties of the cemented casing. The cement bond log for CW-1 was run on November 12, 1998. Based on the log the following evaluation of cement bonding in **Table E-8** was made:

Table E-8
Cement Bond Evaluation

CW-1	Cement Bond Quality
3,040 feet to 2,770 feet bpl 2,426 feet to 238 feet bpl	Good to moderate bond
2,770 feet to 2,426 feet bpl	Moderate to poor bond

Note: CBL was not run between 0 and 281 feet bpl.
This interval was tremied in after the CBL was performed.

Although moderately to poorly bonded intervals do exist behind the final casing of CW-1, there is no evidence of voids or lack of cement across these intervals. The cement bond log is typical of difficult cementing conditions but does not indicate any failure of cement seal.

Sector Bond Log in Monitor Well DZMW-1

The Sector Bond Log (SBL) was run on December 28, 1998. The interval logged was from the bottom of casing at 1,958 feet bpl to 1,610 feet bpl. The cemented interval separating the upper and lower monitor zones is of limited thickness and extends from the bottom of the casing at 1,958 feet bpl to the bottom of the upper monitor zone at 1,700 feet bpl (258 feet). The SBL showed variable cement bonding over the entire interval between the upper and lower monitor zones with amplitudes reading from 3 to 30 millivolts. The casing above the top of cement at 1,700 feet bpl exhibits true free pipe and reads 68 millivolts.

The log indicates that the emplacement of the cement has achieved hydraulic isolation. One hundred percent cemented pipe is observed in the intervals from 1,945 feet to 1,930 feet bpl, 1,894 feet to 1,870 feet bpl, 1,864 feet to 1,850 feet, and 1,714 feet to 1,704 feet bpl. The remainder of the cemented interval contains cement in the good to moderate range with the exception of 1,840 feet to 1,810 feet bpl and 1,798 feet to 1,786 feet, which exhibits moderate to poor cement bonding.

Oxygen Activation (Water Flow) Log in Monitor Well DZMW-1

A Water Flow Log (WFL) was run on DZMW-1 on January 12, 1999, after cementing of the 6 5/8-inch diameter final casing had been completed. The cemented interval separating the upper and lower monitor zones is of limited thickness and extends from the bottom of the casing at 1,958 feet below pad level (bpl) to the bottom of the upper monitor zone at 1,700 feet bpl (258 feet). The WFL was used to verify the integrity of the cement seal between the upper and lower monitor zones and confirm that no fluid is moving vertically behind the casing in this cemented interval. The log indicates that hydraulic isolation between the upper and lower monitoring zones has been accomplished.

Temperature and Video Survey (CW-1 and DZMW-1)

A background high resolution temperature log was performed in CW-1 to evaluate internal casing mechanical integrity and external hydraulic seal. The temperature log will also act as a base log for future mechanical integrity tests. The log showed a gradual decrease in temperature with depth with no indication of a breach in the casing. This decreasing temperature gradient is typical of wells in southeast Florida.

The video television survey is used as a visual inspection of the internal nature of the final casing string. Its purpose is to detect any visual defects in the casing wall. It is also used as a comparison log for future mechanical integrity tests. Video logs from CW-1 and DZMW-1 show no visible flaws or breaks in the final casings.

Radioactive Tracer Survey (RTS)

The RTS, is a measure of the gamma ray intensity following the ejection of a radioactive tracer, usually Iodide-131, into the well. The RTS consists of four parts: an initial gamma ray/casing collar locator log for background readings, a static well portion, a dynamic well portion, and an after gamma ray/casing collar locator log for final background readings. The RTS results showed no fluid migrating upwards behind the wall of the casing, or within the wellbore, due to channeling or inadequate cement.

REPORT CONCLUSIONS

To comply with the requirements of Construction Permit 0129008-001-UC issued by FDEP on May 28, 1998; the following assurances were to be provided:

- Confinement between the injection zone and the base of the Underground Source of Drinking Water (USDW)
- Justification for the dual monitor zone interval
- Identification of the depth of the USDW and the active injection zone of IW-1
- Verification of the presence of an adequate injection zone for the disposal of membrane softening concentrate and wastewater effluent
- Proof of the Mechanical Integrity of CW-1 and DZMW-1

The following conclusions can be derived from the information collected and analyzed during the construction of CW-1 and DZMW-1.

Confinement

Confining units were evaluated based on data from lithologic samples, the analysis and description of core samples, geophysical log interpretations, straddle packer tests, and water samples collected during drilling as required in Specific Condition 3(j) of the FDEP Construction and Testing Permit. The Middle Confining Unit that separates the Upper and Lower Floridan Aquifer, and the Upper Confining Unit that marks the bottom of the Surficial Aquifer and the Top of the Floridan Aquifer meets the criteria of Chapter 62-528, FAC with respect to designation of a confining unit. The lower confining unit, below all underground sources of drinking water and below the injection zone also meets these criteria. Producing zones were also determined using composite information collected during drilling and by observations made from the video TV surveys and geophysical logs.

Confining units and producing intervals were identified during drilling and testing as follows:

Confining:
- 190 feet to 1,005 feet bpl
- 1,740 feet to 1,865 feet bpl
- 1,920 feet to 2,020 feet bpl
- 2,060 feet to 2,140 feet bpl
- 2,290 feet to 2,304 feet
- 3,315 feet to 3,355 feet
- 2,650 feet to 2,725 feet
- 2,900 feet to 3,100 feet

Producing:
- 0 feet to 190 feet bpl
- 1,005 feet to 1,110 feet bpl
- 1,110 feet to 1,740 feet bpl
- 1,950 feet to 1,980 feet bpl
- 2,304 feet to 2,315 feet bpl
- 2,400 feet to 2,650 feet bpl
- 2,757 feet to 2,810 feet bpl
- 3,100 feet to 3,200 feet bpl
- 3,200 feet to 3,370 feet bpl

Vertical hydraulic conductivities determined from core tests ranged from 13.6×10^{-3} to 1.1×10^{-9} cm/sec and the horizontal hydraulic conductivity from the cores ranged from 1.1×10^{-3} to 1.1×10^{-9} cm/sec. Indirectly, the results obtained from the packer testing program also were used to identify the presence of confinement above and, in some tests, below the tested interval. Confinement was indicated by the rapid degradation of water quality from 3,960 milligrams per liter (mg/l) TDS to 10,533 mg/l TDS within the interval from 1,810 feet to 1,920 feet bpl. Similarly, the existence of confinement was indicated between the interval 1,740 feet and 2,060 feet bpl, between the lower monitor zone and the injection zone, by a significant change in water quality between the packer test samples.

Justification for the Upper and Lower Monitor Zone Intervals

Specific Condition 3(i) states that identification of the dual monitor zone shall be determined utilizing the following information: "Borehole televiewer log (BHTV) interpretation, the permeability of the transition zone in the vicinity of the USDW, packer test water quality data, specific capacity data of the upper and lower monitor zones, and the identification of the USDW".

The BHTV log showed a homogenous loss of signal for the dual monitor zone interval between 1,620 feet to 1,640 feet bpl indicating the likely presence of solution activity. The Dual-Induction log indicated that the interval was above the water quality change characteristic of the base of the USDW, and that the formation was slightly less resistive than adjacent formations. The caliper log indicated that the formation material was less consolidated. Additionally, the sonic log showed some evidence of bedding features on the Variable Density Log (VDL) from 1,680 feet to 1,692 feet, and the sonic porosity increased, indicating that the interval would produce water.

The transmissivity, estimated from the straddle packer test for the interval 1,620 feet to 1,670 feet bpl, was 6,453 gpd/ft. These results indicate that this interval will produce an adequate supply of water to be used as a monitoring interval. The results were confirmed by specific capacity testing on the completed well.

A straddle packer test was also conducted over the lower monitor interval between 1,950 feet to 1,980 feet bpl. The indicated transmissivity (T) for this formation interval was 6,485 gpd/ft. The results of this Straddle packer test in the lower monitor zone shows that this zone is transmissive enough to produce water. The results were confirmed by specific capacity testing on the completed well.

Depth of the Base of the USDW

Specific Condition 3(h) required that the depth of the 10,000 mg/L TDS interface (USDW) be determined utilizing "packer test water samples, aquifer performance tests, geophysical logs (specifically, caliper, gamma, Dual Induction, borehole compensated sonic, pumping flowmeter, temperature and fluid resistivity), plots of sonic porosity, and apparent formation fluid resistivity (RWA)".

The base of the USDW was identified using geophysical logs, log-derived TDS values, packer test water quality data, and calculated aquifer parameters as required in the FDEP Construction and Testing Permit Specific Conditions 3(h), determine depth of the 10,000 mg/L TDS interface and 3(i), identification of the upper monitoring zone. The water quality results from straddle packer tests conducted at intervals between 1,780 feet to 1,810 feet bpl and 1,920 feet to 1,950 feet bpl indicated TDS values of 3,960 and 10,533 mg/L, respectively. The Dual Induction log showed that a clear transition zone existed between 1,800 feet and 2,000 feet bpl. Using the sonic porosity log and the deep induction trace, a total dissolved solids (TDS) curve was plotted using average data from south Florida waters. From this information, the base of the USDW was determined to exist at an approximate depth of 1,920 feet bpl.

The top of the target injection zone occurs at approximately 3,130 feet bpl. The majority of fluid will be accepted into cavities between 3,130 feet and 3,155 feet bpl. The active injection zone at the site based on the uppermost limit of effluent detected in the borehole at CW-1, is 2,350 feet bpl. This is the top of the injection zone for IW-1 and IW-2 wells, installed at the WWTP in 1985. Later wells installed at this site, IW-3 and now CW-1, tap a deeper injection zone below 3,000 feet.

Verification of Injection Zone

An evaluation of the injection zone in Injection Well CW-1 was made based upon the results from testing conducted during and after drilling. Testing included description of lithologic cuttings, drill stem water quality sampling, packer testing, geophysical logging, video surveys, and an injection test. Based on the existing injection well system (IW-1, IW-2, and IW-3), the injection zone consisted of fractured, and in places cavernous, dolomite. This dolomite has the capacity to receive membrane softening concentrate and WWTP effluent as a result of the high secondary porosity associated with solution and fracture features.

The nature of the injection zone was determined based on lithologic descriptions below 2,887 feet bpl and the following geophysical log features:

- The caliper log showed borehole diameters of up to 59 inches in the cavernous zones of the well.
- The sonic log showed no returns or very weak late arrivals in the cavernous and fractured zones. The broken nature of the VDL also gives an indication of the amount of fracturing.
- The Dual Induction log result was similar to the sonic log indicating solution features/fractures (very low density).

- The temperature log showed a very uniform temperature in the cavernous zones where high permeability allowed thorough mixing of formation fluids.

Additionally, the video survey showed borehole walls of alternating structural features such as fractures, cavities, and vugs from approximately 100 feet below the base of the CW-1 injection well tubing (at 3,130 feet) to 3,155 feet bpl. The borehole diameter varies abruptly and erratically through the injection zone from 3,130 feet to 3,155 feet bpl. Water movement was visible at a depth of approximately 3,148 feet bpl, and many fractures are present in the walls of the borehole to the total depth of the well.

The injection test data demonstrated the existence of a very transmissive injection zone below the depth of the USDW (10,000 mg/L Total Dissolved Solids [TDS]) and within the existing active injection zone below the site. The injection zone is capable of accepting the design volume of concentrate from the City of Sunrise WTP at an acceptable injection pressure.

In summary, the following conditions were met:

1. A transmissive injection zone with water having greater than 10,000 mg/L TDS exists,
2. There is reasonable assurance of the existence of a suitable confining sequence,
3. Suitable dual monitoring zones meeting the requirements of the regulations were selected with concurrence from the FDEP and TAC, and
4. There is reasonable assurance of mechanical integrity.

Fulfillment of these criteria permits the use of the injection well for disposal of industrial concentrate and municipal wastewater, in accordance with existing State and Federal Underground Injection Control (UIC) regulations.

Section 1
Introduction

PURPOSE

This report documents the design, construction, and testing of Injection Well CW-1, a Class I Industrial Injection Well, and a dual-zone monitor well, DZMW-1, constructed for the City of Sunrise in 1998. The subject wells were constructed in accordance with Florida Department of Environmental Protection (FDEP) Construction Permit 0129008-001-UC. The report presents the data collected during the construction and testing of CW-1 to provide technical justification for the issuance of an operating permit. Injection Well CW-1 will be used to inject membrane softening process concentrate at a rate of up to 3.8 million gallons per day (mgd) from the City of Sunrise Sawgrass Water Treatment Plant (WTP). The dual-zone monitor well (DZMW-1) is located approximately 70 feet west of CW-1 and monitors above and below the Underground Source of Drinking Water (USDW) at the site.

SCOPE

On May 28, 1998, the FDEP issued a permit to construct a twenty-four inch outside diameter (OD) Class I Industrial Injection Well with 20-inch OD seamless steel tubing, CW-1, and associated dual-zone monitor well, DZMW-1. CW-1 was permitted for construction as the primary concentrate disposal system for the City of Sunrise Sawgrass WTP with an injection rate of up to 3.8 mgd. The injection interval was specified in the permit as the "Boulder Zone" located in the lower Oldsmar Formation between 3,000 feet and 3,400 feet below land surface. The monitor zones for DZMW-1 were designated as the interval between 1,650 feet and 1,700 feet below land surface (bpl) and between 1,920 feet and 2,000 feet bpl.

Construction Permit 0129008-001-UC contained 12 Specific Conditions that had to be fulfilled during construction, testing, and reporting for the injection well system. This report presents how those conditions were fulfilled by providing the results of the construction and testing program developed for CW-1 and DZMW-1. The construction and testing program was structured to demonstrate confinement, location of the Underground Source of Drinking Water (USDW), shallow monitor zone acceptability, mechanical integrity of the constructed wells, and the injectivity of CW-1.

To accomplish the above listed tasks, the construction and testing program included the following items:

- Documentation of drilling conditions
- Lithologic cuttings collection and description
- Core collection

- Geophysical logging
- Packer testing
- Pump testing
- Water quality sampling
- Pressure testing
- Injection testing

The report is organized to present and discuss the background, methods, and results of the construction and testing program as they pertain to fulfillment of the Construction Permit requirements.

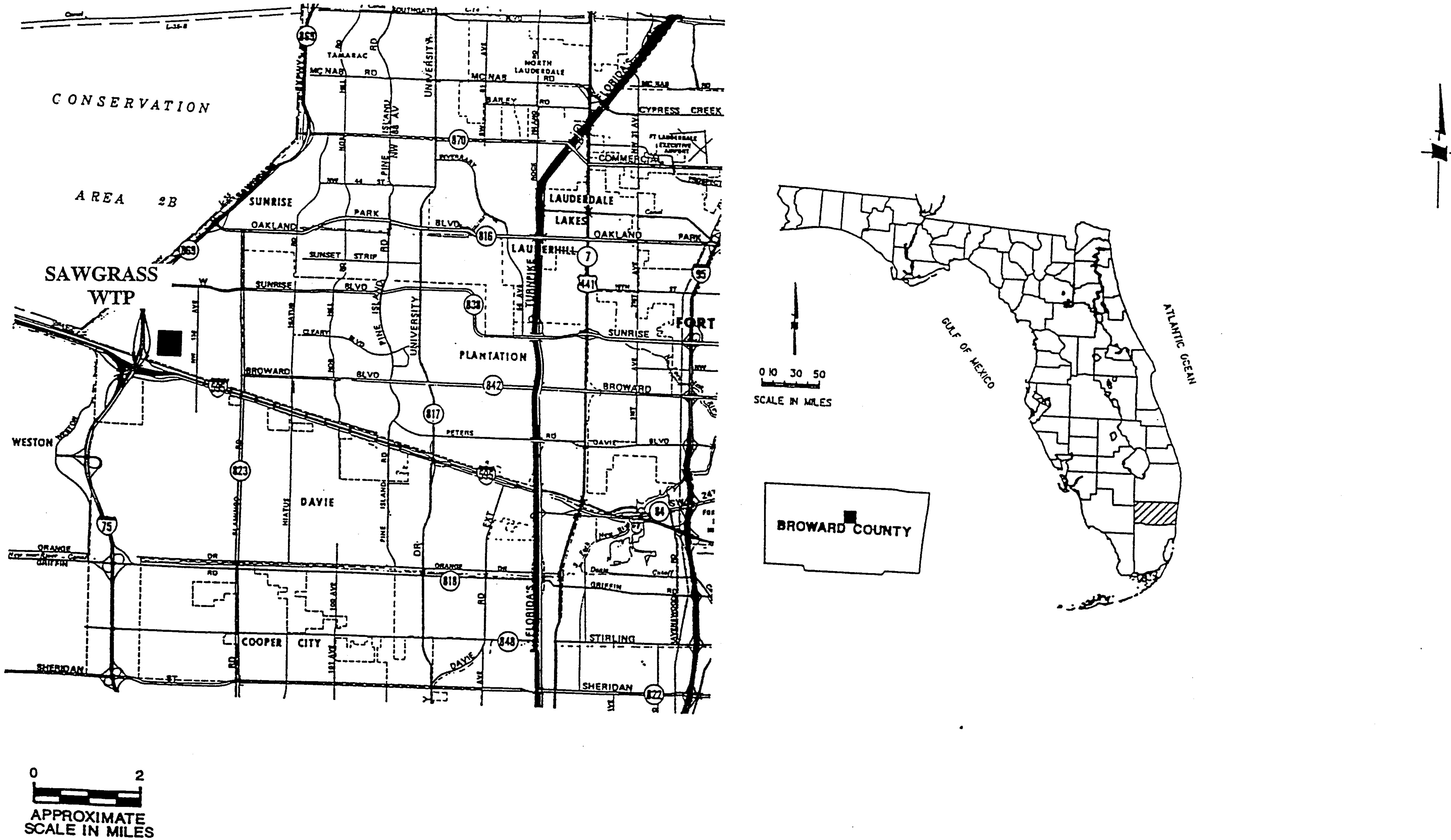
PROJECT DESCRIPTION

The City of Sunrise (City) is a metropolitan area located in western Broward County, Florida. **Figure 1-1** presents a project location map. The City utility system serves a population of approximately 170,000 residents and expects to provide service for an additional 40,000 residents by the year 2010. A membrane softening WTP, currently under construction, will be operated by the City and is located at 14150 NW Eighth Street, in Sunrise. The WTP is scheduled for completion in spring 2000.

Adjacent to this new construction is the City of Sunrise Wastewater Treatment Plant. There are three existing Class I deep injection wells located at this site (IW-1, IW-2, and IW-3), used for the disposal of treated effluent. Wells IW-1 and IW-2 were completed in 1985, and IW-3 was completed in 1996. Part of the effluent disposed of at this site is produced from two WWTPs at remote locations within the city, and pumped to the site. The rest of the effluent is produced at the Sawgrass plant located on site.

To increase the City's ability to provide potable water to the growing service area, a new water treatment facility is being constructed. This treatment facility will use a membrane softening treatment process to produce high quality finished water for distribution. The membrane softening treatment process is accomplished by allowing raw water to pass through a semi-permeable membrane under a pressure gradient. This process produces high quality finished water and a concentrate stream. The concentrate stream is typically 20 percent of the volume of finished water produced.

The WTP is situated in Section 35 of Township 49 South, Range 40 East in Broward County, Florida. This property is located adjacent to the Sawgrass Wastewater Treatment Plant (WWTP) and utility administration offices at the Sawgrass Utility Complex. The Sawgrass Utility Complex is located between international Parkway and Sawgrass Corporate Parkway on NW 8th Street in the City of Sunrise. The location of the new injection well is within the property limits of the WTP at the southeast corner of



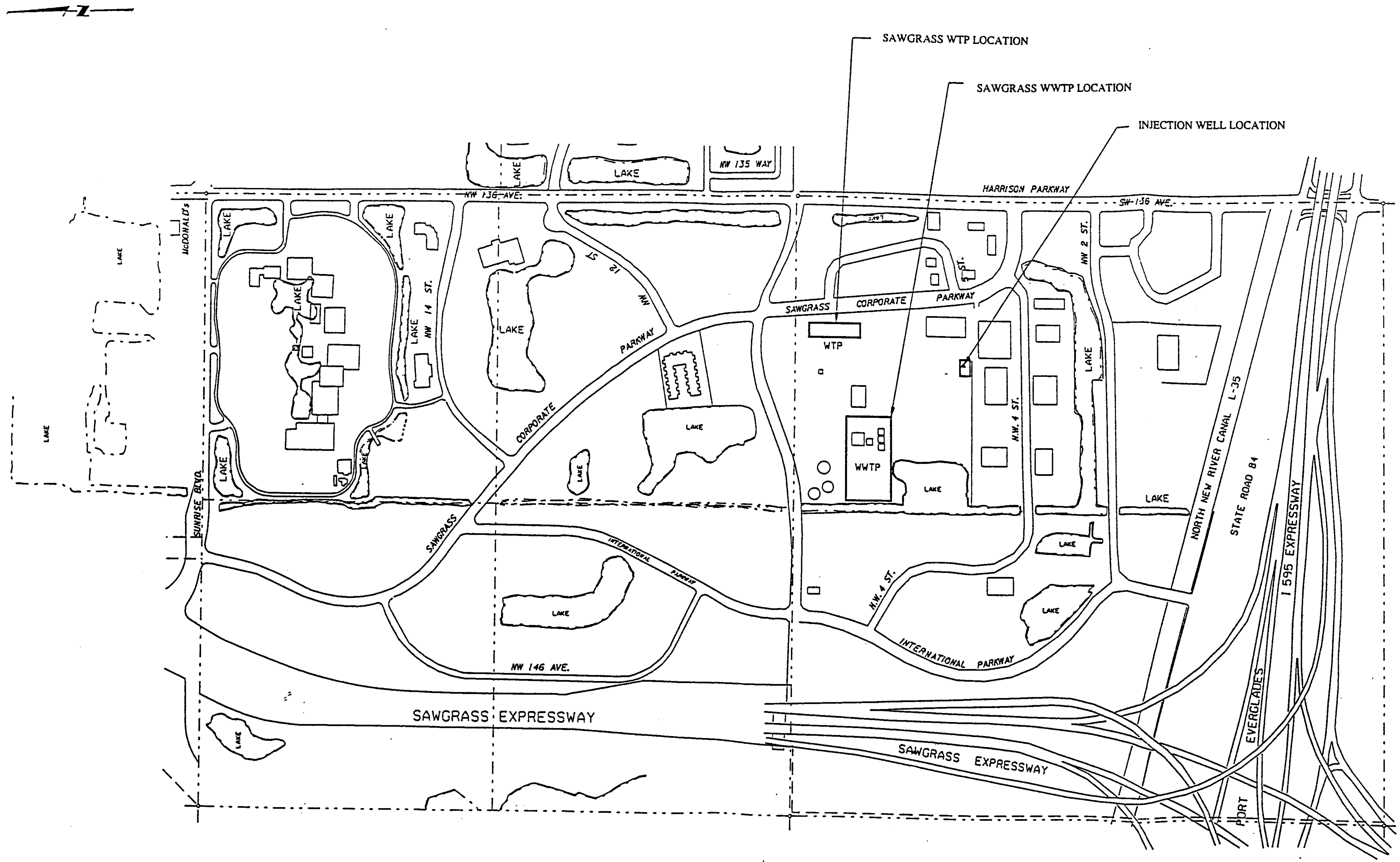
SAWGRASS WATER TREATMENT PLANT (WTP) SITE
IN BROWARD COUNTY, FLORIDA
FIGURE 1-1

the site. The site map in **Figure 1-2** shows the location of the WTP relative to the WWTP landmarks.

The WTP will have a projected build-out capacity of 18 mgd with an initial capacity of 8 mgd. Based on the 18 mgd build-out capacity, an average daily flow of 3.8 mgd of reject concentrate will be generated. Additional disposal capacity in CW-1 will provide for emergency disposal of secondarily treated effluent from the WWTP if necessary.

On May 28, 1998, FDEP issued a Construction Permit (No. 0129008-001-UC) to the City (**Appendix A**). The permit authorized the construction of CW-1 and DZMW-1. The permit allowed for the construction of one 24-inch OD injection well equipped with a 20-inch OD tubing and packer assembly for the disposal of up to 3.8 mgd (peak hour flow) of membrane softening process concentrate from the City's Sawgrass Membrane Softening WTP. The proposed dual-zone monitoring well DZMW-1 would provide water quality and water level monitoring within and below the USDW.

The City signed a contract with Youngquist Brothers, Inc. (YBI) of Fort Myers, Florida to construct the concentrate and monitor wells, and a Notice to Proceed was issued on August 3, 1999 by the FDEP. Drilling of CW-1 commenced on August 24th, 1998 Construction of both wells was completed by January 12th, 1999. Final injection testing of CW-1 was completed by March 20th, 1999.



MONTGOMERY WATSON
Plantation, Florida

SAWGRASS WELLSITE VICINITY MAP

Figure 1-2

Section 2
Construction Details

SITE DEVELOPMENT

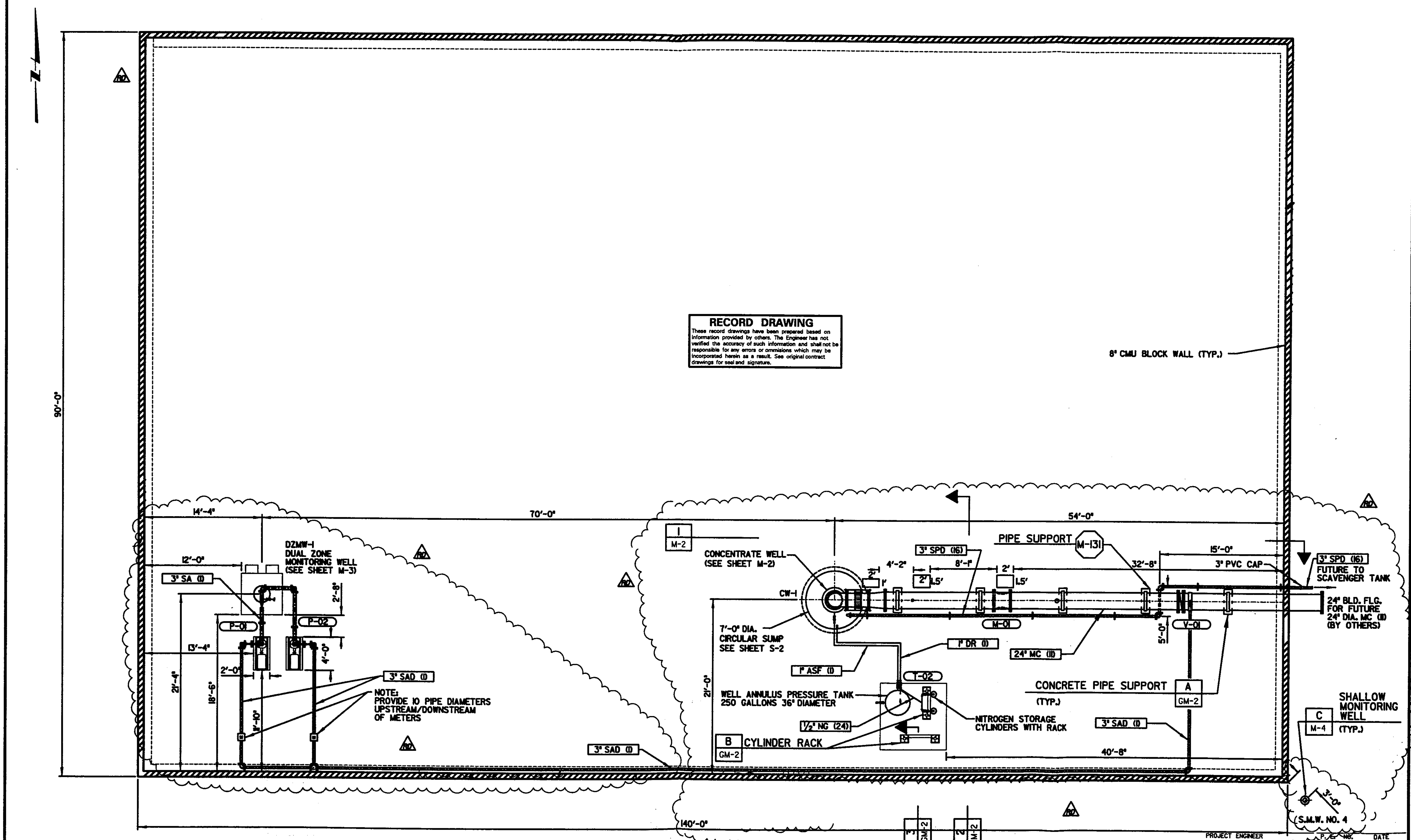
The City's WTP is located adjacent to the WWTP site, between International Parkway and Sawgrass Corporate Parkway south of 8th Avenue. The new injection well is located in the southeast corner of the WTP site, within the property limits. Prior to construction, the site was cleared and shell rock used to build up a working area. The average elevation of the site was between 6 feet and 10 feet, above the National Geodetic Vertical Datum of 1929 (NGVD). The site was graded to an approximate elevation of 10 feet NGVD prior to pad construction.

Containment Pad

A steel-reinforced concrete containment pad was constructed for the injection well and dual- zone monitor well. The pad was 10,000 square feet with a 2-foot high retaining wall and provided support for the drilling equipment. The concrete block perimeter retaining wall was designed to contain any fluid spills, principally saline water, to within the limits of the pad, thereby protecting the surficial aquifer. A permanent sump was installed in the vicinity of the injection well to remove water from the pad, which included rainwater and drilling fluids. The total volume of the pad was approximately 225,000 gallons. DZMW-1 was constructed 70 feet southeast of CW-1 and is located on the same concrete pad. The area around the injection well is shown on the site plan in **Figure 2-1.**

Pad Monitor Wells

Four water table monitor wells were drilled between August 17 and August 19, 1998. The pad monitor wells were located at the northeast, northwest, southeast, and southwest corners of the drilling pad. The four pad monitor wells were installed prior to the start of injection well drilling activities. Each well was constructed to a depth of 19 feet below land surface with 5 feet of 0.020-inch slot screen at the base of the well and Schedule 40 PVC blank casing from the top of screen to land surface. Water quality samples were collected from the wells after construction completion and well development; samples were analyzed for chloride concentration, specific conductivity, temperature, and pH. Results from the wells were used as a baseline for comparison with pad monitor well water quality data from weekly field sampling. The wells were left in place after construction of the injection well for future monitoring as required by Specific Condition 2(d) of the Construction Permit.



REV	DATE	BY	DESCRIPTION
2	2/99	GJT	RECORD DRAWING
1	7/97	TW	FOR BIDDING
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SCALE: 3/16" = 1'-0"

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

DESIGNED T.L. WATSON
DRAWN J.A.Z.
CHECKED F.E. DURAN

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

MONTGOMERY WATSON
Plantation, Florida

CITY OF
sunrise
FLORIDA

PROJECT ENGINEER — P. E. NO. — DATE

CITY OF SUNRISE
SAWGRASS CONCENTRATE WELL No. 1
Concentrate Well and Monitor Well Location Map

FIGURE 2-1

JOB No. — FILE No. — Plot Date: ●●●●date●●●● ●●time●●

WELL CONSTRUCTION SEQUENCE

Construction of CW-1 commenced on August 24, 1998 and drilling activities were conducted on a 24 hour per day, 7 day per week schedule. The injection well was completed on November 20, 1998. Construction of DZMW-1 began on November 23, 1998, after the rig was moved to the new location. Drilling activities for the construction of DZMW-1 were also conducted on a 24 hour per day, 7 day per week schedule. The lower monitor zone of DZMW-1 was completed as an open-hole, designed to monitor water quality below the base of the USDW. The upper monitor zone was completed within the annular space between the base of the intermediate casing and the top of cement for the final casing. Water quality stratification at the site was determined during construction of CW-1 through straddle packer testing, open-hole (drill stem) flow testing, and geophysical logging.

A standard generalized sequence for drilling and testing of the injection and monitoring wells, based on Construction Permit Specific Condition 3 - Construction and Testing Requirements, consisted of the following sequence:

1. For each stage of injection and monitor well drilling, a pilot borehole was advanced and lithologic cuttings were collected.

2. Cores were collected during CW-1 drilling at selected intervals of the pilot borehole and used to estimate porosity and permeability.

3. Geophysical logs were performed during pilot borehole drilling to estimate formation competency, the presence of clay minerals, porosity, permeability, water quality, and in CW-1, to estimate the contribution of water from zones of flow within the borehole.

4. Packer pumping tests were conducted in the CW-1 pilot borehole to isolate discrete intervals for determination of transmissivity, hydraulic conductivity, and water quality.

5. Video surveys were conducted in two phases of the open pilot borehole to observe physical borehole characteristics and to visually confirm log results.

6. Caliper logs were performed after each reaming operation to provide data with which to calculate hole volumes.

7. The information collected during pilot hole drilling was used to identify setting depths for each well casing. Following drilling and testing of each pilot borehole stage, the pilot borehole was reamed to the appropriate size for casing installation.

8. Casings were set in place and the annular space was cemented. Temperature and gamma ray logs were performed to verify cement stage tag depths. This sequence was repeated for each consecutive casing of smaller diameter set concentrically within the previous casing.

9. Deviation surveys (sure shots) of the pilot boreholes and reamed boreholes were measured approximately every 80 feet to track hole straightness during drilling. A summary of the deviation survey measured during the drilling operations for CW-1 and DZMW-1 is presented in **Appendix B.**

10. After setting and cementing the final casing in CW-1, the open borehole was drilled out to a nominal 24 inches in diameter. The 20-inch OD tubing was set in place with a positive seal packer and the annular space was filled with an anti-corrosion fluid. The open hole then was developed and a water sample was collected.

11. In DZMW-1 the final borehole was 12.25 inches in diameter, drilled to the total depth of the well at 1,980 feet bpl. A specially designed cement basket was used to set and cement the final casing at 1,950 feet bpl.

Drilling Methods

The injection and monitor wells were both drilled using the mud rotary method through the Hawthorn Formation, to a depth of 1,066 feet (above the top of the production portion of the Floridan aquifer). In addition, mud rotary drilling was continued in DZMW-1 to a depth of 1,656 feet for installation of the intermediate casing. The drilling rig then was configured for reverse air drilling. The reverse air drilling method was used to drill to the total depth of both wells.

Pilot Hole Cementing

Cement was emplaced in the pilot hole following completion of each stage of pilot hole drilling and testing below 1,030 feet bpl in the injection well. Cementing the pilot hole reduced the possibility of an open conduit for fluid migration outside of the intermediate and final well casings. The cemented pilot hole also stabilized the drilled holes, reduced the number of lost circulation zones and caverns that may have occurred during reaming operations, and minimized the probability of poor cement returns during casing cementing.

Injection Well Casings

All casings in the injection well were centralized in the borehole using strap-type centralizers welded at intervals along the pipe at 0, 90, 180, and 270 degrees around the casing at each position. Details of the casing materials and sizes are listed in **Table 2-1.**

Monitor Well Casings

All casings in the monitor well were centralized in the borehole using strap-type centralizers welded at intervals along the pipe at 0, 90, 180, and 270 degrees around the casing at each position. The factory-beveled ends of the casings were welded by the same method described for CW-1 above. Details of the casing materials and sizes are listed in **Table 2-2.**

Table 2-1
CW-1 Injection Well Casing Summary

Casing Name and setting depth	Outside Diameter (inches)	Wall Thickness (inches)	Casing Type	Grade	Joint Connection
Conductor 190 feet	54	0.375	Spiral Welded Steel	ASTM A 139 Grade B	Welded
Surface 1,030 feet	44	0.375	Spiral Welded Steel	ASTM A 139 Grade B	Welded
Intermediate 2,021 feet	34	0.375	Spiral Welded Steel	ASTM A 139 Grade B	Welded
Final 3,040 feet	24	0.500	Rolled Steel Seamless	ASTM A 53 Grade B	Welded
Tubing 3,030 feet	20	0.500	Rolled Steel Seamless	ASTM A 53 Grade B	Welded

Table 2-2
DZMW-1 Monitor Well Casing Summary

Casing Name and setting depth	Outside Diameter (inches)	Wall Thickness (inches)	Casing Type	Grade	Joint Connection
Conductor 190 feet	20	0.375	Spiral Welded Steel	ASTM A 53 Grade B	Welded
Final Upper 1,620 feet	14	0.375	Spiral Welded/ Rolled Steel	ASTM A 53 Grade B	Welded
Final Lower 1,950 feet	6.625	0.562	Rolled Steel Seamless	ASTM A 53 Grade B	Welded

A 34 inch pit casing was proposed for installation in DZMW-1, and a 64 inch pit casing was proposed for installation in CW-1. However, suitable formation was present at the site, therefore, pit casing was not necessary in either CW-1 or DZMW-1. The casing mill certificates for CW-1 and DZMW-1 casings are found in **Appendix C**.

Welding Methods

The factory-beveled ends of all casings were arc welded by certified pipeline welders to standard pipeline certifications. They were welded with 2 to 4 layers of weld. The first layer was a hot pass, which was subsequently ground, cleaned, and inspected. The subsequent passes were filler passes used to completely fill the beveled gap. Each pass was wire-brushed clean and inspected prior to the next pass.

Cementing Operations

Caliper logs were run inside the reamed hole to determine hole volumes for cement calculations. The complete annular space between each successive casing in CW-1 and DZMW-1 was then filled using sulfate-resistant cement. ASTM C 150 Type II cement was used in the injection well, and in the monitor well with additives as necessary. Cement emplaced in the lowermost 200 feet of all casings was neat cement; other cement stages used up to 12 percent bentonite gel.

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 a tremie pipe placed in the annulus between casing and borehole. After each stage of cementing, the top of cement was located physically (tagged) with a tremie pipe and by the performance of a temperature log inside the casing. The contractor collected representative samples of cement from each pumped stage. A summary of the cementing programs for CW-1 and DZMW-1 is presented in **Appendix D**.

Cement emplacement in DZMW-1 for both casing seals and pilot holes followed the same procedure described above with the exception of the final casing. The procedure for setting the 6.625-inch diameter monitor casing in DZMW-1 was accomplished using a cement basket. This procedure was developed to preserve the 12.25-inch diameter open hole at the base of the monitor well.

The cement basket was welded to a 6-foot section of the 6.625-inch diameter casing. The short section of casing was attached to the base of the first section of 6.625-inch diameter casing and the monitor casing was installed in the 12.25-inch diameter borehole. Neat cement then was emplaced in the basket during the first cement stage. After the first stage had cured, the cement plug was tagged to ensure that the base of the casing had been sealed. Normal cementing operations, as described above, were conducted to seal the remaining annular space around the final casing after verification that the monitor zone open hole had been protected. An installation procedure and diagram for the cement basket is included in **Appendix D.**

INJECTION WELL CW-1 CONSTRUCTION SUMMARY

Construction of CW-1 commenced on the morning of August 24, 1998. A 12.25-inch pilot hole was drilled by the mud rotary method to a depth of 226 feet bpl and the hole was geophysically logged as described in Section 3: Geophysical Logging Program. Following geophysical logging, the pilot hole was reamed to a nominal 60-inch diameter, to a depth of 190 feet bpl. A caliper log was performed on the reamed section of the borehole followed by the setting of the 54-inch diameter, 0.375-inch wall thickness conductor casing to 190 feet bpl, with casing joints joined by the arc-welding method. The annular space between the borehole and casing was pressure grouted to surface with neat cement to pad level in two stages with 1,599 cubic feet (cu ft) of neat cement.

Drilling of the 12.25-inch pilot hole resumed on August 28, 1998. It was drilled from the top of the neat cement tag at 183 feet to 1,067 feet bpl, and the borehole was geophysically logged. Following geophysical logging, the pilot hole was reamed with a nominal 54-inch diameter bit to a depth of 1,030 feet bpl. A caliper log was then performed on the reamed section of the borehole followed by the setting of the 44-inch diameter, 0.375-inch wall thickness surface casing to a depth of 835 feet bpl. Casing joints were joined by the arc-welding method. The annular space between the borehole and casing was pressure grouted to pad level in one stage with 3,085 cu ft of 12 percent bentonite gel and 1,100 cu ft of neat cement. The 12 percent bentonite gel was emplaced in the annular space at the upper portion of the casing, and neat cement was used to seal the bottom of the casing.

At this point in the well construction, the drilling method was changed from the mud-rotary method to the reverse-air method. At the completion of this changeover, drilling operations were resumed. Beginning on September 8, 1998, the drilling of the 12.25-inch pilot hole resumed from the top of the neat cement, at a depth of 1,030 feet, to a total depth of 2,105 feet bpl. Four cores were retrieved during pilot hole drilling. Cored intervals were 1,743 feet to 1,753 feet bpl, 1,955 feet to 1,965 feet bpl, 2,030 feet to 2,040 feet bpl, and 2,077 feet to 2,087 feet bpl. Upon completion of drilling to a depth of 2,105 feet bpl, geophysical logging and packer testing took place. In addition to the geophysical logs previously listed for this depth interval, this phase of logging operations included the performance of an Acoustic Borehole Televiewer Log.

Packer testing of the completed pilot borehole was undertaken primarily to further evaluate the location of the base of the USDW. A secondary goal of the packer testing program for the interval between 1,030 and 2,105 feet bpl was to identify the appropriate interval for the shallow monitoring. Five straddle packer tests were completed at intervals from 1,620 to 1,700 feet bpl, 1,780 to 1,810 feet bpl, 1,920 to 1,950 feet bpl, 1,950 to 1,980 feet bpl, and 2,060 to 2,090 feet bpl. The analyses performed on water samples collected during the tests consisted of chloride, specific conductance, sulfate, total dissolved solids, laboratory pH, temperature, bicarbonate, calcium, potassium, sodium, magnesium, nitrate, ammonia nitrogen, total kjeldahl nitrogen and total phosphorous.

Following the packer testing, tremie pipe was lowered to the bottom of the 12.25-inch pilot hole, and the borehole was cemented up to the bottom of the 44-inch diameter casing. After completion of cementing, a 42.5-inch diameter reaming assembly was used to ream a borehole from 1,030 to 2,021 feet bpl. A caliper log was run in the completed reamed hole to calculate annular volumes for casing cementing. A 34-inch diameter, 0.375-inch wall thickness intermediate casing then was set to 2,021 feet bpl. The annular space between the borehole and casing was pressure grouted to pad level in five stages. The cement comprised two blends: 12 percent bentonite followed by neat cement, for the first stage, sealing the bottom of the casing, and 12 percent bentonite cement, filling the annular space above the first stage to the top of the casing. Following setting of each stage, the depth of the cement top was tagged with tremie pipe and corroborated by temperature and gamma logs. A summary of the cement quantities for each stage is presented in **Appendix D**. A 12.25-inch pilot hole then was drilled from the top of the neat cement at 2,008 feet bpl to 3,084 feet bpl. Four cores were cut at intervals from 2,135 feet to 2,147 feet bpl, 2,201 feet to 2,221 feet bpl, 2,295 feet to 2,307.5 feet bpl, and 3,024 feet to 3,044 feet bpl during pilot hole drilling between October 7 and 13, 1998. Drill-stem water quality samples were collected every 40 feet during drilling of the pilot hole in an effort to identify the active injection zone as the hole was advanced.

Geophysical logs were run from 2,100 feet bpl in the open borehole section of the pilot hole to 3,084 feet bpl. The logs were examined to locate packer test intervals within the borehole that would provide information on the existence of confinement and the location of the active injection zone. Only one packer test interval was selected as suitable in diameter for inflation of a packer. The packer test was completed from 2,320 feet to 2,348 feet bpl. A representative water sample was collected at the end of the packer test and was analyzed for the drill stem water quality parameters listed above. The pilot hole was flushed with potable water after the completion of packer testing, and a video survey of the open borehole was conducted between 2,100 feet and 3,084 feet bpl.

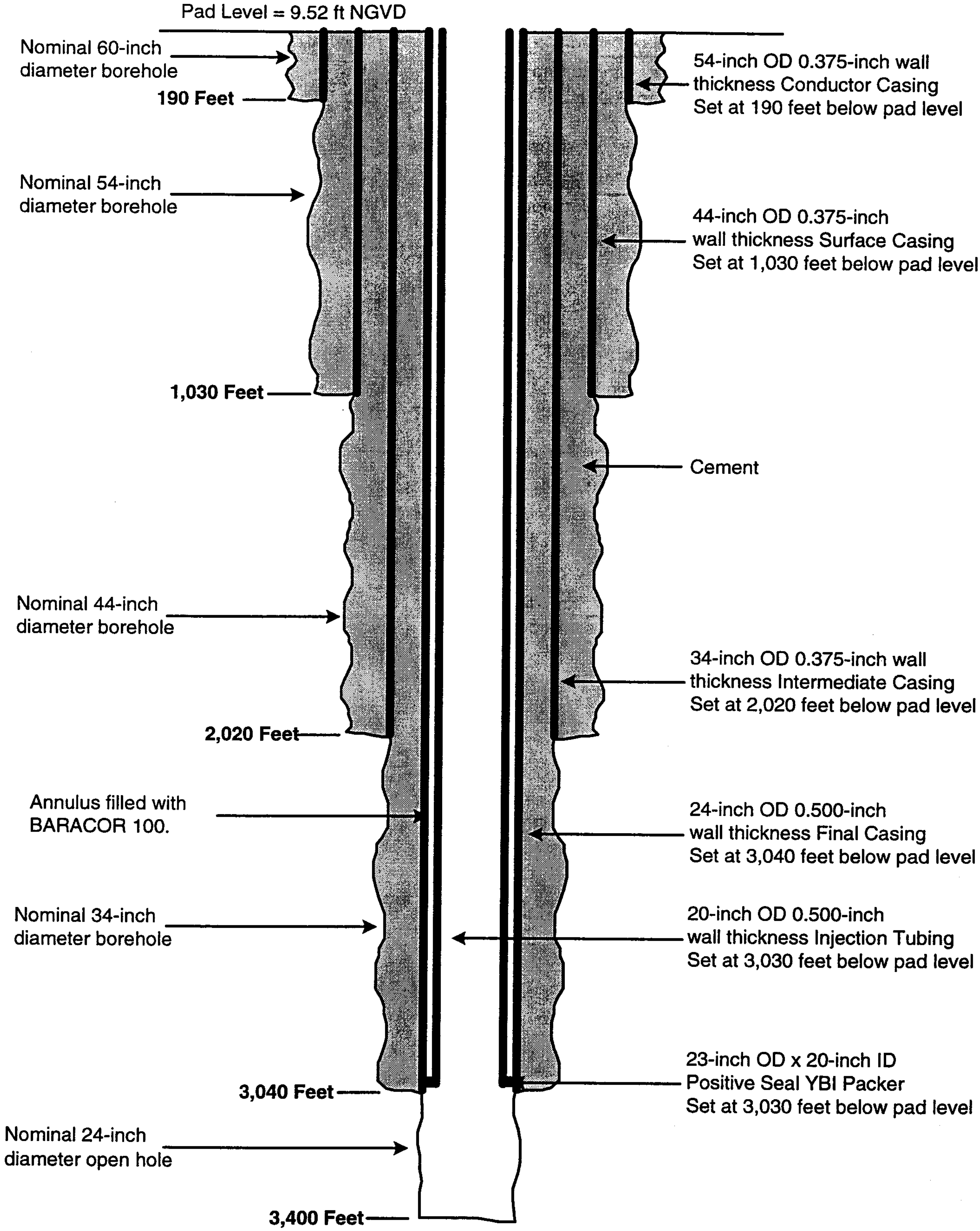
The pilot hole was cemented up in 4 stages prior to the reaming of a nominal 34-inch borehole. The pilot hole then was reamed to 34-inch diameter from 2,021 feet to 3,040 feet bpl. A nominal 24-inch pilot hole then was drilled from 3,040 feet to 3,400 feet bpl and geophysical logging was performed. A bridge plug was set in place at 3,070 feet bpl and topped with a cement plug. The 24-inch diameter, 0.5-inch wall thickness final casing was set at a depth of 3,040 feet bpl, and a packer was set and inflated between

3,030 and 3,040 feet bpl. A hydrostatic pressure test (witnessed by FDEP) was performed to demonstrate mechanical integrity of the final casing on November 9, 1998. The annular space between the borehole and casing was then pressure grouted to pad level in eight stages. Cementing was comprised of two blends: 12 percent bentonite followed by neat cement, for the first stage, sealing the bottom of the casing, and 12 percent bentonite cement in the annular space to the top of the casing. Following setting of each stage, the depth of the cement top was tagged with tremie pipe and corroborated by temperature and gamma logs. A summary of the cement quantity for each stage is presented in **Appendix D**. A video inspection of the casing and welded joints was performed on November 13 and 14, and a cement bond log were conducted on November 15, 1998, prior to the eighth and final stage of cementing. Cement was brought from 238 feet bpl to land surface in stage eight.

The 20-inch OD injection tubing was lowered to 3,030 feet bpl, just above the positive seal packer. The annular space then was flushed with fresh water and filled with a 1% solution of BARACOR 100 as a corrosion inhibitor. The casing then was set into the positive seal packer applying approximately 150,000 pounds, and a pressure test was performed on the annulus between the 20-inch injection tubing and the 24 inch final casing.

Following the pressure test of the 20-inch injection tubing, the bridge plug was drilled out, and the well was developed by airlifting for approximately 6 hours. This was the open hole injection zone completion in the lower part of the Oldsmar formation known as the boulder zone. A laboratory certified in the State of Florida then sampled the injection zone on November 18, 1998. Following collection of the water sample, flow and fluid resistivity/temperature logs were run on CW-1. While the logs were being run the flowmeter tool cable broke and the tool dropped into the open hole from where it had to be retrieved. The open hole below the casing was video surveyed on November 20, 1998. While trying to install a valve to video survey, the well came alive and flooded the pad. Approximately 1,500 gallons of water was lost from the pad. The impacted fill material was immediately excavated and daily monitoring of the pad monitor wells for three weeks showed no adverse effect.

The well then was temporarily capped in preparation for the installation of the well head valve. On November 21, 1998, the rig was moved to the monitor well location, which is approximately 70 feet west of the injection well. On December 17, 1998, a video camera survey was performed on the final injection tubing, including inspection of the welds from the bottom of the final tubing to the surface. Following the video survey, the radioactive tracer survey was performed. Well completion diagram presented in **Figure 2-2.**



City of Sunrise WTP
Concentrate Well - CW-1
Figure 2-2

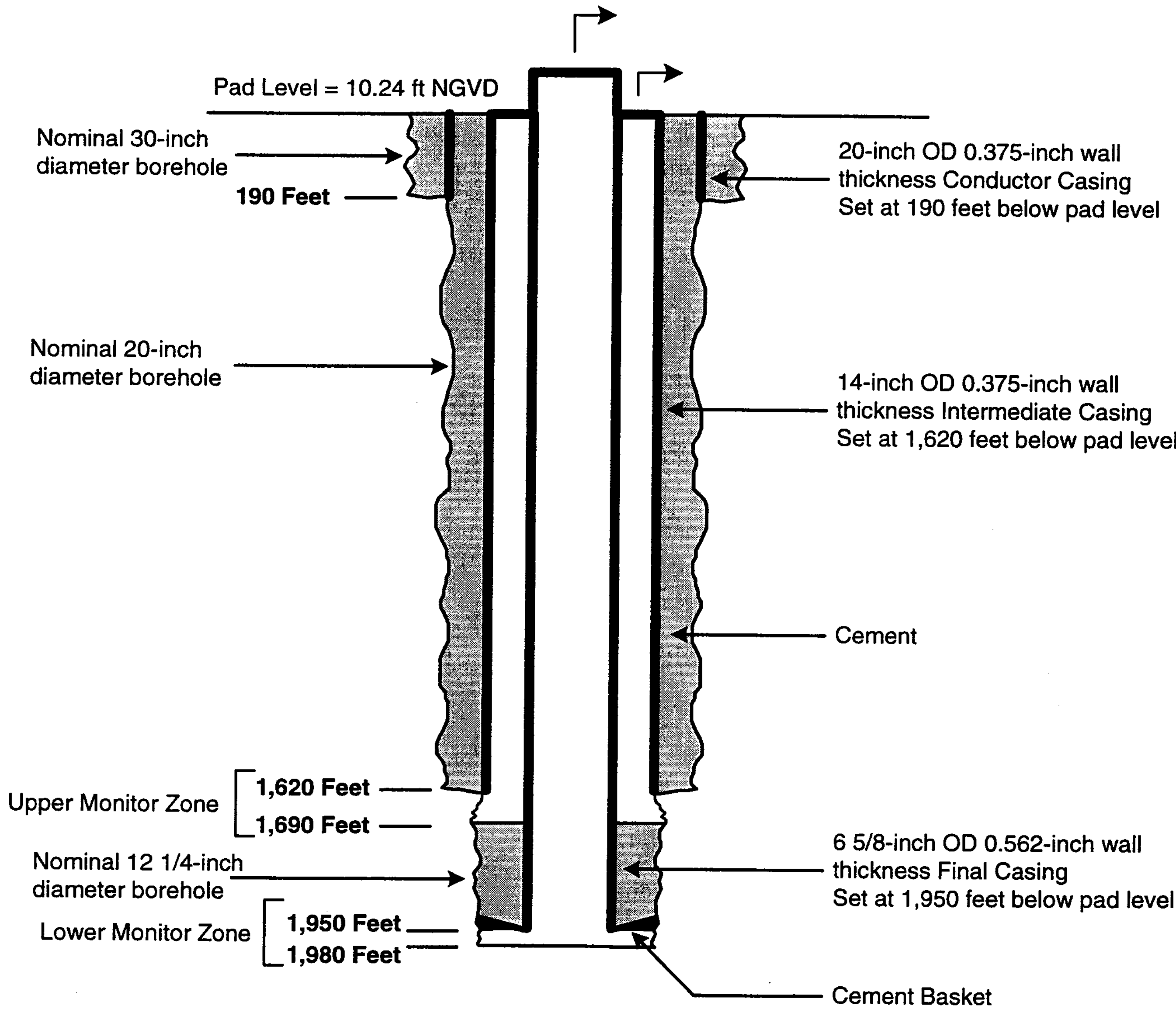
DUAL-ZONE MONITOR WELL DZMW-1 CONSTRUCTION SUMMARY

Construction of DZMW-1 began on November 23, 1998, with the drilling of a 12.25-inch diameter pilot hole followed by geophysical logging to a depth of 210 feet bpl. The pilot hole was reamed to 30-inches diameter, a caliper log was performed, and 190 feet of 20-inch diameter conductor casing was set and cemented in place in one stage with 943 cu ft of neat cement. Drilling of the 12.25-inch pilot hole was resumed to 1,656 feet bpl. Geophysical logging of the completed pilot hole occurred on November 28, 1998, and the pilot hole was reamed to a nominal 20-inch diameter. A caliper log then was performed and 1,620 feet of 14-inch diameter intermediate casing was set and cemented in place in two stages, using 1,671 cu ft of cement (426 cu ft-neat, 1,245 cu ft-12 percent). On December 2, 1998, a pressure test was performed on the 14-inch casing.

The final stage of drilling using the reverse air method of circulating was started on December 4, 1998. The 12.25-inch diameter borehole was drilled to a depth of 1,980 feet bpl, and geophysical logging conducted. The 6.625-inch diameter final tubing was set to a depth of 1,950 feet bpl and cemented in place using a cement basket. Cementing was conducted in four stages using 252 cu ft of neat cement. On December 10, 1998, a pressure test was conducted on the 6.625-inch final casing.

After the completion of construction, a temporary well head was installed, and the drilling rig was demobilized. The upper and lower monitor zones were developed and allowed to recover before beginning step rate and constant rate pumping tests. At the completion of each constant rate test, a water quality sample was collected. The sample was analyzed for all constituents listed in Chapter 62-550 of the Floridan Administrative Code (FAC) as primary and secondary drinking water standards, including analysis for microbiological, radionuclides, biological oxygen demand, and constituents listed under EPA Methods 608, 624, and 625.

On December 28, 1998, a cement bond log was performed and a video survey of the final casing was conducted. During the video survey, the cable broke and a camera had to be retrieved. The camera was successfully retrieved on January 4, 1999. A well completion diagram of DZMW-1 is shown as **Figure 2-3.**



City of Sunrise WTP
Dual Zone Monitor Well - DZMW-1
Figure 2-3

Section 3
Geophysical Logging Program

The objectives of the geophysical logging program were to estimate formation characteristics and borehole water quality changes and identify flow zones. These objectives are described below in more detail for the various phases of injection well and monitor well pilot hole drilling. Geophysical logs were also run to test the mechanical integrity of the injection and monitor wells. The geophysical logging program for mechanical integrity is presented in **Section 6** of this report.

GEOPHYSICAL LOG DEFINITIONS

Geophysical logs were conducted in the pilot borehole in accordance with Specific Condition 3(f) of the FDEP Construction Permit. These logs were performed to confirm the formation characteristics and depths recorded by the geologist from the lithologic cuttings, and estimate the relative rate of fluid movement within the borehole. The following is a description of the uses and interpretation of the geophysical logs performed.

- **Caliper**: This log measures the diameter of the borehole and is useful in identifying fractures and solution features, and providing indirect evidence concerning the mechanical strength of the formation material.

- **Dual Induction/Spontaneous Potential (SP)**: The Dual Induction/SP log is used to measure the electrical properties of the formation. The electrical resistivities of the formation are affected by porosity and water quality. These logs give important information concerning the water quality transition found at the base of the USDW, the porosity of the formation and possible producing and confining zones, and the mixing of formation water with the drilling fluid in the borehole. The log consists of four traces:

    - **ILD**: Measures the resistivity of the formation material with a wide receiver spacing that penetrates deep into the formation.

    - **ILM**: Measures the resistivity of the formation with a medium receiver spacing that examines the formation material close to the borehole, where drilling fluids may have invaded the formation.

    - **LL3**: This log reads the lateral resistivity with closely spaced electrodes that measure primarily within the borehole and on the borehole wall.

- **SP**: Measures potential differences within the borehole and in the formation. This trace is strongly affected by water quality changes and formation differences.

- **Borehole Compensated Sonic (BHCS) with Variable Density Log (VDL)**: The BHCS log measures the acoustic properties of the formation material. This log is strongly affected by the mechanical strength of the formation and by porosity. The VDL provides important information about fractures and solution features.

- **Gamma Ray**: The gamma ray log measures the natural gamma radiation produced by the formation material. The sources of gamma radiation contained in the formation are mostly associated with clays, phosphates and uranium compounds. These components are important in identifying geologic formations and give clues about the origins of the formational layers.

- **Temperature and Fluid Resistivity**: This log measures the temperature and resistivity of the fluid filling the borehole. These logs are used to measure the characteristics of the formation fluid under static and dynamic flow conditions and give clues about the movement of the fluids within the borehole.

- **Flowmeter Survey**: The fluid velocity log measures the rate of fluid movement in the borehole and detects the entry of water into the borehole as the well is pumped.

- **Digital Borehole Televiewer**: This log produces a 360 degree borehole ultrasonic image output from measurement of the acoustic properties around the borehole wall. This log is similar to the BHCS log, but has a much higher frequency of measurement with more complete coverage of the circumference of the borehole. Due to the high resolution of this tool, it can be used to identify bedding and fractures.

GEOPHYSICAL LOGGING PROGRAM FOR CW-1

The geophysical logs run for each stage of pilot hole drilling in CW-1 are listed below. Logging was performed to assess formation competency, estimate composition, porosity and permeability, identify water quality changes, and locate zones of flow and fractures within the borehole. Detailed descriptions of the logs are presented below by pilot hole stages.

Pilot Hole Logs Run from 0 feet to 225 feet bpl: The following logs were run in the 12.25-inch diameter pilot hole prior to selection of the 54-inch diameter conductor casing setting depth:

- Caliper
- Dual Induction/SP
- Gamma Ray

The conductor casing pilot hole logs were used to identify the depth of the base of the surficial aquifer and to identify competent formation at which to set the conductor casing. The caliper log was run to identify and evaluate the physical nature of the surficial aquifer formation materials. The Dual-Induction/SP log was used to measure porosity changes within the formation materials and the gamma ray log aided in identification of the clays associated with the Hawthorn Group by a measurement of natural gamma radiation. The base of the surficial aquifer can typically be identified by the accumulation of sediments that emit gamma rays indicating a formation change. A gamma ray log is run as a part of every logging suite, because it provides correlation due to the characteristics of the gamma ray emissions, which are related to the physical properties of a specific formation.

<u>Pilot Hole Logs Run from 190 feet to 1067 feet bpl</u>: The following logs were run in the 12.25-inch diameter pilot hole prior to selection of the 44-inch diameter surface casing setting depth:

- Caliper
- Dual Induction/SP
- Gamma Ray

The primary objective of this logging suite was to identify the depth of the base of the Hawthorn Group and to pick a mechanically secure depth for the surface casing. The caliper log was run to locate the limestone that marks the base of the Hawthorn Group and the top of the Suwannee Limestone. The mechanical properties of the formations were also evaluated using the caliper log in order to determine an appropriate casing setting depth. The Dual-Induction/SP log was conducted to identify the formation change between the Hawthorn Group and Suwannee Limestone by variation in formation porosity and density and the reduction in clay mineral concentration. The gamma ray log was used for depth correlation and to identify the high concentrations of phosphate nodules at the base of the Hawthorn Group, which mark the top of the Suwannee Limestone.

<u>Pilot Hole Logs Run from 1030 feet to 2,110 feet bpl</u>: The following logs were run in the 12.25-inch diameter pilot hole prior to selection of the 34-inch diameter intermediate casing setting depth:

- Caliper
- Dual Induction/SP
- Gamma Ray

- Borehole Compensated Sonic (BHCS) with Variable Density Log (VDL)
- Digital Borehole Televiewer
- Temperature and Fluid Resistivity (Dynamic and Static)
- Flowmeter Survey (Dynamic and Static)

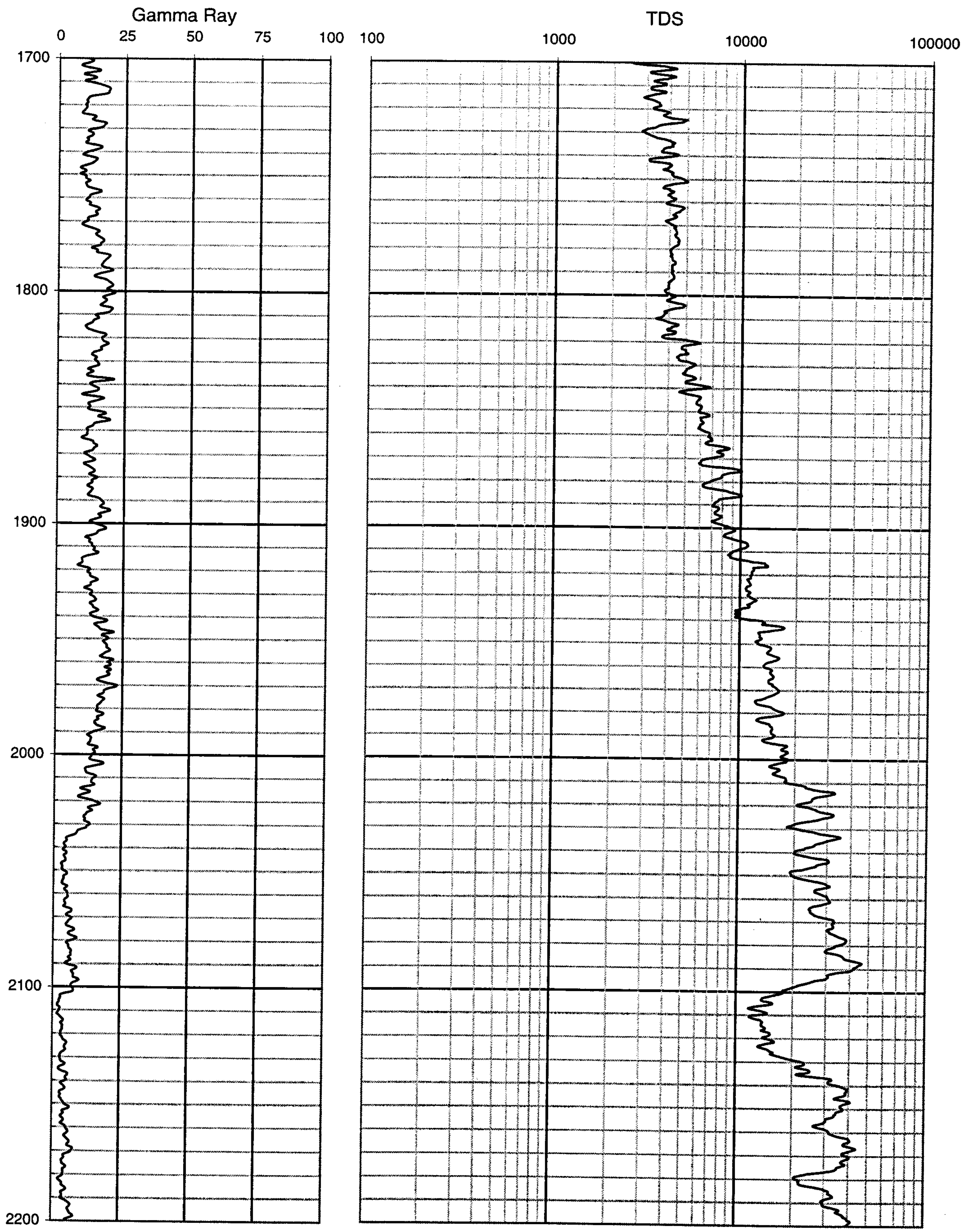
These geophysical logs were used to identify the changes in water quality, the producing zones, the confining intervals, and to select a monitor zone. The logs were also performed to assess mechanical formation properties prior to selecting a secure casing seat. From the results of these logs, packer test intervals were selected. Packer testing results yielded measurements of the permeability or hydraulic conductivity of the formations and water quality data from distinct intervals. The base of the USDW was identified in this interval using the logs and the results of packer testing. The confining intervals below the base of the USDW were also identified using the logs, packer test results, and core analyses.

The caliper log was performed to assist in identifying fractures, solution features and borehole wall collapse which are all associated with producing intervals in the carbonate formations found in this interval (Suwannee Limestone, Ocala Limestone and Avon Park Formation). The Dual-Induction log was particularly useful in identifying the high water quality gradient that is associated with the base of the USDW in southern Florida. This log, used together with the formation porosity calculated from the sonic log, provided an estimate of the formation water resistivity to identify the base of the USDW. A plot of estimated total dissolved solids (TDS) is presented in **Figure 3-1.** The gamma ray log was used with the Dual-Induction/SP log data to identify formation boundaries and lithology changes within the formations.

The dynamic temperature, fluid resistivity, and flowmeter logs were used to directly detect the producing intervals by measuring the water flow, the temperature changes, and the water quality changes generated by water production. The digital borehole televiewer log was used with the sonic and Dual-Induction logs to identify fracture planes, producing zones, and confining intervals. The producing zones were evaluated in terms of water production potential and water quality for the selection of monitor zones. A packer test was performed in intervals considered as a potential monitor zone.

Pilot Hole Logs Run from 2,021 feet to 3,086 feet bpl: The following logs were run in the 12.25-inch diameter pilot hole prior to selection of the 24-inch diameter final casing setting depth:

- Caliper
- Dual Induction/SP
- Gamma Ray
- BHCS with VDL
- Digital Borehole Televiewer



PLOT OF FORMATION WATER TDS VALUES

FIGURE 3-1

- Temperature and Fluid Resistivity (Dynamic and Static)
- Flowmeter Survey(Dynamic and Static)

These geophysical logs were run to identify the formation boundaries, producing zones, and confining intervals and to assess the formation for the mechanical properties necessary to select an appropriate casing-setting depth. These logs were used to determine the depth for the final casing based on the evaluation of confinement and the mechanical properties of the formation. The gamma ray log was used along with the Dual-Induction log data to identify formation boundaries and lithologic changes within the formations. The digital borehole televiewer log was used with the sonic and Dual-Induction logs to identify the producing zones, confining intervals, and fractures. The dynamic temperature, fluid resistivity, and flowmeter logs were used to directly detect the producing intervals by measuring the water flow, the temperature changes, and the water quality changes caused by water production.

<u>Open Hole Logs Run from 2,000 feet to 3,410 feet bpl</u>: The following logs were run in the nominal 24-inch open hole upon completion of the well:

- Caliper
- Dual Induction/SP
- Gamma Ray
- BHCS with VDL
- Temperature and Fluid Resistivity (static only)
- Flowmeter Survey (static only)

These logs were run in the open hole section of the well to provide a general indication of the physical aspects of the injection zone. The gamma ray and Dual-Induction/sonic log data was used to evaluate potential lithology changes within the injection zone. The temperature, fluid resistivity, and fluid velocity logs were run only under static conditions as a general indication of flow and potential water quality since the injection zone was already active and contained considerable volumes of effluent. Pumping conditions were not used for measuring induced water flow due to the high potentiometric head in the open hole. The borehole televiewer log was not run in this section of the well due to a diameter limitation with the instrument. Notification of any deviations to the testing program in the open borehole from the originally proposed program were made to FDEP in writing; they accepted the changes.

Construction Permit Special Condition No. 3 (f) (4) states that a pumping flowmeter survey (dynamic) should be run to identify the injection zone beneath the final casing. A dynamic flowmeter log would not have shown the presence of flow within the open hole interval due to the size (24-inch diameter) of the open hole. This log was not run in the open borehole interval.

Geophysical surveys performed in the injection zone open borehole included caliper, gamma ray, compensated sonic, and induction logs performed under no-flow conditions. Flowmeter, temperature, and fluid resistivity logs were performed under static conditions. Results of the testing and the geophysical logging program are discussed later in this report.

GEOPHYSICAL LOGGING PROGRAM FOR DZMW-1

The objectives of the geophysical logging program for DZMW-1 were to verify information gathered from the injection well and to obtain an indication of various physical formation properties. These objectives are described in more detail for the various phases of pilot hole drilling below.

Reamed Hole Logs Run from 0 feet to 208 feet bpl: The following logs were run in the 29-inch diameter borehole prior to setting the 20-inch diameter conductor casing:

- Caliper
- Gamma Ray

Since detailed information for the surficial formations was collected from Injection Well CW-1 during drilling, the pilot hole was omitted and a 30-inch diameter borehole was drilled to 175 feet. As stated above, caliper and gamma ray logs were run to provide information on the physical condition of the formations and verify previously identified source markers observed in the CW-1 logs.

Pilot Hole Logs Run from 190 feet to 1,650 feet bpl: The following logs were run in the 12.25-inch diameter pilot hole to confirm geologic information identified in CW-1:

- Caliper
- Dual Induction/SP
- Gamma Ray

These logs were used to confirm the depth of the formation change that marks the base of the Hawthorn Group and the top of the Suwannee Limestone, determined during drilling of the injection well. Once confirmation was obtained, reaming operations could begin for the previously selected surface casing setting depth.

Pilot Hole Logs Run from 1,600 feet to 1,985 feet bpl: The following logs were run in the 12.25-inch diameter borehole to the base of the shallow monitoring interval:

- Caliper
- Dual Induction/SP

- Gamma Ray
- BHCS with VDL
- Digital Borehole Televiewer

These logs were run to compare and contrast logs performed in CW-1, and confirm the selected casing setting depth for the 6.625-inch monitor casing, confirm characteristics determined in the injection well testing program. This enabled conclusions to be drawn regarding the appropriateness of the selected monitor zones.

Section 4
Formation Testing Program

This section of the report describes the formation testing that was conducted in CW-1 and DZMW-1. Descriptions of test methods for the collection of cores, the performance of packer tests, drill stem water samples, the injection test in CW-1, the pumping tests in DZMW-1, and collection of background water samples for CW-1 and DZMW-1 are provided below.

CORING

Conventional cores were collected in accordance with Specific Condition 3(j)(4) of the Construction Permit, below 1,700 feet bpl. The purpose of coring was to evaluate the porosity, permeability, and mechanical properties of the formation materials. This information was used to support the existence of confinement between the base of the USDW and the injection zone as well as confinement between the upper and lower monitor zones. Cores were collected using a 4-inch diameter, 30-foot long core barrel. This enabled the driller to collect up to 27 feet of continuous core. After advancing the core barrel to the desired depth, the core barrel was removed and laid on the pad at land surface. The cutting head was removed and the core sample was allowed to slide out of the inner barrel. Samples were labeled and boxed. Several of the larger pieces were submitted to a geotechnical laboratory for analysis, of porosity, permeability, specific gravity, and hydraulic conductivity, to aid in confining interval evaluation.

PACKER TESTS

Packer testing was performed in CW-1 as required by Construction Permit Specific Condition 3(g). Packer testing consisted of a single packer or combination of two straddle packers separated by a perforated section installed in the open hole section of the pilot hole on drill pipe to isolate a specific interval of the open pilot hole for pump testing. Packers were set and inflated to seal off the selected intervals for testing. The isolated intervals were pumped until fully developed and the formation fluid flowed freely into the borehole. This procedure purged the drilling fluids from the single or straddle packer interval. Following development, the wellhead was shut in, and the water level in the zone was allowed to recover to static level. Subsequently, a four-hour constant rate pumping test and three-hour recovery period were performed on each interval. Drawdown and recovery readings were measured using a pressure transducer and automatic data recording equipment. Water samples for laboratory analysis of chloride, conductivity, TDS, nitrates, ammonia, phosphorus, calcium, magnesium, potassium, sodium, and sulfates were collected from each interval prior to the completion of the four-hour pumping test. Field measurements of chloride and conductivity were also conducted.

Packer tests were performed at selected intervals in the CW-1 pilot hole between 1,600 feet and 2,800 feet bpl. Transducers were placed in the packer interval and the annular space to monitor water level changes in response to pumping. The transducer placed in the packer interval was used to determine the aquifer parameters and the transducer placed in the annular space was used to monitor the effectiveness of the packer seal.

From the packer tests, certain aquifer parameters such as hydraulic conductivity, transmissivity, and specific capacity were derived. Water quality samples were collected to provide data on the formation water quality in isolated zones within the aquifer. Drawdown and recovery measurements were collected and plotted on graphs. The hydraulic conductivities and specific capacities were estimated from the Theis Recovery Method approximation for each of the tests.

The water quality data from the packer tests was used to determine the location of the base of the USDW. The hydraulic data was used to assist in determining the relative confining and productive nature of the formations for confinement justification, location of fracturing, and also to determine if the monitor zones had adequate flow for a monitoring interval.

DRILL STEM WATER SAMPLES

Drill stem water samples were collected every 40 feet as the pilot hole was advanced below a depth of 2,160 feet. The samples were collected from the flowing wellhead (during pipe connections) and analyzed in an effort to locate the active injection zone during drilling. Identification of the active injection zone would allow the contractor to take the necessary precautions as work progressed. Each drill stem sample was analyzed for the parameters listed in **Table 4-1**.

Table 4-1
Drill-Stem Water Quality Parameters

Chloride	Conductivity
TDS	Ammonia
Sulfate	pH
Bicarbonate	Calcium
Potassium	Sodium
Magnesium	Nitrate
Total Kjeldahl nitrogen	Total phosphorus

INJECTION TEST

The injection test plan required by FDEP in accordance with Specific Condition 5(h) of the Construction Permit was presented in a letter dated February 9, 1999, and approval was provided on March 8, 1999. The injection test was conducted for a period of 24 hours, and preceded by a 24-hour static background period and followed by 48 hours of static recovery. The main objective of the injection test was to determine if the injection zone could accept the quantity of fluids for which it was designed. A secondary objective was to test the pipeline and newly installed equipment. Since the water treatment plant was not completed at the time of testing, the emergency backup facilities were used. The emergency backup facility provides WWTP treated effluent through a pipeline near IW-1 into the concentrate pipeline. Monitoring was conducted to confirm that injection would occur at an acceptable operating pressure and that there would be no adverse effects on overlying aquifers due to injection. Twenty-four hours, or one tidal cycle, was considered an adequate length of time to demonstrate if the well could accept the fluids and determine if there was any response to injection in the overlying aquifers. A water quality sample was collected from CW-1 prior to the injection test to compare injection zone water quality to the intended injection fluid. The results of this water quality sample are contained in **Appendix** E.

Water levels and wellhead pressures were monitored in CW-1 and DZMW-1 during the background, injection, and recovery phases of the injection test. Monitoring was performed with a downhole pressure and temperature transducer to record changes in CW-1 during all phases of the test. The transducer was placed in CW-1 within 20 feet of the base of the injection casing. During the injection test, water from the City of Sunrise WWTP was routed through a 16 inch T-valve at the IW-2 wellhead. The CW-1 well was connected to this T-valve by a 24 inch pipe line, to be later used to connect the well to the WTP under construction. Treated domestic effluent was supplied down this pipeline by the WWTP injection pump system at a rate of 6,070 gpm for the duration of the 24-hour injection test. This flow represented the total volume that the plant was able to send to the CW-1 well due to pump curve restrictions, the in line 16 inch T-valve, and the required pumping distance, using the wastewater treatment plant injection pumps.

SHALLOW MONITOR ZONE PUMPING TEST

After completion of well construction and development of DZMW-1, a short pump test was performed on the monitoring zone (1,620 feet to 1,700 feet bpl) to determine if sufficient water was available for continued sampling. Transducers were placed inside the 14-inch and 6.625-inch diameter final casing to measure water level changes. A step rate pump test was conducted over a four-hour period with one-hour duration steps at successively higher pump rates. The well was allowed to recover for 4 hours prior to the performance of an 8-hour duration constant rate pump test. Background, pumping, and recovery head levels were monitored during the test. At the completion of the 8-

hour constant rate pumping test, water samples were collected and analyzed for primary and secondary drinking water standards as well as minimum criteria. This sample was collected prior to injection testing CW-1, as required. The water quality analysis will be used as background for future comparisons with annual samples. The results of water quality sampling are presented in **Appendix E.**

LOWER MONITOR ZONE PUMPING TEST

After completion of well construction and development in DZMW-1, a brief pumping test was performed on the lower monitoring zone (1,950 feet to 1,980 feet bpl) to determine if sufficient water was available for continued sampling. Transducers were placed inside the 14-inch and 6.625-inch diameter final casing to measure water level changes. A step rate test was conducted over a four-hour period with one-hour duration steps at successively higher pump rates. The well was allowed to recover for 4 hours prior to the performance of an 8-hour duration constant rate test. Background, pumping, and recovery head levels were monitored during the test. At the completion of the 8-hour constant rate pumping test, water samples were collected and analyzed for primary and secondary drinking water standards as well as minimum criteria. This sample was collected prior to injection testing CW-1, as required. The water quality analysis will be used as background for future comparisons with annual samples. The results of water quality sampling are presented in **Appendix E.**

WATER SAMPLING

Prior to the injection test, CW-1 was pumped a minimum of three well volumes until temperature, conductivity, and chloride concentrations were stable. A water quality sample then was collected from the injection zone. The sample was analyzed for primary and secondary drinking water parameters and other constituents listed in Chapters 62-550 and 62-520, FAC. This analysis provided the existing background water quality for CW-1. The results of the CW-1 sample represent existing injection zone background water quality that has been altered by the operation of IW-1, IW-2, and IW-3. Drill stem samples collected during drilling activities confirmed that the injection zone at CW-1 was already invaded by effluent indicator parameters. This would be expected since effluent from IW-1 and IW-2, located approximately 2,200 feet and 1,100 feet respectively, from CW-1, has been injected since 1985. Also effluent has been injected into IW-3 since 1997.

Section 5
Formation Testing Results

This section of the report describes the results of the comprehensive formation testing program conducted at the WTP site. These results determine the criteria required to demonstrate that the injection well installed at the site qualifies to receive an operating permit. The testing program was consistent with both the Federal and State regulations governing Underground Injection Control (UIC) and the testing program approved in Specific Condition 3 of the Construction Permit.

GEOLOGIC BACKGROUND

The State of Florida lies on the Florida Platform on the southeastern edge of the North American continent. The platform extends 400 miles north to south and nearly 400 miles east to west (at its widest point). More than half of the platform is presently under water, leaving a narrow peninsula of land extending from the mainland. A thick sequence of primarily carbonate rocks, nearly five thousand feet thick (in southern Florida) and ranging in age from mid-Mesozoic to Recent, forms the Florida Platform (Scott, 1992). The stratigraphy and aquifer systems under discussion in this report range in age from Early Eocene to Late Pleistocene.

Injection Well IW-3 Geology

Information on the geologic and hydrologic conditions at the WTP was available from the existing injection wells (IW-1, IW-2, and IW-3) located at the WWTP adjacent to the WTP site. IW-3 was the most recently constructed of the three injection wells and was built on a construct-only permit basis. Extensive testing was required during construction by FDEP to obtain information on the site subsurface geology, and to determine if adequate confinement was present. Consequently, IW-3 became the primary reference for correlation of geologic parameters during construction of CW-1. IW-3 was drilled to a depth near the base of the Oldsmar Formation. The geologic cross-section of that well was representative of the lithology encountered in the new concentrate well CW-1, as discussed below.

Injection Well IW-3 Hydrogeology

The Upper Confining Unit at the site is approximately 815 feet thick (from 190 feet bpl to 1,005 feet bpl) and is comprised of the Hawthorn Group. This formation separates two aquifers, the Biscayne Aquifer and the Upper Floridan aquifer. The Biscayne Aquifer overlies the Upper Confining Unit at this site, and is composed of undifferentiated Plio-Pleistocene deposits, which lie unconformably on the top of the Upper Confining Unit.

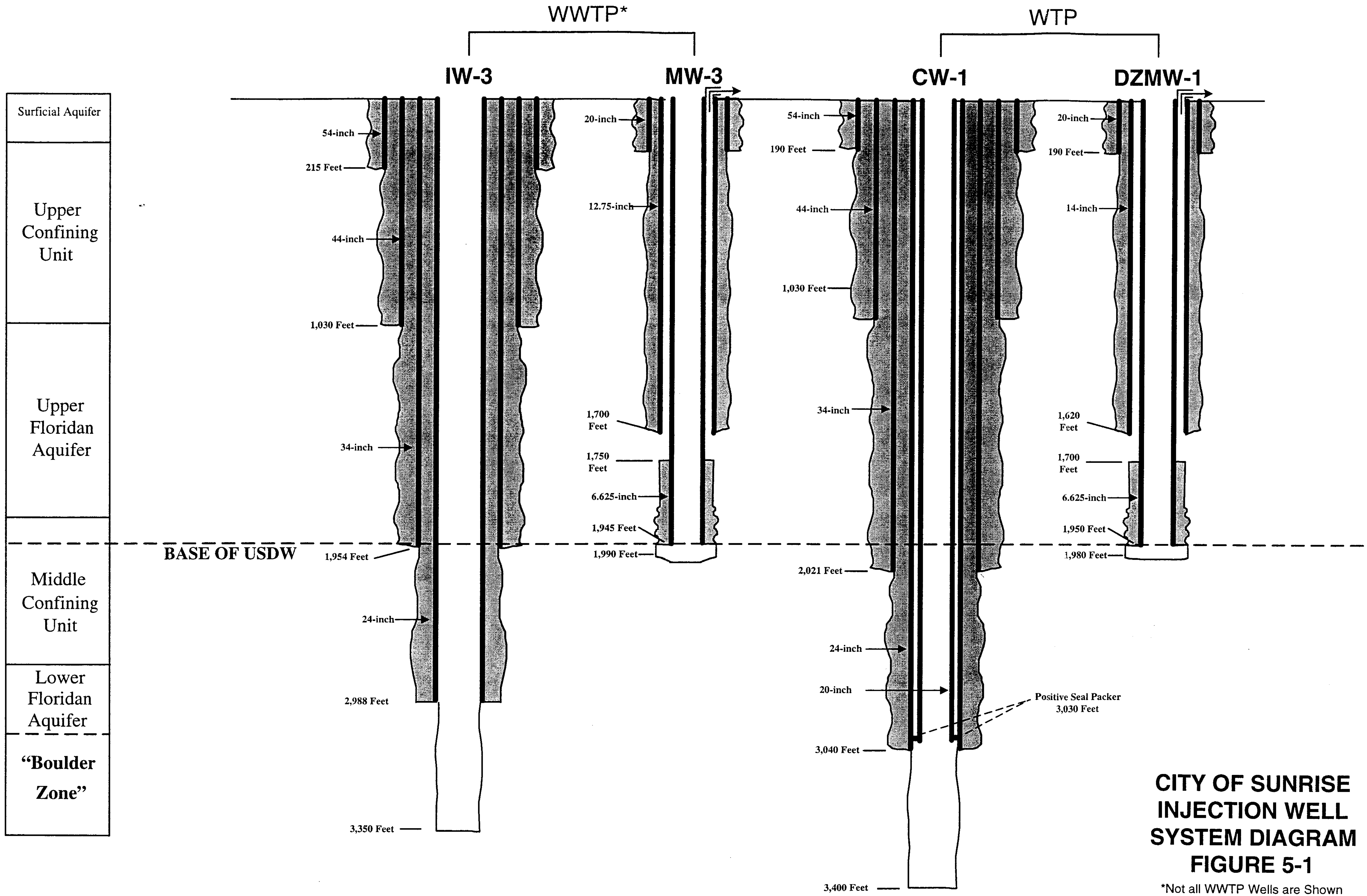
The Middle Confining Unit identified at IW-3 was a zone 1,150 feet thick which is part of the Oldsmar and Avon Park Formations. This interval is actually composed of three confining intervals, separated by zones of moderate intergranular and solution enhanced bedding porosity. Miller (1986), identified these three confining intervals in Broward County, referenced as Middle Confining Units I, VI, and VIII. The top of the Middle Floridan Confining Unit VI was identified at a depth of approximately 1,740 feet bpl. This portion of the Floridan aquifer system is found within the Avon Park Formation. Based upon the construction report for IW-3, the injection zone was estimated as being approximately 100 feet thick, lying entirely within the Oldsmar Formation between 3,100feet and 3,200 feet bpl.

GEOLOGY AND HYDROGEOLOGY IN CW-1 AND DZMW-1

During the construction of CW-1 and DZMW-1, the presence of the above-described geology and hydrogeology from IW-3 was confirmed, although additional confining formations were identified between 1,700 feet and 2,340 feet bpl. The geology and hydrogeology of the site was confirmed which demonstrated the suitability of the new well site location for disposal of reject concentrate from the WTP. This was achieved by:

- Collection and analysis of lithologic cuttings
- Continuous monitoring of drilling conditions
- Performance of geophysical logs according to the program described in Section 3 (Geophysical logging summaries, composite presentations, and all geophysical logs are contained in **Appendix Volume II** of this report)
- Collection of cores in the Avon Park and Oldsmar Formations in order to demonstrate confinement and the hydrologic characteristics of the monitoring zones
- Performance of straddle packer and pumping tests in the sections of pilot hole between 1,600 feet and 2,350 feet bpl, including water sampling in open portions of the borehole, at discrete intervals to the bottom of the well.

The following section presents a description of the geologic and hydrogeologic conditions in the vicinity of CW-1 and DZMW-1, followed by the results of the testing program and the satisfactory demonstration of regulatory-required criteria for operation of the well. The testing program was designed to obtain the majority of the information required to meet the regulatory requirements for construction and operation of CW-1. This information included data to select the monitoring interval depths for DZMW-1, prior to drilling of the monitoring well. **Figure 5-1** illustrates the configurations of CW-1 and DZMW-1 relative to a generalized site hydrogeology



CITY OF SUNRISE INJECTION WELL SYSTEM DIAGRAM FIGURE 5-1

*Not all WWTP Wells are Shown

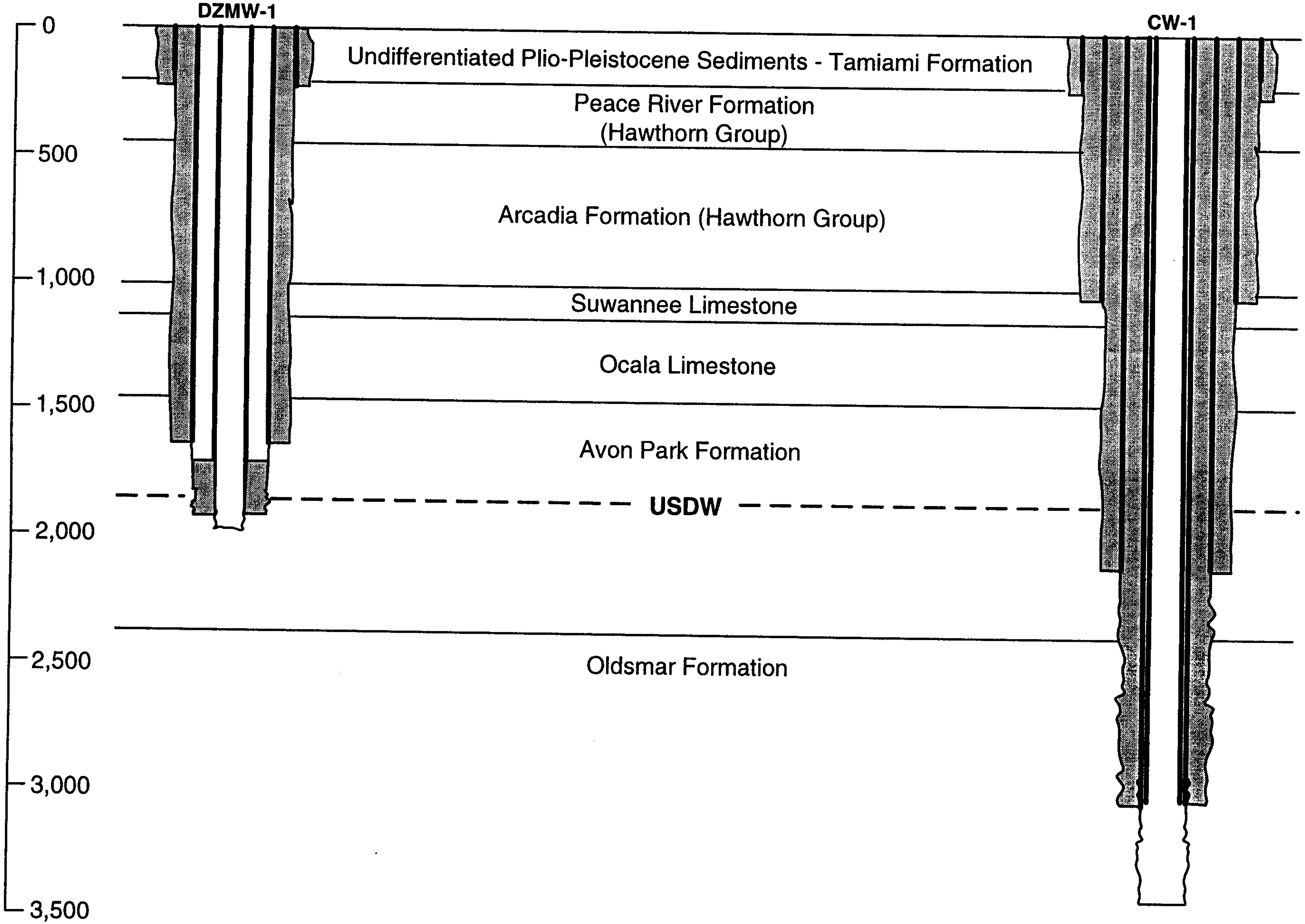
identified in the existing WWTP injection wells, and the WTP wells is also included. Detailed lithologic logs for CW-1 and DZMW-1 are presented in **Appendix F**.

Injection Well CW-1 and Monitor Well DZMW-1 Geology

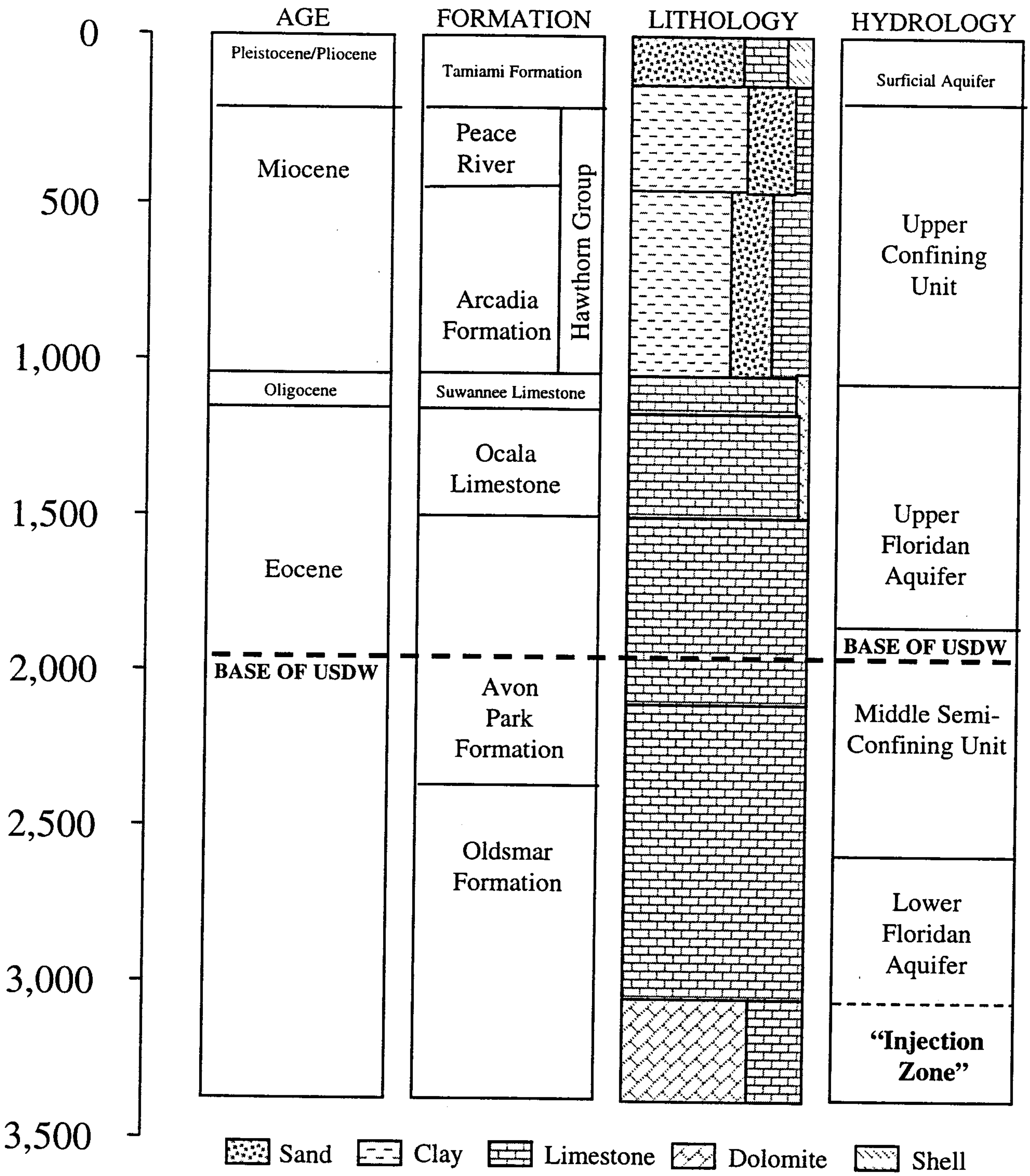
During drilling and testing of CW-1 and DZMW-1, undifferentiated Plio-Pleistocene-aged limestone, sand, clay, and variable amounts of whole and broken pelecypod and gastropod material were observed from land surface to a depth of approximately 190 feet bpl. These sediments unconformably overlie the Miocene-aged Hawthorn Group. At the location of wells CW-1 and DZMW-1, the Hawthorn Group extends from approximately 190 feet to approximately 1,005 feet bpl, for a total thickness of approximately 815 feet. The Hawthorn Group is generally segregated into two formations including an upper unit called the Peace River Formation and a lower unit called the Arcadia Formation. The Peace River Formation, found at this well between 190 feet and 475 feet bpl, consists of a light green to dark olive clay. The clay is plastic and interbedded with minor amounts of light olive gray to white limestone. The clay contains quartz sand, silt, a minor percentage of pelecypoda material, with calcite and dolostone cement. The Arcadia Formation occurs here between 470 feet and 1,005 feet bpl and is composed of interbedded argillaceous limestone and clay. Limestones of the Arcadia Formation are generally light gray to white, poor to moderately indurated mudstones. In contrast to the Peace River Formation, the Arcadia Formation contains as much as 50 percent limestone. **Figure 5-2** shows a generalized cross-section and **Figure 5-3** shows the local hydrologic and lithologic features of the WTP site.

Lying below the Hawthorn Group is the Oligocene age Suwannee Limestone. The formation top is located at a depth of approximately 1,005 feet bpl in these wells. The Suwannee Limestone is comprised of white to medium gray, well-indurated, highly fossiliferous packstones and grainstones. Some bioclasts are represented as moldic porosity, and high porosity and permeability are present. Locally, the rock is recrystallized. Biotics include bryozoans, gastropods, pelecypods, cnidarians, foraminifera, and plant fossils. The Suwannee Limestone is approximately 100 feet thick in this vicinity. Below the Suwannee Limestone is the Eocene-aged Ocala limestone, the top of which is located at 1,110 feet bpl. It is composed of moderately soft, highly fossiliferous, pelletal, white to very pale orange wackestones and packstones, with 15 percent to 40 percent intergranular porosity. Locally, the unit is composed of thin layers of very hard micrite of low porosity and permeability. Abundant foraminifera and echinoids are present in the Ocala limestone, which is approximately 350 feet thick at this location.

The stratum below the Ocala Limestone is the Avon Park Formation. This formation, located between 1,460 feet and 2,410 feet bpl, is comprised of Eocene-aged limestones and dolostones consisting of moderately soft, poorly to well-indurated pelletal wackestones and packstones. The unit is grayish orange to pale yellowish brown in



GEOLOGIC CROSS-SECTION OF THE CITY OF SUNRISE CONCENTRATE WELL SITE
Figure 5-2



GENERALIZED HYDROLOGY AND LITHOLOGY IN THE VICINITY OF THE CITY OF SUNRISE SAWGRASS CONCENTRATE WELL SITE

Figure 5-3

color. Dolostone is found in the section but is restricted to the base of the formation. Intergranular porosity is common in the pelletal zones of the section, and some of the samples appear to have been recrystallized. Locally, the unit is composed of thin layers of hard micrite (few inches to few feet) of low porosity and permeability. Abundant foraminifera can be found in the unit but generally concentrated in zones; minor amounts of lignite and pelecypoda debris are also present. Diagenetic features include the formation of dolostone as well as enhanced and reduced porosity through dissolution and cementation. At the location of these wells, the Avon Park Formation is approximately 950 feet thick. Monitor Well DZMW-1 was completed in the Avon Park Formation to depths of 1,700 feet, and 1,980 feet bpl.

The Oldsmar Formation is present in CW-1 from 2,410 feet to the total depth of the well at 3,400 feet bpl. This same formation in IW-3 is present from a depth of 2,400 feet to the total depth of the well at 3,400. The base of the Oldsmar Formation was not encountered during drilling. The formation is comprised of wackestones and packstones similar to those described for the Avon Park Formation (above). This section of the well however, contains up to 75 percent dolostone, appearing as alternating layers with the limestone. Small amounts of glauconitic clay and lignite are also present. Foraminifera and mollusca are found in the limestone portions of the section. In the dolostones of the lower sections of the formation replaced, recrystallized, and moldic porosity from foraminifera and pelecypods are found. Similar diagenetic processes as described above (Avon Park) are responsible for the current state of the Oldsmar Formation. From 3,100 feet to 3,200 feet bpl, the formation has undergone extensive fracturing and dissolution. This cavernous interval is known as the "Boulder Zone". Diagenesis has obscured, through recrystallization, much of the depositional fabric of the section and the formation of dolostone.

Injection Well CW-1 and Monitor Well DZMW-1 Hydrogeology

The hydrogeologic units encountered during the construction of CW-1 include the Biscayne Aquifer, the Hawthorn Group Upper Confining Unit, the Upper Floridan Aquifer, the Middle Floridan Confining Unit, and the Lower Floridan Aquifer. These units are discussed separately in the following paragraphs.

Biscayne Aquifer. The Biscayne Aquifer in Broward County is present at the Sunrise injection well site to a depth of 190 feet bpl. This aquifer is found in undifferentiated Plio-Pleistocene deposits. No upper confining unit exists for this aquifer, and it is exposed at land surface in the Sunrise area. The Biscayne Aquifer is composed of well-consolidated, highly porous and permeable, limestone, and shell material. Porosity in this aquifer is primary intergranular, fabric selective, and non fabric selective dissolution. The transmissivity of the Biscayne Aquifer in the Sunrise vicinity is reported at approximately 2 to 5 million gallons per day per foot (gpd/ft).

Hawthorn Confining Unit. From 190 feet to 1,005 feet bpl, the section includes clay, sand, silt, and low porosity limestones, which are collectively designated as the Hawthorn Group or Hawthorn Confining Unit. This aquitard comprises the upper confining unit, which overlies the Floridan aquifer. While minor amounts of water can be found in the sands and lower limestones of the Hawthorn Group in Broward County, insufficient volumes of water perclude these intervals from being used for production. This is unlike the equivalent formation on the west coast of Florida, for example in Lee County, where parts of the Hawthorn Formation are major water producing aquifers.

FLORIDAN AQUIFER

Upper Floridan Aquifer. Between 1,005 feet and 1,740 feet bpl, the section includes sediments of the Suwannee Limestone, Ocala Limestone, and part of the Avon Park Formation. This is known as the Upper Floridan Aquifer. Porosity in the Upper Floridan Aquifer is a mixture of primary intergranular, moldic, and fabric selective, and nonfabric selective dissolution, resulting in the formation of vugs, and enlargement of bedding planes. The upper monitor zone at the Sunrise injection well site is located in a zone at the base of the Upper Floridan Aquifer. The transmissivity of the Upper Floridan Aquifer in this area of Broward County is typically reported at as high as 500,000 gpd/ft.

Middle Confining Unit. The Upper Floridan Aquifer is separated from the Lower Floridan Aquifer by the middle confining unit. In Broward County, the middle confining unit is comprised of three intervals (Miller, 1986) of low to moderate porosity/ permeability, well-cemented, micritic limestones from the middle of the Avon Park Formation, and Oldsmar Formation. These limestones are inter-layered with limestones of higher relative porosity and permeability. This confining unit is found in the interval from 1,740 feet to approximately 3,100 feet bpl. The base of the USDW (10,000 mg/L TDS interface) at the Sunrise site lies within the middle confining unit.

Lower Floridan Aquifer. The Lower Floridan Aquifer at the Sunrise site is located below the middle confining unit, from a depth of approximately 3,100 feet to the total drilled depth of the well at 3,400 feet bpl. Drilling at the site did not identify the base of the Lower Floridan Aquifer, which is generally recognized by the first appearance of anhydrites characteristic of the Cedar Keys Formation. The formations that contain this aquifer include the lower Avon Park and the Oldsmar Formations. Porosity in the Lower Floridan Aquifer is a mixture of primary intragranular, and fabric selective, and nonfabric selective dissolution, resulting in vug and cavern formation, as well as enlargement of bedding planes, and other primary porosity types. The "Boulder Zone" is included in this aquifer and was identified at the site as occurring at a depth of 3,135 feet bpl. The "Boulder Zone" was the targeted injection zone and is generally accepted as the identifiable base of the Oldsmar Formation.

The Floridan Aquifer System in South Florida, is divided into the upper and lower aquifer, and regionally contains eight pronounced confining units. At WTP site, middle confining Unit 1 is present and has a thickness of approximately 660 feet (Miller, 1986). The confining interval is present from 1,740 feet to 2,400 feet bpl and is composed of alternating sequences of low to moderate permeability limestones and their equivalent dolostone sequences. This alternating between porous and non-porous, and well cemented to poorly cemented rock, is representative of both depositional texture, and subsequent dissolution and cementation. This diagenenetic process is well documented in south Florida's Eocene limestones by Miller (1986) and Randazzo (1997).

Also, at the WTP site, middle confining Unit 6 is present and has a thickness of approximately 495 feet (Miller, 1986). The confining interval is present from 2,550 feet to 3,130 feet bpl and is composed of alternating sequences of low to moderate permeability dolostone and heavily cemented limestone. Minor dissolution enhanced bedding is present in this confining interaval, as it has been the site of large scale secondary cemenataion. Secondary dolomitization of the lower portion of this interval is also a result of alteration and has resulted in the formation of intervals of very dense, confining rock.

Confinement in the Vicinity of CW-1 and DZMW-1

Confining units were evaluated based on data from lithologic samples, the analysis and description of core samples, geophysical log interpretations, straddle packer tests, and water samples collected during drilling as required in Specific Condition 3(j) of the City's FDEP Construction Permit. The Middle Confining Unit that separates the Upper and Lower Floridan Aquifer, and the Upper Confining Unit that marks the bottom of the Biscayne Aquifer and the Top of the Floridan Aquifer meets the criteria of Chapter 62-528, FAC with respect to designation of a confining unit. The lower confining unit, below all underground sources of drinking water and below the injection zone, also meets these criteria.

Hawthorn Confining Unit. From 190 feet to 1,005 feet bpl, the section includes clay, sand, silt, and low porosity limestones, which is designated as the Hawthorn Group or Hawthorn Confining Unit.

> <u>Confining Interval 190 feet - 1,005 feet bpl</u>: This interval contains the Hawthorn Group, and although it is a confining unit, small sand layers in the lower third of the section, and limestones below 950 feet bpl produce small amounts of water.

Middle Confining Unit. The Upper Floridan Aquifer is separated from the Lower Floridan Aquifer by the middle confining unit. At the Sunrise injection well site, the middle confining unit is comprised of three distinct intervals (Miller, 1986) of low porosity and permeability, well cemented, micritic limestones and some hard dolostones from the middle to the base of the Avon Park Formation, and the top of the

Oldsmar Formation. The limestones are inter-layered with limestones of higher relative porosity and permeability. The recrystallization of the limestone has reduced primary porosity by the growth of pore-filling calcite. The diagenetic activity of water has also produced secondary porosity by dissolution of limestone. As a result, below the USDW, the effective confining beds are numerous and are separated by very narrow producing zones. There is some development of solution features in this interval, but it appears to be associated only with bedding planes. There is no evidence of fracturing in this interval. The producing zones are discussed below, and the confining natures of the formations are discussed here. This three interval confining unit is found from 1,740 feet to approximately 3,100 feet bpl.

Examination of the drill cuttings also indicated that porosity was low to moderate throughout the intervals between 1,740 feet to 3,100 feet bpl. Porosity is secondary or intergranular and has been reduced due to the cementation and recrystallization of the formations. In some intervals, carbonate silt (marl) and secondarily cemented fine carbonate sand are present.

The below listed intervals of significant confinement were identified between 1,740 feet and 3,130 feet bpl (top of the injection zone in CW-1) based on the information collected during the drilling and testing program. These intervals are also included on **Figure 5-4.**

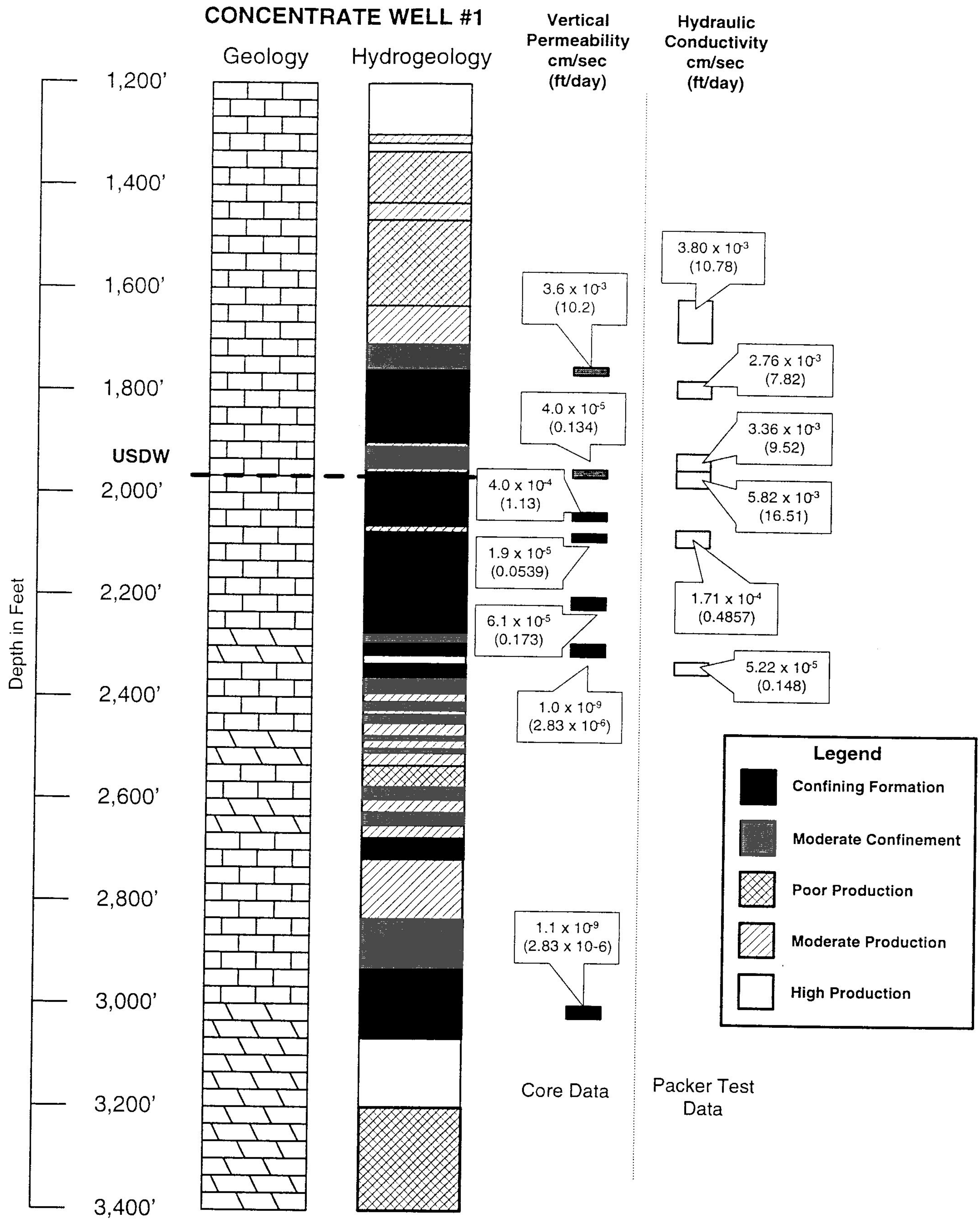
> **Confining Interval 1,740 feet - 1,865 feet bpl:** The confining unit shown on Figure 5-4 was identified from the following information, and represents Miller (1986) Confining Unit I:

Lithologic samples: LIMESTONE 100%, very pale orange to tan. Recrystallized wackestone/packstone, poorly cemented, poorly indurated, calcareous sand and forams. Porosity is reduced intergranular. Unit is locally hard, but poorly cemented.

Dual-Induction: The Dual-Induction log of the pilot hole indicates the relative homogeneity of the formation and indirectly the formation porosity and the water quality. The interval between 1,740 and 1,865 feet bpl shows constant readings on the Dual-Induction log, representing uniform conditions in the borehole through the interval.

BHTV: The borehole televiewer log shows dense, hard, or massive borehole walls with the appearance of a bright yellow color in the left-hand track. This indicates a higher amplitude signal being returned to the tool. This type of signal is associated with non-porous materials. Extensive layers of non-porous materials are apparent throughout the entire interval.

BHCS & VDL: A borehole compensated sonic log of the pilot borehole was reviewed for indications of bedding within the formation. Bedding planes within the formation



CITY OF SUNRISE CONCENTRATE WELL SYSTEM CONFINEMENT AT INJECTION WELL SITE
Figure 5-4

are usually open due to dissolution, and can be horizontal conduits for fluid movment. Further, the BHCS is a valuable tool in determining the layered nature of the formation. The BHCS shows variability in the limestones encountered during the drilling of this interval of the pilot hole. Alternating fast and slow travel times indicate that the formation is layered with the beds of well-cemented and poorly cemented limestone.

Flowmeter log: No fluid was seen entering the borehole in the 1,740-foot to 1,865-foot interval.

Temperature log: The temperature log gives an indication of fluid entry points into the borehole. Increases in temperature result from frictional forces between the formation and moving fluid. No temperature fluctuations were observed in this interval.

Core: A core sample was successfully retrieved from the 1743 feet to 1,753 feet interval. Core recovery percentage was poor due to the layering of softer and harder materials across the cored intervals. Descriptions and laboratory analysis verified that porosity and permeability for each of the samples was moderate **(Table 5-2).**

Packer Tests: Transmissivities calculated from the packer test verify the presence of confinement between 1,780 feet and 1,810 feet bpl with low to moderate transmissivity values (1,755 gallons per day per foot [gpd/ft]).

Video: Intervals were identified based on the appearance of smooth gauge hole, lack of apparent porosity (vugs or fractures), the presence of silt or silt nodules, and the presence of possible exposure surfaces indicating secondary cementation. The video survey results provided visual confirmation of confinement between 1,740 feet and 1,865 feet bpl. Written observations made during the video survey are presented in **Appendix G**

Confining Interval 1,920 feet – 1,950 and 1,980 feet to 2,020 feet bpl: The confining unit shown on Figure 5-4 was identified from the following information, and represents the upper portion of Miller (1986) confining unit VI:

Lithologic samples: LIMESTONE 100%, very pale orange to tan. Recrystallized packstone/grainstone, poorly cemented, poorly indurated, calcareous sand and forams. Porosity is reduced intergranular. Traces of dolostone are present. Unit is locally hard, but poorly cemented.

Dual-Induction: The Dual-Induction log of the pilot hole indicates the relative homogeneity of the formation and indirectly the formation porosity and the water quality.

BHTV: The borehole televiewer log shows dense, hard, or massive borehole walls with the appearance of a bright yellow color in the left-hand track. This indicates a higher amplitude signal being returned to the tool. This type of signal is associated with non-porous materials. Extensive layers of non-porous materials are apparent between 1,920 feet to 2,020 feet bpl.

BHCS & VDL: A borehole compensated sonic log of the pilot borehole was reviewed for indications of bedding within the formation. Bedding planes within the formation are usually open due to dissolution, and can be horizontal conduits for fluid migration. Further, the BHCS is a valuable tool in determining the layered nature of the formation. The BHCS shows variability in the limestones encountered during the drilling of this interval of the pilot hole. Alternating fast and slow travel times indicate that the formation is layered with beds of well-cemented and poorly cemented limestone.

Flowmeter log: No fluid was seen entering the borehole in the 1,920 feet to 2,020 feet bpl interval.

Temperature log: The temperature log gives an indication of fluid entry points into the wellbore. Increases in temperature result from frictional forces between the formation and moving fluid. No fluid entry points can be seen in this interval.

Core: A core sample was successfully retrieved from 1,955 feet to 1,965 feet bpl. Core recovery percentage was poor due to the layering of softer and harder materials across the cored intervals. Descriptions and laboratory analysis verified that porosity and permeability for each of the samples was moderate **(Table 5-2)**.

Packer Tests: Transmissivities calculated from the packer test verify the presence of confinement between 1,920 feet and 1,950 feet bpl with moderate transmissivity values (3,705 gallons per day per foot [gpd/ft]).

Video: Intervals were identified based on the appearance of smooth gauge hole, lack of apparent porosity (vugs or fractures), the presence of silt or silt nodules, and the presence of possible exposure surfaces indicating secondary cementation.

<u>**Confining Interval 2,060 feet - 2,140 feet bpl**</u>. The confining unit on Figure 5-4 was identified from the following information, and represents the middle portion of Miller (1986) confining unit VI:

Lithologic Samples: LIMESTONE 100%, very pale orange to very light gray, recrystallized packstone to grainstone, contains forams, molluscs, and corals. Porosity is low, and permeability is low due to recrystallization and secondary pore filling cement. Unit is well-lithified, non-sucrosic.

BHTV: The borehole televiewer log shows dense, hard, or massive borehole walls with the appearance of a bright yellow color in the left-hand track. This indicates a higher amplitude signal being returned to the tool. This type of signal is associated with non-porous materials. Extensive layers of non-porous materials are apparent between 2,060 feet and 2,140 feet bpl.

Temperature log: The temperature log gives an indication of fluid entry points into the wellbore. Increases in temperature result from frictional forces between the formation and moving fluid. No fluid entry points can be seen in this interval.

Core: A core sample was successfully retrieved from 2,077 feet to 2,087 feet bpl. Descriptions and laboratory analysis verified that porosity and permeability for each of the samples was moderate **(Table 5-2).**

Packer Tests: Transmissivities calculated from the packer test verify the presence of confinement between 2,060 feet and 2,090 feet bpl with very low transmissivity values (109 gallons per day per foot [gpd/ft]).

Video: Intervals were identified based on the appearance of smooth gauge hole, lack of apparent porosity (vugs or fractures), the presence of silt or silt nodules, and the presence of possible exposure surfaces indicating secondary cementation. The video survey results provided visual confirmation of confinement between 2,060 feet and 2,140 feet bpl.

Confining Interval 2,290 feet - 2,355 feet bpl. The confining unit shown on Figure 5-4 was identified from the following information, and represents the lower portion of Miller (1986) confining unit VI:

Lithologic samples: LIMESTONE 50%, DOLOSTONE 50%, very pale orange to very dark gray, recrystallized packstone to grainstone, contains forams, red algae, molluscs, and corals. Porosity and permeability are low due to recrystallization and secondary pore filling cement. Well-lithified, nonsucrosic unit. Contains packstone to grainstone. Also 20% coarsely crystallized spar. Foraminifera, corals, and molluscs abundant. (This type of packstone/grainstone dominates the hole for hundreds of feet) Appears to be a "Hawk Channel" type deposit being composed of abundant grains of limited transport. Cementation is dominantly secondary and porosity reducing. Further diagenic deposition of coarsely crystalline calcite occludes most remaining porosity. Areas of dolomitization are highly crystalline and non-porous.

BHCS & VDL: A borehole compensated sonic log of the pilot borehole was reviewed for indications of dolostone within the formation. Dolostones are usually more massive and contain less porosity than limestones. The presence of dolostone would be an indication of confinement. Dolostones were detected on the logs at depth interval 2,290 feet to 2,325 feet bpl.

Video: Intervals were identified based on the appearance of smooth gauge hole, lack of apparent porosity (vugs or fractures), the presence of silt or silt nodules, and the presence of possible exposure surfaces indicating secondary cementation. The video survey results provided visual confirmation of confinement between 2,290 feet and 2,355 feet bpl.

Core: A Core sample was successfully retrieved from 2,295 feet to 2,307 feet bpl. Core recovery percentage was poor due to the layering of softer and harder materials across the cored intervals. Descriptions and laboratory analysis verified that porosity and permeability for each of the samples was very low.

Packer Tests: Transmissivities calculated from the packer test verify the presence of confinement between 2,290 feet and 2,355 feet bpl with very low transmissivity values (31 gallons per day per foot [gpd/ft]).

Confining Interval 2,650 feet - 2,725 feet bpl. The confining unit on Figure 5-4 was identified from the following information:

Lithologic samples: DOLOSTONE 80%, LIMESTONE 20%, very pale orange to very light gray, recrystallized packstone to grainstone. Porosity is low and permeability is low due to recrystallization and secondary pore filling cement. Well lithified, non-sucrosic unit. Mostly crystaline.

BHCS & VDL: A borehole compensated sonic log of the pilot borehole was reviewed for indications of dolostone within the formation. Dolostones are usually more massive and contain less porosity than limestones. Dolostones were detected on the log through out the depth interval 2,650 feet to 2,725 feet bpl. The VDL of the sonic log shows dolomitization as decreases in signal arrival times. Due to the amount of recrystallization that occurs between limestone and dolomite, the lithology confirms that these intervals display generally low porosity and permeability. The VDL of the sonic log also gives an indication of the amount of fracturing within the formation. Highly fractured sections of the formation are shown as broken, disjointed returns, while the lack of fractures is seen as solid, consistent returns.

Video: Intervals were identified based on the appearance of smooth gauge hole, lack of apparent porosity (vugs or fractures), the presence of silt or silt nodules, and the presence of possible exposure surfaces indicating secondary cementation. The video survey results provided visual confirmation of confinement between 2,650 feet and 2,725 feet bpl.

Confining Interval 2,900 feet – 3,130 feet bpl. The confining unit on Figure 5-4 was identified from the following information, and represents Miller (1986) confining unit VIII:

Lithologic Samples: LIMESTONE 90%, DOLOSTONE 10% Grainstone, well cemented (secondary), highly recrystallized. Well indurated. Highly Crystaline. Well cemented.

Porosity and permeability are secondary interparticle dissolution and fracturing. Porosity is reduced.

Dual-Induction: The Dual-Induction log of the pilot hole indicates the relative homogeneity of the formation and indirectly the formation porosity and the water quality. The interval between 2,900 feet and 3,130 feet bpl is homogeneous and shows resistivity that corresponds to homogeneous water quality.

BHTV: The borehole televiewer log shows dense, hard, or massive borehole walls with the appearance of a bright yellow color in the left-hand track. This indicates a higher amplitude signal being returned to the tool. This type of signal is associated with non-porous materials. Extensive layers of non-porous materials are apparent through out this interval and increase in abundance towards the base.

BHCS & VDL: A borehole compensated sonic log of the pilot hole was reviewed for indications of dolostone within the formation. Dolostones are usually more massive and contain less porosity than limestones. The presence of dolostone would be an indication of confinement. Dolostones were detected on the logs at depth interval 3,020 feet to 3,130 feet bpl.

Flowmeter log: No fluid was seen entering the borehole in the interval from 2,900 feet to 3,130 feet bpl.

Temperature log: The temperature log gives an indication of fluid entry points into the borehole. Increases in temperature result from frictional forces between the formation and moving fluid. No fluid entry points can be seen in this interval.

Video Survey: The survey showed a round, smooth hole indicative of harder, homogenous formation.

Core: A core sample was successfully retrieved from 3,024 feet to 3,044 feet bpl. Core recovery percentage was poor due to the layering of softer and harder materials across the cored intervals. Descriptions and laboratory analysis verified that porosity and permeability for each of the samples was very low.

No packer tests were conducted in this interval.

Producing Intervals in the Vicinity of CW-1 and DZMW-1

From composite information collected at the site during drilling, and from the video TV surveys and geophysical logs, it was possible to determine the major producing intervals in the vicinity of CW-1 and DZMW-1. The porosity associated with some of these intervals is of the lithologic type and does not appear to be a result of fractures; other producing intervals are clearly a result of secondary porosity or fracturing. Using the testing program outlined in Section 4, an effort was made to separate the principal confining intervals, described above, from the principal producing intervals. Furthermore, this part of the report further separates the producing intervals into those resulting from primary porosity and those that appear to result from fracturing. The principal geophysical logs used for this determination were the borehole televiewer, flowmeter, and fluid resistivity and temperature logs, in addition to the Dual-Induction and sonic logs.

Biscayne Aquifer

The Biscayne Aquifer in Broward County is present at the Sunrise Injection well site to a depth of 190 feet bpl.

- **0 feet to 190 feet bpl:** A producing interval is present from 0 feet to 190 feet bpl. This interval is the Biscayne aquifer. The unit comprises highly porous layers of limestone and shell. It contains high, primary intergranular porosity. Diagenesis, including dissolution and cementation appear to have produced the porosity in this interval.

Floridan Aquifer

Between 1,005 feet and 3,400 feet bpl, the section includes sediments of the Suwannee Limestone, Ocala Limestone, Avon Park Formation, and Oldsmar Formation. These units comprise the Floridan Aquifer, including the Upper Floridan Aquifer, Middle Confining Unit, and Lower Floridan Aquifer.

- **1,005 feet to 1,110 feet bpl (Suwannee Limestone):** This interval consists of interbedded, well-indurated limestones of moderate to high porosity, a majority of which is secondary porosity. Abundant fossil grains resulted in moldic porosity through diagenesis. Effective porosity is also high due to the packstone to grainstone nature of the rock. Bedding planes through this interval have been expanded through dissolution and add to the total porosity.

- **1110 feet to 1,740 feet bpl (Ocala Limestone and upper Avon Park Formation):** The porosity in the Ocala Limestone is primarily intergranular, with some secondary enhancement through solution activity. The BHTV log shows a very fine-grained mixture of high amplitude and medium to low amplitude returns, reflecting the intergranular nature of the porosity. Porosity is intergranular, and cementation has had little porosity reducing effect on the interval. Bedding planes showing possible solution enhancement are found in the interval.

- **1,950 feet to 1,980 feet bpl (lower Avon Park Formation/upper Oldsmar Formation):** This interval consists of moderately porous, fine grained, granular packstones and grainstones, interbedded with micritic limestones of lower porosity.

Porosity is primary intergranular, as well as solution enhanced intragranular and exists along horizontal pathways. Porosity reduction through cementation is low. The somewhat higher porosity is a result of the granular nature of the unit. This interval is present as a enlarged bedding plane fature within the middle confining unit and was selected as the lower monitor zone.

- **2,304 feet bpl to 2,315 feet bpl (Oldsmar Formation):** This interval consists of highly recrystallized dolostone. Dissolution and recrystallization has enhanced the porosity within this interval. The flowmeter log indicated an increase in flow rate relative to the borehole diameter within this interval

- **2,400 feet bpl to 2,810 feet bpl (Oldsmar Formation):** This interval consists of highly recrystallized grainstone, poorly cemented and indurated. Grains are sorted molluscs, forams, (some are transported). Porosity and permeability are prevalent, secondary interparticle and dissolution in nature. Minor fracturing due to the brittle nature of the rock is also present. The porosity is generally enhanced by the process of recrystallization and dissolution in this interval. Minor layers of low porosity rock are found in this interval, but it is dominated by moderate porosity.

- **3,100 feet to 3,200 feet bpl (Oldsmar Formation):** This interval is the "Boulder Zone", the targeted principal injection target. Porosity is vuggy to cavernous, and formed from extensive dissolution and secondary dolomitization. No depositional fabric is visible in the unit.

- **3,200 feet to 3,370 feet bpl (Oldsmar Formation):** This interval consists of very hard dolostone, with limited solution features. Porosity is dolomitic-intercrystalline and vug. No depositional fabric is visible, except for a possible enlarged bedding planes at 3,250 feet, 3,318 feet, and 3,374 feet bpl. The borehole is mostly of gauge (20 inch) and solution vugs are 2 inches and smaller. Solution features are randomly spaced. All from comes from the three dissolution features mentioned.

TESTING RESULTS

This section of the report discusses the results of the formation testing program. It includes coring, packer test, water quality, pump test and injection test information. The presented information is then summarized with reference to the regulatory criteria.

Coring Results for Injection Well CW-1

The coring program in CW-1 was designed to collect detailed lithologic information in the interval from approximately 1,895 feet to 2,900 feet bpl. Coring depths in CW-1 were selected to augment those cores collected during the drilling of CW-1. Formation lithology based on the cores was described using Dunham's Classification of

Limestones and is presented in **Appendix H.** Included in the lithologic descriptions were color, matrix, cement, hardness, and fossil content. Eight cores were collected from the CW-1 pilot hole at different depths. The percent recovery for each core collected is listed in **Table 5-1** below.

Table 5-1
Coring Summary for CW-1

Core Number	Depth Interval	% Recovery
1	1,743 – 1,753	33
2	1,955 – 1,965	100
3	2,030 – 2,040	40
4	2,077 – 2,087	90
5	2,135 – 2,147	4
6	2,201 – 2,221	40
7	2,295 – 2,307	90
8	3,024 – 3,044	65

Selected intervals from each core were sent to Ardaman and Associates, Inc. in Orlando for analysis of horizontal and vertical permeability (HP and VP), porosity (P), compressive strength, and specific gravity (SG), as required by Specific Condition 3(j)(4) of the Construction Permit. The results of that analysis are listed in **Table 5-2** below and copies of the laboratory reports are contained in **Appendix H.** The core information assisted in determining the hydrologic character of the middle confining unit.

Descriptions and laboratory analysis verified that porosity and permeability for each of the samples was low to moderate.

Packer Test Results for CW-1

Packer testing consisted of six straddle packer tests, all performed in the pilot hole during the drilling of CW-1. The interval or span between the two packers (straddle interval) varied from 30 feet to 80 feet. Distances between packers were selected based upon the presence of mechanically competent formation materials as determined from a review of the borehole televiewer, Dual-Induction, borehole compensated sonic, and caliper log to identify sections of the borehole that would support the inflated packers.

Table 5-2
Summary of CW-1 Core Data Analysis

Core	Sample	Depth	VP	HP	P	SG
		(feet)	(cm/sec)	(cm/sec)	%	
1	1	1,745	3.6×10^{-3}	4.4×10^{-3}	40	2.75
2	1	1,955	2.8×10^{-3}	6.2×10^{-3}	42	2.72
	2	1,959	4.3×10^{-4}	1.1×10^{-3}	43	2.71
	3	1,964	4.0×10^{-5}	3.0×10^{-5}	40	2.70
3	1	2,040	4.0×10^{-4}	5.6×10^{-4}	38	2.72
4	1	2,078	1.9×10^{-5}	2.1×10^{-5}	36	2.71
	2	2,079	No Test	No Test	NT	2.73
	3	2,080	1.2×10^{-4}	1.8×10^{-4}	41	2.72
6	1	2,205	6.1×10^{-5}	2.9×10^{-5}	41	2.74
	2	2,206	3.3×10^{-5}	4.3×10^{-5}	32	2.74
7	1	2,298	1.6×10^{-8}	6.3×10^{-8}	3	2.84
	2	2,301	1.0×10^{-8}	1.4×10^{-8}	7	2.86
8	1	3,025	1.1×10^{-9}	8.1×10^{-9}	6	2.87
	2	3,027	8.4×10^{-5}	No Test	28	2.73
	3	3,034	2.3×10^{-5}	8.4×10^{-5}	27	2.73

Aquifer Characteristics. The results of these tests with respect to physical aquifer characteristics are summarized in **Table 5-3**. The aquifer characteristics obtained from packer testing aided in the evaluation of confining zones, potential monitoring zones, producing intervals, and the overall hydrogeologic characteristics of the formation materials tested. The aquifer parameters of interest were hydraulic conductivity or transmissivity and specific capacity. These parameters were determined from pumping tests of limited duration. Drawdown and recovery rates were measured and plotted and the hydraulic conductivities and specific capacities were estimated from the Theis Recovery Method approximation. Drawdown and recovery graphs with analytical hydrologic results are presented in **Appendix I.**

Table 5-3
Summary of Straddle Packer Tests Performed in CW-1

Interval	Test Number	Pumping Rate	Drawdown	Transmissivity*
2,060-2,090	1	9 gpm	122 feet	109 gpd/ft
1,950-1,980	2	79 gpm	65 feet	6,485 gpd/ft
1,920-1,950	3	77 gpm	95 feet	3,705 gpd/ft
1,780-1,810	4	67 gpm	129 feet	1,755 gpd/ft
1,620-1,700	5	330 gpm	85 feet	6,453 gpd/ft
2,320-2,348	6	2.5 gpm	85 feet	31 gpd/ft

* *Transmissivity values calculated using the Theis Recovery Method in CW-1.*

Transmissivities calculated from the packer tests verify the presence of confinement between 2,060 feet and 2,090 feet bpl, and 2,320 feet and 2,348 feet bpl with low transmissivity values (109 and 31 gallons per day per foot [gpd/ft]).

Water Quality. Based on the laboratory-analyzed water quality analyses of the packer test water samples shown in **Table 5-4**, the USDW was tentatively identified between 1,905 feet and 1,920 feet bpl.

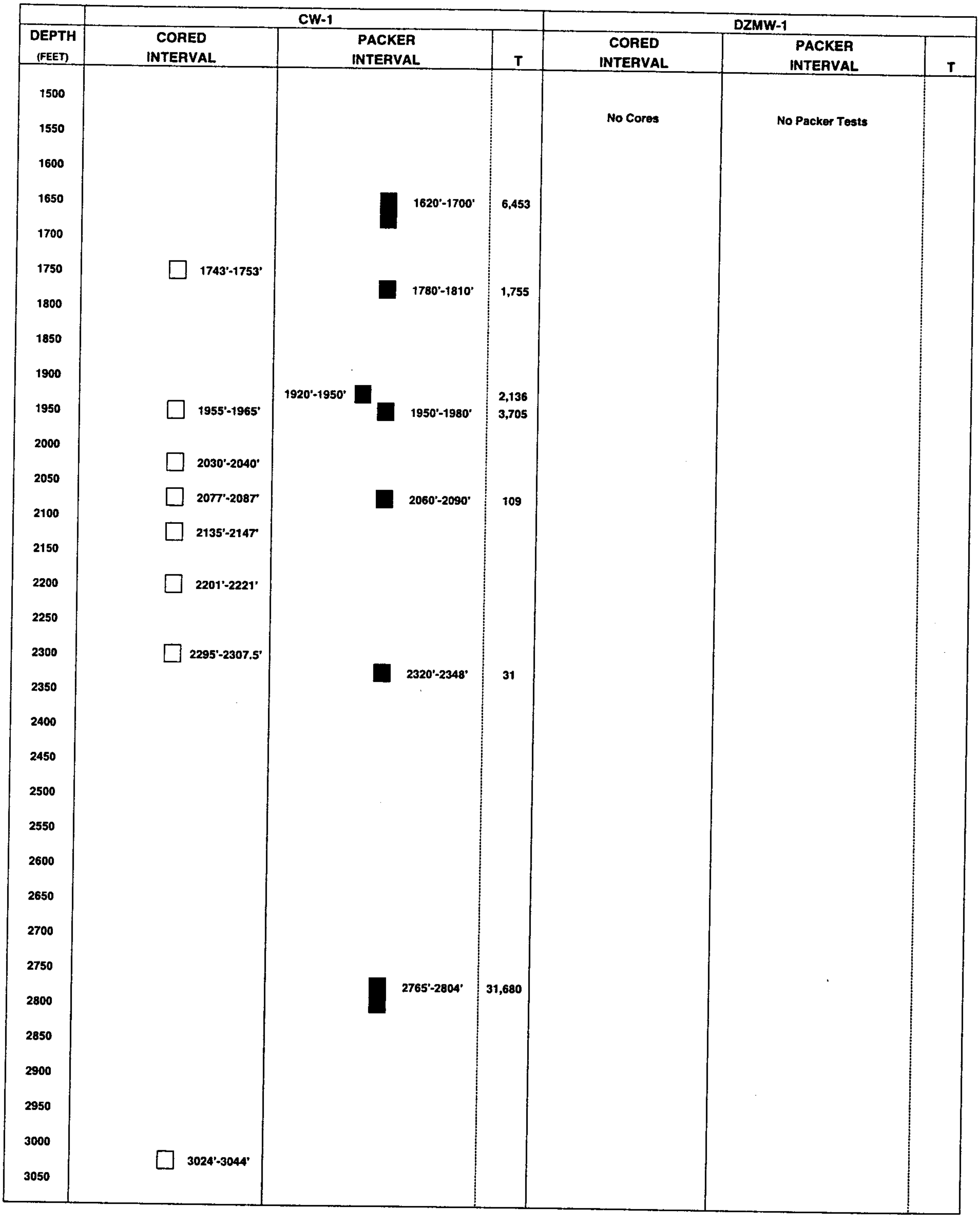
Confinement was indicated by the rapid degradation of water quality from 3,960 milligrams per liter (mg/l) TDS to 10,533 mg/l TDS over the 110-foot interval from 1,810 feet to 1,920 feet bpl. Similarly, the existence of confinement was indicated between the interval 1,740 feet and 2,060 feet bpl, between the lower monitor zone and the injection zone, by a significant change in water quality between the packer test samples. A diagram showing the location of core samples and packer tests that confirm the presence of confinement in the pilot hole is shown in **Figure 5-5.**

Table 5-4
Summary of CW-1 Packer Test Water Samples

Depth	Specific Conductance	TDS	Cl^-	SO^4	NH^3	TKN	TP	PH	Ca	Mg	K	Na
(feet)	(umhos/cm)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(std unit)	(mg/L)	(mg/L)	(mg/L)	(mg/L)
1,620-1,700	6,120	3,580	1,750	656	0.67	0.52	<0.02	7.18	46	103	59.5	653
1,780-1,810	7,545	3,960	2,399	637	1.09	0.49	0.02	6.66	67.6	173	85.1	928
1,920-1,950	17,040	10,533	7,698	533	1.3	1.2	0.04	7.44	182	380	159	3,702
1,950-1,980	18,320	11,300	8,847	939	6.0	5.73	0.02	7.45	141	408	271	4,247
2,060-2,090	45,250	22,800	15,120	2,656	0.48	0.48	0.03	7.39	274	808	727	7,327
2,320-2,348	36,200	25,950	21,115	2,679	0.64	0.64	<0.02	7.32	273	1,449	963	10,862

Water Quality Sampling Results From CW-1

Water samples were collected and analyzed at various times during the construction and testing of CW-1. Samples collected at the completion of each packer test were used to evaluate the hydrogeology of tested intervals as described above. During the pilot hole drilling in CW-1, drill stem water samples were collected at 40-foot intervals between 2,100 feet and 3,040 feet bpl as required by Construction Permit Specific Condition 3(k). These data were used to help identify the upper limit of effluent from the adjacent injection well system and aid in the location of confining intervals. **Table 5-5** summarizes the results from the collected drill stem water samples. Complete laboratory results are found in **Appendix E.**



CITY OF SUNRISE CONCENTRATE INJECTION WELL SYSTEM
CW-1 & DZMW-1 PACKER TEST AND CORE INTERVALS
FIGURE 5-5

Table 5-5
Summary of CW-1 Drill Stem Water Samples

Depth	Specific Conductance	TDS	Cl^-	NH^3	TKN	TPO_4
(feet)	(umhos/cm)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)
2160	33,300	3,898	11,800	2.18	3.82	0.00
2223	28,180	18,361	9,600	3.48	4.09	0.53
2240	31,350	20,548	11,000	3.42	3.99	0.00
2295	28,830	18,901	10,300	4.72	4.74	0.36
2320	12,080	7,342	3,950	1.82	3.49	0.36
2370	13,610	8,239	4,750	2.15	3.67	0.38
2400	14,410	8,060	4,250	1.92	3.66	0.00
2440	15,160	8,293	5,150	2.45	3.56	0.00
2480	14,100	8,340	4,550	2.41	3.65	0.33
2520	15,010	9,094	5,000	2.71	2.95	0.42
2560	16,010	9,999	5,150	2.76	3.07	0.31
2600	15,200	9,149	5,300	1.94	3.01	0.35
2640	17,240	10,866	5,850	2.18	3.69	0.35
2680	18,930	12,004	6,600	1.79	3.36	0.40
2726	18,740	11,705	6,300	2.76	3.54	0.35
2760	17,710	10,845	6,050	4.19	4.53	0.37
2800	19,000	12,128	5,900	2.60	3.19	0.36
2840	19,080	11,959	6,000	2.49	3.64	0.00
2880	18,790	11,758	6,050	2.90	3.60	0.00
2920	19,000	11,729	6,200	2.47	3.37	0.00
2960	19,140	12,090	6,350	2.58	3.59	0.00
3000	19,050	11,808	6,250	3.11	3.41	0.00
3040	19,520	12,297	6,400	2.57	3.41	0.33

A discussion of the results of drill stem sampling is presented later in this section. Water samples were also collected from the injection zone of CW-1 and each of the monitoring intervals in DZMW-1, at the completion of each well. The samples were analyzed for primary and secondary water quality standards and minimum criteria. The samples were collected to establish background water quality for both wells to facilitate the monitoring of water quality over time. The results of these analyses are found in **Appendix E.** Since the injection zone of CW-1 is already an active injection zone from over 14 years of effluent injection into the City of Sunrise WWTP Injection Well System, the injection zone sample represents an "as-is" water quality rather than a true background condition.

DEPTH OF THE BASE OF THE USDW

The base of the USDW was identified using geophysical logs, log-derived TDS values, packer test water quality data, and calculated aquifer parameters as required in the FDEP Construction and Testing permit under Specific Conditions 3(h) and 3(i).

These conditions specifically require the following:

The depth of the 10,000 mg/L TDS interface (USDW): This interface was determined using packer test water samples, aquifer performance tests, geophysical logs (specifically, caliper, gamma, Dual-Induction, borehole compensated sonic, pumping flowmeter, temperature and fluid resistivity). **Figure 5-6** is a plot of sonic porosity and apparent formation fluid resistivity (RWA).

Geophysical Log Interpretation

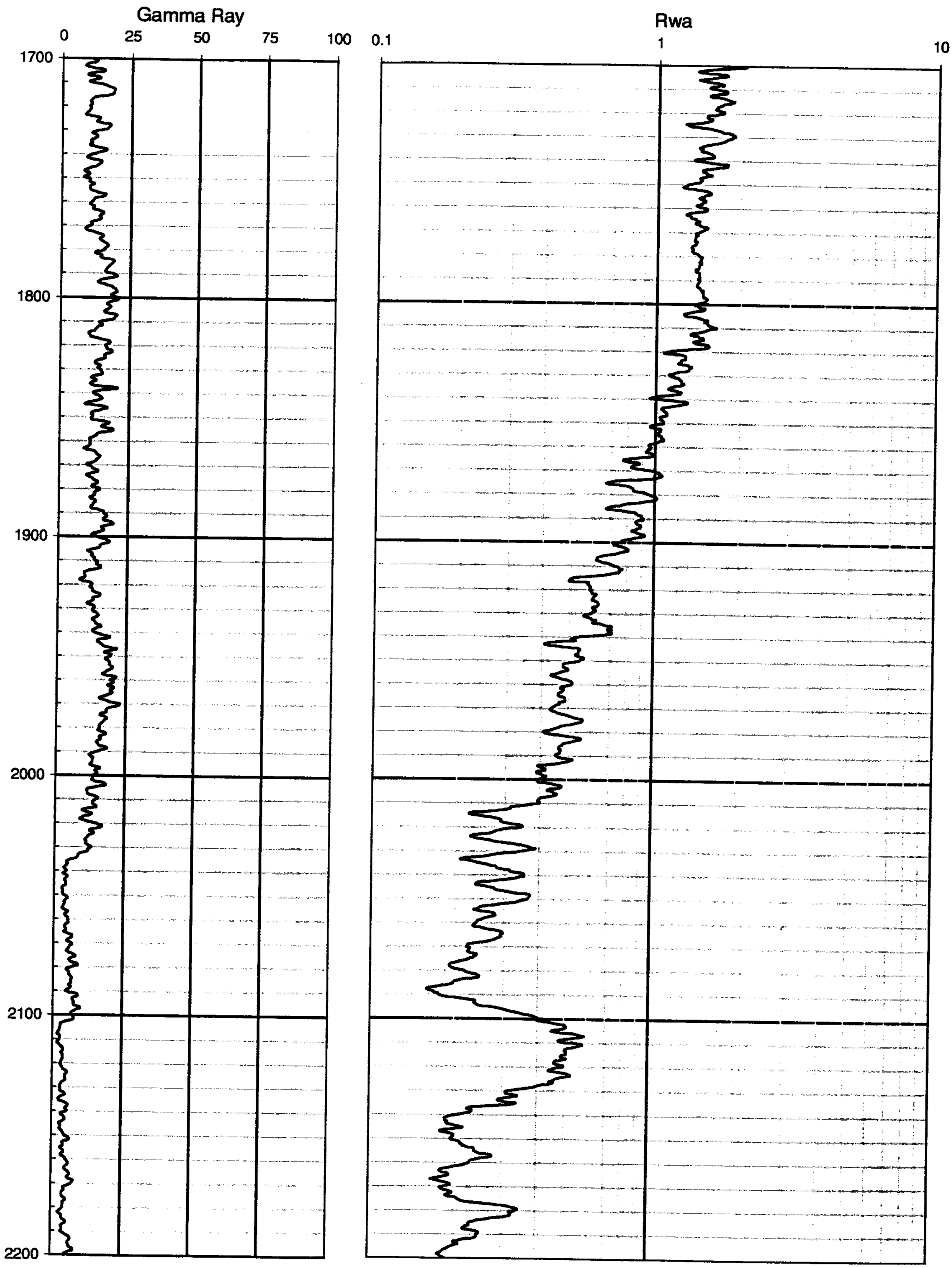
The base of the USDW is found within an interval of decreasing resistivity as shown on the Dual-Induction Log. The decreasing resistivity results from an increase in salinity as depth increases, which is seen between 1,800 feet and 2,000 feet bpl. The depth at which the base of the USDW (10,000 mg/L TDS) interface was selected is a depth of 1,920 feet bpl.

Packer Testing

Straddle packer tests were conducted in the intervals from 1,920 feet to 1,950 feet bpl and 1,950 feet to 1,980 feet bpl to establish the base of the USDW. These depths were selected after reviewing the caliper, Dual-Induction, and BHCS logs. The water quality results obtained from samples collected during these tests are shown in Table 5-4 above. Water quality samples taken from the packer test intervals of 1,910 feet to 1,940 feet bpl and 1,950 feet to 1,980 feet bpl indicated TDS values of 10,533 mg/L and 11,300 mg/L, respectively. The Dual-Induction log showed that a clear transition zone existed between 1,890 feet and 1,910 feet bpl. Using the sonic porosity log, the deep induction log, and the equations from a paper recently published by the USGS entitled Hydrogeology and the Distribution and Origin of Salinity in the Floridan Aquifer System, Southeastern Florida (USGS Publication No. 94-4010), a TDS curve was plotted using data from south Florida waters. From this information, the base of the USDW was determined to exist at an approximate depth of 1,920 feet bpl.

DETERMINATION OF THE UPPER MONITOR ZONE

Establishment of the upper monitor zone was based on geophysical log interpretation, the permeability of the transition zone in the vicinity of the base of the USDW, packer test water quality data, specific capacity, and the identification of the base of the USDW.



PLOT OF LOG DERIVED WATER RESISTIVITY (Rwa)

FIGURE 5-6

Geophysical Log Interpretation

The geophysical logs showed a fairly uniform formation for the packer interval selected to test the suitability of the shallow monitor zone between 1,620 feet and 1,700 feet bpl. The loss of signal over this interval indicated the likely presence of solution activity such as vugs and open features. Below 1,630 feet, the BHTV showed a higher amplitude signal over a smaller diameter hole, indicating a tighter, more competent formation than was appropriate for a packer setting interval. The Dual-Induction log indicated that the interval between 1,620 feet and 1,700 feet bpl was above the water quality change characteristic of the base of the USDW and that the formation was slightly less resistive than adjacent formations. The caliper log indicated that the formation over the packer interval was less consolidated and softer than the interval directly below 1,700 feet bpl. Additionally, the sonic log showed some evidence of bedding features on the VDL

.

Packer Testing

An additional straddle packer test was performed from 1,620 feet to 1,700 feet bpl to test the productivity of the proposed upper monitor zone for DZMW-1. The interval was pumped at 330 gpm for 4 hours, sampled, and allowed to recover 3 hours. The results of the water quality analysis indicate this interval is located above the base of the USDW. The results from the Theis Recovery Method indicate a transmissivity (T) for this interval of 6,453 gpd/ft. These results indicate that this interval will produce an adequate supply of water to be used as a monitoring interval.

A straddle packer test was also conducted over the lower monitor interval between 1,950 feet and 1,980 feet bpl. The interval was pumped at 78.6 gpm for 4 hours and allowed to recover 3 hours. Results from the Theis Recovery Method calculations indicate a transmissivity for this formation interval of 6,485 gpd/ft. The results of this straddle packer test in the lower monitor zone shows that this zone is transmissive enough to produce water.

DZMW-1 Final Pumping Test Results

Following construction completion of DZMW-1, a step rate pumping test and a constant rate pumping test were performed to determine the production characteristics of the monitoring interval between 1,620 feet and 1,700 feet bpl, and between 1,950 and 1,980 feet bpl. The results are summarized in **Table 5-6a and 5-6b** and presented in full in **Appendix J**.

Table 5-6a
Summary of Pumping Test Results for Upper Monitor Zone

Pumping Test	Pumping Rate (gpm)	Drawdown (feet)	Specific Capacity (gpm/ft)
Constant Rate	113	36	3.14
Step Rate 1	67	21	3.19
Step Rate 2	92	28	3.29
Step Rate 3	106	34	3.11
Step Rate 4	113	37	3.05

Table 5-6b
Summary of Pumping Test Results for Lower Monitor Zone

Pumping Test	Pumping Rate (gpm)	Drawdown (feet)	Specific Capacity (gpm/ft)
Constant Rate	63	34	1.85
Step Rate 1	70	15	4.66
Step Rate 2	93	24	3.875
Step Rate 3	105	32	3.28
Step Rate 4	112	34	3.29

To satisfy Specific Condition 6.b.13. of the Construction Permit, water samples were collected from the monitor well by Sanders Environmental Laboratory of Fort Myers, Florida. The samples were analyzed for primary and secondary drinking water quality standards along with minimum criteria as listed in Chapter 62-550 FAC. The laboratory results show no parameters measured above expected ranges. All of the other parameters were measured below the detectable limit. This water quality data will serve as a baseline for all future upper monitor zone water quality comparisons. The results of the water quality analysis are presented in **Appendix E.**

DEFINITION OF THE INJECTION INTERVAL

An evaluation of the injection zone was made based upon the results from testing conducted during and after drilling. Testing included description of lithologic cuttings, drill stem water quality sampling, packer testing, geophysical logging, video surveys, and an injection test. Based on the existing injection well (IW-3), the injection zone consisted of fractured, and in places cavernous, dolostone. This dolostone has the capacity to receive effluent and concentrate as a result of the high secondary porosity associated with solution and fracture features. The testing program conducted in CW-1 verified that this zone existed in CW-1 and identified the upper extent of the active injection zone. The description of CW-1 lithologic cuttings is presented in **Appendix F.**

The lithologic descriptions of the injection zone were confirmed by the geophysical logging program results.

Drill Stem Water Quality

Water quality from drill stem tests between 2,160 feet and 3,040 feet bpl and packer test samples helped define the location of the active injection zone. Straddle packer tests were conducted at 2,060 feet to 2,090 feet bpl and 2,320 feet to 2,348 feet bpl. Water quality data from these tests support the information obtained from the drill stem samples. The data is presented in Table 5-4 and Table 5-5 above. Water samples taken above the 2,295 foot interval contain higher chloride and conductivity levels, indicative of background water quality. Water samples from below this level show a decrease in chloride and conductance. A confining interval located between the depths of 2,290 feet and 2,355 feet effectively block the upward migration of fluid injected into IW-1 and IW-2 at the Sunrise WWTP Site. Due to fluid being injected since 1985 at the WWTP, "ponding" has occurred under this confining interval resuting in fresher water being found at a greater depth than formation water. New construction at the WWTP and WTP site (wells IW-3 and CW-1 respectively) has been completed to a greater depth and will utilize confinement from 2,900 feet to 3,100 feet bpl.

Geophysical Logs

Geophysical logs were run in the injection zone after setting of the final tubing to evaluate the potential of the injection zone to accept effluent. The porosity, mechanical strength, and fracturing or solution features in this interval are the key properties that make injection possible. The caliper log was run to identify fractures, solution features, and wall collapse associated with the Boulder Zone of southern Florida. The borehole compensated sonic log was run to evaluate the porosity of the formation in the fractured intervals. The Dual-Induction and SP logs were run to make an independent estimate of the porosity of the formation. Fluid velocity, temperature, and fluid resistivity logs were run to evaluate the flow patterns in the borehole under pumping conditions.

Secondary porosity, identified from lithologic descriptions below 3,130 feet bpl, was also seen in the geophysical logs and was identified by the following log features:

- The caliper log showed borehole diameters of up to 59 inches in the cavernous zones of the well and very nearly gauge hole diameter (22 inches) in the hard dolomitic sections.

- The sonic log showed no returns or very weak late arrivals in the cavernous and fractured zones, which strongly contrasted with the rapid travel times occurring in the hard dolomitic intervals. The broken nature of the VDL also gives an indication of the amount of fracturing.

- The Dual-Induction log showed a contrast similar to the sonic log between solution features/fractures (very low density) and the dolomitic ledges (high resistivity).

- The temperature log showed a very uniform temperature in the cavernous zones where high permeability allowed thorough mixing of formation fluids. A very slight positive gradient was observed below the injection zone.

Video Surveys

The formation in the open hole portion of the injection well consisted of dolostone identifiable in the video survey. The borehole walls are composed of alternating structural features such as fractures, cavities, and vugs from approximately 100 feet below the base of the CW-1 injection well casing (at 3,130 feet) to 3,155 feet bpl. From 3,160 feet bpl to the bottom of the hole, the rock is more resistive which results in a nearly gauge borehole. The borehole diameter varies abruptly and erratically through the injection zone from 3,130 feet to 3,155 feet bpl. Water movement from the injection of fresh water or cross-currents was visible at a depth of approximately 3,148 feet bpl, and many fractures are present in the walls of the borehole to the total depth of the well. The total depth of the well was verified with the video survey at approximately 3,400 feet bpl.

Injection Test

The injection test performed in CW-1 was approximately 24 hours in duration. The injection test was performed between March 11 and March 14, 1999. The purpose of the injection test was to predict the operating pressure of the final well and to assess the suitability of the selected zone to accept the quantity of effluent for which the well was designed. The test was performed at an average rate of 6,070 gpm. This injection rate represents the maximum volume of effluent that can be supplied to CW-1 under current piping and pumping conditions. After WTP construction is completed it may be possible for the well to be re-tested and permited at its design capacity. Twenty-four hours, or one tidal cycle, was considered a sufficient time length to demonstrate the trend of injection pressure on long term operating conditions. Water levels and wellhead pressures were monitored in CW-1 and in Monitor Well DZMW-1 during the background, injection, and recovery phases of the injection test. A downhole pressure and temperature transducer was placed 20 feet inside the final casing of the injection well to determine the pressure and temperature changes throughout the test. The fluid used for injection was treated effluent from the WWTP.

Pressure readings from the CW-1 wellhead gauge increased from approximately 70 psi to a maximum of 96 psi early in the test. The wellhead pressure responded immediately to injection. Similarly, wellhead pressure decreased at the end of the injection test from 93 psi to 73 psi. The variation in wellhead pressure during the injection test can be attributed to tidal fluctuation. The graphical representations of the injection test results are presented in **Appendix K**.

The downhole pressure in CW-1 responded similarly to the surface readings. Downhole pressure increased during the injection test from approximately 1,354.16 psi to 1,354.71 psi, an increase of 0.55 psi. The downhole pressure responded to tidal fluctuations during the test.

Water quality samples were collected and analyzed for primary and secondary drinking water parameters and other selected constituents listed in Chapter 62-550, FAC. This analysis provided the "as-is" background water quality for the injection zone. The water quality analysis for the injection zone is in **Appendix E**, and shows an active injection zone, of formation water mixed with injection fluid from IW-3.

Section 6
Mechanical Integrity Testing and Results

Mechanical Integrity testing was performed in CW-1 and DZMW-1 to verify the internal and external well integrity. The testing included Cement Bond logs, and oxygen activation logs in DZMW-1, temperature and video surveys in both wells, and a Radioactive Tracer Survey (RTS) and background temperature and gamma ray logs in CW-1. These logs are designed to give a direct indication of the borehole hydraulic seal quality, the potential for upward migration of injection fluids, and to identify the existence of casing leaks. Additionally, the logs coupled with a video survey of the well interior provide background information with which to evaluate future mechanical integrity. Below is a description of the testing and results for each well.

MECHANICAL INTEGRITY TESTING PROGRAM FOR CW-1

The following mechanical integrity testing program was completed for the concentrate injection well:

- Cement Bond Log
- Casing Pressure Test
- Annular Pressure Test
- Radioactive Tracer Survey (RTS)
- Background Cased Temperature
- Background Cased Gamma Ray
- Video Television Survey

Cement Bond Log

A Cement Bond Log was run to evaluate the quality of the cement seal emplaced in the annular space behind the wall of the final casing. This log aids in the determination of the external mechanical integrity of the well and gives a direct indication of the quality of the hydraulic seal adjacent to the well bore which inhibits vertical flow within the annular space.

Radioactive Tracer Survey (RTS)

The RTS was used to assist in determination of external mechanical integrity. This log was performed after the final 20-inch diameter tubing and packer was emplaced in the well. The purpose of the survey was to determine if water pumped into the injection zone could readily migrate upwards adjacent to the well bore. This is accomplished by recording background gamma radiation in the well then adding a radioactive fluid (Iodide-131) that emits gamma radiation to the well at depth and measuring the levels of radiation in the well over time. Very small quantities of Iodide-131 are used in the survey. By strategic placement of three gamma ray detectors on the geophysical logging tool, it is possible to track the movement of the tracer fluid precisely as it disperses within the well bore.

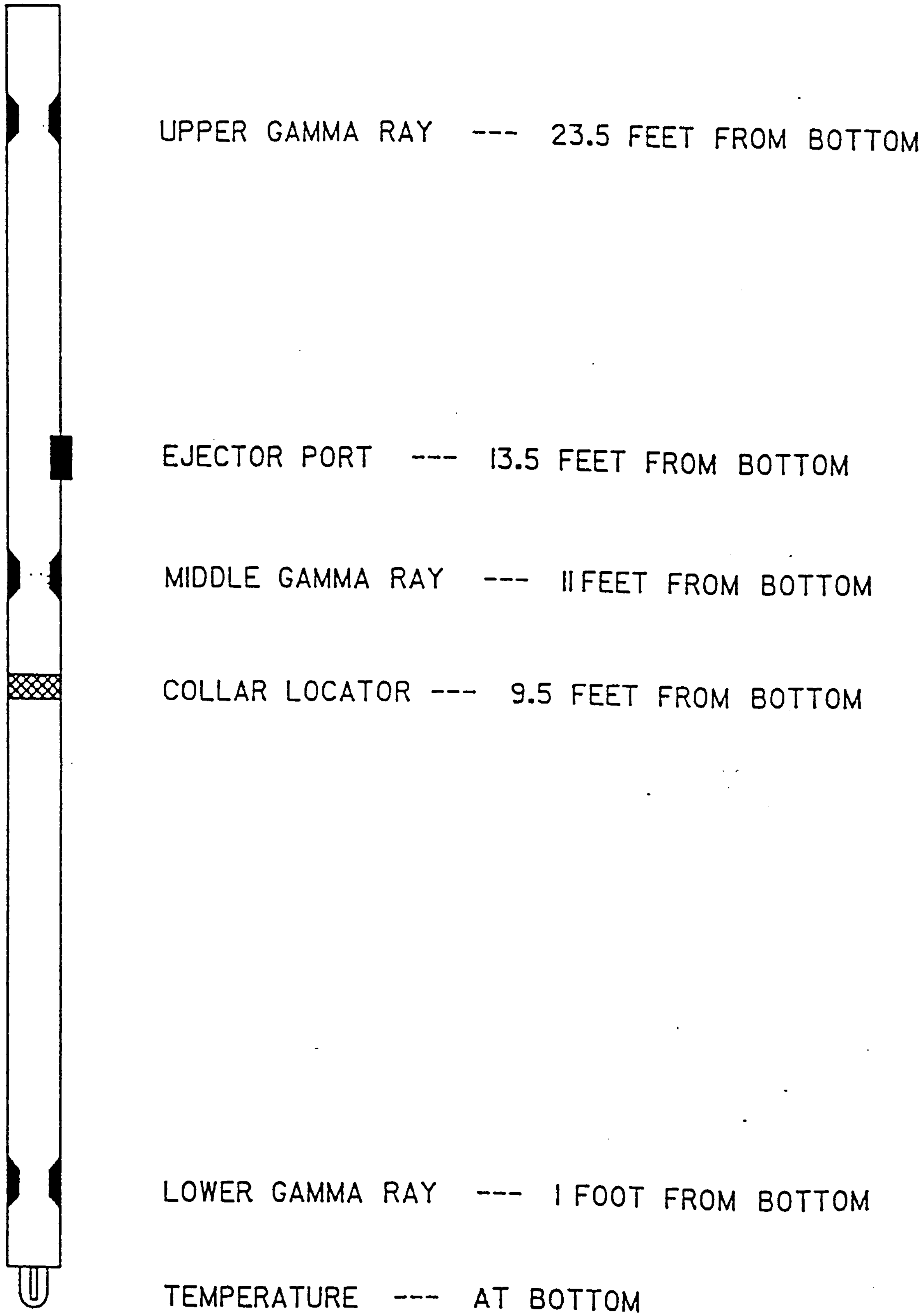
The RTS consists of a gamma ray intensity record (log), measured after the ejection of a radioactive tracer, Iodide-131, in the well. Static conditions are maintained in the injection well during the first test, and dynamic flow conditions are maintained in two subsequent tests. The radioactive tracer tool was configured with three detectors; Gamma Ray Top (GRT), Gamma Ray Middle (GRM), and Gamma Ray Bottom (GRB) arranged above and below the ejector as shown in **Figure 6-1**.

The RTS consisted of four steps. These are as follows:

- **An initial Gamma Ray/Casing Collar Locator Log:** The logs were run to determine background gamma ray emission and to precisely locate the bottom of the casing. The logs were run the entire length of well.

- **A static well portion:** The ejection port of the tool was run to one foot below the bottom of the casing, as determined by the casing collar locator. A slug of radioactive Iodide-131 measuring 2 milliCuries (mCi) was ejected. The radioactive Iodide-131 slug movement was monitored for one hour; the tool remained stationary and the well fluids were static. After the one-hour monitoring period, a log out of position was performed between the ejection point and 200 feet above the highest movement of the slug. Upon completion of the logging section the well was completely flushed at 400 gpm for 120 minutes (approximately one well volume of fluid). After the completion of the well flushing, the tool was run to the base of the casing and an after-flush logging pass was performed over the same interval as described above.

- **A dynamic well portion:** The RTS consisted of two dynamic flow tests, "A" and "B". Both tests were identical; the second functioned as a repeatability test for the first. A pumping rate of 120 gpm (5 feet per minute) was used. The tool was positioned with the ejector port 5 feet above the bottom of the casing and the flow of water into the well started. A slug of radioactive Iodide-131 measuring 2 mCi was ejected. Radioactive slug movement was monitored for one hour. During this period, the tool was stationary and the injection rate constant. After the one-hour monitoring period, a log out of position was performed between the ejection point and 200 feet above the highest movement of the slug. Upon completion of the logging section, the well was completely flushed at 400 gpm for 60 minutes (1/2 casing volume of fluid). After the completion of the well flushing, the tool was run to the base of the casing and an after-flush logging pass was performed over the same interval as described above. The second dynamic flow test "B" was run in the same manner as flow test "A" to provide repeatability.



RADIOACTIVE TRACER TOOL
Figure 6-1

- **A post test Gamma Ray/Casing Collar Locator Log:** Following the completion of the dynamic sections of the RTS, a Gamma Ray/Casing Collar Log was run on the entire length of well as an after-flush final background pass.

Pressure Tests

Casing Pressure Test: The casing pressure test, designed to detect leaks in the final casing, was used to evaluate the integrity of the final casing string prior to the installation of the final tubing. Utilizing an inflatable packer set at the bottom of the casing, the casing was filled with water and pressurized to 159.5 psi. A gauge on the wellhead was monitored, and the pressure changes were recorded over the period of one hour.

Annular Pressure Test: The injection tubing was tested by pressurizing the annular space between the final casing and the injection tubing after the tubing was set into the packer. The annular space was pressurized to 157.0 psi. A gauge on the wellhead was monitored, and the pressure changes were recorded over the period of one hour.

Ideally, under stable temperature conditions within the injection well, there should be no pressure change over the period of either test if there are no leaks in the casing or tubing. Changes in pressure may occur due to the following influences:

- Temperature fluctuations
- Leaks in the pressure test apparatus

Temperature changes during the test can cause the pressure to increase (if the wellhead becomes warmer) or decrease (if the wellhead cools). The acceptance criterion established by FDEP is within a ±5 percent change in pressure over a 1-hour period. This criterion allows for ordinary heating or cooling of the wellhead by temperature fluctuations throughout the day. During preparations for the pressure test, the contractor generally eliminates significant leaks in the pressure test apparatus. Pressure on the inflatable packer located in the well also could be a probable cause of leakage so it too is maintained during testing.

Background Cased Temperature Log

The temperature log is used to evaluate internal casing mechanical integrity and external hydraulic seal. Externally, it is used to detect fluid movement behind the casing in the annular space. Internally, it is used to detect leaks in the casing wall. The temperature log is also important as a base log for future mechanical integrity tests.

Background Cased Gamma Ray Log

The gamma ray log is used as a main component of the RTS. It is used as a background log for comparisons of gamma radiation before and after ejection of the tracer material. Its major purpose is to monitor the movement of the radioactive Iodide-131 following ejection into the well.

Video Television Survey

The video television survey is used as a visual inspection of the internal nature of the final casing string. Its purpose is to detect any visual defects in the casing wall. It is also used as a comparison log for future mechanical integrity tests.

MECHANICAL INTEGRITY TESTING PROGRAM FOR DZMW-1

After the installation of the final casing, the mechanical integrity of the monitor well was investigated and the following testing program was completed:

- Sector Bond Log
- Oxygen Activation Log
- Casing Pressure Test
- Video Television survey
- Temperature Log with Casing Collar Locator

The intent of the sector bond log is to determine the satisfactory nature of the final casing cement. The required pressure test and television survey demonstrated the internal mechanical integrity of the final casing, and the temperature survey provided a background log for comparison with future mechanical integrity tests. Results of the testing and the geophysical logging program for DZMW-1 are discussed later in this report.

Sector Bond Log

The sector bond tool is a hybrid cement bond log tool. The principal of operation is exactly the same as the cement bond log with the addition of a sector section. Like the CBL it has one transmitter, a 3-foot receiver and a 5-foot receiver. The sector section consists of 8 transmitters and 8 - 2-foot receivers, each 45 degrees offset. The purpose of the sector section is to obtain a full 360 degree evaluation of the cement for channel identification. The log presentation contains the typical bond log information of travel time, amplitude, and variable density. The sector section adds an average, minimum, and maximum amplitude from the 8 sector receivers and a cement image map of the cement behind the pipe.

Oxygen Activation or Water Flow Log

The oxygen activation tool is a nuclear logging tool used to determine water flow behind the casing wall. The tool contains a small particle accelerator which, when turned on shoots high velocity electrons at a tritium-deuterium target. The bombardment of the target results in the production and emission of high-energy neutrons (the neutron generator). The neutrons are emitted by the tool and randomly strike water molecules in the formation behind the casing. Neutrons that strike the oxygen atom in a water molecule are absorbed, creating an "excited" or radioactive form of oxygen. To return to a stable "unexcited" state, the oxygen atoms release gamma rays which are detected by the logging tool. The oxygen activation tool is operated in a pulsing mode. A minimum of 15 pulses are required for accurate statistical calculations.

Each pulse "activates" an oxygen atom. When the pulse ends, the tool measures the decay rate at which the oxygen returns to the stable "unexcited" state. The exponential decay curve for this process is characteristic and time dependent. The distance traveled by an "activated" water molecule can be measured by the amount of gamma radiation detected at a specific point on the decay curve.

EVALUATION OF MECHANICAL INTEGRITY

Demonstration of mechanical integrity was performed on CW-1 and DZMW-1 to verify the integrity of the final casing, injection tubing and monitor casings, and confirm the effectiveness of the hydraulic seal at the base the casing. The final mechanical integrity test (MIT) on CW-1 required the performance of a pressure test to prove that there were no leaks in the casing and a video survey to provide visual inspection of the interior of the final casings. In order to demonstrate that there is no fluid movement behind the casing, a high resolution temperature log and RTS were also performed during the final MIT in the injection well. In order to determine if an adequate cement seal exists between casing and cement, a cement bond log was performed on the final casing of CW-1 and a sector bond log was performed on the monitor casing of DZMW-1. Further, a oxygen activation log was performed on the monitor casing of DZMW-1, to verify that no free space existed, in the cemented area separating the monitoring intervals. The FDEP was notified so that a representative would be present during testing. The mechanical integrity testing program was conducted to comply with FDEP Chapter 62-528.300 (6), (b)2, and (c) of the Florida Administrative Code as prescribed in the City's Construction and Testing Permit Special Condition 3(i).

Pressure Tests

CW-1 Casing Pressure Test: The pressure test on the final casing string of CW-1 was performed on November 9, 1999. This pressure test used an inflatable packer set at 3,035 feet bpl in the bottom of the final casing to seal the base of the casing from the formation below. The top of casing was sealed with a pressure head equipped with a pressure gauge and valve, and the pressure in the casing was increased to 159.5 psi. The valve then was shut, and the pressure was measured every five minutes for one hour. The pressure at the end of the hour was 159 psi, a 0.3 percent decrease in pressure from the start of the test. The pressure test was successfully completed within the 5 percent tolerance established by the FDEP. The test was witnessed and recorded by Mr. Randal Skinner, P.G. of Montgomery Watson and Ms J.P. Listick, P.G., FDEP. The results of the pressure test and pressure gauge calibration certification are presented in **Appendix L.**

CW-1 Annular Pressure Test: The pressure test on the injection tubing of CW-1 was performed on November 17, 1999. This pressure test was completed using the annular space between the final casing and the injection tubing. The annular space was pressurized to 151 psi and shut in for a period of 1 hr. The top of annulus was sealed with a pressure head equipped with a pressure gauge and valve, and the pressure in the casing was increased to 157 psi. The valve then was shut, and the pressure was measured every five minutes for one hour. The pressure at the end of the hour was 156 psi, a 0.6 percent decrease in pressure from the start of the test. The pressure test was successfully completed within the 5 percent tolerance established by the FDEP. This pressure test also demonstrates that the Positive Seal Packer was set properly and will hold pressure. The test was witnessed and recorded by Mr. Randal Skinner, P.G. of Montgomery Watson and Ms J.P. Listick, P.G., FDEP. The results of the pressure test and pressure gauge calibration certification are presented in **Appendix L.**

DZMW-1 Casing Pressure Test: The monitor tubing pressure test in DZMW-1 was performed on December 10, 1999. An inflatable packer was set in the monitor tubing at a depth of 1,945 feet bpl on drill pipe. The packer was inflated to form a watertight seal against the casing. The differential pressure in the packer was held at 400 psi in order to maintain a seal. The top of the tubing was sealed with a pressure head equipped with a pressure gauge and valve, and the pressure in the casing was increased to 151 psi. The valve was shut and the pressure was measured every five minutes for one hour. The pressure at the end of the hour was 151 psi, a 0.0 percent increase in pressure from the start of the test. The pressure test was successfully completed within the 5 percent tolerance established by the FDEP. The test was witnessed and recorded by Mr. Randal Skinner, P.G. of Montgomery Watson. FDEP declined an invitation to witness the pressure test in the monitor well. The results of the pressure test are presented in **Appendix L.**

Radioactive Tracer Survey

The RTS, is a measure of the gamma ray intensity following the ejection of a radioactive tracer, usually Iodide-131, into the well. The RTS consists of 4 parts: an initial gamma ray/casing collar locator log for background readings, a static well portion, a dynamic well portion, and an after gamma ray/casing collar locator log for final background readings. A base temperature log is also performed along with the RTS. The radioactive tracer tool is configured with three gamma ray detectors; Gamma Ray Top (GRT), Gamma Ray Middle (GRM), and Gamma Ray Bottom (GRB), arranged above and below the ejector

The first part of the test consisted of a gamma ray/casing collar locator log and a base Temperature Log covering the entire length of the well for initial background readings. The second part of the test consisted of the static well conditions portion. The ejection port of the tool was run to one foot below the bottom of the casing, as determined by the casing collar locator, and a slug of radioactive Iodide-131 measuring 2 mCi was ejected. Monitoring of the radioactive Iodide-131 slug movement was conducted for one hour. During this period, the tool was kept stationary and fluid was neither withdrawn from nor injected into the well. After the one-hour monitoring period, a log out of position was performed between the ejection point and 200 feet above the highest movement of the slug. Upon completion of the logging section the well was completely flushed at 400 gpm for 120 minutes (1 casing volume of fluid). After the completion of the well flushing, the tool was run to the base of the casing and an after-flush logging pass was performed over the same interval as described above.

The third portion of the RTS consisted of two dynamic flow condition tests, "A" and "B". Both of these tests were identical in nature, with Test B used as a repeatability test of Test A. A constant fluid velocity of 5 feet per minute was attained using a pumping rate of 118 gpm into the well. The tool was positioned with the ejector port 5 feet above the bottom of the casing and the flow of water into the well was started. A slug of radioactive Iodide-131 measuring 2 mCi was ejected, and monitoring of the radioactive Iodide-131 slug movement was conducted for one hour. During this period, the tool was kept stationary and the injection rate was held constant. After the one-hour monitoring period, a log out of position was performed between the ejection point and 200 feet above the highest movement of the slug. Upon completion of the logging section, the well was completely flushed at 400 gpm for 120 minutes (1 casing volume of fluid). After completion of the well flushing, the tool was run to the base of the casing, and an after-flush logging pass was performed over the same interval as described above. The second Dynamic flow test, Test B, was run in the same manner as Test A to prove repeatability. Following the completion of the dynamic sections of the RTS, a gamma ray/casing collar locator log was run on the entire length of well as an after-flush final background pass.

Static Test - One Hour Monitoring

The RTS for CW-1 was performed on December 18, 1998. The first slug of 2 milliCuries of radioactive tracer was ejected from the tool into the borehole at 11:43 AM at a depth of 3,045 feet below pad level (bpl). This depth was selected by the use of a collar locator log, run in conjunction with the Gamma Ray Log, which indicated the base of the injection well casing to be at 3,044 feet bpl. The tool was kept stationary for one hour to monitor the gamma activity. **Table 6-1** below summarizes the data collected during this portion of the static test.

Table 6-1
Summarized Results of Static Test - One Hour Monitoring

RTS Tool Specifics		Sequence of Events During Test				
Tool Detector/ Ejector	Depth (feet bpl)	Test Start	Response Time Since Start of Test			
		2 mCi tracer released at *11:43* hours	15 sec.	17 min. 50 sec.	22 min. 45 sec.	Maximum Gamma Value (API units)
GRT	3,035				X	840
Ejector	3,045	X				---
GRM	3,047.5		X			1,680
GRB	3,057.5			X		1,743

The sequence in which the indicators detected the tracer is indicative of vertical fluid movement through the process of diffusion inside the well casing.

Static Test - Log Out of Position

Following the monitoring period, a log-out-of-position was performed with the well remaining under static conditions. The tool was raised from its measuring position to 2,800 feet bpl. This log was designed to detect the distance which the tracer traveled behind the casing during the monitoring period. **Table 6-2** below summarizes the data collected during this portion of the static test.

Table 6-2
Summarized Results of Static Test - Log Out Of Position

Tool Detector	Initial Measuring Depth (feet bpl)	Upper Detectable Limit of Tracer (feet bpl)	Final Measuring Depth (feet bpl)
GRT	3,035	3,004	2,800
GRM	3,047.5	3,006	2,800
GRB	3,057.5	3,002	2,800

All three gamma detectors measured elevated gamma activity up to the depth indicated in the table above, beyond which the signal paralleled the background log (represented by dashed lines on the logs). The elevated gamma activity resulted from staining of the detectors during the movement of the tool through the slug of tracer material.

The middle detector GRM is calibrated for a much broader measurement scale, and is not applicable for detecting subtle vertical differences in tracer concentration. The GRT measurements are more appropriate for delineating vertical extent of tracer movement than those measured by GRB or GRM for the log-out-of-position. The GRT measurements indicate vertical movement up to 3,004 feet bpl, which can either be interpreted as movement within the casing or behind the casing; the GRT measurements closely correlate to the background log continuing with shallower depth. Therefore, results from the static test are inconclusive for the lowest reaches of the well casing, but do show a close match with the background logs above 3,000 feet bpl. Correlation within 10 API units of background is indicative of mechanically sound wells.

Post Static - After Flush Pass

Following the log-out-of-position, approximately 1 casing volume of fresh water was pumped into the well at a rate of 400 gpm to discharge the tracer into the formation and clean the stained portions of the gamma tool string. This flushing provided the energy to move the tracer higher into the formation, should there be a channel or void present behind the casing. **Table 6-3** below summarizes the data collected during this portion of the testing.

Table 6-3
Summarized Results of the Post Static - After Flush Pass

Tool Detector	Initial Measuring Depth (feet bpl)	Upper Detectable Limit of Tracer (feet bpl)	Final Measuring Depth (feet bpl)
GRT	3,035	None	2,800
GRM	3,047.5	3,028	2,800
GRB	3,057.5	3,024	2,800

During the after flush pass, the detector GRT measured gamma ray activities which matched the background log, indicating the absence of Iodide 131. The detectors GRM and GRB show slightly elevated readings near the base of the casing, indicating a slight staining of Iodide 131 on the tool and casing wall. These measurements indicate the absence of moving tracer either within or behind the casing. The dynamic portion of the RTS provided a more comprehensive test to the vertical extent of fluid migration behind the well casing.

Dynamic Test "A" One Hour Monitoring

A second slug of tracer was ejected into CW-1 at 3:20 PM under dynamic, or pumping, conditions at 3,039 feet bpl, 5 feet above the bottom of the casing. This 2 milliCurie slug was ejected over a 6 second interval while fresh water was pumped into the well at 118 gpm; pumping continued at that rate, approximately equal to 5 feet per minute, for the full hour of the dynamic test. **Table 4** below summarizes the data collected during this portion of the testing.

Detectors GRM and GRB both detect downward movement of the tracer fluid within 2 minutes of ejection of the tracer fluid. Within 3 minutes, shortly after the tracer fluid reached the bottom detector, the slug of trace material passed the middle detector. Within 4 minutes 10 seconds, the bottom detector started a slow but continuous decline in gamma activity indicating that the slug of Iodide 131 is moving down into the injection zone. This result is substantiated by the lack of gamma activity seen at detector GRT. It continues at background readings for the entire hour of monitoring.

Table 6-4
Summarized Results of the First Dynamic Test "A"
One Hour Monitoring

RTS Tool Specifics		Sequence of Events During Test				
Tool Detector/ Ejector	Depth (feet bpl)	Test Start	Response Time Since Start of Test			
		2 mCi tracer released at *15:20* hours	15 sec.	1 min. 50 sec.	None detected	Maximum Gamma Value (API units)
GRT	3,029				X	20
Ejector	3,039	X				---
GRM	3,041.5		X			1,710
GRB	3,051.5			X		1,790

Dynamic Test "A" - Log Out of Position

Following the monitoring period, a log-out-of-position was performed by moving the tool upward from its monitoring position to 2,800 feet bpl. This log was designed to detect the distance which the tracer traveled behind the casing during the monitoring period. **Table 6-5** below summarizes the data collected during this portion of the testing.

Table 6-5
Summarized Results of the First Dynamic Test "A"
Log Out Of Position

Tool Detector	Initial Measuring Depth (feet bpl)	Upper Detectable Limit of Tracer (feet bpl)	Final Measuring Depth (feet bpl)
GRT	3,029	None	2,800
GRM	3,041.5	3,030	2,800
GRB	3,051.5	3.026	2,800

The detectors GRM and GRB indicate a slight stain on the casing wall at the point of ejection and return to background within 16 feet of the ejection point. The detector GRT shows no indication of upward movement of fluid behind the casing wall.

Post Dynamic Test "A" - After Flush Pass

Following the log-out-of-position, approximately 1/2 casing volume of fresh water was pumped into the well at a rate of 400 gpm to discharge the tracer into the formation and clean the stained portions of casing wall. **Table 6-6** below summarizes the data collected during this portion of the testing.

Following the flushing of the casing, the stain remained on the casing wall at the point of ejection. The upper detector GRT measured gamma readings which match background values indicating no upward movement of trace material.

Table 6-6
Summarized Results of the After Flush Pass
Following Dynamic Test "A"

Tool Detector	Initial Measuring Depth (feet bpl)	Upper Detectable Limit of Tracer (feet bpl)	Final Measuring Depth (feet bpl)
GRT	3,029	None	2,800
GRM	3,041.5	3,030	2,800
GRB	3,051.5	3.026	2,800

Dynamic Test "B"

A second dynamic test was run to confirm the results of the previous tests. The test method was exactly the same as the previous dynamic test.

The second dynamic test commenced at 5:46 PM, with a third slug of tracer ejected into CW-1 at 5:48 PM under dynamic, or pumping, conditions at 3,039 feet bpl, 5 feet above the bottom of the casing. This 2 milliCurie slug was ejected while fresh water was pumped into the well at 120 gpm; pumping continued at that rate, approximately equal to 5 feet per minute, for the full hour of the dynamic test. **Table 6-7** below summarizes the data collected during this portion of the testing.

These results are nearly identical to those of the dynamic test A showing repeatability. At approximately 35 minutes into the test, the computer shut down and the test was temporarily interrupted. The interruption lasted about three minutes then the test was resumed. No adverse effects were detected when the test was resumed.

Table 6-7
Summarized Results of the Second Dynamic Test "B"
One Hour Monitoring

RTS Tool Specifics		Sequence of Events During Test				
Tool Detector/ Ejector	Depth (feet bpl)	Test Start	Response Time Since Start of Test			
		2 mCi tracer released at *17:48* hours	15 sec.	1 min. 40 sec.	None detected	Maximum Gamma Value (API units)
GRT	3,029				X	20
Ejector	3,039	X				---
GRM	3,041.5		X			1,720
GRB	3,051.5			X		1,800

Dynamic Test "B" - Log Out of Position

Following the monitoring period, a log-out-of-position was performed by moving the tool upward from its monitoring position to 2,800 feet bpl. This log was designed to detect the distance which the tracer traveled behind the casing during the monitoring period. **Table 6-8** below summarizes the data collected during this portion of the testing.

Table 6-8
Summarized Results of the Second Dynamic Test "B"
Log Out Of Position

Tool Detector	Initial Measuring Depth (feet bpl)	Upper Detectable Limit of Tracer (feet bpl)	Final Measuring Depth (feet bpl)
GRT	3,029	None	2,800
GRM	3,041.5	3,026	2,800
GRB	3,051.5	3.024	2,800

After Flush/Final Background Check

Water was injected at a rate of 400 gpm for 60 minutes (1/2 casing volume) to flush the well and clean the tracer tool. The tracer tool was also flushed of all excess tracer material below the base of the casing. The well was logged from 3,150 feet bpl to surface to compare initial to final gamma radiation. The final background log matched the initial background log to within 10 API units with the exception of two areas. These two areas are at 3,140 to 3,110 feet bpl, 3,076 to 3,022 feet bpl. These areas correspond to the ejection point and the area of the injection zone where tool flushing took place.

Table 6-9 below summarizes the data collected during this final portion of the testing.

Table 6-9
Summarized Results of the After Flush Pass/ Final Background Check

Tool Detector	Initial Measuring Depth (feet bpl)	Upper Detectable Limit of Tracer (feet bpl)	Final Measuring Depth (feet bpl)
GRT	3,023	3,022	0
GRM	3,035	3,022	0
GRB	3,145	3,022	0

SUMMARY

Montgomery Watson has concluded that the RTS has shown that no fluid is migrating upwards behind the wall of the casing, or within the wellbore, due to channeling or inadequate cementing. The initial and final background passes showed responses that were very similar. This similarity in the initial background and post-test gamma ray log passes indicates that the injection well has external mechanical integrity as defined by Chapter 62-528. It is Montgomery Watson's understanding that radioactive tracer surveys verify the hydraulic seal created at the base of the casing between the outer casing wall and the formation. The limits of upward migration can therefore be defined as within the confines of the wellbore.

Background Cased Temperature Log

A background cased temperature log was run in the final casing and open hole of CW-1 prior to the RTS. The log shows a gradual decrease in temperature with increase in depth throughout the cased interval and in the injection zone. The temperature log shows no abnormalities and will serve as background data for future mechanical integrity tests.

Cement Bond Logs

A cement bond log (CBL) was run in the final casing of CW-1 to evaluate the strength and continuity of the cement bond to the casing. This log detects potential voids in the grout sheath around the casing by measuring the acoustic properties of the cemented casing. The City's Construction Permit 0129008-001-UC requires the performance of a CBL in CW-1 under Special Condition 5(h) prior to the injection test. Below are the details of the CBL results.

CW-1 Cement Bond Log

The cement bond log (CBL) is used to assess the quality of the cement-to-casing bond and cement-to-formation bond around a cemented casing. The principle is to record the travel time and attenuation of an acoustic wave after propagation through the borehole fluid, casing, cement and formation. All CBL measurements are made from the received wave signal. They include: the amplitude of the first arrival of the waveform and the time in which this first arrival is received. The variable density portion of the log is a composite of the received waveform.

The CBL records the amplitude, in millivolts, of the first arrival of the wave signal at the 3-foot receiver created by a calibrated, 1,000 millivolt output signal. It is a maximum in unsupported pipe and a minimum in well cemented casing. The amplitude is a function of the attenuation of the transmitted signal due to the coupling of the cement to the casing. The attenuation rate depends on the cement compressive strength, the casing diameter, casing thickness, and the degree of cement bonding.

The variable density log (VDL) is a composite of the received waveform at the 5-foot receiver. It is generally used to assess the cement-to-formation bond, detect the presence of channels and for better discrimination between casing and formation arrivals. In unsupported pipe, the casing arrivals will appear very strong while the formation arrivals will seem weaker and washed out. In well bonded pipe, with good cement-to-formation bond, the casing arrivals will be weak to absent and the formation signals will be very strong.

Cementing of the 24-inch diameter final casing string was completed on the evening of November 12, 1998 to within 238 feet of land surface. The upper section of the casing (surface to 2,778 feet bpl) was cemented with 12% bentonite cement and the lower section of the casing (2,778 feet bpl to casing bottom at 3,040 feet bpl) was cemented with neat cement.

A CBL was run on CW-1 after cementing of the 24-inch diameter, 1/2-inch wall thickness, final casing had been completed. Using the Schlumberger CBL interpretation chart, Montgomery Watson estimates that good bond for neat cement (3000 pound compressive strength) under normal conditions would result in amplitudes in the range of 2.8 millivolts or less. Moderate to good bond would result in amplitudes of 2.8 to 5.0 millivolts. Good bond for 12% bentonite cement (1500 pound compressive strength) should result in CBL amplitudes of 3.0 millivolts or less. This range of CBL response should indicate an acceptable cement seal in the opinion of Montgomery Watson. The free pipe readings at the top of the casing, where cement had not been applied, was 35 to 38 millivolts. This CBL response range indicates a lack of cement behind the casing. Between 10 and 38 millivolts is a range of questionable cement bond, indicating the presence of cement but of relatively poor quality. Poor cement seal can be the result of channeling of cement during pumping, the formation of a micro-annulus when the pressure is released from the casing or simply a poor connection between cement and casing. In some cases, poor cement bond may indicate that a hydraulic flow path exists between cement and pipe, whereas in others no such path may exist even though the cement quality is poor.

The cement bond log was run on November 15, 1998. It showed good to moderate bonding over the intervals from 3, 040 feet bpl (total depth logged) to 2,770 feet bpl, 2,426 feet bpl to 238 feet bpl. Within these intervals there exists some localized spots of poor quality cement, however, they are small and isolated and do not appear to be detrimental to the hydraulic seal. Moderate to poor bonding is seen in the intervals from 2,770 feet bpl to 2,426 feet bpl. The top of cement was found to be at a depth of 238 feet bpl. Although these intervals do not demonstrate good cement bond, there is no evidence that there are voids or lack of cement across these intervals. The cement bond log is typical of difficult cementing conditions, but does not indicate any failure of cement seal.

Sector Bond Log

The sector bond tool is a hybrid cement bond log tool. The principal of operation is exactly the same as the cement bond log with the addition of a sector section. Like the CBL it has one transmitter, a 3-foot receiver and a 5-foot receiver. The sector section consists of 8 transmitters and 8 - 2-foot receivers, each 45 degrees offset. The purpose of the sector section is to obtain a full 360 degree evaluation of the cement for channel identification. The log presentation contains the typical bond log information of travel time, amplitude, and variable density. The sector section adds an average, minimum, and maximum amplitude from the 8 sector receivers and a cement image map of the cement behind the pipe.

DZMW-1

A Sector Bond Log (SBL) was run on DZMW-1 after cementing of the 6 5/8-inch diameter final casing had been completed. Using the Schlumberger CBL interpretation chart, Montgomery Watson estimates that good bond for neat cement encasing the 6 5/8-inch diameter casing would result in amplitudes in the range of 9 millivolts or less. Moderate to good bond would result in amplitudes of 9 to 14 millivolts. This range of SBL response should indicate an acceptable cement seal in the opinion of Montgomery Watson. The free pipe readings in the casing above the top of the cement were approximately 68 millivolts. This SBL response range indicates a lack of cement behind the casing. Between 14 and 68 millivolts is a range of questionable cement bond, indicating the presence of cement but of relatively poor quality. Poor cement seal can be the result of channeling of cement during pumping, the formation of a micro-annulus when the pressure is released from the casing or simply a poor connection between cement and casing. In some cases, poor cement bond may indicate that a hydraulic flow path exists between cement and pipe, whereas in others no such path may exist even though the cement quality is poor.

The SBL was run on December 28, 1998. The interval logged was from the bottom of casing at 1,958 feet bpl to 1,610 feet bpl. The cemented interval separating the upper and lower monitor zones is of limited thickness and extends from the bottom of the casing at 1,958 feet bpl to the bottom of the upper monitor zone at 1,700 feet bpl (258 feet). The SBL showed variable cement bonding over the entire interval between the upper and lower monitor zones with amplitudes reading from 3 to 30 millivolts. The casing above the top of cement at 1,700 feet bpl exhibits true free pipe and reads 68 millivolts.

The log indicates that the emplacement of the cement has achieved hydraulic isolation. One hundred percent cemented pipe is observed in the intervals from 1,945 feet to 1,930 feet bpl, 1,894 feet to 1,870 feet bpl, 1,864 feet to 1,850 feet, and 1,714 feet to 1,704 feet bpl. The remainder of the cemented interval contains cement in the good to moderate range with the exception of 1,840 feet to 1,810 feet bpl and 1,798 feet to 1,786 feet, which exhibits moderate to poor quality cement.

Oxygen Activation or Water Flow Log

A Water Flow Log (WFL) was run on DZMW-1 on January 12, 1999, after cementing of the 6 5/8-inch diameter final casing had been completed. The cemented interval separating the upper and lower monitor zones is of limited thickness and extends from the bottom of the casing at 1,958 feet below pad level (bpl) to the bottom of the upper monitor zone at 1,700 feet bpl (258 feet). The WFL was used to verify the integrity of the cement seal between the upper and lower monitor zones and confirm that no fluid is moving vertically behind the casing in this cemented interval.

Five stations were selected to determine if water would flow between the upper and lower monitor zones. Three stations were used to determine upward water flow and two stations were used to determine downward water flow. In order to induce any potential flow between the monitoring intervals, water was allowed to flow from each monitor zone while logging was taking place. During up flow logging, the upper interval was allowed to flow and during down flow logging, the lower interval was allowed to flow.

The three stations selected for up flow logging were at 1,819 feet bpl (middle of cemented interval), 1,709 feet bpl (top of cemented interval), and 1,594 feet bpl (in the upper monitor zone). The station selected in the upper monitor zone was used to demonstrate that is flow was observed it would be detected by the tool. The two stations selected for down flow logging were at 1,850 feet bpl (middle of cemented interval) and 1,925 feet bpl (bottom of cemented interval).

The log indicates that hydraulic isolation between the upper and lower monitoring zones has been accomplished. No flow was observed at any of the four stations within the cemented interval. However, the station at 1,594 feet bpl within the upper monitoring zone indicated that approximately 145 gpm water flow was present. This calculated volume of water closely matched the measured rate of 140 gpm at the wellhead while the monitoring zone was under flowing conditions.

Video Television Surveys

A video television survey was performed on the final casing of CW-1 on November 15, 1998 (**Appendix M**). No visible flaws were detected in the casing and welds. The casing was clean, and factory markings and labels were visible at nearly all welded joints.

A video television survey was performed on the injection tubing and open hole of CW-1 on December 16, 1998, and was submitted to FDEP, in the February 1999 request to perform operational testing submittal. No visible flaws were detected in the casing and welds. The casing was clean, and factory markings and labels were visible at nearly all welded joints.

The video television survey of DZMW-1 was conducted on January 5, 1999. The casing showed no signs of damage, and all welds appeared normal. Vertical extrusion marks were visible throughout the length of the casing. A complete description of the CW-1 and DZMW-1 video surveys is included in **Appendix G.**

Appendix A

Construction Permit
CW-1

FLORIDA

Department of
Environmental Protection

Lawton Chiles
Governor

MAY 2 8 1998

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

RECEIVED
MAY 29 1998
MONTGOMERY WATSON
PALM BEACH COUNTY OFFICE

Virginia B. Wetherell
Secretary

NOTICE OF PERMIT

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

Mr. Chris Helfrich, P.E.
Assistant Director of Utilities
City of Sunrise
14150 Northwest 8th Street
Sunrise, Florida 33325

BROWARD COUNTY
UIC - Sunrise Sawgrass Membrane Softening WTP
Class I Injection Well CW-1 and Monitor Well DZMW-1
File: 0129008-001-UC

Dear Mr. Helfrich:

Enclosed is Permit Number 0129008-001-UC, to construct the City of Sunrise Sawgrass Water Treatment Plant (WTP) Class I industrial Injection Well CW-1 and the associated dual zone Monitor Well DZMW-1, issued pursuant to Section(s) 403.087, Florida Statutes (F.S.) and Florida Administrative Codes (F.A.C.) 62-4, 62-520, 62-522, 62-528, 62-550, 62-600, 62-601 and 62-660.

Any party to this Order (permit) has the right to seek judicial reviewof the permit under Section 120.68, F.S., by the filing of 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 Councel, 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 thirty days after 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 Ms. J.P. Listick at (561) 681-6692.

Executed in West Palm Beach, Florida.

STATE OF FLORIDA
DEPARTMENT OF ENVIRONMENTAL PROTECTION

5/28/98

Carlos Rivero-deAguilar
Director of District Management
Southeast Florida District

Date

CRA:AM:WWC:JPL

BC JO

cc: Richard Deuerling, FDEP, UIC, TLH
Ron Reese, USGS, MIA
Francine Ffolkes, OGC, TLH
Nancy Marsh, USEPA, ATL
William Evans, FDEP, UIC, TLH
Steve Anderson, SFWMD
Helen Hickman, MWA, Lk. Worth
Scott Hoskins, USEPA, ATL
Garth Hinkle, BCDNRP
J.P. Listick, UIC, WPB

CERTIFICATE OF SERVICE

This is to certify that this NOTICE OF PERMIT and all copies were mailed before the close of business on MAY 2 8 1998 to the listed persons.

Clerk Stamp

FILING AND ACKNOWLEDGEMENT FILED, on this date, pursuant to the § 120.52, F.S., with the designated Department Clerk, receipt of which is hereby acknowledged.

Clerk

MAY 2 8 1998
Date

Department of Environmental Protection

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

Lawton Chiles
Governor

Virginia B. Wetherell
Secretary

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

GMS I.D. NUMBER: 5006M07695
PERMIT/CERTIFICATION NUMBER: 129008-001-UC
DATE OF ISSUE: MAY 2 8 1998
EXPIRATION DATE: MAY 2 7 2003
LATITUDE/LONGITUDE: 26°09"35'N/80°19"50"
PROJECT: Sunrise Sawgrass Class I Injection Well CW-1 and DZMW-1

PROJECT: Construction permit for Sunrise Sawgrass Class I Injection Well CW-1 and associated dual zone Monitor Well DZMW-1.

This permit is issued under the provisions of Chapter 403.087, Florida Statutes, and Florida Administrative Code (F.A.C.) Rules 62-4, 62-520, 62-522, 62-528, 62-550, 62-600, 62-601 and 62-660. The above named Permittee is hereby authorized to perform the work or construct the facility shown on the application and approved drawing(s), plans, and other documents attached hereto or on file with the Department and made a part hereof and specifically described as follows:

TO CONSTRUCT: One twenty-four (24) inch (O.D.) Class I Membrane Softening Concentrate injection well with 20-inch O.D., 0.500-inch thickness, seamless, steel tubing and retrievable liner hanger packer, CW-1, and a dual zone monitor well, DZMW-1. Injection Well CW-1 will be used as the primary concentrate disposal system and will be used to inject a flow rate of up to 3.8 million gallons per day (MGD) (peak hour flow) of membrane softening process concentrate (concentrate) from the City of Sunrise Sawgrass Membrane Softening Water Treatment Plant (WTP). The injection interval is in the "Boulder Zone" in the lower Oldsmar Formation between 3,000 feet and the total depth of the well at 3,400 feet below land surface (ft. bls). The confinement of the injection zone from overlying underground source of drinking water (USDW) aquifers and fluid movement adjacent to the wellbore of the injection well is monitored by a dual-zone monitor well, DZMW-1. The lower monitoring interval is between approximately 1,920 to 2,000 feet bls for the purpose of monitoring below the lowermost USDW. The upper monitoring interval is between approximately 1,650 to 1,700 ft. bls and is designed to monitor the lowermost transmissive interval of the USDW. The actual monitoring intervals shall be determined during construction and field testing. Upon completion of all appurtenances required for the transport and disposal of the Sunrise Regional WWTP secondarily treated effluent to the Sunrise Sawgrass injection well CW-1, the City of Sunrise may inject up to 8.8 MGD of secondarily treated effluent into the Sunrise Sawgrass WTP injection well CW-1, during emergency conditions only at the WWTP. If the Sunrise Sawgrass WTP is incomplete and not on-line at the time of completion of the Sunrise Sawgrass WTP injection well CW-1, then the City of Sunrise may inject into CW-1 up to 3.8 MGD of secondarily treated effluent from the Sunrise Sawgrass Regional WWTP, until the WTP comes on-line. This is agreed upon in order to protect the tubing and packer well from injection horizon waters causing corrosion of the injection well CW-1, until the WTP comes on-line.

IN ACCORDANCE WITH: Received Predesign Report for CW-1 on November 10, 1996; Pre-application meeting on November 23, 1996; Received Application to Construct a Class I Industrial Injection Well System on January 31, 1997; Received Contract Documents, Design Report, Specifications, and Set of Plans on January 31, 1997; Request for Information (RFI-1) concerning construction application issued on February 28, 1997; Response to RFI received on March 17, 1997; Revised Design Report received on May 9, 1997; Request for Information (RFI-2) concerning revised construction application issued on July 9, 1997; Response to RFI-2 received on August 14, 1997; Financial Demonstration received October 1, 1997 and additional responses received on September 15, 1997; RFI-3 requesting drawings and calculations issued November 10, 1997; Response to RFI-3 received on December 5, 1997 (drawings and calculations); Draft permit issued on February 12 1998; publication of Notice of Draft Permit 0129008-001-UC in the Sun Sentinel newspaper on February 18, 1998; consideration of receipt of public comments received as a result of the public meeting held on March 24, 1998; Intent to Issue Permit 0129008-001-UC on April 23, 1998; and Publication of the Intent to Issue Permit 0129008-001-UC in the Sun Sentinel newspaper on April 30, 1998

LOCATED AT: The City of Sunrise Sawgrass Membrane Softening Water Treatment Plant, 14150 NW Eighth Street, Sunrise, Broward County, Florida 33325.

TO SERVE: The City of Sunrise Sawgrass Membrane Softening Water Treatment Plant and the City of Sunrise Regional Wastewater Treatment (under emergency conditions only).

SUBJECT TO: General Conditions 1-17 and Specific Conditions 1-12.

DER Form 17-1.201(5)
Effective November 30, 1982

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

GMS I.D. NUMBER: 5006M07695
PERMIT/CERTIFICATION NUMBER: 129008-001-UC
DATE OF ISSUE: MAY 28 1998
EXPIRATION DATE: MAY 27 2003
LATITUDE/LONGITUDE: 26°09'35'N/80°19'50"
PROJECT: Sunrise Sawgrass Class I Injection Well CW-1 and DZMW-1

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

13. This permit also constitutes:

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

14. The permittee shall comply with the following:

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

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

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

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

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

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

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

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

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

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

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

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

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

1. GENERAL REQUIREMENTS

a) This permit is for construction of the Sunrise Sawgrass Class I injection well CW-1 and the associated dual zone Floridan Aquifer monitor well DZMW-1, and four (4) pad monitor wells. This permit does not authorize the construction of any other well or wells associated with the City of Sunrise Sawgrass Membrane Softening Water Treatment Plant Injection Well System.

b) Any permit noncompliance constitutes a violation of the Safe Drinking Water Act and is grounds for enforcement action; for permit termination, revocation and reissuance, or modification; or for denial of a permit renewal application.

c) It shall not be a defense for a permittee in an enforcement action that it would have been necessary to halt or reduce the permitted activity in order to maintain compliance with the conditions of this permit.

d) The permittee shall take all reasonable steps to minimize or correct any adverse impact on the environment resulting from noncompliance with this permit.

e) Proper operation and maintenance includes effective performance, adequate funding, adequate operator staffing and training, and adequate laboratory and process controls, including appropriate quality assurance procedures.

f) This permit may be modified, revoked and reissued, or terminated for cause. The filing of a request by the permittee for a permit modification, revocation or reissuance, or termination, or a notification of planned changes or anticipated noncompliance, does not stay any permit condition.

g) When requested by the Department, the permittee shall furnish, within the time specified, any information needed to determine whether cause exists for modifying, revoking and reissuing, or terminating this permit, or to determine compliance with this permit.

h) The permittee shall retain all records concerning the nature and composition of injected fluid until five years after completion of any plugging and abandonment procedures specified under Rule 62-528.400(3) (hazardous waste wells) or 62-528.435, F.A.C. The permittee shall deliver the records to the Department office that issued the permit at the conclusion of the retention period unless the permittee elects to continue retention of the records.

i) The permittee shall notify the Department and obtain approval prior to any physical alterations or additions to the injection or monitor well, including removal of the well head.

j) The permittee shall give advance notice to the Department of any planned changes in the permitted facility or injection activity which may result in noncompliance with permit requirements.

k) If injection is to continue beyond the expiration date of this permit the permittee shall apply for, and obtain an operation permit. If necessary to complete the two-year operational testing period, the permittee shall apply for renewal of the construction permit at least 60 days prior to the expiration date of this permit.

2. SITE REQUIREMENTS

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

b) The injection well shall be surveyed by a Florida registered land surveyor for latitude and longitude and submitted on a site plan prior to commencement of construction activities.

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

d) Four (4) permanent surficial aquifer monitor wells, identified as Pad Monitor Wells (PMWs), shall be located at the corners of the injection well drilling pad and identified by location number and pad location, i.e. NW, NE, SW, and SE

i) These wells shall be sampled and analyzed prior to the onset of drilling for chlorides (mg/l), conductivity (μmhos), temperature, and water level (relative to NGVD). Initial analyses must be submitted prior to the initiation of work on the Class I injection well.

ii) These wells are to be retained in service, sampled weekly for the above parameters during the construction phase and quarterly thereafter.

iii) 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.

3. CONSTRUCTION AND TESTING REQUIREMENTS

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

b) A revised set of contract documents that includes this permit and approved specification changes documented in all responses to requests for information (RFI's) shall be submitted to the Department and TAC prior to construction.

c) Blow-out preventers or equal shall be installed on the respective wells prior to penetration of the Floridan Aquifer System.

d) The monitor well DZMW-1 shall not be drilled below the base of the Hawthorn Group, located at approximately 900 feet bls, until testing to determine the lower limit of the Underground Source of Drinking Water (USDW) in the injection well pilot hole is completed and the results are submitted to the Department.

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

i) Secure all on-site chemicals, and other stockpiled additive materials to prevent surface and/or groundwater contamination.

ii) Properly secure drilling equipment and rig(s) to prevent damage to well(s) and on-site treatment process equipment as well as public property.

f) The geophysical logging program proposed in the "Injection Well Design Report", submitted by the City in January 1997 and as revised in May 1997, is to be accomplished as described, and will at a minimum, include:

i) Prior to setting the surface casing: pilot hole geophysical logs (caliper, gamma ray, Dual Induction) to identify the base of the Hawthorn Group (approximately 900 feet below land surface), and to establish a mechanically secure casing-setting depth.

ii) To determine the intermediate casing depth: Pilot hole geophysical logs (caliper gamma, Dual Induction, borehole compensated sonic, borehole televiewer, and the following logs under pumping and static conditions: flow meter, temperature, and fluid resistivity). A downhole television survey will also be run over this interval. These logs may be used for stratigraphic correlation, identification of monitoring zones, identification of confining units, and identification of producing intervals.

iii) To determine the final casing depth: Pilot hole geophysical logs (caliper gamma, Dual Induction, borehole compensated sonic, borehole televiewer, the following logs under pumping and static conditions: flow meter, temperature, and fluid resistivity). A downhole television survey will also be run over this interval. These logs may be used for stratigraphic correlation, identification of confining units, and identification of producing intervals.

iv) In the injection zone beneath the final casing, the following geophysical logs will be run: caliper gamma, Dual Induction, borehole compensated sonic, borehole televiewer, the following logs under pumping and static conditions: flow meter, temperature, and fluid resistivity.

v) Caliper logs shall be run on all reamed holes.

vi) Temperature logs shall be run after all cement stages that are completed without positive return at the surface to identify the top of the cement.

vii) In the monitor well pilot hole, geophysical logs (caliper gamma, Dual Induction, borehole compensated sonic and borehole televiewer) will be run to the casing setting depth. These logs may be used for stratigraphic correlation and identification of monitoring zones.

viii) In the monitor well pilot hole, geophysical logs (caliper gamma, Dual Induction, borehole compensated sonic and borehole televiewer) will be run from the intermediate casing depth to the total depth of the monitor well. These logs may be used for stratigraphic correlation and identification of monitoring zones.

ix) In the monitor well, either a sector bond log, ultra sonic imager, cement bond log, or equivalent log, as well as an oxygen activation log, shall be run after the cementing of the final casing.

g) Packer testing, as proposed in the "Injection Well Design Report" submitted by the City at a minimum include the following:

i) One straddle packer test conducted in each prospective monitor zone.

1920-1950
1950-1980
2060-2090
2320-2350

ii) Three straddle packer tests conducted from the lowermost zone of the USDW to the top of the proposed injection horizon.

iii) Water samples shall be collected from each packer test, and analyzed for TDS, chlorides, conductivity, NH_3, TKN. A five (5) gallon water sample from intervals where sufficient water is available, shall be collected at the end of the packer test. These samples shall be shipped to the Underground Injection Control Section of the Department of Environmental Protection, in Tallahassee.

h) The depth of the 10,000 mg\L total dissolved solids (TDS) interface and the background water quality of the monitor zone shall be determined during drilling and testing. Determination of the depth of the 10,000 mg/l TDS interface shall be accomplished, interpreted, analyzed using the following information:

i) Water samples from packer tests with interpretation and analysis

ii) Aquifer performance tests data analysis

iii) Geophysical logging upon reaching the total depth of the appropriate pilot hole interval using these logs: caliper, gamma, Dual Induction, borehole compensated sonic, pumping flow meter, temperature, and fluid resistivity.

iv) Plots of sonic porosity and apparent formation fluid resistivity (RWA). Interpretation will include the calculation of sonic porosity and RWA, and the input parameters used will be provided.

i). To identify the upper and lower monitoring zones, the following information from the injection well shall be submitted, analyzed, and interpreted: borehole televiewer , the permeability of the transition zone in the vicinity of the USDW, packer test data including water quality (TDS, chloride, NH_3, TKN, and conductivity), the specific capacity of the upper and lower monitor zones, and the identification of the base of the USDW.

j) Confinement shall be demonstrated using, at a minimum, directly measured lithologic properties, geophysical evidence, and tests performed while pumping the formation, in addition to items 1, 2, 3, and 4 below:

i) Formation tests shall include flow meter logs, packer tests, water quality sampling during packer tests, and analysis of drawdown curves measured during packer tests. These tests shall be conducted under pumping conditions.

ii) For the purpose of determining confinement, flow meter, temperature and fluid resistivity logs shall be run under pumping conditions, at a pumping rate that adequately stresses (as demonstrated by drawdown) the confining beds, in the pilot hole from the base the USDW to the potential confining unit immediately prior to the intersection of the top of the injection interval, so that the permeability of the zones within the base of the potential confining intervals can be evaluated.

iii) Other geophysical logs will be used as indirect evidence to deduce or correlate formation properties measured in pumping tests and direct lithologic sample analysis.

iv) Lithologic properties measured in laboratory analyses of core samples shall include: Hydraulic conductivity (vertical and horizontal) Young's modulus/elastic modulus Formation factor, and Archie's cementation exponent and coefficient.

k) Identification of the upper limit of effluent, if present, from injection at the Sunrise Wastewater Treatment Plant (WWTP) will be undertaken through analysis of water quality samples from packer tests, and through analysis of drill stem water samples collected at a minimum of every forty (40) feet in drilling from a depth of approximately 2,160 feet to 2,920 feet bpl.

l) Mechanical integrity of the injection well shall be determined pursuant to rule 62-528.300 (6), (b)2, and (c), F.A.C.

i) The pressure test for the final casing shall be accepted if tested with a liquid filled casing at 1.5 times the expected operating pressure with a test tolerance of not greater than + or - five (5) per cent.

ii) Verification of pressure gauge calibration must be provided to the Department representative at the time of the test and in the certified test report.

iii) PAD Monitor Wells shall be sampled and waters analyzed for water depth, chloride, TDS, temperature and conductivity one week prior to the onset of the Mechanical Integrity testing. (a copy of the SED reporting sheet is attached)

m) Department approval and TAC review pursuant to Chapter 62-528 F.A.C. is required for the following stages of construction.

i) Intermediate injection well casing seat and monitor zone selection.

ii) Final injection well casing seat.

iii) Proposed cementing procedures (cement volumes, no. of stages,) for the deep intermediate (34-inch) and final (24-inch) casing must be submitted with the caliper logs (reamed sections) for Department approval and TAC review.

iv) Injection testing with surface water

n) 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 TAC members. Emergency meetings may be arranged to avoid undue construction delays.

o) Department approval at a scheduled TAC meeting shall be based on the Permittee's presentation that shows compliance with the rules and this permit.

i) The confinement of the injection zone in the injection well system from overlying aquifers is to be monitored by the dual zone monitor well and a regular monitoring program. The lower interval is to be positioned in a transmissive interval below the Underground Source of Drinking Water (USDW), i.e. where groundwater has greater than 10,000 mg/l Total Dissolved Solids, at an appropriate point above the injection interval and major confining units to monitor for reasonable assurance of vertical confinement of injected fluids and external mechanical integrity of the injection wells. The upper interval shall ideally be positioned in a transmissive interval immediately above the base of the USDW, i.e. where groundwater has less than 10,000 mg/l Total Dissolved Solids. If a sufficiently transmissive zone is not present below the 10,000 mg/l TDS interface and above the top of the injection horizon as defined by testing during the drilling of injection wells a sufficiently transmissive zone above the base of the USDW shall be utilized as the lower monitor zone and the upper monitor zone shall be established in a lower interval within the USDW. The data and analysis supporting the selection of these monitoring intervals must be submitted to the TAC after the collection, interpretation and analysis of all pertinent cores, geophysical logs and analysis of fluid samples. The hydrogeologic evaluation of the proposed monitoring zone will be submitted only after the collection, interpretation and analysis of all pertinent cores, packer tests, geophysical logs and analysis of fluid samples. The final selection of the specific upper and lower monitoring intervals shall be approved by the Department.

4. QUALITY ASSURANCE/QUALITY CONTROL REQUIREMENTS

a) Pursuant to Rule 62-528.440(5)(b) Florida Administrative Code (F.A.C.), the Professional Engineer(s) of Record shall certify all documents related to the completion of the Class I injection well system as a disposal facility and associated Floridan Aquifer monitor well. The Department shall be notified immediately of any change of the Engineer(s) of Record.

b) All documents prepared for the geological/hydrogeological evaluation of this injection well system 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.

d) The Technical Advisory Committee (TAC) shall consist of representatives from these agencies:

i) Department of Environmental Protection, West Palm Beach and Tallahassee
ii) United States Geological Survey, Miami
iii) South Florida Water Management District, West Palm Beach
iv) Broward County Department of Natural Resources Protection (BCDNRP)
v) Special Advisors to the TAC:
vi) United States Environmental Protection Agency (USEPA), Region IV, Atlanta

5. REPORTING REQUIREMENTS.

a) All reports and surveys required by this permit shall be submitted concurrently to all the members of the Technical Advisory Committee and the United States Environmental Protection Agency, Region IV, Atlanta

b) The Department and other applicable agencies must be notified immediately, within twenty-four (24) hours, of any unusual events occurring during construction, and in the event the Permittee is temporarily unable to comply with the provisions of the permit (e.g. on-site spills, artesian flows, large volume 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 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 of the event, discuss its cause(s), and the steps being taken to prevent reoccurrence of the event and all other information deemed necessary by the Department. In the event the Permittee is temporarily unable to comply with any of the conditions of the permit (including the monitoring provisions) due to the breakdown of equipment, power outages, destruction by hazard of fire, wind, drilling difficulties, or by other cause, the Permittee shall notify the Department. Notification shall be made in person, by telephone, or by telegraph within twenty-four (24) hours of breakdown of malfunction to the Department's Southeast District office. A written report shall be submitted to the Department within five (5) days 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 written report shall be contain a complete description of the occurrence discussing it's causes(s) and the steps being taken to reduce, eliminate, and prevent recurrence of the event and any other pertinent information requested by the Department.

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

d) All testing for mechanical integrity must be initiated during normal business hours, Monday through Friday.

e) A weekly submittal of construction progress reports shall include at a minimum the following information:

   i) A cover letter summary of the daily engineer report, work log and a projection for activities in the next reporting period.

   ii) Daily engineers report and work log with detailed descriptions of all testing, logging, and casing installation activities with appropriate interpretations.

   iii) Driller's' log.

   iv) Detailed description of any unusual construction-related events that occur during the reporting period.

   v) Weekly water quality analysis and water levels for the four (4) pad monitor wells. (See S.C. 2b)

   vi) A certified evaluation of all logging and test results must be submitted with test data.

   vii) Description of the formations encountered.

   viii) Details of cementing operations including the following information, for each stage of cement: cement slurry composition, specific gravity, pumping rate, volume of cement pumped, theoretical fill depth, actual tag depth. And from both the physical tag and the geophysical logs, a percent fill, and an explanation of any variation between actual versus theoretical fill. For each casing Laboratory analysis of dry cement composition of a sample taken during the neat cement stage emplaced at the base of each casing.

f) Upon completion of analysis of cores and sample cuttings recovered during the construction of the monitor well and the injection well, the Permittee shall contact the Underground Injection Control Section of the Department of Environmental Protection for transfer to Florida State Geologic Survey.

g) Casing seat recommendation shall include technical justification utilizing the following information:

   i) Geophysical logs with interpretations.
   ii) Water quality data.
   iii) Identification of confining units.
   iv) Casing depth evaluation (mechanically secure formation, potential for grout seal).
   v) Identification of the base of the USDW using water quality, RWA plots, and log interpretations.

h) Injection test request shall contain the following justifications:

   i) Cement bond logs and interpretation
   ii) Final downhole TV survey with interpretation

iii) Water quality analysis of injection fluid from every source

i) Monitor Zone requests shall contain the following:

i) Identification of the base of the USDW.
ii) Identification of confining beds.
iii) Water quality of proposed monitor zone.
iv) Transmissivity or specific capacity of proposed monitor zone.
v) Packer test drawdown curves and interpretation.

j) A final report of the construction and testing of the injection well and dual zone monitor well, pursuant to 62-528.430(1)(e) shall be submitted no later than one hundred and twenty (120) days after commencement of operational testing. This report shall include, as a minimum, definitions of the injection interval, all relevant confining beds, the depth of the base of the USDW and all monitor zones, including all relevant data and interpretations.

6. OPERATIONAL TESTING REQUIREMENTS

a) The operation testing of the Class I injection well system under this permit shall not commence without written authorization from the Department.

b) Prior to operational testing the permittee shall comply with the requirements of Rule 62-528.450(3)(a), F.A.C.

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

i) Certification of completion of well construction including as-built record drawings and specifications. The well construction drawings shall include a geologic stratigraphic cross section depicting the corresponding formations, the base of the USDW, and the boundaries of the confining and injection zone intervals.

ii) Results of the short term injection test with interpretation of the data. This test shall be conducted for a minimum of twelve (12) hours at the maximum rate at which the well is to be permitted. Pressure/water level data from the injection well and both monitor zones shall be recorded continuously for at least twenty four (24) hours before the test and at least twelve (12) hours following the test.

iii) A copy of the borehole television survey with interpretation.

iv) Geophysical logs with interpretations.

v) Certification of mechanical integrity and interpretation of the test data.

vi) A description of the actual injection procedure including the anticipated maximum pressure and flow rate at which the well will be operated under normal and emergency conditions.

vii) Information concerning the compatibility of the injected waste with fluids and minerals in the receiving zone.

viii) Surface equipment (including pumping station, piping, and all appurtenances) completion certified by the engineer of record.

ix) Signed and sealed record "as-built" engineering drawings of the injection well system including the pump station, surface piping, all appurtenances and equipment.

x) Draft operating and maintenance manual with emergency discharge management plan procedures. The emergency discharge system must be fully constructed and operational prior to approval of operational testing.

xi) Receipt of the demonstration of confinement prepared providing confirmation of confinement and defining the injection and confining sequences utilizing data collected during the drilling, logging and testing of the injection well and dual zone monitor well. The report shall include the results of hydraulic testing (permeability, porosity, etc.) on the cores shall be reviewed and updated as appropriate after the completion of any additional injection/monitor well pairs in the future from the confining interval. Please note that this submittal, shall be prepared, signed, and sealed by a Florida Registered Professional Geologist or appropriately experienced Professional Engineer,

xii) Wastestream analysis for primary and secondary drinking water standards and minimum criteria parameters as attached.

xiii) Background water quality data from the monitor and injection zones, analyzed for primary and secondary drinking water standards and minimum criteria parameters as attached.

d) Prior to the authorization of operational testing by the Department, the Permittee shall contact the Underground Injection Control Section of the Department, Southeast District, to arrange for a site inspection. The inspection will determine if all of the equipment necessary to operate and monitor the injection well are in compliance with the permit and Department rules has been installed. During the inspection, emergency procedures and reporting requirements shall be reviewed.

7. OPERATIONAL TESTING CONDITIONS:

a) Upon receipt of written authorization from the Department (S.C. 6a), the operational testing of the injection well system shall be subject to the following conditions:

i) The progress of the operational testing for the system shall extend for a six (6) month period and may be reviewed during TAC meetings scheduled by the Permittee at three (3) months and six (6) months after operational testing has begun. Reports evaluating the system's progress must be submitted to each member of the UIC TAC at least two (2) weeks prior to the scheduled TAC meeting. The conditions for the operational testing period may be modified by the Department at each of these TAC review intervals.

ii) Membrane softening concentrate generated at the City of Sunrise Sawgrass Membrane Softening Water Treatment Plant may be injected into this well. At no time shall hazardous waste be injected into this well. Upon completion of all appurtenances required for the transport and disposal of the Sunrise Regional WWTP secondarily treated effluent to the Sunrise Sawgrass injection well CW-1, the City of Sunrise may inject up to 8.8 MGD of secondarily treated effluent into the Sunrise Sawgrass WTP injection well CW-1, during emergency conditions only at the WWTP. The flows to the injection well shall be monitored and controlled at all times to ensure the maximum pressure on the wellhead does not exceed sixty six (66) percent (%) of the tested pressure on the final casing and the flow down the well does not exceed 3.8 MGD at any time.

iii) Mechanical Integrity

a) Injection is prohibited until the permittee affirmatively demonstrates that the well has mechanical integrity. Prior to operational testing the permittee shall establish, and thereafter maintain the mechanical integrity of the well at all times

b) If the Department determines that the injection well lacks mechanical integrity, written notice shall be given to the Permittee.

c) Unless the Department requires immediate cessation of injection, within 48 hours of receiving written notice that the well lacks mechanical integrity, the permittee shall cease injection into the well unless the Department allows continued injection pursuant to (iv) below.

d) The Department may allow the permittee to continue operation of a well that lacks mechanical integrity if the permittee demonstrates that fluid movement into or between USDWs is not occurring .

iv) Any failure of the Class I injection well monitoring and recording equipment for a period of more than forty-eight (48) hours shall be reported immediately, within twenty-four (24) hours, to the Department.

An interim written report describing the incident shall also be given to the Department within seventy-two (72) hours of the notification 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.

v) The following injection well performance and monitoring zone data shall be recorded for the monitoring zones and the injection wells as indicated and reported to the Department in a Monthly Operating Report (MOR):

vi) No underground injection is allowed that causes or allows movement of fluid into an underground source of drinking water.

vii) The permittee shall report any noncompliance which may endanger health or the environment, including:

a) Any monitoring or other information which indicates that any contaminant may cause an endangerment to an underground source of drinking water; or
b) 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.
c) Any information shall be provided orally within 24 hours of the time the permittee becomes aware of the circumstances. A written submission shall also be provided within 5 days of the time the permittee becomes aware of the circumstances. The written condition shall contain a written description of the noncompliance and its cause, the period of noncompliance, including exact dates and times, and if the noncompliance has not been corrected, the anticipated time it is expected to continue; and the steps taken or planned to reduce, eliminate, and prevent reoccurrence of the noncompliance.

viii) The injection well system shall be monitored in accordance with Rules 62-528.425(1)(g) and 62-528.430(2), F.A.C. The following injection well performance and monitor zone data shall be recorded and reported in the Monthly Operating Report (MOR) as indicated below. Samples and measurements taken for the purpose of monitoring shall be representative of the monitored activity.

i) injection well performance:

(1) Physical characteristics of the wastestream:

SAMPLING SITE CW-1				MONITORING CONDITIONS		
PARAMETER	UNITS	MAX/MIN	STORET CODE	MONITORING FREQUENCY	SAMPLE TYPE	REPORTING FREQUENCY
SUSTAINED INJECTION PRESSURE, DAILY AVG	psig	Average	50056AD	Continuous	Meter Reading	Daily
SUSTAINED INJECTION PRESSURE, DAILY MAX	psig	Maximum	50056BD	Continuous	Meter Reading	Daily
SUSTAINED INJECTION PRESSURE, DAILY MIN	psig	Minimum	50056CD	Continuous	Meter Reading	Daily
SUSTAINED INJECTION PRESSURE, MO AVG	psig	Average	50056AMO	Continuous	Meter Reading	Monthly
SUSTAINED INJECTION PRESSURE, MO MAX	psig	Maximum	50056BMO	Continuous	Meter Reading	Monthly
SUSTAINED INJECTION PRESSURE, MO MIN	psig	Minimum	50056CMO	Continuous	Meter Reading	Monthly
SHUT IN PRESSURE, MO AVG	psig	Average	81913AMO	Continuous	Meter Reading	Monthly
FLOW, VOLUME DAILY	mgd	Total	82221	Continuous	Flow Meter	Daily
FLOW, MO MAX OF DAILY FLOW VOLUMES	mgd	Maximum	82221BMO	Continuous	Flow Meter	Monthly
FLOW, MO MIN OF DAILY FLOW VOLUMES	mgd	Minimum	82221CMO	Continuous	Flow Meter	Monthly
FLOW, TOTAL MO. FLOW VOLUME	mg/mo	Total	82220	Continuous	Flow Meter	Monthly

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

GMS I.D. NUMBER: 5006M07695
PERMIT/CERTIFICATION NUMBER: 129008-001-UC
DATE OF ISSUE: MAY 2 2000
EXPIRATION DATE: MAY 27 1998
LATITUDE/LONGITUDE: 26°09"35'N/80°19"50"
PROJECT: Sunrise Sawgrass Class I Injection Well CW-1 and DZMW-1

FLOW, MAX DURING 24 Hr PERIOD	mgd	Maximum	50047	Continuous	Flow Meter	Daily
FLOW, MIN DURING 24 Hr PERIOD	mgd	Minimum	50048	Continuous	Flow Meter	Daily
FLOW, MO MAX OF DAILY MAX	mgd	Maximum	50047BMO	Continuous	Flow Meter	Monthly
FLOW, MO MIN OF DAILY MIN	mgd	Minimum	50048CMO	Continuous	Flow Meter	Monthly
PRESSURE IN ANNULUS; DAILY MINIMUM	psig	minimum	50057CD	continuous	Meter Reading	Daily
PRESSURE IN ANNULUS DAILY AVERAGE	psig	average	50057AD	continuous	Meter Reading	Daily
PRESSURE IN ANNULUS, DAILY MAXIMUM	psig	Maximum	50057CD	Continuous	Meter Reading	Daily
PRESSURE IN ANNULUS MONTHLY MAXIMUM	psig	Maximum	50057BMO	Continuous	Meter Reading	Monthly
PRESSURE IN ANNULUS MONTHLY AVERAGE	psig	Average	50057AMO	Continuous	Meter Reading	Monthly
PRESSURE IN ANNULUS, MONTHLY MINIMUM	psig	Minimum	50057CMO	Continuous	Meter Reading	Monthly
WATER LEVEL ON PRES COMP TANK, DAILY AVG	ft	Average	NA	Continuous		Daily
WATER LEVEL ON PRES COMP TANK, MO AVG	ft	Average	NA	Continuous		Monthly

DER Form 17-1.201(5)
Effective November 30, 1982

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

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(2) Chemical characteristics of the wastestream sampled from the composite concentrate sample point weekly and reported as monthly averages

SAMPLING SITE : Composite Conc. Sampling Point				MONITORING CONDITIONS		
PARAMETER	UNITS	MAX/MIN	STORET CODE	MONITORING FREQUENCY	SAMPLE TYPE	REPORTING FREQUENCY
CONDUCTIVITY	umh/cm	Maximum	00094	Monthly	Grab	Monthly
pH	std un	Range	00406	Monthly	Grab	Monthly
TEMPERATURE WATER	deg C	Maximum	00010	Monthly	Grab	Monthly
CHLORIDE	mg/L	Maximum	00940	Monthly	Grab	Monthly
AMMONIA TOTAL as N	mg/L	Maximum	00610	Monthly	Grab	Monthly
NITROGEN TOTAL KJELDAHL as N (TKN)	mg/L	Minimum	00625	Monthly	Grab	Monthly
PHOSPHATE TOTAL as P	mg/L	Minimum	70505	Monthly	Grab	Monthly
PHOSPHORUS TOTAL as P	mg/L	Maximum	00665	Monthly	Grab	Monthly
POTASSIUM, DISSOLVED	mg/L	Maximum	00935	Monthly	Grab	Monthly
SULFATE, TOTAL as SO_4	mg/L	Maximum	00945	Monthly	Grab	Monthly
RESIDUE, TOTAL FILTERABLE	mg/L	Maximum	00515	Monthly	Grab	Monthly
IRON	mg/L	Maximum	74010	Monthly	Grab	Monthly

(ii) Monitor well DZMW-1 performance:

(1) Physical characteristics of the upper and lower monitoring zones to be sampled continuously and reported as monthly averages:

SAMPLING SITE Monitor well DZMW-1 - upper and lower zones				MONITORING CONDITIONS		
PARAMETER	UNITS	MAX/MIN	STORET CODE	MONITORING FREQUENCY	SAMPLE TYPE	REPORTING FREQUENCY
PRESSURE, DAILY AVG	psig	Average	01266AD	Continuous	Meter Reading	Daily
SUSTAINED MONITOR ZONES PRESSURE, DAILY MAX	psig	Maximum	01266BD	Continuous	Meter Reading	Daily
SUSTAINED MONITOR ZONES PRESSURE, DAILY MIN	psig	Minimum	01266CD	Continuous	Meter Reading	Daily
PRESSURE, MONTHLY AVG	psig	Average	01266AMO	Continuous	Meter Reading	Monthly
SUSTAINED MONITOR ZONES PRESSURE, MONTHLY MAX	psig	Maximum	01266BMO	Continuous	Meter Reading	Monthly
SUSTAINED MONITOR ZONES PRESSURE, MONTHLY MIN	psig	Minimum	01266CMO	Continuous	Meter Reading	Monthly

(2) Chemical and bacteriological characteristics of the upper and lower monitoring zones to be sampled weekly and reported as monthly averages:

SAMPLING SITE Monitor Well DZMW-1 - upper and lower zones				MONITORING CONDITIONS		
PARAMETER	UNITS	MAX/MIN	STORET CODE	MONITORING FREQUENCY	SAMPLE TYPE	REPORTING FREQUENCY
AMMONIA TOTAL as N	mg/L	Maximum	00610	Weekly	Grab	Monthly
CHLORIDE	mg/L	Maximum	00940	Weekly	Grab	Monthly
BICARBONATE as HCO_3	mg/L	Maximum	00440	Monthly	Grab	Monthly
CARBONATE as CO_3	mg/L	Maximum	00445	Monthly	Grab	Monthly
MAGNESIUM, DISSOLVED	mg/L	Maximum	00925	Monthly	Grab	Monthly
CONDUCTIVITY	umh/cm	Maximum	00094	Weekly	Grab	Monthly
IRON	mg/L	Maximum	74010	Monthly	Grab	Monthly
pH	std un	Range	00406	Weekly	Grab	Monthly
POTASSIUM, DISSOLVED	mg/L	Maximum	00935	Monthly	Grab	Monthly
RESIDUE, TOTAL FILTERABLE	mg/L	Maximum	00515	Weekly	Grab	Monthly
SODIUM	mg/L	Maximum	00929	Monthly	Grab	Monthly
SULFATE, TOTAL as SO_4	mg/L	Maximum	00945	Weekly	Grab	Monthly
TEMPERATURE WATER	deg C	Maximum	00010	Weekly	Grab	Monthly
NITROGEN TOTAL KJELDAHL as N (TKN)	mg/L	Minimum	00625	Weekly	Grab	Monthly

b) Weekly sampling as described above will be continued for a minimum of six (6) months. At that point the Permittee may submit data for UIC TAC review and Department approval to demonstrate that reasonable assurance of groundwater stability has been established in justification of any written request to reduce the sampling frequency to monthly sampling.

c) A minimum of three (3) well volumes of fluid shall be evacuated from the monitor system prior to sampling for the chemical parameters listed above. All samples shall be analyzed by a state-certified laboratory.

d) The flow to the injection well at the wellhead shall be monitored and controlled at all times to ensure the maximum fluid velocity down the well does not exceed a peak hourly flow rate of ten (10) feet per second (12.62 MGD), during normal operation and when the permittee provides the Department with reasonable assurances that higher velocities will not compromise the integrity or operation of the injection well, then the injection well may be operated at twelve (12) feet per second during planned testing, maintenance, or when emergency conditions occur at the Sunrise Sawgrass WWTP and disposal from the WWTP of secondarily treated effluent goes down the WTP injection well CW-1.

e) The pressure at the well head and in the annular space shall be monitored and controlled at all times to ensure the maximum pressures on the final casing and the tubing and packer does not exceed sixty-six (66) percent (%) of the mechanical integrity test pressures.

f) Pursuant to Rule 62-528.425(1)(b), F.A.C., the injection well system shall be monitored at all times by continuous indicating, recording and totaling devices for concentrate flow rate and volume, and the pressure in all monitoring zones and the annular space. All gauges and recording devices shall be maintained in good operating condition and calibrated semiannually at a minimum. The monitoring zone pressures shall be referenced to the National Geodetic Vertical Datum (NVGD) of 1929, and the MOR shall indicate that the pressures are referenced to NGVD.

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

h) All required data submissions, including Monthly Operating Reports (MOR's), shall be clearly identified on each page with Facility Name, ID. Number, date of sampling/recording, operator's name, license and telephone number, and type of data shown (monitor zones will be identified by monitor well number and depth interval).

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.

i) The permittee shall submit to the Department the results of all injection well and monitor well data required by this permit no later than the twenty-eighth (28) day of the month immediately following the month of record. The results shall be sent to the Florida Department of Environmental Protection, Southeast District, Underground Injection Control Section, Post Office Box 15425, West Palm Beach, Florida, 33416. A copy of this report shall also be sent to the Florida Department of Environmental Protection, Underground Injection Control Program, MS-3530, 2600 Blair Stone Road, Tallahassee, Florida, 32399-2400.

j) The Department must be notified in writing of the date of start-up of operations.

k) A controlled quarterly test of well injectivity (rate/pressure) shall be conducted in accordance with Rule 62-528.430(2)(c), F.A.C., with at least three (3) specified injection flow rates. The high rate should approach maximum design flow. (a copy of the SED reporting sheet is attached) Secondarily treated effluent from the Sunrise Sawgrass Regional WWTP may be used to supply enough fluid for the high flow portion of the injectivity test. The following data shall be recorded and reported on the SED Reporting Sheet and in graphical format at each injection rate:

I) * injection flow rate (MGD)
ii) * injection pressure (psig)
iii) * wellhead pressure with no flow (shut-in pressure in psig)
iv) * monitor zone pressures (psig)

1) All readings shall be taken after a minimum five (5) minute period of stabilized flow.

2) Pursuant to Rule 62-528.430(2)(c), F.A.C., as part of the specific injectivity test, the well shall be shut-in for a period of time necessary to conduct a valid observation of pressure fall-off.

l) A wastestream analysis (24 hour composite sample) for primary and secondary drinking water standards (Chapter 62-550, F.A.C.) and minimum criteria, see attached list, must be submitted annually (sampled 30 days after startup of the WTP and submitted within 120 days of the sampling date).

8. SURFACE EQUIPMENT

a) The surface equipment for the injection well system shall maintain compliance with Chapter 62-600, F.A.C. for water hammer control, screening, access for logging and testing, reliability and flexibility in the event of damage to the well and concentrate piping. A regular program of exercising the valves integral to the well head shall be instituted. At a minimum, all valves integral to the injection well system shall be exercised during the regularly scheduled quarterly injectivity testing.

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

c) Spillage onto the injection well pad during construction activities, and any waters spilled during mechanical integrity testing, other maintenance, testing or repairs to the system shall be contained by an impermeable wall around the edge of the pad and directed to a sump pump which in turn discharges to the pumping station wet well or via other approved means to the injection well system.

d) The injection well construction pad with impermeable perimeter retaining wall shall be maintained and retained in service for the life of the injection well. The injection and monitoring well pad(s) are not, unless specific approval is obtained from the Department, to be used for storage of any material or equipment at any time.

e) The four (4) surficial aquifer monitor wells installed at the corners of the injection well pad shall be secured, maintained, and retained in service.

f) The integrity of the monitor zone sampling system shall be maintained at all times. Sampling lines shall be clearly and unambiguously identified by monitoring zone at the point at which samples are drawn. All reasonable and prudent precautions shall be taken to insure that samples are properly identified by monitor zone and that samples obtained are representative of those zones. Sampling lines and equipment shall be kept free of contamination with independent discharges and no interconnections with any other lines.

9. FINANCIAL RESPONSIBILITY.

a) The Permittee shall maintain the resources necessary to close, plug and abandon the injection and associated monitor wells, at all times [Rule 62-528.435(9), F.A.C.].

b) The Permittee shall review annually the plugging and abandonment cost estimates. An increase of ten (10) percent or more over the cost estimate upon which financial responsibility is based shall require the Permittee to submit documentation to obtain an updated Certificate of Demonstration of Financial Responsibility.

c) In the event the mechanism used to demonstrate financial responsibility should become invalid for any reason, the Permittee shall notify the Department of Environmental Protection in writing within fourteen (14) days of such invalidation. The Permittee shall then within thirty (30) days of said notification submit to the Department for approval new financial documentation in order to comply with Rule 62-528.435(9), F.A.C., and the conditions of this permit.

10. EMERGENCY DISPOSAL

a) All applicable federal, state, and local permits shall be in place to allow for any alternate discharges due to emergency or planned outage conditions.

b) Any proposed changes in emergency disposal methods shall be submitted for UIC-TAC review and Department approval prior to implementation.

c) The alternate disposal method shall be maintained in working order at all times.

d) In the event of an emergency and/or discharge, or other abnormal event where the Permittee is temporarily unable to comply with any of the conditions of this permit due to breakdown of equipment, power outages, destruction by hazard or fire, wind, or by other cause, the Department shall be notified in person or by telephone within twenty-four (24) hours of the incident. A written report describing the incident shall also be submitted to the Department within five (5) days of the start of the incident. The written report shall contain a complete description of and discuss the cause of the emergency and/or discharge, and if it has been corrected, the anticipated time the discharge is to continue, the steps being taken to reduce, eliminate, and prevent recurrence of the event, and all other information deemed necessary by the Department.

e) The Wastewater Treatment Plant's Injection Wells IW-1, IW-2 and IW-3 are the disposal backup wells for Injection Well CW-1 during planned outages of Injection Well CW-1. During catastrophic conditions, where disposal to the Sunrise WWTP IW-1, IW-2 and IW-3 is not possible, then the Sunrise Sawgrass WTP shall shut down.

11. OPERATING PERMIT APPLICATION.

a) Pursuant to Rule 62-4.090, Florida Administrative Code, an operating permit application with appropriate application fee must be submitted at least sixty (60) days prior to the expiration of this permit.

[THIS SPACE WAS LEFT BLANK INTENTIONALLY]

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

GMS I.D. NUMBER: 5006M07695
PERMIT/CERTIFICATION NUMBER: 129008-001-UC
DATE OF ISSUE: MAY 28 1998
EXPIRATION DATE: MAY 27 2000
LATITUDE/LONGITUDE: 26°09'35"N/80°19"50"
PROJECT: Sunrise Sawgrass Class I Injection Well CW-1 and DZMW-1

12. SIGNATORIES AND CERTIFICATION REQUIREMENTS.

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), F.A.C.

b) In accordance with Rule 62-528.340(4), F.A.C., 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 fine and imprisonment for knowing violations."

Issued this 28 day of MAY, 1998

STATE OF FLORIDA
DEPARTMENT OF ENVIRONMENTAL PROTECTION

Carlos Rivero-deAguilar
Director of District Management

Date

DER Form 17-1.201(5)
Effective November 30, 1982

UNDERGROUND INJECTION CONTROL SECTION
POTABLE WATER MEMBRANE SOFTENING CONCENTRATE INJECTION WELL
STANDARDIZED MONTHLY OPERATING REPORT DATA SUMMARY

MONTHLY REPORT DATE	

FACILITY	Sunrise Sawgrass WTF	FACILITY GMS ID #	5006M07695
TEST SITE - INJECTION WELL (CLASS I)	CW-1	TEST SITE GMS ID #	N/A
		TEST SITE PA ID #	129008

UIC PERMIT NUMBER	129008-001-UC	LEAD OPERATOR	
PERMIT DATE OF ISSUANCE		LEAD OPERATOR'S FL LICENSE #	
EXPIRATION DATE		DAY TIME PHONE NUMBER	

CASING DEPTH		FT BLS
TOTAL DEPTH		FT BLS
CASING DIAMETER (O.D.)	20	INCHES
RO DISPOSAL CAPACITY	3.8	MGD
SECONDARY EFFLUENT DISPOSAL CAP	8.8	MGD
COMBINED DISPOSAL CAPACITY (PkHr)	12.6	MGD
ASSOCIATED MONITORING WELL(S)	DZMW-1U & DZMW-1L	
MAX PERMITTED INJ PRESSURE		PSIG

LEAD OPERATOR	
LEAD OPERATOR FL LISENCE #	
DAY TIME PHONE NUMBER	

PARAMETER	STORET CODE*	VALUE	UNITS
INJECTION PRESSURE, MO AVG	50056AMO		PSIG
SUSTAINED INJECTION PRESSURE, MO MAX	50056BMO		PSIG
SUSTAINED INJECTION PRESSURE, MO MIN	50056CMO		PSIG
SHUT IN PRESSURE, MO	81913		PSIG
RO CNCNTR FLOW, VOLUME DAILY INTO A WELL, MO AVG	NA		MGD
WW EFFLUENT FLOW, VOLUME DAILY IN A WELL, MO AVG	NA		MGD
COMBINED FLOW,VOLUME DAILY INTO A WELL, MO AVG	82221AMO		MGD
COMBINED FLOW, MO MAX OF DAILY FLOW VOLUMES	82221BMO		MGD
COMBINED FLOW, MO MIN OF DAILY FLOW VOLUMES	82221CMO		MGD
COMBINED FLOW, TOT MO INF	82220		MG/MO
SUSTAINED FLOW, MO MAX OF DAILY MAX	50047BMO		MGD
SUSTAINED FLOW, MO MIN OF DAILY MIN	50048CMO		MGD
PRESSURE IN ANNULUS, MO AVG	50057AMO		PSIG
PRESSURE IN ANNULUS, MO MAX	50057BMO		PSIG
PRESSURE IN ANNULUS, MO MIN	50057CMO		PSIG
WATER LEVEL ON PRESSURE COMP TANK, MO AVG	N/A		FT

LEAD OPERATOR'S SIGNATURE

Date

* Storet Codes are modified to reflect the specifics of the parameters in the permit. AMO denotes monthly average, BMO - monthly maximum, and CMO - monthly minimum.

DUAL ZONE MONITORING WELL
UPPER ZONE

DZMW-1U

SUNRISE SAWGRASS WTF

UNDERGROUND INJECTION CONTROL SECTION
STANDARDIZED WEEKLY OPERATING DATA SUMMARY

MONTHLY REPORT DATE	

FACILITY	Sunrise Sawgrass WTF	FACILITY GMS ID #	5006M07695

TEST SITE (AMBIENT MW)	DZMW-1U	TEST SITE GMS ID #	N/A
		TEST SITE PA ID #	NA

UIC PERMIT NUMBER	129008-001-UC	LEAD OPERATOR	
PERMIT DATE OF ISSUANCE		LEAD OPERATOR'S FL LICENSE #	
EXPIRATION DATE		DAY TIME PHONE NUMBER	

CASING DEPTH		FT, BLS
TOTAL DEPTH		FT, BLS
ASSOCIATED INJECTION WELL	CW-1	

PARAMETER	STORET CODE*	UNITS	SAMPLING DATE					MO AVG
CONDUCTIVITY	00094	UMH/CM						
PH	00406	STD UN						
TEMPERATURE WATER	00011	DEG C						
CHLORIDE	00940	MG/L						
AMMONIA, TOTAL as N	00610	MG/L						
NITROGEN TOTAL KJELDAHL as N (TKN	00625	MG/L						
RESIDUE, TOTAL FILTERABLE (TDS)	00515	MG/L						
SULFATE	00945	MG/L						

LEAD OPERATOR'S SIGNATURE

Date

*Storet Codes are modified to reflect the specifics of the parameters in the permit. AMO denotes monthly average, BMO - monthly maximum, and CMO - monthly miminum.

DUAL ZONE MONITORING WELL
LOWER ZONE

DZMW-1L

SUNRISE SAWGRASS WTF

UNDERGROUND INJECTION CONTROL SECTION
STANDARDIZED WEEKLY OPERATING DATA SUMMARY

MONTHLY REPORT DATE	

FACILITY	Sunrise Sawgrass WTF	FACILITY GMS ID #	5006M07695

TEST SITE (AMBIENT MW)	DZMW-1L	TEST SITE GMS ID #	N/A
		TEST SITE PA ID #	NA

UIC PERMIT NUMBER	129008-001-UC	LEAD OPERATOR	
PERMIT DATE OF ISSUANCE		LEAD OPERATOR'S FL LICENSE #	
EXPIRATION DATE		DAY TIME PHONE NUMBER	

CASING DEPTH		FT. BLS
TOTAL DEPTH		FT. BLS
ASSOCIATED INJECTION WELL	CW-1	

			SAMPLING DATE					
PARAMETER	STORET CODE*	UNITS						MO AVG
CONDUCTIVITY	00094	UMH/CM						
PH	00406	STD UN						
TEMPERATURE WATER	00011	DEG C						
CHLORIDE	00940	MG/L						
AMMONIA, TOTAL as N	00610	MG/L						
NITROGEN TOTAL KJELDAHL as N (TKN	00625	MG/L						
RESIDUE, TOTAL FILTERABLE (TDS)	00515	MG/L						
SULFATE	00945	MG/L						

LEAD OPERATOR'S SIGNATURE ______________________

Date

*Storet Codes are modified to reflect the specifics of the parameters in the permit. AMO denotes monthly average, BMO - monthly maximum, and CMO - monthly miminum.

UNDERGROUND INJECTION CONTROL SECTION

STANDARDIZED MONTHLY OPERATING DATA SUMMARY

		MONTHLY REPORT DATE	
FACILITY	Sunrise Sawgrass WTF	FACILITY GMS ID #	5006M07695
TEST SITE (AMBIENT MW)	DZMW-1U	TEST SITE GMS ID #	N/A
		TEST SITE PA ID #	NA
UIC PERMIT NUMBER	129008-001-UC	LEAD OPERATOR	
PERMIT DATE OF ISSUANCE		LEAD OPERATOR'S FL LICENSE #	
EXPIRATION DATE		DAY TIME PHONE NUMBER	
CASING DEPTH		FT. BLS	
TOTAL DEPTH		FT. BLS	
ASSOCIATED INJECTION WELL	CW-1		
TEST PERIOD (MONTHLY)		SAMPLING DATE	

PARAMETER	STORET CODE*	VALUE	UNITS
PRESSURE, MO AVG	01266AMO		PSIG
SUSTAINED PRESSURE, MO MAX	01266BMO		PSIG
SUSTAINED PRESSURE, MO MIN	01266CMO		PSIG
BICARBONATE as HCO_3	00440		MG/L as HCO_3
CARBONATE as CO_3	00445		MG/L
MAGNESIUM, DISSLOVED	00925		MG/L
IRON	74010		MG/L
POTASSIUM, DISSOLVED	00935		MG/L
SODIUM	00929		MG/L
SULFATE, TOTAL as SO_4	N/A		N/A
NITROGEN, TOTAL KJELDAHL as N (TKN)	00625		MG/L
TEMPERATURE WATER	00010		DEG C

LEAD OPERATOR'S SIGNATURE

Date

*Storet Codes are modified to reflect the specifics of the parameters in the permit. AMO denotes monthly average, BMO - monthly maximum, and CMO - monthly miminum.

UNDERGROUND INJECTION CONTROL SECTION

STANDARDIZED MONTHLY OPERATING DATA SUMMARY

MONTHLY REPORT DATE	

FACILITY	Sunrise Sawgrass WTF	FACILITY GMS ID #	5006M07695

TEST SITE (AMBIENT MW)	DZMW-1L	TEST SITE GMS ID #	N/A
		TEST SITE PA ID #	NA

UIC PERMIT NUMBER	129008-001-UC	LEAD OPERATOR	
PERMIT DATE OF ISSUANCE		LEAD OPERATOR'S FL LICENSE #	
EXPIRATION DATE		DAY TIME PHONE NUMBER	

CASING DEPTH		FT. BLS
TOTAL DEPTH		FT. BLS
ASSOCIATED INJECTION WELL	CW-1	

TEST PERIOD (MONTHLY)		SAMPLING DATE	

PARAMETER	STORET CODE*	VALUE	UNITS
PARAMETER	STORET CODE*	VALUE	UNITS
PRESSURE, MO AVG	01266AMO		PSIG
SUSTAINED PRESSURE, MO MAX	01266BMO		PSIG
SUSTAINED PRESSURE, MO MIN	01266CMO		PSIG
BICARBONATE as HCO_3	00440		MG/L as HCO_3
CARBONATE as CO_3	00445		MG/L
MAGNESIUM, DISSLOVED	00925		MG/L
IRON	74010		MG/L
POTASSIUM, DISSOLVED	00935		MG/L
SODIUM	00929		MG/L
SULFATE, TOTAL as SO_4	N/A		N/A
NITROGEN, TOTAL KJELDAHL as N (TKN)	00625		MG/L
TEMPERATURE WATER	00010		DEG C

LEAD OPERATOR'S SIGNATURE

Date

*Storet Codes are modified to reflect the specifics of the parameters in the permit. AMO denotes monthly average, BMO - monthly maximum, and CMO - monthly miminum.

UNDERGROUND INJECTION CONTROL SECTION
STANDARDIZED MONTHLY OPERATING/TESTING DATA SUMMARY

FACILITY	Sunrise Sawgrass WTF	FACILITY GMS ID #	5006M07695
		FACILITY ALT ID #	
EFFLUENT POINT	WET WELL	TEST SITE GMS ID #	N/A
		TEST SITE PA ID #	N/A

UIC PERMIT NUMBER	129008-001-UC	LEAD OPERATOR	
DATE(S) OF ISSUANCE		LEAD OPER FL LICENSE #	
EXPIRATION DATE(S)		DAY TIME PHONE #	

ASSOCIATED INJECTION WELL	CW-1

PARAMETER	STORET CODE*	VALUE	UNITS
CONDUCTIVITY	00094		UMH/CM
PH	00406		STD UN
TEMPERATURE WATER	00010		DEG C
CHLORIDE	00940		MG/L
AMMONIA TOTAL as N	00610		MG/L
NITROGEN. TOTAL KJELDAHL as N (TKN)	00625		MG/L
PHOSPHATE TOTAL as P	70505		MG/L
PHOSPHORUS TOTAL as P	00665		MG/L
POTASSIUM DISSOLVED	00935		MG/L
SULFATE. TOTAL as SO4	00945		MG/L
RESIDUE. TOTAL FILTERABLE	00515		MG/L
IRON	74010		MG/L

LEAD OPERATOR'S SIGNATURE

Date

*Storet Codes are modified to reflect the specifics of the parameters in the permit. AMO denotes monthly average, BMO - monthly maximum, and CMO - monthly minimum.

UNDERGROUND INJECTION CONTROL

INJECTIVITY TESTING SUMMARY SHEET

FACILITY________________________________

TIME

Deep Injection Well System
Injectivity Testing

Injection Well No. :	
DATE OF TEST:	
FDER PERMIT No.:	

	START	SHUT-IN PRESSURE
	MINS AFTER SHUT-IN	CALIBRATED PRESSURE GAUGE AT WELL HEAD (PSI)
	10	
	20	
	30	

____
Signature of Lead Operator

Were Wellhead Valves Exercised ________YES ________ NO

COLUMN: 1	2	3	4	5	6	7	8	9	10
TIME	INJECTION WELL SHUT-IN PRESSURE AFTER 30 MINUTES (PSI)	PUMP NUMBER(S) ON-LINE	INJECTION RATE (gpm) or (mgd)	Injection Pressure after 10 minutes of pumping		PRESSURE DIFFERENTIAL (Col 5 - Col 2)	INJECTIVITY INDEX (Col 4 divide by Col 7)	UPPER MONITOR ZONE IN FEET OF HEAD ABOVE NGVD (FEET)	LOWER MONITOR ZONE IN FEET OF HEAD ABOVE NGVD (FEET)
				CALIBRATED GAUGE AT INJECTION WELLHEAD (PSI)	PRESSURE RECORDER (PSI)	FROM CALIBRATED PRESSURE GAUGE AT INJECTION WELLHEAD (PSI)	FROM CALIBRATED PRESSURE GAUGE AT INJECTION WELLHEAD (GPM / PSI)		

NOTES

1. INJECTIVITY INDEX (GPM/PSI) $=$ $\dfrac{\text{INJECTION RATE (GPM) (COLUMN 4)}}{\text{(INJECTION PRESSURE (PSI) - (SHUT-IN PRESSURE (PSI)) (COLUMN 5) (COLUMN 2)}}$

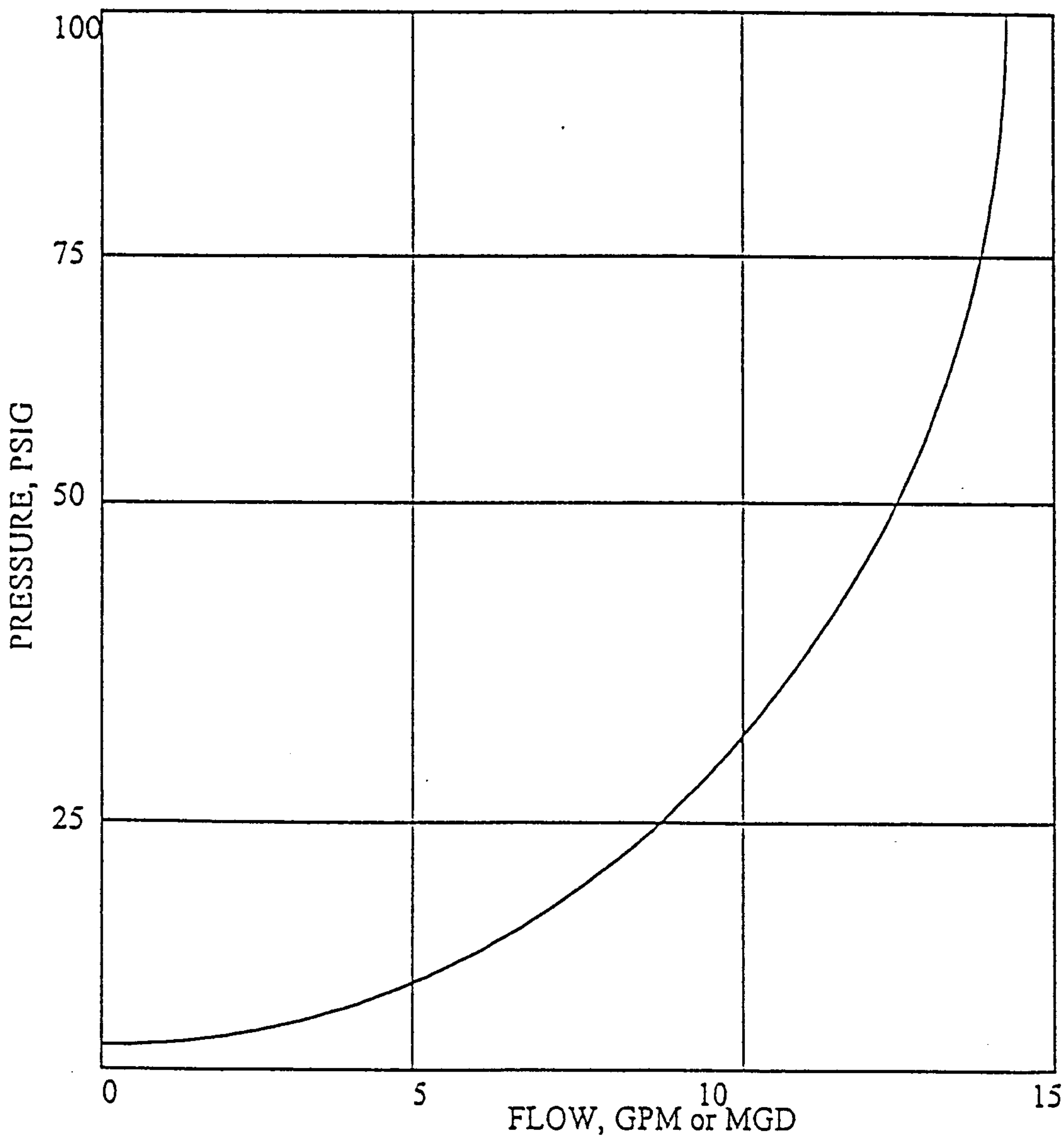
2. FOR MORE INFORMATION REGARDING EXECUTION OF THIS TEST CONSULT THE INJECTIVITY TESTING PROTOCOL IN THE O&M MANUAL

UNDERGROUND INJECTION CONTROL

DATE OF TEST :	FACILITY :
PERMIT NO. :	I.D. # :
WELL NO.	LEAD OPERATOR______________ SIGNATURE

INJECTIVITY TEST

SAMPLE



SOUTHEAST DISTRICT UIC SECTION

SURFICIAL AQUIFER MONITOR WELL QUARTERLY REPORT

FACILITY NAME ______________________ REPORT MO/YR ______________________

OPERATOR NAME ______________________ LICENSE # ______________________

I.D.NUMBER ______________________ PERMIT # ______________________

INJECTION WELL # ______________________

SAMPLING DATE ______________________ TIME ______________________

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

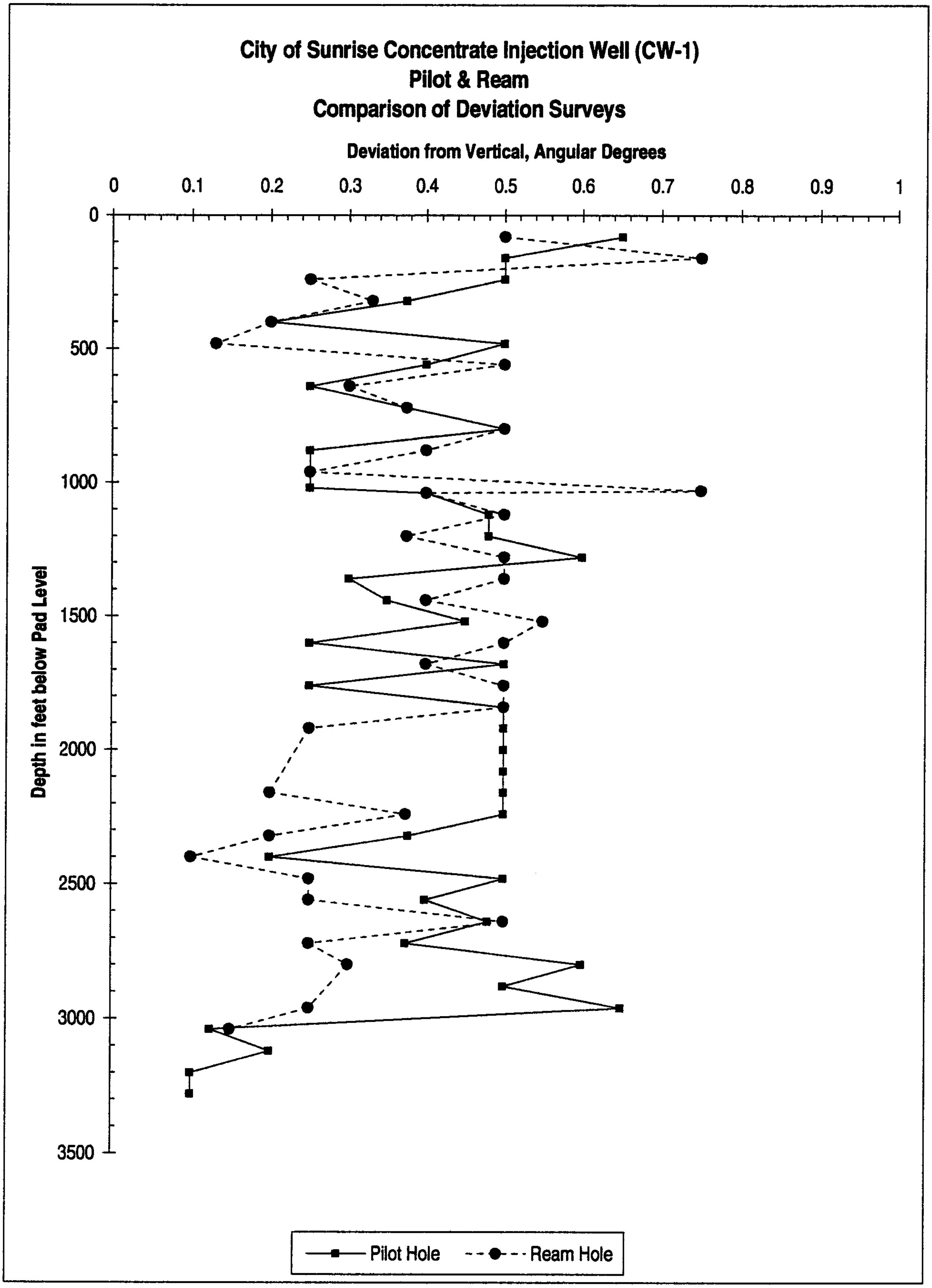
ANALYZED BY: ______________________ SAMPLED BY: ______________________

PHONE # ______________________ TITLE ______________________

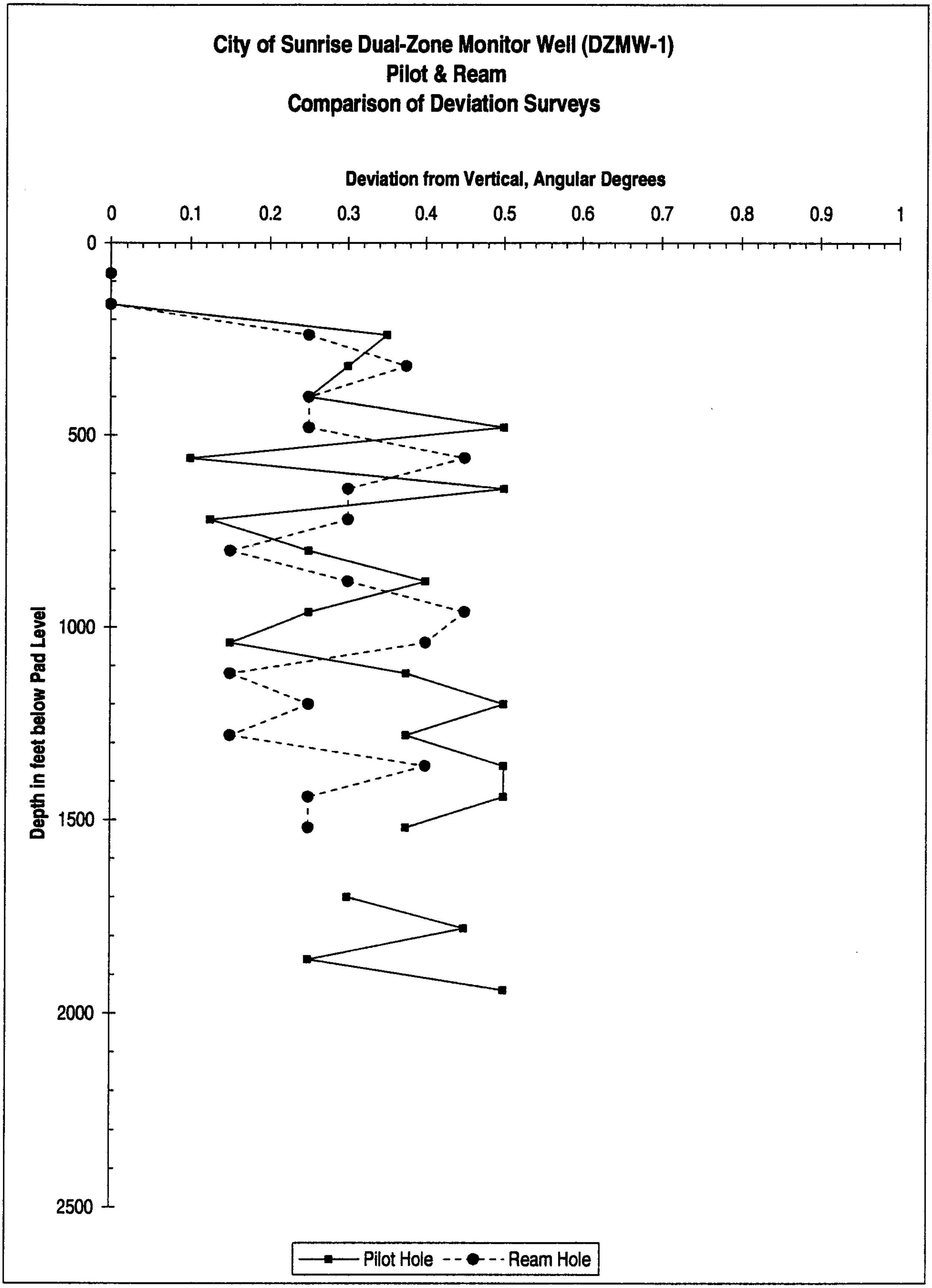
SITE PLAN OF PMW LOCATIONS

Appendix B

Deviation Surveys
CW-1


City of Sunrise Concentrate Injection Well (CW-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
500
1000
1500
2000
2500
3000
3500
Pilot Hole
Ream Hole

Deviation Surveys
DZMW-1


City of Sunrise Dual-Zone Monitor Well (DZMW-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
0
500
1000
1500
2000
2500
Depth in feet below Pad Level
Pilot Hole
Ream Hole

Appendix C

Mill Certificates
CW-1

MONTGOMERY WATSON

SHOP DRAWING REVIEW

TO: Youngquist Brothers, Inc.
15465 Pine Ridge Rd.
Ft. Myers, FL 33908

Attn: Mr. Ed McCullers

Date: August 26, 1998

Project: City of Sunrise
Sawgrass Concentrate Injection Well #1
Project No. 403-6135D

Submittal: 11.1 **Section:** 2633

Subject submittal has been reviewed and review action is as indicated below:

No. of Copies	Description
5	54" Mill Certifications

Review Action:

[X] No Exceptions Taken [ ] Make Corrections Noted

[ ] Amend Resubmit [ ] Rejected - Resubmit

Comments:

Checking of shop drawing is limited to general design and general arrangement only and is not intended to be a verification of compliance with all requirements. Engineers's review shall not relieve the Contractor from the responsibility of details of design, correct dimensions for proper fitting, the satisfactory and safe performance of the work, coordination with others' performance, or any other requirement of the Contract.

c: T. Kelaher
R. Skinner
File SD 11.1

William Vogel

William Vogel, Resident Engineer

STANDARD CERTIFIED TEST REPORT
GEORGIA TUBULAR PRODUCTS, INC.

GTP

Customer Name	YOUNGQUIST BROTHERS, INC.	Date:	8-6-98
Customer Address	15465 PINE RIDGE RD.	Customer Order No.	20536
City, State, Zip	FORT MYERS, FL 33908	G.T.P. Sales Order No.	200115

Specification ASTM A139 GR B SPIRALWELD STEEL PIPE "MADE IN U.S.A."

Heat No.	Size O.D.	Wt./Ft. or Wall Thick	Min. Hydro Test Pres. P.S.I.	MECHANICAL PROPERTIES: Yield Strength P.S.I. Point	Tensile Strength P.S.I.	Elong In 2" %	CHEMICAL ANALYSIS (%): C	Mn	P	S	SI
2803385	54"	.375	292	49,400	77,600	31.	.23	.88	.015	.002	

MONTGOMERY WATSON			
NO EXCEPTIONS TAKEN	X	AMEND RESUBMIT	
MAKE CORRECTIONS NOTED		REJECTED RESUBMIT	
REVIEWED BY	KS	DATE	8.25.98
RECOMMENDED BY		DATE	

CORRECTIONS OR COMMENTS MADE ON CONTRACTORS SHOP DRAWINGS DURING THIS REVIEW DO NOT RELIEVE THE 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, COORDINATING WORK WITH OTHER TRADES, AND SATISFACTORY AND SAFE PERFORMANCE OF THE WORK.

CWI   SD 11.1

The undersigned hereby certifies that the above materials have been inspected and tested in accordance with the methods prescribed in the applicable specifications and the results of such inspection and tests shown above. In determining properties or characteristics for which no methods of inspecting or testing are prescribed by said specifications, the standard mill inspection and testing practices of Georgia Tubular Products, Inc. have been applied. Unless it appears otherwise in the results of such inspection and tests shown above, the undersigned believes that said materials conform to said specifications.

Subscribed and sworn to before me

This 6 day of Aug, 19 98

My Commission Expires Oct. 6, 1998

[signature]

Notary Public

[signature]

R. SCOTT PANTER
MFG MGR

Name & Title

GTP

Georgia Tubular Products, Inc.
109 Dent Drive, Cartersville, GA 30121
(770) 386-2553

MONTGOMERY WATSON

SHOP DRAWING REVIEW

TO: Youngquist Brothers, Inc.
15465 Pine Ridge Rd.
Ft. Myers, FL 33908

Attn: Mr. Ed McCullers

Date: August 26, 1998

Project: City of Sunrise
Sawgrass Concentrate Injection Well #1
Project No. 403-6135D

Submittal: 13.1

Section: 2633

Subject submittal has been reviewed and review action is as indicated below:

No. of Copies	Description
5	44" Mill Certifications

Review Action:

X No Exceptions Taken

Make Corrections Noted

Amend Resubmit

Rejected - Resubmit

Comments:

Checking of shop drawing is limited to general design and general arrangement only and is not intended to be a verification of compliance with all requirements. Engineers's review shall not relieve the Contractor from the responsibility of details of design, correct dimensions for proper fitting, the satisfactory and safe performance of the work, coordination with others' performance, or any other requirement of the Contract.

c: T. Kelaher
R. Skinner
File SD 13.1

William Vogel, Resident Engineer

COPY

METALLURGICAL TEST REPORT

NUCOR STEEL
A Division of NUCOR Corporation
Hickman, Arkansas

Date: 9/17/97
Mill Order #: 24193-2

Ship Dte	B/L #	Vehicle #	P/O #	Description	Size
9/17/97	89521	ATSF92093	51337		.3700 NOM x 48.610 NOM

Sold To: NAYLOR PIPE COMPANY
1230 E. 92ND STREET

CHICAGO, IL 60619

Ship To: NATIONAL PROCESSING PLT 2
FOR NAYLOR PIPE

E. CHICAGO, IN 46312

Chemistry certification only

Heat	C	Mn	P	S	Si	Cu	Ni	Cr	Mo	Sn	Al	V	Nb	N
774628	.26	.71	.009	.004	.05	.101	.056	.025	.013	.006	.016	.005	.002	.008

Ti: .003 B: .000 Ca: .001 CE: .179

Coil Nbrs: 774628-3

All goods are sold subject to the description, specifications and terms and conditions set forth on the face and reverse side of NUCOR Steel's order acknowledgment.

Tensile specimens are tested in accordance with ASTM A-370 specification: andard rectangular test configuration (Figure 3) with a 2 inch gauge length and a .2% offset yield method. Steel is aluminum killed and produced to a fine grain practice.

This material has been produced in compliance with the chemistry and established rolling practices of the ordered specification. If material is ordered to a chemistry only, and if physical testing is not a requirement of the customer's order, testing is not performed by the producer.

We hereby certify the above is correct as contained in the records of the corporation.

Donna L. Demark
Hot Mill Metallurgist

MELTED AND MANUFACTURED IN THE USA

MONTGOMERY WATSON			
NO EXCEPTIONS TAKEN	✓	AMEND RESUBMIT	
MAKE CORRECTIONS NOTED		REJECTED RESUBMIT	
REVIEWED BY	RS	DATE 8.5.98	
RECOMMENDED BY		DATE	

CORRECTIONS OR COMMENTS MADE ON CONTRACTORS SHOP DRAWINGS DURING THIS REVIEW DO NOT RELIEVE THE 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, COORDINATING WORK WITH OTHER TRADES, AND SATISFACTORY AND SAFE PERFORMANCE OF THE WORK

CWI SD 13.1

NAYLOR PIPE COMPANY

1230 EAST NINETY-SECOND STREET • CHICAGO, ILLINOIS 60619 7937
TELEPHONE: (773) 721-9400 • FAX: (773) 721-9494

TO WHOM IT MAY CONCERN:

RE: YOUNGQUIST BROTHERS INC.
15465 PINE RIDGE ROAD
FORT MYERS, FLORIDA 33908
YOUR P.O. #20537
NAYLOR PIPE CO. ORDER #B-36498

This is to certify that 6 pcs. 44" O.D. .375" wall furnished on the subject order was manufactured in strict accordance with ASTM A-139, Grade B.

NAYLOR PIPE COMPANY

Kevin E. Joyce

Kevin E. Joyce/jH/C-1434

Subscribed and sworn to me a Notary Public this 10th day of August, 1998.

NOTARY PUBLIC

STANDARD CERTIFIED TEST REPORT

GEORGIA TUBULAR PRODUCTS, INC.

GTP

Customer Name: YOUNGQUIST BROTHERS
Customer Address: 15000 PINE RIDGE ROAD
City, State, Zip: FT MYERS FL 33908

Date: 4-10-97
Customer Order No. 103199
G.T.P. Sales Order No. 1931

Specification: SPIRALWELD STEEL PIPE ASTM A139 GR B "made in usa"

Heat No.	Size O.D.	Wt./Ft. or Wall Thick	Min. Hydro Test Pres. P.S.I.	MECHANICAL PROPERTIES Yield Strength P.S.I. Point	Tensile Strength P.S.I.	Elong In 2" %	CHEMICAL ANALYSIS (%) C	Mn	P	S	PCS
A7P0531	44"	.375W	360	53000	74800	38.3	.162	.880	.009	.009	11
B7P0532	↓	↓	↓	54600	74600	48.9	.168	.870	.010	.014	7
C7P0530	↓	↓	↓	53300	72600	41.5	.172	.870	.012	.002	11
D7P0529	↓	↓	↓	62700	82400	35.1	.172	.850	.008	.003	3

The undersigned hereby certifies that the above materials have been inspected and tested in accordance with the methods prescribed in the applicable specifications and the results of such inspection and tests shown above. In determining properties or characteristics for which no methods of inspecting or testing are prescribed by said specifications, the standard mill inspection and testing practices of Georgia Tubular Products, Inc. have been applied. Unless it appears otherwise in the results of such inspection and tests shown above, the undersigned believes that said materials conform to said specifications.

Subscribed and sworn to before me

This 10th day of Apr 1997

Notary Public

My Commission Expires Oct. 8, 1998

R. SCOTT PANTER MFG MGR
Name & Title

Georgia Tubular Products, Inc.
109 Dent Drive, Cartersville, GA 30121
(770) 386-2553

MONTGOMERY WATSON

SHOP DRAWING REVIEW

TO: Youngquist Brothers, Inc.
15465 Pine Ridge Rd.
Ft. Myers, FL 33908

Attn: Mr. Ed McCullers

Date: September 21, 1998

Project: City of Sunrise
Sawgrass Concentrate Injection Well #1
Project No. 403-6135D

Submittal: 27.1

Section: 2633

Subject submittal has been reviewed and review action is as indicated below:

No. of Copies	Description
5	34" Mill Certifications

Review Action:

X No Exceptions Taken

Make Corrections Noted

Amend Resubmit

Rejected - Resubmit

Comments:

Checking of shop drawing is limited to general design and general arrangement only and is not intended to be a verification of compliance with all requirements. Engineers's review shall not relieve the Contractor from the responsibility of details of design, correct dimensions for proper fitting, the satisfactory and safe performance of the work, coordination with others' performance, or any other requirement of the Contract.

c: T. Kelaher
R. Skinner
File SD 27.1

William Vogel

William Vogel, Resident Engineer

STANDARD CERTIFIED TEST REPORT

GEORGIA TUBULAR PRODUCTS, INC.

Customer Name	YOUNGQUIST BROTHERS, INC.
Customer Address	15465 PINE RIDGE RD.
City, State, Zip	FORT MYERS, FL 33908

Date: 8-6-98

Customer Order No. 20536

G.T.P. Sales Order No. 200115

Specification ASTM A139 GR B SPIRALWELD STEEL PIPE "MADE IN U.S.A."

Heat No.	Size O.D.	Wt./Ft. or Wall Thick	Min. Hydro Test Pres. P.S.I.	MECHANICAL PROPERTIES: Yield Strength P.S.I. Point	Tensile Strength P.S.I.	Elong in 2" %	CHEMICAL ANALYSIS (%): C	Mn	P	S	SI
2803385	54"	.375	292	49,400	77,600	31.	.23	.88	.015	.002	
182158	34"	.375	463	52,553	73,488	30.	.20	.84	.007	.005	
170771	34"	.375	463	49,527	70,334	30.	.21	.71	.006	.007	
183888	34"	.375	463	55,781	81,542	30.	.20	.91	.011	.007	
183878	34"	.375	463	51,216	74,981	30.	.20	.83	.013	.004	

The undersigned hereby certifies that the above materials have been inspected and tested in accordance with the methods prescribed in the applicable specifications and the results of such inspection and tests shown above. In determining properties or characteristics for which no methods of inspecting or testing are prescribed by said specifications, the standard mill inspection and testing practices of Georgia Tubular Products, Inc. have been applied. Unless it appears otherwise in the results of such inspection and tests shown above, the undersigned believes that said materials conform to said specifications.

Subscribed and sworn to before me

this 7th day of Aug 19 98

[signature]

Notary Public

My Commission Expires Oct. 6, 1998

[signature]

R. SCOTT PANTER

MFG MGR

Name & Title

Georgia Tubular Products, Inc.
109 Dent Drive, Cartersville, GA 30121
(770) 386-2553

MONTGOMERY WATSON

SHOP DRAWING REVIEW

TO: Youngquist Brothers, Inc.
15465 Pine Ridge Rd.
Ft. Myers, FL 33908

Attn: Mr. Dave Collins

Date: November 11, 1998

Project: City of Sunrise
Sawgrass Concentrate Injection Well #1
Project No. 403-6135D

Submittal: 31.1

Section: 2633

Subject submittal has been reviewed and review action is as indicated below:

No. of Copies	Description
4	24" Mill Certifications

Review Action:

- [X] No Exceptions Taken
- [ ] Make Corrections Noted
- [ ] Amend Resubmit
- [ ] Rejected - Resubmit

Comments:

Checking of shop drawing is limited to general design and general arrangement only and is not intended to be a verification of compliance with all requirements. Engineers's review shall not relieve the Contractor from the responsibility of details of design, correct dimensions for proper fitting, the satisfactory and safe performance of the work, coordination with others' performance, or any other requirement of the Contract.

c: T. Kelaher
R. Skinner
File SD 31.1

William Vogel

William Vogel, Resident Engineer

U.S. STEEL GROUP
A DIVISION OF USX CORPORATION

TUBULAR PRODUCTS CERTIFIED TEST REPORT

DATE: 04/14/98
TIME: 09:42:15 USX

(TYPE B - IN ACCORDANCE WITH EN 10204/ISO 10474/DIN 50049)

11916 pg 3

USS, USX are trademarks of USX Corporation

MILL ORDER/ITEM NO.	SHIPPERS REF.	P.O. NUMBER	VEHICLE ID
DR33065 40		6245-USS	

SOLD TO ADDRESS:

MAIL TO ADDRESS:

VENDOR:
USS TUBULAR PRODUCTS
1807 EAST 28TH ST.
LORAIN, OH 44055

SPECIFICATION AND GRADE

PIPE CARBON SMLS STD PIPE API 5L-X41ST EDITION DTD 4/1/95 GRADE B ASTM A53-M96 GRADE B ASME SA53-M1995 EDITION 1996 ADDENDUM GRADE B ASTM A106-M95 GRADE B/C ASME SA106-M1995 EDITION 1996 ADDENDUM GRADE B/C BLK REG MILL COAT PE BEV 30 DEG MEETING ALL THE APPLICABLE REQUIREMENTS OF NACE STANDARD MR-01-75

THESE MILL TEST REPORTS APPLY TO
YOUR P.O. # 20540
BARTOW STEEL REF. # 27269

MATERIAL COND: AS ROLLED

OD: 24.000 (609.600) in (mm) WALL: 0.500 (12.700) in (mm)

TENSILE

PRODUCT IDENTIFICATION	TEST TYPE/ ORIENTATION	TEST COND.	GAUGE WIDTH IN	YIELD PSI	EXT % .50	TENSILE PSI	Y/T	ELONG % IN 2"	HARDNESS SCALE: HRB	MIN HYDRO PSI	DWELL (SEC)
				MIN: 40000 MAX:		MIN: 70000 MAX:	LOUA	MIN: 29.5	MIN: MAX: 100.0	1000	5
Y48401	STRIP/T/B	AR	1.500	47600	.50	77000	0.62	43.0	B 81.7	1000	5

** 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*
																			MAX
Y48401	HEAT		24	92	010	006	22	01	01	06	01	031		003					.50
Y48401	PROD		25	91	009	006	22	01	01	06	01	027		001					.41
Y48401	PROD		26	90	009	007	22	01	01	06	01	027		001					.42
																			.43

** END OF DATA THIS SHEET **

*CE IS BASED ON THE FOLLOWING EQUATION(S): CE=C+(MN/6)+(CR+MO+V)/5+ (NI+CU)/15

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

941 619 8779 1998.10-19 14:07 #470 P.09/09

U.S. STEEL GROUP
A DIVISION OF USX CORPORATION

TUBULAR PRODUCTS
CERTIFIED TEST REPORT

DATE: 04/14/98
TIME: 09:42:16

17916

MILL ORDER/ITEM NO.	SHIPPERS NO.	P.O. NUMBER	
DR33865 40		0245-USG	

MATERIAL COND: AS ROLLED

O.D.: 24.000(609.600) in (mm) WALL: 0.500 (12.700) in (mm)

PRODUCT IDENTIFICATION	FLAT	BEND	GRAIN SIZE	... COLLAPSE	CHARPY V-NOTCH IMPACT TESTING
Y40481	OK				

** END OF DATA THIS SHEET **

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

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

ADDITIONAL NOTES/COMMENTS

ALL MELTING AND 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. NIKULSKI MGR. MET. & Q.A. USS TUBULAR PRODUCTS

DATE 04/14/98

FROM :BARTOW STEEL

10/19/98 15:16 TX/RX NO.2031 P.009

U.S. STEEL GROUP
A division of USX Corporation

TUBULAR PRODUCTS CERTIFIED TEST REPORT

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

DATE: 09/29/97
TIME: 14:50:14 USX
USS USX, USX are trademarks of USX Corporation

1713.5 Pij

USX ORDER/ITEM NO.	SHIPPERS NO.	P.O. NUMBER	VEHICLE NO.
0R18490 14		6050-USS	

SOLD TO ADDRESS

MAIL TO ADDRESS

VENDOR
USS TUBULAR PRODUCTS
1807 EAST 28TH ST.
LORAIN, OH 44055

SPECIFICATION AND GRADE

PIPE CARBON SMLS STD PIPE API 5L-X41ST EDITION DTD 4/1/95 GRADE B AND GRADE X42 ASTM A53-X96 ASTM A106-X95 GRADE B QUAD STENCIL ASME SA53-X1995 EDITION 1996 ADDENDUM ASME SA106-X1995 EDITION 1996 ADDENDUM GRADE B BLK REG MILL COAT PE BEV 30 DEG MEETING ALL THE APPLICABLE REQUIREMENTS OF NACE STANDARD MR-01-75

THESE MILL TEST REPORTS APPLY TO
YOUR P.O. # 20540
BARTOW STEEL REF. # 272169

MATERIAL COND. AS ROLLED

O.D. 24.000 (609.600) in (mm) WALL: 0.500 (12.700) in (mm)

TENSILE

PRODUCT IDENTIFICATION	TEST TYPE/ ORIENTATION	TEST COND.	GAUGE WIDTH IN	YIELD PSI	EXT % .50	TENSILE PSI	Y/T	ELONG % GM 2"	HARDNESS SCALE: HRB	MIN HYDRO PSI	DWELL (SEC)
				MIN 42000		MIN: 60000	MAX:	MIN	MIN:		
Y58398	STRIP/T/B	AR	1.500	MAX: 48200	.50	MAX: 79700	0.60	29.5	MAX: 100.0	1500	5
			** END OF DATA THIS SHEET **					39.0	B 73.0	1500	5

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				C.E.*
Y58398	HEAT		24	91	009	009	26	01	02	04	01	028		002								
Y58398	PROD		26	91	009	009	25	01	02	04	01	026		001								
Y58398	PROD		25	91	009	009	25	01	02	04	01	027		001								
				** END OF DATA THIS SHEET **																		

*C.E. IS BASED ON THE FOLLOWING EQUATION(S):

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

0082600-02 13744

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 1807 EAST 28TH ST. LORAIN, OH 44055

SPECIFICATION AND GRADE

PIPE CARBON SMLS STD PIPE API 5L-X41ST EDITION DTD 4/1/95 GRADE B AND GRADE X42 ASTM A53-N95 ASTM A106-N94A GRADE B QUAD STENCIL ASME SA53-N1992 EDITION 1994 ADDENDUM ASME SA106-N1992 EDITION 1994 ADDENDUM GRADE B BLK REG MILL COAT PE BEV 30 DEG

THESE MILL TEST REPORTS APPLY TO
YOUR P.O. # 20540
BARTOW STEEL REF. # 27269

MATERIAL COND: AS ROLLED

OD: 24.000 (609.600) in (mm) WALL: 0.500 (12.700) in (mm)

TENSIL

PRODUCT IDENTIFICATION	TEST TYPE/ ORIENTATION	TEST COND.	GAUGE WIDTH IN	YIELD PSI	EXT % .50	TENSILE PSI	Y/T	ELONG % IN 2"	HARDNESS SCALE: HRB	MIN HYDRO PSI	DUR (SEC)
				MIN: 42000 MAX:		MIN: 60000 MAX:	MAX:	MIN: 29.5	MIN: MAX: 100.0	1500	5
A22048	STRIP/T/B	AR	1.500	48100	.50	79600	0.60	38.0	B 84.7	1500	5
A32043	STRIP/T/B	AR	1.500	48300	.50	79700	0.61	42.0	B 84.7	1500	5

** 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*
A22048	HEAT	23	90	007	010	23	01	02	05	01			001					
A22048	PROD	26	91	006	012	23	01	02	05	01			001					
A22048	PROD	24	93	005	012	24	01	02	05	01			002					
A32043	HEAT	24	90	006	003	25	01	02	04	01			001					
A32043	PROD	26	92	004	004	25	01	02	04	01			002					
A32043	PROD	24	90	003	004	26	01	02	04	01			001					

** END OF DATA THIS SHEET **

*C.E. IS BASED ON THE FOLLOWING EQUATION(S):

DECIMAL POSITIONS FOR ELEMENTS ARE INDICATED BY THE LEFT MARGIN, VERTICAL DOTT--

U. S. STEEL GROUP
A division of USX Corporation

TUBULAR PRODUCTS
INSPECTION CERTIFICATE
(TYPE B - IN ACCORDANCE WITH ISO 10474/EN10204/DIN50049)

TIME: 08:41:38 Work

USS, USX, USX are trademarks of USX Corporation

MILL ORDER NUMBER	SHIPPERS NO.	PO NUMBER	INVOICE NUMBER
DR82600 02		13744	

MATERIAL COND: AS ROLLED

OD: 24.000 (609.600) in (mm) WALL: 0.500 (12.700) in (mm)

PRODUCT IDENTIFICATION	FLAT	BEND	GRAIN SIZE	MIN COLLAPSE	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
A22048	OK																
A32043	OK																

(Columns DIR through % SHEAR AVG: CHARPY V-NOTCH IMPACT TESTING)

** 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	
FULL LENGTH MPI		OD X OD/ID ___ L X L/T ___
FULL LENGTH UT		
END AREA INSPECTION (PLAIN END)		OD ___ OD/ID ___ L ___ L/T ___
SPECIAL END AREA (SEA) INSP.		MPI ___ UT ___
FULL LENGTH DRIFT		MPI ___ UT ___
		DRIFT MANDREL SIZE:

ADDITIONAL NOTES/COMMENTS

ALL MELTING AND 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. & Q.A. USS TUBULAR PRODUCTS

DATE 08/19/96

U. S. STEEL GROUP
A division of USX Corporation

TUBULAR PRODUCTS INSPECTION CERTIFICATE

(TYPE 3 - IN ACCORDANCE WITH ISO 10474/EN10204/DIN50049)

DATE: 06/21/96
TIME: 12:22:22 USX™

USS and USX are trademarks of USX Corporation

DR82600 02 | 13744

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 1807 EAST 28TH ST. LORAIN, OH 44055

SPECIFICATION AND GRADE

PIPE CARBON SMLS STD PIPE API 5L-M41ST EDITION DTD 4/1/95 GRADE B AND GRADE X42 ASTM A53-M95 ASTM A106-M94A GRADE B QUAD STENCIL ASME SA53-M1992 EDITION 1994 ADDENDUM ASME SA106-M1992 EDITION 1994 ADDENDUM GRADE B BLK REG MILL COAT PE BEV 30 DEG

THESE MILL TEST REPORTS APPLY TO
YOUR P.O. # 20540
BARTOW STEEL REF. # 272169

MATERIAL COND: AS ROLLED | O.D.: 24.000(609.600) in (mm) | WALL: 0.600 (12.700) 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: HRB	MILL HYDRO PSI	DWELL (SEC)
				MIN: 42000 / MAX:		MIN: 60000 / MAX:	MAX:	MIN 29.5	MAX: 100.0	1500	5
A22044	STRIP/T/B	AR	1.500	47300	.50	80700	0.59	41.0	B 89.0	1500	5
A22050	STRIP/T/B	AR	1.500	43600	.50	76300	0.67	40.0	B 85.7	1600	5

** 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				C.E.*
A22044	HEAT		24	90	008	008	24	01	03	09	01			001								
A22044	PROD		23	87	004	007	26	01	02	08	01			001								
A22044	PROD		24	87	004	007	24	01	02	08	01			001								
A22050	HEAT		24	92	008	011	24	01	01	04	02			001								
A22050	PROD		26	92	006	012	24	01	02	04	01			001								
A22050	PROD		24	90	005	012	24	01	01	04	02			001								

** END OF DATA THIS SHEET **

*C.E. IS BASED ON THE FOLLOWING EQUATION(S):...

DECIMAL POSITIONS FOR ELEMENTS ARE INDICATED BY THE LEFT MARGIN, VERTICAL DOTTED LINE OR DECIMAL POINT. PAGE 1 OF 2

To: DANA ANDERSON From: FAX Gate 2

To:DANA ANDERSON

U.S. STEEL GROUP
A division of USX Corporation

TUBULAR PRODUCTS INSPECTION CERTIFICATE

(TYPE 3 - IN ACCORDANCE WITH ISO 10474/EN10204/DIN50049)

DATE: 05/21/98
TIME: 12:22:22 USX

USX Line, USX are trademarks of USX Corporation

[illegible]	[illegible]	[illegible]	[illegible]
0R32000 02		13744	

MATERIAL COND: AS ROLLED — O.D.: 24.000 (609.600) in (mm) — WALL: 0.500 (12.700) in (mm)

PRODUCT IDENTIFICATION	FLAT	BEND	GRAIN SIZE	MIN COLLAPSE	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
A22044	OK																
A22050	OK																

(CHARPY V-NOTCH IMPACT TESTING)

** 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

ADDITIONAL NOTES/COMMENTS

ALL MELTING AND 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. & Q.A. USS TUBULAR PRODUCTS

DATE 05/21/96

U. S. STEEL GROUP
A division of USX Corporation

TUBULAR PRODUCTS CERTIFIED TEST REPORT

(TYPE 3 - IN ACCORDANCE WITH ISO 10474/EN10204/DIN50049)

DATE: 09/29/97
TIME: 14:50:14 USX™

17135 Pg 2

USS, USS, USX are trademarks of USX Corporation

MILL ORDER/ITEM NO.	SHIPPER NO.	P.O. NUMBER	
DR18498 14		6050-USS	

MATERIAL COND: AS ROLLED

OD: 24.000(609.600) in (mm) WALL: 0.500 (12.700) in (mm)

PRODUCT IDENTIFICATION	FLAT	BEND	GRAIN SIZE	API COLLAPSE	CHARPY V-NOTCH IMPACT TESTING: DIR	TEST LOC.	TEMP	SIZE	TEST COND.	FT-LBS 1	2	3	AVG	% SHEAR 1	2	3	AVG
YS8398	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:

ADDITIONAL NOTES/COMMENTS

ALL MELTING AND 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. & Q.A. USS TUBULAR PRODUCTS

DATE 09/29/97

MONTGOMERY WATSON

SHOP DRAWING REVIEW

TO: Youngquist Brothers, Inc.
15465 Pine Ridge Rd.
Ft. Myers, FL 33908

Attn: Mr. Dave Collins

Date: November 11, 1998

Project: City of Sunrise
Sawgrass Concentrate Injection Well #1
Project No. 403-6135D

Submittal: 36.1

Section: 2633

Subject submittal has been reviewed and review action is as indicated below:

No. of Copies	Description
5	Additional 24" Mill Certifications

Review Action:

[X] No Exceptions Taken

[ ] Make Corrections Noted

[ ] Amend Resubmit

[ ] Rejected - Resubmit

Comments:

Checking of shop drawing is limited to general design and general arrangement only and is not intended to be a verification of compliance with all requirements. Engineers's review shall not relieve the Contractor from the responsibility of details of design, correct dimensions for proper fitting, the satisfactory and safe performance of the work, coordination with others' performance, or any other requirement of the Contract.

c: T. Kelaher
R. Skinner
File SD 36.1

William Vogel

William Vogel, Resident Engineer

U. S. STEEL GROUP
A division of USX Corporation

TUBULAR PRODUCTS
CERTIFIED TEST REPORT
(TYPE B - IN ACCORDANCE WITH ISO 10474/EN10204/DIN50049)

DATE: 09/29/97
TIME: 14:50:14 USX

USS, USX are trademarks of USX Corporation

MILL ORDER/ITEM NO.	SHIPPERS NO.	P.O./CARRIER	VEHICLE ID.
OR10490 1		6050-USS	

SOLD TO ADDRESS	MAIL TO ADDRESS	VENDOR
		USS TUBULAR PRODUCTS 1807 EAST 28TH ST. LORAIN, OH 44055

SPECIFICATION AND GRADE

PIPE CARBON SMLS STD PIPE API 5L-X41ST EDITION DTD 4/1/95 GRADE B AND GRADE X42 ASTM A53-X96 ASTM A106-X95 GRADE B QUAD STENCIL ASME SA53-X1995 EDITION 1996 ADDENDUM ASME SA106-X1995 EDITION 1996 ADDENDUM GRADE B BLK REG MILL COAT PE BEV 30 DEG MEETING ALL THE APPLICABLE REQUIREMENTS OF NACE STANDARD MR-01-75

MATERIAL COND: AS ROLLED — OD: 24.000 (609.600) in (mm) — WALL: 0.500 (12.700) in (mm)

TENSILE

PRODUCT IDENTIFICATION	TEST TYPE/ ORIENTATION	TEST COND.	GAUGE WIDTH IN	YIELD PSI	EXT % .50	TENSILE PSI	Y/T	ELONG % (IN 2")	HARDNESS SCALE: HRB	HYDRO PSI	DWELL (SEC)
				MIN: 42000 MAX:		MIN: 60000 MAX:	MAX:	MIN: 29.5	MIN: MAX: 100.0	1500	5
Y1004	STRIP/T/D	AR	1.500		.50	79700	0.60	39.0	B 73.0	1500	5

XX END OF DATA THIS SHEET XX

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				C.E.*
Y1004	HEAT		2	91	009	009	26	01	02	04	01	020		002								
Y1004	PROD		26	91	009	009	25	01	02	04	01	026		001								
Y1004	PROD		25	91	009	009	25	01	02	04	01	027		001								

XX END OF DATA THIS SHEET XX

*C.E. IS BASED ON THE FOLLOWING EQUATION(S):

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

U. S. STEEL GROUP
A division of USX Corporation

TUBULAR PRODUCTS
CERTIFIED TEST REPORT

(TYPE 3 - IN ACCORDANCE WITH ISO 10474/EN10204/DIN50049)

DATE: 09/29/97
TIME: 14:50:14 USX

USS, USX are trademarks of USX Corporation

Pg 2

MILL ORDER/ITEM NO.	SHIPPER/S NO.	P.O. NUMBER
0R18450 1		6050-USS

MATERIAL COND: AS ROLLED

O.D.: 24.000(609.600) in (mm)   WALL: 0.500 (12.700) in (mm)

PRODUCT IDENTIFICATION	FLAT	BEND	GRAIN SIZE	MIN COLLAPSE	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
Y4804	OK																

(CHARPY V-NOTCH IMPACT TESTING)

** 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 EM	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:

ADDITIONAL NOTES/COMMENTS

ALL MELTING AND 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. & Q.A. USS TUBULAR PRODUCTS

DATE 09/29/97

SOLD TO ADDRESS	MAIL TO ADDRESS	VENDOR
		USS TUBULAR PRODUCTS 1807 EAST 28TH ST. LORAIN, OH 44055

SPECIFICATION AND GRADE

PIPE CARBON SMLS STD PIPE API 5L-*41ST EDITION DTD 4/1/95 GRADE B ASTM A53-*95 GRADE B ASME SA53-*1992 EDITION 1994 ADDENDUM GRADE B ASTM A106-*94A GRADE B/C ASME SA106-*1992 EDITION 1994 ADDENDUM GRADE B/C BLK REG MILL COAT PE BEV 30 DEG

MATERIAL COND: AS ROLLED — O.D. 24.000(609.600) in (mm) — WALL 0.500 (12.700) in (mm)

TENSILE

PRODUCT IDENTIFICATION	TEST TYPE / ORIENTATION	TEST COND.	GAUGE WIDTH IN	YIELD PSI (MIN: 40000, MAX)	EXT % .50	TENSILE PSI (MIN: 70000, MAX)	Y/T (MAX:)	ELONG % (IN 2") MIN: 29.5	HARDNESS SCALE: HRB (MIN:, MAX 100.0)	MIN HYDRO PSI	DWELL (SEC)
										1000	5
A24107	STRIP/T/B	AR	1.500	48700	.50	81200	0.60	40.0	B 81.3	1000	5
A24114	STRIP/T/B	AR	1.500	51800	.50	84200	0.62	40.0	B 81.7	1000	5

** END OF DATA THIS SHEET **

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

PRODUCT IDENTIFICATION	TYPE		C	MN	P	S	SI	CU	NI	CR	MO	AL	N	V	B	TI	CB	CO			C.E.*
A24107	HEAT		25	93	008	008	25	01	01	04	02	032		001							
A24107	PROD		27	91	009	009	25	01	01	04	02	028		000							
A24107	PROD		27	93	011	008	25	02	02	05	02	029		001							
A24114	HEAT		25	94	013	010	25	02	02	04	01	028		001							
A24114	PROD		27	93	013	011	24	02	02	04	01	025		000							
A24114	PROD		27	93	014	011	24	02	02	04	01	025		000							

** END OF DATA THIS SHEET **

*C.E. IS BASED ON THE FOLLOWING EQUATION(S):

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

...ERIAL: AS ROLLED ...OND:					O.D.: 24.000 (...9.600) In (mm)					WALL: 0.500 (12.700) In (mm)							
					CHARPY V-NOTCH IMPACT TESTING												
										FT-LBS				% SHEAR			
PRODUCT IDENTIFICATION	FLAT	BEND	GRAIN SIZE	MIN COLLAPSE	DIR	TEST LOC.	TEMP	SIZE	TEST COND.	1	2	3	AVG	1	2	3	AVG
24107	OK																
24114	OK																
			** END OF DATA THIS SHEET **														

...EGEND: 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:

ADDITIONAL NOTES/COMMENTS

ALL MELTING AND 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. & Q.A. USS TUBULAR PRODUCTS

DATE 10/18/96

MONTGOMERY WATSON

SHOP DRAWING REVIEW

TO: Youngquist Brothers, Inc.
15465 Pine Ridge Rd.
Ft. Myers, FL 33908

Attn: Mr. Dave Collins

Date: November 11, 1998

Project: City of Sunrise
Sawgrass Concentrate Injection Well #1
Project No. 403-6135D

Submittal: 37.1 **Section:** 2633

Subject submittal has been reviewed and review action is as indicated below:

No. of Copies	Description
3	Additional 24" Mill Certifications

Review Action:

[X] No Exceptions Taken [ ] Make Corrections Noted

[ ] Amend Resubmit [ ] Rejected - Resubmit

Comments:

Checking of shop drawing is limited to general design and general arrangement only and is not intended to be a verification of compliance with all requirements. Engineers's review shall not relieve the Contractor from the responsibility of details of design, correct dimensions for proper fitting, the satisfactory and safe performance of the work, coordination with others' performance, or any other requirement of the Contract.

c: T. Kelaher
R. Skinner
File SD 37.1

William Vogel

William Vogel, Resident Engineer

U. S. STEEL GROUP
A division of USX Corporation

TUBULAR PRODUCTS
CERTIFIED TEST REPORT
(TYPE 8 - IN ACCORDANCE WITH ISO 10474 / EN10204 / DIN50049)

DATE: 09/26/97
TIME: 09:44:44

USX

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MILL ORDER/ITEM NO.	SHIPPERS NO.	PO NUMBER	VEHICLE ID
DR18490 14		6060-USS	

SOLD TO ADDRESS	MAIL TO ADDRESS	VENDOR
		USS TUBULAR PRODUCTS 1807 EAST 28TH ST. LORAIN, OH 44055

PIPE CARBON SMLS STD PIPE API 5L-*41ST EDITION DTD 4/1/95 GRADE B AND GRADE X42 ASTM A53-*96 ASTM A106-*95 GRADE B QUAD STENCIL ASME SA53-*1995 EDITION 1996 ADDENDUM ASME SA106-*1995 EDITION 1996 ADDENDUM GRADE B BLK REG MILL COAT PE BEV 30 DEG MEETING ALL THE APPLICABLE REQUIREMENTS OF NACE STANDARD MR-01-75

MATERIAL COND: AS ROLLED

OD: 24.000(609.600) in (mm)

WALL: 0.500 (12.700) 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 HRB	MIN HYDRO PSI	DWELL (SEC)
				MIN: 42000 MAX		MIN: 60000 MAX	MAX:	MIN: 29.5	MIN: MAX 100.0	1580	5
Y48404	STRIP/T/B	AR	1.500	46700	.50	81100	0.60	41.0	B 81.7	1580	5
		**	END OF DATA THIS SHEET			**					

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

PRODUCT IDENTIFICATION	TYPE		C	MN	P	S	SI	CU	NI	CR	MO	AL	N	V	B	TI	CB	CO			CE*
Y48404	HEAT		24	92	008	004	23	03	01	06	01	028		002							
Y48404	PROD		27	90	007	004	23	02	01	06	01	026		001							
Y48404	PROD		27	90	008	004	23	02	01	06	01	027		001							
				** END OF DATA THIS SHEET **																	

*C.E. IS BASED ON THE FOLLOWING EQUATION(S):

U. S. STEEL GROUP
A division of USX Corporation

TUBULAR PRODUCTS CERTIFIED TEST REPORT

(TYPE 3 - IN ACCORDANCE WITH ISO 10474 / EN10204 / DIN50049)

DATE: 09/26/97
TIME: 09:44:44

USX™

USS, USX, USX are trademarks of USX Corporation

MILL ORDER/ITEM NO.	SHIPPERS NO.	PO NUMBER	VEHICLE ID
DR18490 14		6050-USS	

SOLD TO ADDRESS	MAIL TO ADDRESS	VENDOR
		USS TUBULAR PRODUCTS 1807 EAST 28TH ST. LORAIN, OH 44055

SPECIFICATION AND GRADE

PIPE CARBON SMLS STD PIPE API 5L-#41ST EDITION DTD.4/1/95 GRADE B AND GRADE X42 ASTM A53-#96 ASTM A106-#95 GRADE B QUAD STENCIL ASME SA53-#1995 EDITION 1996 ADDENDUM ASME SA106-#1995 EDITION 1996 ADDENDUM GRADE B BLK REG MILL COAT PE BEV 30 DEG MEETING ALL THE APPLICABLE REQUIREMENTS OF NACE STANDARD MR-01-75

MATERIAL COND: AS ROLLED

OD: 24.000 (609.600) in (mm) WALL: 0.500 (12.700) in (mm)

TENSILE

PRODUCT IDENTIFICATION	TEST TYPE / ORIENTATION	TEST COND	GAUGE WIDTH IN	YIELD PSI	EXT % .50	TENSILE PSI	Y/T	ELONG % (IN 2")	HARDNESS SCALE HRB	MIN HYDRO PSI	DWELL (SEC)
				MIN: 42000 MAX		MIN: 60000 MAX	MAX:	MIN: 29.5	MIN: MAX 100.0	1580	5
Y48404	STRIP/T/B	AR	1.500	48700	.50	81100	0.60	41.0	B 81.7	1580	5
		**	END OF DATA THIS SHEET			**					

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

PRODUCT IDENTIFICATION	TYPE		C	MN	P	S	SI	CU	NI	CR	MO	AL	N	V	B	TI	CB	CO				C.E.*
Y48404	HEAT		24	92	008	004	23	03	01	06	01	028		002								
Y48404	PROD		27	90	007	004	23	02	01	06	01	026		001								
Y48404	PROD		27	90	008	004	23	02	01	06	01	027		001								
				** END OF DATA THIS SHEET **																		

*C.E. IS BASED ON THE FOLLOWING EQUATION(S):

U. S. STEEL GROUP
A division of USX Corporation

TUBULAR PRODUCTS
INSPECTION CERTIFICATE
(TYPE B - IN ACCORDANCE WITH ISO 10474/EN10204/DIN50049)

DATE: 06/17/96
TIME: 13:58:18 USX

MILL ORDER/ITEM NO.	SHIPPERS NO	P.O NUMBER	VEHICLE I.D.
DR86995 02		14967	

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 1807 EAST 28TH ST. LORAIN, OH 44055

SPECIFICATION AND GRADE

PIPE CARBON SMLS STD PIPE API 5L-X41ST EDITION DTD 4/1/95 GRADE B ASTM A53-X95 GRADE B ASME SA53-X1995 EDITION 1995 ADDENDUM GRADE B ASTM A106-X94A GRADE B/C ASME SA106-X1995 EDITION 1995 ADDENDUM GRADE B/C
BLK REG MILL COAT PE BEV 30 DEG

MATERIAL COND: AS ROLLED | OD: 24.000(609.600) in (mm) | WALL: 0.500 (12.700) in (mm)

PRODUCT IDENTIFICATION	TENSIL TEST TYPE/ ORIENTATION	TEST COND.	GAUGE WIDTH IN	YIELD PSI	EXT % .50	TENSILE PSI	Y/T	ELONG % in 2"	HARDNESS SCALE: HRB	MIN HYDRO PSI	DWELL (SEC)
				MIN: 40000 MAX:		MIN: 70000 MAX:	MAX:	MIN: 25.5	MIN: MAX: 100.0	1000	5
A22047	STRIP/T/B	AR	1.500	44400	.50	78800	0.56	41.0	B 84.5	1000	5
A22051	STRIP/T/B	AR	1.500	62100	.50	82700	0.75	38.0	B 84.9	1000	5

** 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				C.E.*
A22047	HEAT		24	90	009	009	23	01	02	06	01			001								
A22047	PROD		24	89	007	011	22	01	02	06	01			001								
A22047	PROD		24	90	007	011	23	01	02	06	01			001								
A22051	HEAT		24	91	009	007	24	01	02	06	02			001								
A22051	PROD		25	90	005	007	23	01	01	04	02			001								
A22051	PROD		25	92	007	007	23	01	02	06	02			002								

** END OF DATA THIS SHEET **

*C.E. IS BASED ON THE FOLLOWING EQUATION(S):

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

DATE: 06/17/96
TIME: 13:56:18 USX™

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U. S. STEEL GROUP
A division of USX Corporation

TUBULAR PRODUCTS INSPECTION CERTIFICATE

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

MILL ORDER-ITEM NO.	SHIPPER NO.	P.O. NUMBER	INVOICE NUMBER
DR86965 02		14567	

MATERIAL COND.	O.D.	WALL
AS ROLLED	24.000 (609.600)	0.500 (12.700)

PRODUCT IDENTIFICATION	FLAT	BEND	GRAIN SIZE	LAW COLLAPSE	DIR	TEST LOC.	TEMP	SIZE	TEST COND.	FT/LBS 1	2	3	AVG	% SHEAR 1	2	3	AVG
A22047	OK																
A22051	OK																

(CHARPY V-NOTCH IMPACT TESTING)

** 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:

ADDITIONAL NOTES/COMMENTS

ALL MELTING AND 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. & Q.A. USS TUBULAR PRODUCTS

DATE 06/17/96

MONTGOMERY WATSON

SHOP DRAWING REVIEW

TO: Youngquist Brothers, Inc.
15465 Pine Ridge Rd.
Ft. Myers, FL 33908

Attn: Mr. Dave Collins

Date: November 11, 1998

Project: City of Sunrise
Sawgrass Concentrate Injection Well #1
Project No. 403-6135D

Submittal: 35.1

Section: 2633

Subject submittal has been reviewed and review action is as indicated below:

No. of Copies	Description
5	Additional 20" Mill Certifications

Review Action:

[X] No Exceptions Taken
[ ] Make Corrections Noted
[ ] Amend Resubmit
[ ] Rejected - Resubmit

Comments:

Checking of shop drawing is limited to general design and general arrangement only and is not intended to be a verification of compliance with all requirements. Engineers's review shall not relieve the Contractor from the responsibility of details of design, correct dimensions for proper fitting, the satisfactory and safe performance of the work, coordination with others' performance, or any other requirement of the Contract.

c: T. Kelaher
R. Skinner
File SD 35.1

William Vogel

William Vogel, Resident Engineer

A DIVISION OF USX CORPORATION

TUBULAR PRODUCTS
CERTIFIED TEST REPORT
(TYPE B - IN ACCORDANCE WITH ISO 10474/EN10204/DIN50049)

TIME: 12:07:53

USX
USS, USX, USX are trademarks of USX Corporation

MILL ORDER/ITEM NO.	SHIPPERS NO.	P.O. NUMBER	VEHICLE I.D.
DR38775 01		19892	

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 1807 EAST 28TH ST. LORAIN, OH 44055

SPECIFICATION AND GRADE

PIPE CARBON SMLS STD PIPE API 5L-X41ST EDITION DTD 4/1/95 GRADE B AND GRADE X42 ASTM A53-X97 ASTM A106-X97A GRADE B QUAD STENCIL ASME SA53-X1995 EDITION 1996 ADDENDUM ASME SA106-X1995 EDITION 1996 ADDENDUM GRADE B CARBON EQUIVALENT ON HEAT ANALYSIS .40 MAX BASED ON C+MN OVER 6 + (CR+MO+V) OVER 5 + (CU+NI) OVER 15 BLK BARE PE BEV 30 DEG MEETING ALL THE APPLICABLE REQUIREMENTS OF NACE STANDARD MR-01-75

MATERIAL COND: AS ROLLED

OD: 20.000(508.000) in (mm) WALL: 0.500 (12.700) in (mm)

TENSILE

PRODUCT IDENTIFICATION	TEST TYPE/ ORIENTATION	TEST COND.	GAUGE WIDTH IN	YIELD PSI	EXT % .50	TENSILE PSI	Y/T	ELONG % (IN 2")	HARDNESS SCALE: HRB	MIN HYDRO PSI	DWELL (SEC)
				MIN: 42000		MIN: 60000	MAX:	MIN: 29.5	MIN: MAX: 100.0	1890	5
A63121	STRIP/T/B	AR	1.500	MAX: 45100	.50	MAX: 73600	0.61	45.0	E 80.0	1890	5

** 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* MAX .40
A63121	HEAT	17	103	006	006	24	01	01	04	01	030		004			001		.36
A63121	PROD	16	104	007	005	23	01	01	04	01	032		001			001		.34
A63121	PROD	17	104	007	005	23	01	01	06	01	030		001			001		.36

** END OF DATA THIS SHEET **

*C.E. IS BASED ON THE FOLLOWING EQUATION(S): CE=C+(MN/6)+(CR+MO+V)/5+ (NI+CU)/15

CW-1

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

Mill Certificates
DZMW-1

MONTGOMERY WATSON

SHOP DRAWING REVIEW

TO: Youngquist Brothers, Inc.
15465 Pine Ridge Rd.
Ft. Myers, FL 33908

Attn: Mr. Ed McCullers

Date: October 20, 1998

Project: City of Sunrise
Sawgrass Concentrate Injection Well #1
Project No. 403-6135D

Submittal: 29.1

Section: 2633

Subject submittal has been reviewed and review action is as indicated below:

No. of Copies	Description
5	20" Mill Certifications

Review Action:

X No Exceptions Taken

Make Corrections Noted

Amend Resubmit

Rejected - Resubmit

Comments:

Checking of shop drawing is limited to general design and general arrangement only and is not intended to be a verification of compliance with all requirements. Engineers's review shall not relieve the Contractor from the responsibility of details of design, correct dimensions for proper fitting, the satisfactory and safe performance of the work, coordination with others' performance, or any other requirement of the Contract.

c: T. Kelaher
R. Skinner
File SD 29.1

William Vogel

William Vogel, Resident Engineer

STANDARD CERTIFIED TEST REPORT
GEORGIA TUBULAR PRODUCTS, INC.

Customer Name	YOUNGQUIST BROTHERS, INC.	Date:	8-6-98
Customer Address	15465 PINE RIDGE RD.	Customer Order No.	20536
	FORT MYERS, FL 33908		
City, State, Zip		G.T.P. Sales Order No.	200115

Specification ASTM A139 GR B SPIRALWELD STEEL PIPE "MADE IN U.S.A."

Heat No.	Size O.D.	Wt./Ft. or Wall Thick	Min. Hydro Test Pres. P.S.I.	MECHANICAL PROPERTIES Yield Strength P.S.I. Point	Tensile Strength P.S.I.	Elong In 2" %	CHEMICAL ANALYSIS (%) C	Mn	P	S	SI
2803385	54"	.375	292	49,400	77,600	31.	.23	.88	.015	.002	
182158	34"	.375	463	52,553	73,488	30.	.20	.84	.007	.005	
170771	34"	.375	463	49,527	70,334	30.	.21	.71	.006	.007	
183888	34"	.375	463	55,781	81,542	30.	.20	.91	.011	.007	
183878	34"	.375	463	51,216	74,981	30.	.20	.83	.013	.004	
282217	20"	.375	788	50,199	76,708	30.	.21	.89	.009	.007	
A0019	20"	.375	788	55,400	81,500	33.	.21	.53	.017	.010	
60832	14"	.375	1125	49,560	74,600	36.	.21	.94	.010	.017	
60831	14"	.375	1125	50,620	78,730	39.	.23	.95	.010	.017	
60833	14"	.375	1125	49,910	77,170	37.	.23	.97	.011	.021	

The undersigned hereby certifies that the above materials have been inspected and tested in accordance with the methods prescribed in the applicable specifications and the results of such inspection and tests shown above. In determining properties or characteristics for which no methods of inspecting or testing are prescribed by said specifications, the standard mill inspection and testing practices of Georgia Tubular Products, Inc have been applied. Unless it appears otherwise in the results of such inspection and tests shown above, the undersigned believes that said materials conform to said specifications.

Subscribed and sworn to before me

This 6th day of Aug. 1998

My Commission Expires Oct. 6, 1998

Notary Public

R. SCOTT PANTER
MFG MGR
Name & Title

Georgia Tubular Products, Inc.
109 Dent Drive, Cartersville, GA 30121
(770) 386-2553

MONTGOMERY WATSON

SHOP DRAWING REVIEW

TO: Youngquist Brothers, Inc.
15465 Pine Ridge Rd.
Ft. Myers, FL 33908

Attn: Mr. Dave Collins

Date: December 14, 1998

Project: City of Sunrise
Sawgrass Concentrate Injection Well #1
Project No. 403-6135D

Submittal: 43.1

Section: 2632

Subject submittal has been reviewed and review action is as indicated below:

No. of Copies	Description
5	6" Mill Certs

Review Action:

[X] No Exceptions Taken

[ ] Make Corrections Noted

[ ] Amend Resubmit

[ ] Rejected - Resubmit

Comments:

Checking of shop drawing is limited to general design and general arrangement only and is not intended to be a verification of compliance with all requirements. Engineers's review shall not relieve the Contractor from the responsibility of details of design, correct dimensions for proper fitting, the satisfactory and safe performance of the work, coordination with others' performance, or any other requirement of the Contract.

c: T. Kelaher
MW-CIW.1
File SD 43.1

William Vogel

William Vogel, Resident Engineer

Consolidated
PIPE & SUPPLY COMPANY, INC.
PHONE (205) 323-7261
P. O. BOX 2472
BIRMINGHAM, ALABAMA 35201

December 1, 1998

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

Gentlemen:

The material that was processed on Youngquist Brothers po# 20531 for Sawgrass Well #1 was checked against the corresponding mill test reports before the phenolic coating was applied. Enclosed are the matching MTR's along with tally sheets.

Call me at any time if I can be of any further help.

Yours truly,

Miles Benton

Miles Benton
Consolidated Pipe & Supply Company, Inc.

Enclosure:

YOUNGQUIST BROTHERS, INC.
Has reviewed this Shop Drawing/Submittal
YBI / Section No. # 8633-10-A
Transmittal No. # 43.1 Date: 12-3-98
Signature

MONTGOMERY WATSON			
NO EXCEPTIONS TAKEN	✓	AMEND RESUBMIT	
MAKE CORRECTIONS NOTED		REJECTED RESUBMIT	
REVIEWED BY N Johnston		DATE 12-8-98	
RECOMMENDED BY		DATE	

CORRECTIONS OR COMMENTS MADE ON CONTRACTORS SHOP DRAWINGS DURING THIS REVIEW DO NOT RELIEVE THE 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, COORDINATING WORK WITH OTHER TRADES, AND SATISFACTORY AND SAFE PERFORMANCE OF THE WORK.

INSPECTION CERTIFICATE

SUMITOMO METAL INDUSTRIES, LTD.
WAKAYAMA STEEL WORKS (KAINAN)
260-100, FUNOO, KAINAN, JAPAN

CERTIFICATE NO. : BYYF0615 PAGE : 1 DATE : 1998-06-09

CUSTOMER
ORDER NO. :4431C ITEM No 1
SHIPPER :SUMITOMO CORPORATION 057 KEE 1149 1 8P15S4095
COMMODITY :SEAMLESS BLACK STEEL PIPE WITH 30 DEG. BEVELLED ENDS

STANDARD :API 5L GR.X52
SPECIFICATION :

MILL WORK NO. :BYYF0615 O.D.:NB6 W.T.:SCH120 LENGTH:NL40F QUANTITY:51pcs. TOTAL LENGTH:615.60m
MASS:33433kg

HEAT NO.	PRODUCTS PCS.	HEAT NO.	PRODUCTS PCS.	HEAT NO.	PRODUCTS PCS.	HEAT NO.	PRODUCTS PCS.
J814038	13	J834022	1	J834023	3	J834205	10
J834242	24						

HEAT TREATMENT:AS ROLLED

CHEMICAL COMPOSITION(%)

	*1	C	Si	Mn	P *2	S *2	Ti *2	Cb *2
SPEC. MIN.	L	-	-	-	-	-	-	-
MAX.	L	31	-	135	30	30	-	-
MIN.	P	-	-	-	-	-	-	-
MAX.	P	34	-	145	40	40	-	-
HEAT NO.								
J814038	L	8	24	88	17	3	23	14
	P	7	25	88	18	4	24	16
	P	7	24	87	18	4	24	16
J834022	L	7	24	92	16	3	23	14
	P	7	23	92	16	4	25	15
J834023	L	7	22	89	12	4	23	14
	P	7	21	91	12	4	21	14
	P	7	21	91	12	5	22	14
J834205	L	8	23	86	9	3	19	12
	P	5	22	84	16	4	21	12
	P	5	21	85	17	4	21	12
→ J834242	L	7	22	88	15	3	21	12
	P	6	24	85	16	4	22	12
	P	6	24	84	16	4	22	12

*1 L:LADLE ANALYSIS
P:PRODUCT ANALYSIS

*2: X1000
OTHER:X100

TENSILE TEST

	*1	*2	YS *3	TS *3	EL %
SPEC. MIN.	L	B	P 52.0	P 66.0	25.5
MAX.	L	B	P -	P -	-
HEAT NO.					
J814038	L	B	P 56.7	P 76.1	43.6
J834022	L	B	P 56.4	P 70.6	44.5
J834023	L	B	P 52.4	P 70.6	47.6
J834205	L	B	P 56.6	P 74.0	45.1
J834242	L	B	P 58.7	P 74.7	43.3

TYPE OF SPECIMEN
STRIP 1"(25mm) WIDTH
GAUGE LENGTH
2.0"
KIND OF YS
0.5% EXTENSION
UNDER LOAD
*1 DIRECTION
L:LONGITUDINAL
*2 SAMPLING POSITION
B:BASE METAL
*3 UNIT

WE HEREBY CERTIFY THAT THE MATERIAL HEREIN DESCRIBED HAS BEEN MANUFACTURED, SAMPLED, TESTED, AND INSPECTED IN ACCORDANCE WITH ABOVE STANDARD AND SPECIFICATION AND SATISFIES THE REQUIREMENTS.

MANAGER, OCTG & LINEPIPE QUALITY CONTROL SECTION

INSPECTION CERTIFICATE

SUMITOMO METAL INDUSTRIES, LTD.
WAKAYAMA STEEL WORKS (KAINAN)
260-100, FUNOO, KAINAN, JAPAN

CERTIFICATE NO. : BYYF0615 PAGE : 2 DATE : 1998-06-09

P:ksi

NACE MR0175 HARDNESS (HRC 22 MAX.) : GUARANTEED
VISUAL & DIMENSIONS:ACCEPTABLE
HYDROSTATIC TEST 3000psi:ACCEPTABLE

WE HEREBY CERTIFY THAT THE MATERIAL HEREIN DESCRIBED HAS BEEN MANUFACTURED, SAMPLED, TESTED, AND INSPECTED IN ACCORDANCE WITH ABOVE STANDARD AND SPECIFICATION AND SATISFIES THE REQUIREMENTS.

MANAGER, OCTG & LINEPIPE QUALITY CONTROL SECTION

U. S. STEEL GROUP
A division of USX Corporation

TUBULAR PRODUCTS CERTIFIED TEST REPORT

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

DATE: [illegible]
TIME: [illegible]

MILL ORDER / ITEM NO.	SHIPPERS NO.	P.O. NUMBER	VEHICLE I.D.	
D536782 01	Y06547	513-70787		

SOLD TO ADDRESS	MAIL TO ADDRESS	VENDOR
CONSOLIDATED PIPE & SUPPLY CO INC P O BOX 2472 BIRMINGHAM AL 35201-2472	CONSOLIDATED PIPE & SUPPLY CO INC P O BOX 2472 BIRMINGHAM AL 35201-2472	USS TUBULAR PRODUCTS USS FAIRFIELD WORKS P.O. BOX 599 FAIRFIELD ALABAMA 35064

SPECIFICATION AND GRADE

PIPE CARBON SMLS LINE PIPE API 5L-*41ST EDITION DTD 4/1/95 GRADE X52 QUENCH AND TEMPER BLK BARE PE BEV 30 DEG

MATERIAL COND: QUENCH & TEMPER

O.D.: 6.625(168.275) in (mm)

WALL: 0.562 (14.274) in (mm)

PRODUCT IDENTIFICATION	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: 52,000 MAX:		MIN: 66,000 MAX:	MAX:	MIN: 27.0	MIN: MAX:	6620	5
C46155	STRIP/L/B	HT	1.5	70,900	.50	83,000	0.85	39.8		6620	5
U41121	STRIP/L/B	HT	1.5	70,200	.50	85,400	0.82	45.6		6620	5

** END OF DATA THIS SHEET **

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

PRODUCT IDENTIFICATION	TYPE		C	MN	P	S	SI	CU	NI	CR	MO	AL	N	V	B	TI	CB	CO				C.E.*
C46155	HEAT		.14	1.08	.007	.006	.22				.13	.024	.01	.03		.002	.000					
C46155	PROD		.16	1.08	.007	.006	.22				.14	.027	.01	.03		.001	.002					
C46155	PROD		.16	1.07	.007	.007	.22				.13	.027	.01	.03		.001	.001					
U41121	HEAT		.15	1.09	.009	.006	.23				.13	.023	.00	.03		.002	.000					
U41121	PROD		.17	1.08	.009	.006	.23				.13	.022	.01	.03		.001	.001					
U41121	PROD		.17	1.08	.008	.007	.23				.13	.024	.01	.03		.001	.001					

** END OF DATA THIS SHEET **

*C.E. IS BASED ON THE FOLLOWING EQUATION(S):

U. S. STEEL GROUP
A division of USX Corporation

TUBULAR PRODUCTS
CERTIFIED TEST REPORT
(TYPE B - IN ACCORDANCE WITH ISO 10474 / EN10204 / DIN50049)

[illegible] USX™

USS, USX, USX are trademarks of USX Corporation

MILL ORDER / ITEM NO.	SHIPPERS NO.	P.O. NUMBER	
D536982 01	Y06647	513-70787	

MATERIAL COND: QUENCH & TEMPER

O.D.: 6.625 (168.275) in (mm) WALL: 0.562 (14.274) 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
			** 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 ____ OD / ID X L X L / T ____
FULL LENGTH MPI		
FULL LENGTH UT		OD ____ OD / ID ____ L ____ L / T ____
END AREA INSPECTION (PLAIN END)	X	MPI X UT ____
SPECIAL END AREA (SEA) INSP.		MPI ____ UT ____
FULL LENGTH DRIFT		DRIFT MANDREL SIZE:

ADDITIONAL NOTES / COMMENTS

ALL MELTING AND MANUFACTURING TOOK PLACE IN THE USA.
MANUFACTURED IN AN ISO 9001 CERTIFIED FACILITY - CERTIFICATE #30727.
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.
01 MILL

** END OF DATA **

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: J. N. ZGONC

DATE 10/15/97 [signature]

455331001 K00056 1885460J08 [illegible]

^ DIVISION OF USX CORPORATION

CERTIFIED T⁻ST REPORT

(TYPE B - IN ACCORDANCE WITI. I0474/EN10204/DIN50049)

TIME: 17:58:23 USX

MILL ORDER/ITEM NO.	SHIPPERS NO.	P.O. NUMBER	VEHICLE I.D.	
DS39141 10	Y08095	S13-80730		

SOLD TO ADDRESS	MAIL TO ADDRESS	VENDOR
CONSOLIDATED PIPE & SUPPLY CO INC P O BOX 2472 BIRMINGHAM AL 32501-2472	CONSOLIDATED PIPE & SUPPLY CO INC P O BOX 2472 BIRMINGHAM AL 32501-2472	USS TUBULAR PRODUCTS USS FAIRFIELD WORKS P.O. BOX 599 FAIRFIELD ALABAMA 35064

SPECIFICATION AND GRADE

PIPE CARBON SMLS LINE PIPE API 5L-×41ST EDITION DTD 4/1/95 GRADE X52 BLK REG MILL COAT PE BEV 30 DEG

MATERIAL COND: AS-ROLLED | OD: 6.625(168.275) in (mm) | WALL: 0.562 (14.274) in (mm)

PRODUCT IDENTIFICATION	TEST TYPE/ ORIENTATION	TEST COND.	GAUGE WIDTH IN	YIELD PSI	EXT % .50	TENSILE PSI	Y/T	ELONG % (IN 2")	HARDNESS SCALE: HRB	MIN HYDRO PSI	DWELL (SEC)
				MIN: 52,000		MIN: 66,000	MAX:	MIN:	MIN:	6620	5
				MAX:		MAX:		27.0	MAX: 99.5		
C46919	STRIP/L/B	AR	1.5	63,800	.50	94,300	0.68	36.4	90.6	6620	5

** 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				C.E.*
→ C46919	HEAT		25	120	007	008	23	02	01	02	12	027	00	03		001	001					
C46919	PROD		25	120	008	007	24	02	01	02	12	026	01	03		002	000					

** END OF DATA THIS SHEET **

*C.E. IS BASED ON THE FOLLOWING EQUATION(S):

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

455101001 K7043B01 1885460368 SAA 3.0.0 PAGE

USS A DIVISION OF USX CORPORATION

CERTIFIED TEST REPORT

(TYPE B - IN ACCORDANCE WITH IS[illegible]74/EN10204/DIN50049)

USS, USX, USX are trademarks of USX Corporation

MILL ORDER/ITEM NO.	SHIPPERS NO.	P.O. NUMBER
DS39141 10	Y08095	S13-80730

MATERIAL COND: AS-ROLLED

O.D.: 6.625(168.275) In (mm) WALL: 0.562 (14.274) 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	2	3	AVG	% SHEAR 1	2	3	AVG
							DEG										

** 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	X	OD ___ OD/ID X L X L/T ___
END AREA INSPECTION (PLAIN END)	X	MPI X UT ___
SPECIAL END AREA (SEA) INSP.		MPI ___ UT ___
FULL LENGTH DRIFT		DRIFT MANDREL SIZE:

ADDITIONAL NOTES/COMMENTS

ALL MELTING AND MANUFACTURING TOOK PLACE IN THE USA.
MANUFACTURED IN AN ISO 9001 CERTIFIED FACILITY - CERTIFICATE #30727.
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.
01 MILL

** END OF DATA **

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: J. N. ZGONC - MANAGER, Q.A.

DATE 07/20/98

U.S. STEEL GROUP
A DIVISION OF USX CORPORATION

TUBULAR PRODUCTS
CERTIFIED TEST REPORT
(TYPE B - IN ACCORDANCE WITH ...0474/EN10204/DIN50049)

TIME: 15:56:51 USX™

MILL ORDER/ITEM NO.	SHIPPERS NO.	P.O. NUMBER	VEHICLE I.D.	
DS38021 04	Y07717	S13-71370		INVOICE NO 0467402

SOLD TO ADDRESS	MAIL TO ADDRESS	VENDOR
CONSOLIDATED PIPE & SUPPLY CO INC P O BOX 2472 BIRMINGHAM AL 32501-2472	CONSOLIDATED PIPE & SUPPLY CO INC P O BOX 2472 BIRMINGHAM AL 32501-2472	USS TUBULAR PRODUCTS USS FAIRFIELD WORKS P.O. BOX 599 FAIRFIELD ALABAMA 35064

SPECIFICATION AND GRADE

PIPE CARBON SMLS LINE PIPE API 5L-×41ST EDITION DTD 4/1/95 GRADE X52 BLK BARE PE BEV 30 DEG

MATERIAL COND: AS-ROLLED | O.D.: 6.625(168.275) in (mm) | WALL: 0.562 (14.274) in (mm)

PRODUCT IDENTIFICATION	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: 52,000		MIN: 66,000	MAX:	MIN:	MIN:	6620	5
				MAX:		MAX:		27.0	MAX:		
A41027	STRIP/L/B	AR	1.5	63,500	.50	92,900	0.68	39.0		6620	5
A41028	STRIP/L/B	AR	1.5	62,600	.50	89,700	0.70	37.5		6620	5

** 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				C.E.*
A41027	HEAT		24	1.19	009	007	23	02	01	06	11	025	00	04		002	001					
A41027	PROD		25	1.21	008	008	23	02	01	05	13	024	00	04		003	000					
A41028	HEAT		23	1.18	008	007	24	02	02	06	12	029	00	04		002	001					
A41028	PROD		24	1.17	007	008	22	02	02	06	12	027	00	04		002	001					

** END OF DATA THIS SHEET **

*C.E. IS BASED ON THE FOLLOWING EQUATION(S):

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

U.S. STEEL GROUP
A DIVISION OF USX CORPORATION

TUBULAR PRODUCTS
CERTIFIED TEST REPORT
(TYPE B - IN ACCORDANCE WITH ISO ...4/EN10204/DIN50049)

TIME: 15:51:34 USX™

MILL ORDER/ITEM NO.	SHIPPERS NO.	P.O. NUMBER	
DS38021 04	Y07717	S13-71370	INVOICE NO 0467402

MATERIAL COND: AS-ROLLED

O.D.: 6.625(168.275) in (mm) WALL: 0.562 (14.274) in (mm)

PRODUCT IDENTIFICATION	FLAT	BEND	GRAIN SIZE	MIN COLLAPSE	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
							DEG										

CHARPY V-NOTCH IMPACT TESTING

** 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	X	OD ___ OD/ID X L X L/T ___
END AREA INSPECTION (PLAIN END)	X	MPI X UT ___
SPECIAL END AREA (SEA) INSP.		MPI ___ UT ___
FULL LENGTH DRIFT		DRIFT MANDREL SIZE:

ADDITIONAL NOTES/COMMENTS

ALL MELTING AND MANUFACTURING TOOK PLACE IN THE USA.
MANUFACTURED IN AN ISO 9001 CERTIFIED FACILITY - CERTIFICATE #30727.
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.
01 MILL

** END OF DATA **

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: J. N. ZGONC - MANAGER, Q.A.

DATE 04/27/98

USS A DIVISION OF USX CORPORATION

TUBULAR PRODUCTS
CERTIFIED TEST REPORT
(TYPE B - IN ACCORDANCE WITH . 3474/EN10204/DIN50049)

TIME: 15:53:36 USX™

MILL ORDER/ITEM NO.	SHIPPERS NO.	P.O. NUMBER	VEHICLE I.D.	
DS38541 02	Y07717	S13-80018		INVOICE NO 0467404

SOLD TO ADDRESS	MAIL TO ADDRESS	VENDOR
CONSOLIDATED PIPE & SUPPLY CO INC P O BOX 2472 BIRMINGHAM AL 32501-2472	CONSOLIDATED PIPE & SUPPLY CO INC P O BOX 2472 BIRMINGHAM AL 32501-2472	USS TUBULAR PRODUCTS USS FAIRFIELD WORKS P.O. BOX 599 FAIRFIELD ALABAMA 35064

SPECIFICATION AND GRADE

PIPE HIGH STRENGTH LOW ALLOY SMLS LINE PIPE API 5L-×41ST EDITION DTD 4/1/95 GRADE X65 BLK BARE PE BEV 30 DEG

MATERIAL COND: QUENCH & TEMPER — O.D.: 6.625(168.275) in (mm) — WALL: 0.562 (14.274) in (mm)

PRODUCT IDENTIFICATION	TEST TYPE/ ORIENTATION	TEST COND.	GAUGE WIDTH IN	YIELD PSI (MIN: 65,000; MAX:)	EXT % .50	TENSILE PSI (MIN: 77,000; MAX:)	Y/T (MAX:)	ELONG % (IN 2") MIN: 23.5	HARDNESS SCALE: MIN: MAX:	MIN HYDRO PSI	DWELL (SEC)
										8270	5
→ U43341	STRIP/L/B	HT	1.5	73,000	.50	86,200	0.85	40.6		8270	5
→ X43493	STRIP/L/B	HT	1.5	67,300	.50	84,200	0.80	43.6		8270	5

** 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				C.E.*
U43341	HEAT		15	107	008	006	22	03	01	02	14	023	01	04		001	003					
U43341	PROD		16	109	008	006	23	02	01	03	13	026	01	04		002	000					
U43341	PROD		15	109	008	005	23	03	01	02	13	025	01	04		002	000					
X43493	HEAT		14	110	010	006	22	01	00	05	13	021	01	03		002	001					
X43493	PROD		16	112	009	006	23	01	00	05	13	022	01	03		001	001					
X43493	PROD		15	111	010	007	23	02	01	02	13	020	01	03		003	001					

** END OF DATA THIS SHEET **

*C.E. IS BASED ON THE FOLLOWING EQUATION(S):

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

565201001 K1506B01 1885460368

CAA 3-0-0 PAGE

CERTIFIED TEST REPORT

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

MILL ORDER/ITEM NO.	SHIPPERS NO.	P.O. NUMBER	
DS38541 02	Y07717	S13-80018	INVOICE NO 0467404

MATERIAL COND.: QUENCH & TEMPER | O.D.: 6.625(168.275) In (mm) | WALL: 0.562 (14.274) 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	2	3	AVG	% SHEAR 1	2	3	AVG
							DEG										

** 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	X	OD ____ OD/ID X L X L/T ____
END AREA INSPECTION (PLAIN END)	X	MPI X UT ____
SPECIAL END AREA (SEA) INSP.		MPI ____ UT ____
FULL LENGTH DRIFT		DRIFT MANDREL SIZE:

ADDITIONAL NOTES/COMMENTS

ALL MELTING AND MANUFACTURING TOOK PLACE IN THE USA.
MANUFACTURED IN AN ISO 9001 CERTIFIED FACILITY - CERTIFICATE #30727.
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.
01 MILL

** END OF DATA **

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: J. N. ZGONC - MANAGER, Q.A.

DATE 04/27/98

U. S TEEL GROUP
A division of USX Corporation

TUBULAR PR CTS
CERTIFIED TES EPORT
(TYPE B - IN ACCORDANCE WITH ISO 10474 / EN10204 / DIN50049)

TIME: 15:39 USX™

MILL ORDER / ITEM NO.	SHIPPERS NO.	P.O. NUMBER	VEHICLE I.D.	
DS38641 02	Y07717	S13-80018		INVOICE NO 0467404

SOLD TO ADDRESS	MAIL TO ADDRESS	VENDOR
CONSOLIDATED PIPE & SUPPLY CO INC P O BOX 2472 BIRMINGHAM AL 32501-2472	CONSOLIDATED PIPE & SUPPLY CO INC P O BOX 2472 BIRMINGHAM AL 32801-2472	USS TUBULAR PRODUCTS USS FAIRFIELD WORKS P.O. BOX 599 FAIRFIELD ALABAMA 35064

SPECIFICATION AND GRADE

PIPE HIGH STRENGTH LOW ALLOY SMLS LINE PIPE API 5L-*41ST EDITION DTD 4/1/95 GRADE X65 BLK BARE PE BEV 30 DEG

MATERIAL COND: QUENCH & TEMPER

O.D.: 6.625 (168.275) In (mm)

WALL: 0.562 (14.274) In (mm)

PRODUCT IDENTIFICATION	TEST TYPE/ ORIENTATION	TEST COND.	GAUGE WIDTH	YIELD	EXT %	TENSILE	Y/T	ELONG %	HARDNESS	MIN HYDRO	DWELL (SEC)
			IN	PSI MIN: 65,000 MAX:	.50	PSI MIN: 77,000 MAX:	MAX:	(IN 2") MIN: 23.6	SCALE: MIN: MAX:	PSI 8270	5
U41124	STRIP/L/B	HT	1.5	71,500	.50	84,700	0.84	42.0		8270	5
X43626	STRIP/L/B	HT	1.5	67,700	.50	84,700	0.80	44.8		8270	5

** END OF DATA THIS SHEET **

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

PRODUCT IDENTIFICATION	TYPE		C	MN	P	S	SI	CU	NI	CR	MO	AL	N	V	B	TI	CB	CO				C.E.*
U41124	HEAT		.15	1.10	012	006	.22	.01	.01	.03	.13	.021	01	.03	–	.002	.000					
U41124	PROD		.17	1.09	012	008	.23	.01	.01	.03	.14	.023	01	.03		.002	.001					
U41124	PROD		.16	1.09	011	007	.23	.01	.01	.03	.14	.023	01	.03		.001	.001					
X43626	HEAT		.16	1.09	012	006	.22	.01	.00	.06	.13	.023	00	.03		.002	.000					
X43626	PROD		.17	1.07	012	006	.22	.01	.00	.06	.14	.024	00	.03		.001	.001					
X43626	PROD		.17	1.08	012	007	.22	.01	.00	.07	.14	.026	00	.03		.001	.001					

** END OF DATA THIS SHEET **

*C.E. IS BASED ON THE FOLLOWING EQUATION(S):

U. S. STEEL GROUP
A division of USX Corporation

TUBULAR PRODUCTS
CERTIFIED TEST REPORT
(TYPE B - IN ACCORDANCE WITH ISO 10474 / EN10204 / DIN50049)

TIME: 15:39:34 USX™
USS, USX, USX are trademarks of USX Corporation

MILL ORDER / ITEM NO.	SHIPPERS NO.	P.O. NUMBER	
DS38541 02	Y07717	S13-80018	INVOICE NO 0467404

MATERIAL COND:	O.D.: in (mm)	WALL: in (mm)
QUENCH & TEMPER	6.625 (168.275)	0.562 (14.274)

PRODUCT IDENTIFICATION	FLAT	BEND	GRAIN SIZE	MIN COLLAPSE	CHARPY V-NOTCH IMPACT TESTING												
					DIR	TEST LOC.	TEMP	SIZE	TEST COND.	FT-LBS				% SHEAR			
							DEG			1	2	3	AVG	1	2	3	AVG
			** 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	X	OD ___ OD / ID _X_ L _X_ L / T ___
END AREA INSPECTION (PLAIN END)	X	MPI _X_ UT ___
SPECIAL END AREA (SEA) INSP.		MPI ___ UT ___
FULL LENGTH DRIFT		DRIFT MANDREL SIZE:

ADDITIONAL NOTES / COMMENTS

ALL MELTING AND MANUFACTURING TOOK PLACE IN THE USA.
MANUFACTURED IN AN ISO 9001 CERTIFIED FACILITY - CERTIFICATE #30727.
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.
01 MILL

** END OF DATA **

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: J. N. ZGONC - MANAGER, Q.A.

DATE 04/28/98

TUBULAR PRODUCTS
CERTIFIED TEST REPORT
(TYPE B - IN ACCORDANCE WITH ISO 10474/EN10204/DIN50049)

TIME: 15:51:34 USX™

MILL ORDER/ITEM NO.	SHIPPERS NO.	P.O. NUMBER	VEHICLE I.D.	
DS38021 04	Y07717	S13-71370		INVOICE NO 0467402

SOLD TO ADDRESS	MAIL TO ADDRESS	VENDOR
CONSOLIDATED PIPE & SUPPLY CO INC P O BOX 2472 BIRMINGHAM AL 32501-2472	CONSOLIDATED PIPE & SUPPLY CO INC P O BOX 2472 BIRMINGHAM AL 32501-2472	USS TUBULAR PRODUCTS USS FAIRFIELD WORKS P.O. BOX 599 FAIRFIELD ALABAMA 35064

SPECIFICATION AND GRADE

PIPE CARBON SMLS LINE PIPE API 5L-41ST EDITION DTD 4/1/95 GRADE X52 BLK BARE PE BEV 30 DEG

MATERIAL COND: AS-ROLLED | O.D.: 6.625(168.275) in (mm) | WALL: 0.562 (14.274) in (mm)

PRODUCT IDENTIFICATION	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: 52,000 MAX:		MIN: 66,000 MAX:	MAX:	MIN: 27.0	MIN: MAX:	6620	5
B46551	STRIP/L/B	AR	1.5	63,100	.50	89,400	0.71	39.7		6620	5
C46120	STRIP/L/B	HT	1.5	74,500	.50	87,200	0.85	43.2		6620	5

** 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				C.E.*
B46551	HEAT		23	1:19	006	008	23	02	01	04	12	030	00	04		002	001					
B46551	PROD		26	1:17	006	008	22	02	01	04	13	027	00	04		002	001					
C46120	HEAT		15	1:11	010	007	23	02	01	02	13	022	01	03		003	001					
C46120	PROD		16	1:10	010	007	22	02	01	03	13	022	01	03		003	000					

** END OF DATA THIS SHEET **

*C.E. IS BASED ON THE FOLLOWING EQUATION(S):

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

U.S. STEEL GROUP
A 'ISION OF USX CORPORATION

TUBULAR PRODUCTS
CERTIFIED TE REPORT
(TYPE B - IN ACCORDANCE WITH ISO 1..4/EN10204/DIN50049)

TIME: 15:56:51 USX™

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MILL ORDER/ITEM NO.	SHIPPERS NO.	P.O. NUMBER	
DS38021 04	Y07717	S13-71370	INVOICE NO 0467402

MATERIAL COND: AS-ROLLED | O.D.: 6.625(168.275) in (mm) | WALL: 0.562 (14.274) 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	2	3	AVG	% SHEAR 1	2	3	AVG
							DEG										
			** 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	X	OD ____ OD/ID X L X L/T ____
END AREA INSPECTION (PLAIN END)	X	MPI X UT ____
SPECIAL END AREA (SEA) INSP.		MPI ____ UT ____
FULL LENGTH DRIFT		DRIFT MANDREL SIZE:

ADDITIONAL NOTES/COMMENTS

ALL MELTING AND MANUFACTURING TOOK PLACE IN THE USA.
MANUFACTURED IN AN ISO 9001 CERTIFIED FACILITY - CERTIFICATE #30727.
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.
01 MILL

** END OF DATA **

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: J. N. ZGONC - MANAGER, Q.A.

DATE 04/27/98

Consolidated

PIPE & SUPPLY COMPANY

PIPE SHIPPING TALLY

PAGE

SALES ORDER 1389212-001

CUSTOMER ORDER NO.

COLLECT or PREPAID

DATE SHIPPED

CARRIER NAME AC Carr.

VEHICLE I.D. 1006

DATE LOADED 11-18-98

TALLIED BY Marv Harry Dong

CHECKED BY

SOLD TO

SHIP TO CPS Dora

DESCRIPTION	DESCRIPTION	DESCRIPTION	DESCRIPTION	DESCRIPTION	DESCRIPTION
O.D. 6 5/8"	O.D.	O.D.	O.D.	O.D.	O.D.
WALL .562	WALL	WALL	WALL	WALL	WALL
SPEC. X-65	SPEC.	SPEC.	SPEC.	SPEC.	SPEC.
WEIGHT	WEIGHT 26,514	WEIGHT	WEIGHT	WEIGHT	WEIGHT
NO. of PCS. 18	NO. of PCS.	NO. of PCS.	NO. of PCS.	NO. of PCS.	NO. of PCS.
PRODUCT NUMBER 696320	PRODUCT NUMBER	PRODUCT NUMBER	PRODUCT NUMBER	PRODUCT NUMBER	PRODUCT NUMBER
YARD LOCATION #2	YARD LOCATION	YARD LOCATION	YARD LOCATION	YARD LOCATION	YARD LOCATION

NO.	LENGTH	NO.	LENGTH	NO.	LENGTH	NO.	LENGTH	NO.	LENGTH	NO.	LENGTH
1	19-8	21		41		61		81		101	
2	40-7	22	X43493	42		62		82		102	
3	40-8	23	U43341	43	Heat	63		83		103	
4	40-9	24	U41124	44		64		84		104	
5	40-9	25		45	#'s	65		85		105	
6	40-1	26		46		66		86		106	
7	38-2	27		47		67		87		107	
8	39-6	28		48		68		88		108	
9	40-6	29		49		69		89		109	
10	35-3	30		50		70		90		110	
11	40-8	31		51		71		91		111	
12	40-5	32		52		72		92		112	
13	40-9	33		53		73		93		113	
14	37-8	34		54		74		94		114	
15	39-7	35		55		75		95		115	
16	40-7	36		56		76		96		116	
17	40-0	37		57		77		97		117	
~~18~~	40-3	38		58		78		98		118	
19		39		59		79		99		119	
20		40		60		80		100		120	
Footage This Column 728.6		Footage This Column		Footage This Column		Footage This Column		Footage This Column		Footage This Column	

Consolidated

PIPE & SUPPLY COMPANY

PIPE SHIPPING TALLY

CPS ORDER: 1389212

CUSTOMER ORDER NO.:

COLLECT or PREPAID:

DATE SHIPPED:

CARRIER NAME: AC Carriers

VEHICLE I.D.:

DATE LOADED: 11-18-98

TALLIED BY: Marvin

CHECKED BY:

SOLD TO:

SHIP TO: CPS Dora

	DESCRIPTION	DESCRIPTION	DESCRIPTION	DESCRIPTION	DESCRIPTION	DESCRIPTION
O.D.	6 5/8"	Same				
WALL	.562					
SPEC.						
WEIGHT		45,124				
NO. of PCS.	33					
PRODUCT NUMBER	696318	696318				
YARD LOCATION	#2	#2				

NO.	LENGTH	NO.	LENGTH	NO.	LENGTH	NO.	LENGTH	NO.	LENGTH	NO.	LENGTH
1	38-8	21	43-5	41	HtH	61		81		101	
2	36-9	22	43-0	42	[illegible]	62		82		102	
3	36-6	23	36-3	43	C46919	63		83	Heat	103	
4	38-5	24	37-7	44	J834242	64		84		104	
5	38-1	25	31-9	45	C46155	65		85	#'s	105	
6	38-0	26	37-9	46	A41027	66		86		106	
7	43-3	27	35-3	47	B46551	67		87		107	
8	39-8	28	39-5	48		68		88		108	
9	43-5	29	37-0	49		69		89		109	
10	39-7	30	37.4	50		70		90		110	
11	37-7	31	20-5	51		71		91		111	
12	36-6	32	38-4	52		72		92		112	
13	36-5	33	37-9	53	Total	73		93		113	
14	36-9	34		54		74		94		114	
15	37-1	35		55		75		95		115	
16	37-2	36		56	1,240.0	76		96		116	
17	36-7	37		57		77		97		117	
18	37-7	38		58		78		98		118	
19	36-8	39		59		79		99		119	
20	37-3	40		60		80		100		120	
Footage This Column	763.7	Footage This Column	476.3	Footage This Column		Footage This Column		Footage This Column		Footage This Column	

Appendix D

Cement Records
CW-1

MONTGOMERY WATSON

CW-1 CEMENTING RECORD

CITY OF SUNRISE   SAWGRASS CONCENTRATE WELL NO. 1

JOB NUMBER ____________

CONTRACTOR: Youngquist Brothers, Inc.

BID ITEM: 1.06

CASING SIZE: 54"

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	FOOTAGE	TAG DEPTH PAD LEVEL	ACTUAL FILL INTERVAL	FOOTAGE	PERCENT FILLED J/G x 100	CUMULATIVE TOTAL (FT³)	INSPECTOR'S INITIALS
8/26/98	1	Neat	1.18	1083	195 - 83	112	73	195 - 73	122	109	1083	TGU
8/27/98	2	Neat	1.18	516	73 - 0	73	0	73 - 0	73	100	1599	TGU

MONTGOMERY WATSON

CW-1 CEMENTING RECORD

CITY OF SUNRISE SAWGRASS CONCENTRATE WELL NO. 1

JOB NUMBER 1324024.26470100

CONTRACTOR: Youngquist Brothers, Inc.

BID ITEM: 1.11

CASING SIZE: 44"

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
9/5/98	1	12% Gel	2.2	3,085	0 - 780	780	0	0 - 1,030	1,030	100	3,085	NAJ
		Neat	1.18	1,100	780 - 1,030	250					4,185	NAJ

WRTC_CEMENTING RECORD (REV 4/16/97)

MONTGOMERY WATSON

CW-1 CEMENTING RECORD

CITY OF SUNRISE   SAWGRASS CONCENTRATE WELL NO. 1

JOB NUMBER 1324024.26470100

CONTRACTOR: Youngquist Brothers, Inc.

BID ITEM: 1.23

CASING SIZE: 34"

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 (FT^3/SK)	QUANTITY PUMPED (FT^3)	THEORETICAL FILL INTERVAL	THEORETICAL FILL FOOTAGE	TAG DEPTH PAD LEVEL	ACTUAL FILL INTERVAL	ACTUAL FILL FOOTAGE	PERCENT FILLED J/G x 100	CUMULATIVE TOTAL (FT^3)	INSPECTOR'S INITIALS
10/4/98	1	12% Gel	2.2	1,907	1472-1770	298					1,907	JTS
10/4/98	1	Neat	1.18	1,459	1770-2027	257	1,652	2027-1652	375	67.6%	3,366	JTS
10/5/98	2	12% Gel	2.2	3,091	1652-1155	497	1,400	1652-1400	252	50.7%	6,457	NAJ
10/5/98	3	12% Gel	2.2	3,130	1400-893	507	1,065	1400-1065	335	66.1%	9,587	NAJ/JM
10/6/98	4	12% Gel	2.2	2,536	1065-452	613	450	1065-450	615	100.3%	12,123	NAJ/JM
10/6/98	5	12% Gel	2.2	1,739	450-0	450	0	450-0	450	100.0%	13,862	TGU

MONTGOMERY WATSON

CW-1 CEMENTING RECORD

CITY OF SUNRISE   SAWGRASS CONCENTRATE WELL NO. 1

JOB NUMBER 1324024.26470100

CONTRACTOR: Youngquist Brothers, Inc.

BID ITEM: 1.33

CASING SIZE: 24"

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
11/9/98	1	Neat	1.18	1,419	3055-2732	323	2,883	3055-2883	172	53.3%	1,419	JM
11/10/98	2	Neat	1.18	712	2883-2683	200	2,786	2883-2786	97	48.5%	2,131	TGU
11/10/98	3	12% Gel	2.2	2,250	2786-2086	700	2,408	2786-2408	378	54.0%	4,381	JM
11/10/98	4	12% Gel	2.2	1,964	2408-1887	521	2,066	2408-2066	342	65.6%	6,345	TGU
11/11/98	5	12% Gel	2.2	1,683	2066-1536	530	1,662	2066-1662	404	76.2%	8,028	JM
11/11/98	6	12%Gel	2.2	2,036	1662-958	704	962	1662-962	700	99.4%	10,064	JM/TGU
11/12/98	7	12%Gel	2.2	2076	962-244	718	238	962-238	724	100.8%	12,140	JM
11/15/98	8	12%Gel	2.2	684	238-0	238	0	238-0	238	100.0%	12,824	TGU

Cement Records
DZMW-1

MONTGOMERY WATSON

DZMW-1 CEMENTING RECORD

CITY OF SUNRISE   SAWGRASS CONCENTRATE WELL NO. 1

JOB NUMBER 1324024.26470100

CONTRACTOR: Youngquist Brothers, Inc.

BID ITEM: 2.06

CASING SIZE: 20"

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 (FT^3/SK)	QUANTITY PUMPED (FT^3)	THEORETICAL FILL INTERVAL	THEORETICAL FILL FOOTAGE	TAG DEPTH PAD LEVEL	ACTUAL FILL INTERVAL	ACTUAL FILL FOOTAGE	PERCENT FILLED J/G x 100	CUMULATIVE TOTAL (FT^3)	INSPECTOR'S INITIALS
11/25/98	1	Neat	1.18	943	200 - 0	200	0	200 - 0	200	100	943	TGU

WRTC_CEMENTING RECORD (REV 4/16/97)

MONTGOMERY WATSON

DZMW-1 CEMENTING RECORD

CITY OF SUNRISE **SAWGRASS CONCENTRATE WELL NO. 1**

JOB NUMBER 1324024.26470100

CONTRACTOR: Youngquist Brothers, Inc.

BID ITEM: 2.12

CASING SIZE: 14"

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 (FT^3/SK)	QUANTITY PUMPED (FT^3)	THEORETICAL FILL INTERVAL	FOOTAGE	TAG DEPTH PAD LEVEL	ACTUAL FILL INTERVAL	FOOTAGE	PERCENT FILLED J/G x 100	CUMULATIVE TOTAL (FT^3)	INSPECTOR'S INITIALS
12/1/98	1	12% Gel	2.2	785	1622-667	955					785	MRS
12/1/98	1	Neat	1.18	426	667-325	342	257	1622-257	1365	105.2%	1,211	MRS
12/2/98	2	12% Gel	2.2	460	257-		0	257-0	257	#DIV/0!	1,671	NAJ

MONTGOMERY WATSON

DZMW-1 CEMENTING RECORD

CITY OF SUNRISE SAWGRASS CONCENTRATE WELL NO. 1

JOB NUMBER 1324024.26470100

CONTRACTOR: Youngquist Brothers, Inc.

BID ITEM: 2.18

CASING SIZE: 6 5/8"

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
12/7/98	1	Neat	1.18	6	1949-1943	6	1948+	1949-1948	1	16.7%	6	MRS
12/8/98	2	Neat	1.18	6	1948-1942	6	1,942	1948-1942	6	100.0%	11	TGU
12/8/98	3	Neat	1.18	168	1942-1740	202	1,780	1942-1780	162	80.2%	179	TGU
	4	Neat	1.18	73	1780-1692	88	1,690	1780-1690	90	102.3%	252	TGU

Appendix E

MONTGOMERY WATSON

Packer Test Water Quality
CW-1

INTAKE #: 517105

Sanders Laboratories
Environmental Testing Services

Project Name:	Sawgrass/Straddle Packer Test
Project Location:	CW-1 2060-2090
Job ID:	
Sample Supply:	Ground Water
Collector:	Troy Moore
Sample Received Date/Time:	9/16/98 10:45

Date: *21-Sep-98*

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

RECEIVED MAR 2 3 1999

Lab ID **Sample ID** **Type** **Sample Date/Time**

Analysis	Method	Result	D. L.	Unit	Analysis Date/Time	LabID:
N986224 CW-1 RAW 9/16/98 8:26						
Chloride	SM4500 Cl-B	15,120	5	mg/L	9/18/98	E84380
Conductivity	EPA 120.1	45,250	1	umhos/cm	9/16/98	E84380
Sulfate	EPA 375.4	2,656	5	mg/L	9/18/98	E84380
Total Dissolved Solids	EPA 160.1	22,800	7	mg/L	9/18/98	E84380
pH	EPA 150.1	7.39	n/a	std unit	9/16/98	E84380
Magnesium	EPA 242.1	808	0.0008	mg/L	9/18/98	E84380
Temperature	EPA 170.1	29.0	0.1	°C	9/16/98	E84380
Bicarbonate	4500-CO2-D	130		mg/L	9/18/98	E84380
Calcium	EPA 215.1	274	0.022	mg/L	9/18/98	E84380
Potassium	EPA 258.1	727	0.003	mg/L	9/18/98	E84380
Sodium	EPA 273.1	7,327	0.003	mg/L	9/18/98	E84380
Nitrogen, Total	EPA 351.2/353.2	0.48		mg/L	9/18/98	E84380
Ammonia-N	EPA350.3	<0.05	0.05	mg/L	9/18/98	E84380
Nitrogen, Total Kjeldahl	EPA 351.2	0.48	0.2	mg/L	9/18/98	E84380
Phosphorus, Total	EPA 365.2	0.03	0.02	mg/L	9/18/98	E84380

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

Rpt form #7; Rev 1/1/96

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

Lab ID	Sample ID	Type	Sample Date/Time

Analysis	Method	Result	D. L.	Unit	Analysis Date/Time	LabID:

Comments:

Approved by:

Debra A. Sanders

Debra Sanders
Laboratory Director

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

INTAKE #: 517194

Sanders Laboratories
Environmental Testing Services

Project Name:	Sunrise CW-1
Project Location:	1620-1700
Job ID:	0
Sample Supply:	Ground Water
Collector:	Troy Moore
Sample Received Date/Time:	9/21/98 9:00

Date: *28-Sep-98*

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

Lab ID **Sample ID** **Type** **Sample Date/Time**

Analysis	Method	Result	D. L.	Unit	Analysis Date/Time	LabID:
N986319 packer RAW 9/20/98 18:30						
Chloride	SM4500 Cl-B	1,750	5	mg/L	9/23/98	E84380
Conductivity	EPA 120.1	6,120	1	umhos/cm	9/22/98	E84380
Sulfate	EPA 375.4	656	5	mg/L	9/23/98	E84380
Total Dissolved Solids	EPA 160.1	3,580	7	mg/L	9/24/98	E84380
pH	EPA 150.1	7.18	n/a	std unit	9/23/98	E84380
Magnesium	EPA 242.1	103	0.0008	mg/L	9/22/98	E84380
Temperature	EPA 170.1	27.2	0.1	°C	9/21/98	E84380
Bicarbonate	4500-CO2-D	94.1		mg/L	9/23/98	E84380
Calcium	EPA 215.1	46.0	0.022	mg/L	9/22/98	E84380
Potassium	EPA 258.1	59.5	0.003	mg/L	9/23/98	E84380
Sodium	EPA 273.1	653	0.003	mg/L	9/22/98	E84380
Nitrogen, Total	EPA 351.2/353.2	0.67		mg/L	9/24/98	E84380
Ammonia-N	EPA350.3	0.18	0.05	mg/L	9/24/98	E84380
Nitrogen, Total Kjeldahl	EPA 351.2	0.52	0.2	mg/L	9/22/98	E84380
Phosphorus, Total	EPA 365.2	<0.02	0.02	mg/L	9/23/98	E84380

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

Rpt form #7; Rev 1/1/96

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Lab ID	Sample ID	Type	Sample Date/Time

Analysis	Method	Result	D. L.	Unit	Analysis Date/Time	LabID:

Comments:

Approved by:

Debra A. Sanders

Debra Sanders
Laboratory Director

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

Sanders Laboratories
Environmental Testing Services

INTAKE #: 517193

Date: *28-Sep-98*

Project Name:	Sunrise CW-1
Project Location:	1780-1812
Job ID:	0
Sample Supply:	Ground Water
Collector:	Troy Moore
Sample Received Date/Time:	9/21/98 9:00

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

Lab ID **Sample ID** **Type** **Sample Date/Time**

Analysis	Method	Result	D. L.	Unit	Analysis Date/Time	LabID:
N986318 packer RAW 9/19/98 6:15						
Chloride	SM4500 Cl-B	2,399	5	mg/L	9/23/98	E84380
Conductivity	EPA 120.1	7,545	1	umhos/cm	9/22/98	E84380
Sulfate	EPA 375.4	637	5	mg/L	9/23/98	E84380
Total Dissolved Solids	EPA 160.1	3,960	7	mg/L	9/24/98	E84380
pH	EPA 150.1	6.66	n/a	std unit	9/23/98	E84380
Magnesium	EPA 242.1	173	0.0008	mg/L	9/22/98	E84380
Temperature	EPA 170.1	27.0	0.1	°C	9/21/98	E84380
Bicarbonate	4500-CO2-D	102		mg/L	9/23/98	E84380
Calcium	EPA 215.1	67.6	0.022	mg/L	9/23/98	E84380
Potassium	EPA 258.1	85.1	0.003	mg/L	9/23/98	E84380
Sodium	EPA 273.1	928	0.003	mg/L	9/24/98	E84380
Nitrogen, Total	EPA 351.2/353.2	1.09		mg/L	9/24/98	E84380
Ammonia-N	EPA350.3	0.20	0.05	mg/L	9/24/98	E84380
Nitrogen, Total Kjeldahl	EPA 351.2	0.49	0.2	mg/L	9/22/98	E84380
Phosphorus, Total	EPA 365.2	0.02	0.02	mg/L	9/23/98	E84380

RECEIVED OCT - 5 1998

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

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Lab ID	Sample ID	Type	Sample Date/Time

Analysis	Method	Result	D. L.	Unit	Analysis Date/Time	LabID:

Approved by:

Comments:

Debra A. Sanders

Debra Sanders
Laboratory Director

Sanders Laboratories
Environmental Testing Services

CHAIN-OF-CUSTODY RECORD

INTAKE FORM # 517193 ~~517194~~

Page 1 of 1

Client (Sunrise CW-1) Youngquist
Address
Phone Fax

Report To: Troy Moore
Bill To:
P.O. #
Project Name Sunrise CW-1
Project Location:

Sample Supply: GW
Customer Type:
Field Report #:
Kit # 9-25-98
REQUESTED DUE DATE: ~~9-23-98~~

Sampled By (PRINT) Troy Moore
Sampler Signature

ITEM #	SAMPLE DESCRIPTION / LOCATION	JOB #	Sample DATE	TIME	TYPE	NO. OF CONTAINERS	UNPRESERVED	H_2SO_4	HNO_3	HCL	TDS, Cl, SO4, Bicarb	NH3, TKN, TP, TN	Na, K, Mg	LAB NUMBER
1	Sunrise CW-1 1780-1812		9-19-98	0615		3	X	X	X		X	X	X	N98 6318
2	" " 1620-1700		9-20-98	1830		3	X	X	X		X	X	X	6319

OUT / DATE	SHIPMENT METHOD RETURNED / DATE	VIA

ITEM #	RELINQUISHED BY / AFFILIATION	DATE	TIME	ACCEPTED BY / AFFILIATION	DATE	TIME
	[signature]	9-21-98	0900	[signature]	9-21-98	0900

COOLER #

COMMENTS:
6014BB
410L

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

INTAKE #: 517176

Sanders Laboratories
Environmental Testing Services

Project Name:	Sawgrass/Straddle Packer Test
Project Location:	CW-1 1920-1980
Job ID:	
Sample Supply:	Ground Water
Collector:	Troy Moore
Sample Received Date/Time:	9/18/98 11:00

Date: *24-Sep-98*

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

Lab ID	Sample ID	Type	Sample Date/Time				
Analysis	**Method**	**Result**	**D. L.**	**Unit**	**Analysis Date/Time**	**LabID:**	
N986302	**1950-1980**	**RAW**	**9/17/98 8:22**				
Chloride	SM4500 Cl-B	8,847	5	mg/L	9/23/98	E84380	
Conductivity	EPA 120.1	18,320	1	umhos/cm	9/22/98	E84380	
Sulfate	EPA 375.4	939	5	mg/L	9/23/98	E84380	
Total Dissolved Solids	EPA 160.1	11,300	7	mg/L	9/22/98	E84380	
pH	EPA 150.1	7.45	n/a	std unit	9/23/98	E84380	
Magnesium	EPA 242.1	408	0.0008	mg/L	9/22/98	E84380	
Temperature	EPA 170.1	28.5	0.1	°C	9/18/98	E84380	
Bicarbonate	4500-CO2-D	170		mg/L	9/23/98	E84380	
Calcium	EPA 215.1	141	0.022	mg/L	9/23/98	E84380	
Potassium	EPA 258.1	271	0.003	mg/L	9/23/98	E84380	
Sodium	EPA 273.1	4,247	0.003	mg/L	9/22/98	E84380	
Nitrogen, Total	EPA 351.2/353.2	6.00		mg/L	9/23/98	E84380	
Ammonia-N	EPA350.3	4.64	0.05	mg/L	9/18/98	E84380	
Nitrogen, Total Kjeldahl	EPA 351.2	5.73	0.2	mg/L	9/23/98	E84380	
Phosphorus, Total	EPA 365.2	0.02	0.02	mg/L	9/18/98	E84380	
N986303	**1920-1950**	**RAW**	**9/18/98 6:15**				
Chloride	SM4500 Cl-B	7,698	5	mg/L	9/23/98	E84380	
Conductivity	EPA 120.1	17,040	1	umhos/cm	9/22/98	E84380	
Sulfate	EPA 375.4	533	5	mg/L	9/23/98	E84380	
Total Dissolved Solids	EPA 160.1	10,533	7	mg/L	9/22/98	E84380	
pH	EPA 150.1	7.44	n/a	std unit	9/23/98	E84380	

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

Rpt form #7; Rev 1/1/96

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Lab ID	Sample ID	Type	Sample Date/Time

Analysis	Method	Result	D. L.	Unit	Analysis Date/Time	LabID:
Magnesium	EPA 242.1	380	0.0008	mg/L	9/22/98	E84380
Temperature	EPA 170.1	28.5	0.1	°C	9/18/98	E84380
Bicarbonate	4500-CO2-D	104		mg/L	9/23/98	E84380
Calcium	EPA 215.1	182	0.022	mg/L	9/23/98	E84380
Potassium	EPA 258.1	159	0.003	mg/L	9/23/98	E84380
Sodium	EPA 273.1	3,702	0.003	mg/L	9/22/98	E84380
Nitrogen, Total	EPA 351.2/353.2	1.30		mg/L	9/23/98	E84380
Ammonia-N	EPA350.3	0.90	0.05	mg/L	9/18/98	E84380
Nitrogen, Total Kjeldahl	EPA 351.2	1.20	0.2	mg/L	9/22/98	E84380
Phosphorus, Total	EPA 365.2	0.04	0.02	mg/L	9/18/98	E84380

Approved by:

Debra A. Sanders

Debra Sanders
Laboratory Director

Comments:

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

Sanders Laboratories
Environmental Testing Services

CHAIN-OF-CUSTODY RECORD

INTAKE FORM # 517 176

Page 1 of 1

Client: Youngquist
Address:
Phone: Fax:

Report To: Troy Moore
Bill To:
P.O. #
Project Name: Sunrise CW-1
Project Location:

Sample Supply: GW
Customer Type:
Field Report #:
Kit #: 9/23/98
REQUESTED DUE DATE: ~~10-2-98~~

Sampled By (PRINT): Troy Moore
Sampler Signature: [signature]

ITEM #	SAMPLE DESCRIPTION / LOCATION	JOB #	Sample DATE	Sample TIME	Sample TYPE	NO. OF CONTAINERS	UNPRESERVED	H_2SO_4	HNO_3	HCL	TDS, Cl, SO4	Bicarb, Na	K, Mg, NH3	TKN, TP, TN	LAB NUMBER
1	CW-1 1950-1980		9/17	0822	G	4	X	X	X		X	X	X	X	98 4302
2	CW-1 1920-1950		9/18	0615	G	4	X	X	X		X	X	X	X	6303

OUT / DATE	SHIPMENT METHOD RETURNED / DATE	VIA

COOLER #

COMMENTS:
6014BB
410 K, L

ITEM #	RELINQUISHED BY / AFFILIATION	DATE	TIME	ACCEPTED BY / AFFILIATION	DATE	TIME
	[signature]	9/18	0640	[signature]	9/18	0640
	[signature]	9/18	1100		9/18	1100

INTAKE #: 518030

Sanders Laboratories
Environmental Testing Services

Project Name:	Sunrise/Straddle Packer Tests
Project Location:	CW-1 2320.31-2344.48
Job ID:	
Sample Supply:	Ground Water
Collector:	Client
Sample Received Date/Time:	10/19/98 16:10

Date: *21-Oct-98*

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

Lab ID **Sample ID** **Type** **Sample Date/Time**

Analysis	Method	Result	D. L.	Unit	Analysis Date/Time	LabID:
N987118 CW-1 RAW						
Chloride	SM4500 Cl-B	21,115	5	mg/L	10/20/98	E84380
Conductivity	EPA 120.1	36,200	1	umhos/cm	10/20/98	E84380
Sulfate	EPA 375.4	2,679	5	mg/L	10/20/98	E84380
Total Dissolved Solids	EPA 160.1	25,950	7	mg/L	10/19/98	E84380
pH	EPA 150.1	7.32	n/a	std unit	10/20/98	E84380
Magnesium	EPA 242.1	1,449	0.0008	mg/L	10/20/98	E84380
Temperature	EPA 170.1	23.0	0.1	°C	10/19/98	E84380
Bicarbonate	4500-CO2-D	110		mg/L	10/19/98	E84380
Calcium	EPA 215.1	273	0.022	mg/L	10/20/98	E84380
Potassium	EPA 258.1	963	0.003	mg/L	10/20/98	E84380
Sodium	EPA 273.1	10,862	0.003	mg/L	10/20/98	E84380
Nitrogen, Total	EPA 351.2/353.2	0.64		mg/L	10/20/98	E84380
Ammonia-N	EPA350.3	0.10	0.05	mg/L	10/20/98	E84380
Nitrogen, Total Kjeldahl	EPA 351.2	0.64	0.2	mg/L	10/20/98	E84380
Phosphorus, Total	EPA 365.2	<0.02	0.02	mg/L	10/20/98	E84380

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

Rpt form #7; Rev 1/1/96

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Lab ID	Sample ID	Type	Sample Date/Time

Analysis	Method	Result	D. L.	Unit	Analysis Date/Time	LabID:

Comments:

Approved by:

Debra A. Sanders

Debra Sanders
Laboratory Director

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

Sanders Laboratories
Environmental Testing Services

CHAIN-OF-CUSTODY RECORD

INTAKE FORM # 51803

Page_____ of _____

Client: Youngquist Bros., INC.
Address: 15465 Pine Ridge Rd.
Ft. Myers, Fl. 33908
Phone: (941) 489-4444 Fax: (941) 489-4545

Report To: Troy Moore Fax (954) 845-0944
Bill To:
P.O. #:
Project Name: Sunrise CW-1
Project Location:

Sample Supply:
Customer Type:
Field Report #:
Kit #:
REQUESTED DUE DATE: 10-20-98

Sampled By (PRINT): Client
Sampler Signature: Client

ITEM #	SAMPLE DESCRIPTION / LOCATION	JOB #	Sample DATE	Sample TIME	Sample TYPE	NO. OF CONTAINERS	UNPRESERVED	H_2SO_4	HNO_3	HCL		NH3, TKN, TP, TN	TDS, Cl, SO4	Bicarb + Ca	Na, K, Mg		pH Cond - Temp						LAB NUMBER
	CW-1 2320.31-2344.48											X	X	X	X								1498 7118

OUT / DATE	SHIPMENT METHOD RETURNED / DATE	VIA	ITEM #	RELINQUISHED BY / AFFILIATION	DATE	TIME	ACCEPTED BY / AFFILIATION	DATE	TIME
				[signature]	10/19/98	16:10	R. Moorey	10/19/98	16:10

COMMENTS:
410L
60/4CC

COOLER #

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

Injection Zone Water Quality
CW-1

INTAKE #: 518745

Sanders Laboratories
Environmental Testing Services

Date *10-Dec-98*

Project Name:	Youngquist/Sawgrass
Project Location:	
Sample Supply:	Ground Water
Collector:	Ray Burroughs
Sample Received Date/Time:	11/18/98 14:30

Youngquist Brothers, Inc.
15465 Pine Ridge Road

Fort Myers, FL 33908-

Inorganic Analysis
62-550.310(1)
PWS030

Parameter ID	Analysis	Sample ID	Result	Unit	Method	Analysis Date/Time	D. L.	LabID	Analyst
1005	Arsenic (0.05)	N987841	<0.0022	mg/L	EPA 206.2	11/23/98	0.0022	84352	ua
1010	Barium (2)	N987841	0.20	mg/L	EPA 208.2	12/2/98	0.20	84352	ua
1015	Cadmium (0.005)	N987841	<0.003	mg/L	EPA 213.1	12/1/98	0.003	84352	ua
1020	Chromium (0.1)	N987841	0.064	mg/L	EPA 218.1	12/1/98	0.020	84352	ua
1024	Cyanide (0.2)	N987841	<0.0050	mg/L	EPA 335.2	11/24/98	0.0050	83160	ua
25	Fluoride (4.0)	N987841	0.84	mg/L	EPA 340.2	12/1/98	0.2	84352	ua
1030	Lead (0.015)	N987841	<0.005	mg/L	EPA 239.2	11/19/98	0.005	84352	ua
1035	Mercury (0.002)	N987841	<0.002	mg/L	EPA 245.1	12/1/98	0.002	84352	ua
1036	Nickel (0.1)	N987841	0.398	mg/L	EPA 249.1	11/24/98	0.010	84352	ua
1040	Nitrate (10)	N987841	0.28	mg/L	EPA 353.2	11/25/98	0.01	84352	ua
1041	Nitrite (1)	N987841	<0.01	mg/L	EPA 354.1	11/19/98	0.01	84352	ua
1045	Selenium (0.05)	N987841	<0.020	mg/L	EPA 270.2	11/19/98	0.020	84352	ua
1052	Sodium (160)	N987841	10,865	mg/L	EPA 273.1	11/24/98	0.003	84352	ua
1074	Antimony (0.006)	N987841	<0.003	mg/L	EPA 204.2	12/1/98	0.003	83160	ua
1075	Beryllium (0.004)	N987841	<0.001	mg/L	EPA 6010	11/24/98	0.001	83160	ua
1085	Thallium (0.002)	N987841	<0.005	mg/L	EPA 279.2	12/4/98	0.005	83160	ua

Secondary Chemical Analysis
62-550.320
PWS031

Parameter ID	Analysis	Sample ID	Result	Unit	Method	Analysis Date/Time	D. L.	LabID	Analyst
1002	Aluminum (0.2)	N987841	0.30	mg/L	EPA 202.1	11/24/98	0.2	84352	ua
1017	Chloride (250)	N987841	21,490	mg/L	SM4500Cl-B	11/23/98	5	84352	ua
1022	Copper (1.0)	N987841	0.074	mg/L	EPA 220.1	12/1/98	0.01	84352	ua
1025	Fluoride (2.0)	N987841	0.84	mg/L	EPA 340.2	12/1/98	0.2	84352	ua
1028	Iron (0.3)	N987841	1.18	mg/L	EPA 236.1	12/2/98	0.015	84352	ua
'32	Manganese (0.05)	N987841	0.031	mg/L	EPA 243.1	12/2/98	0.005	84352	ua

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

Rpt form #5; Rev 1/1/96

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)	N987841	<0.01	mg/L	EPA 272.1	12/2/98	0.01	84352	ua
1055	Sulfate (250)	N987841	1,964	mg/L	EPA 375.4	11/20/98	5	84352	ua
[illegible]5	Zinc (5.0)	N987841	<0.005	mg/L	EPA 289.1	12/1/98	0.005	84352	ua
[illegible]5	Color (15.0)	N987841	37	PtCo units	EPA 110.3	11/24/98	1	84352	ua
1920	Odor (3.0)	N987841	3	TON	EPA 140.1	11/18/98	1	84352	ua
1925	pH (6.5-8.5)	N987841	7.69	std units	EPA 150.1	11/18/98	n/a	84352	ua
1930	Total Dissolved Solids (500)	N987841	27,400	mg/L	EPA 160.1	11/20/98	7	84352	ua
2905	Foaming Agents (1.5)	N987841	0.64	mg/L	EPA 425.1	11/20/98	0.10	83160	ua

Radiochemical Analysis

62-550.310(5)

PWS033

4000	Gross Alpha	N987841	5.6	pCi/L	EPA 900.0	11/27/98	+/-2.8	83141	ua
4020	Radium 226	N987841	2.4	pCi/L	EPA 903.1	12/1/98	+/-0.3	83141	ua
4030	Radium 228	N987841	<0.9	pCi/L	Brks/Blnchrd	12/1/98	+/-0.6	83141	ua

Trihalomethane Analysis

62-550.310(2)(a)

PWS027

2950	Total THM's (0.10)	N987841	<0.0005	mg/L	EPA 502.2	12/2/98	0.0005	83160	ua

Volatile Organic Analysis

62-550.310(2)(b)

PWS028

2378	1,2,4-Trichlorobenzene (70)	N987841	<0.50	ug/L	EPA 502.2	12/2/98	0.50	83160	ua
2380	Cis-1,2-Dichloroethylene (70)	N987841	<0.50	ug/L	EPA 502.2	12/2/98	0.50	83160	ua
2955	Xylenes (Total) (10,000)	N987841	<0.50	ug/L	EPA 502.2	12/2/98	0.50	83160	ua
2964	Dichloromethane (5)	N987841	<0.50	ug/L	EPA 502.2	12/2/98	0.50	83160	ua
2968	O-Dichlorobenzene (600)	N987841	<0.50	ug/L	EPA 502.2	12/2/98	0.50	83160	ua
2969	Para-Dichlorobenzene (75)	N987841	<0.50	ug/L	EPA 502.2	12/2/98	0.50	83160	ua
2976	Vinyl Chloride (1)	N987841	<0.50	ug/L	EPA 502.2	12/2/98	0.50	83160	ua
2977	1,1-Dichloroethylene (7)	N987841	<0.50	ug/L	EPA 502.2	12/2/98	0.50	83160	ua
2979	Trans-1,2-Dichloroethylene(100)	N987841	<0.50	ug/L	EPA 502.2	12/2/98	0.50	83160	ua
2980	1,2-Dichloroethane (3)	N987841	<0.50	ug/L	EPA 502.2	12/2/98	0.50	83160	ua
2981	1,1,1-Trichloroethane (200)	N987841	<0.50	ug/L	EPA 502.2	12/2/98	0.50	83160	ua
2982	Carbon Tetrachloride (3)	N987841	<0.50	ug/L	EPA 502.2	12/2/98	0.50	83160	ua
2983	1,2-Dichloropropane (5)	N987841	<0.50	ug/L	EPA 502.2	12/2/98	0.50	83160	ua
2984	Trichloroethylene (3)	N987841	<0.50	ug/L	EPA 502.2	12/2/98	0.50	83160	ua
2985	1,1,2-Trichloroethane (5)	N987841	<0.50	ug/L	EPA 502.2	12/2/98	0.50	83160	ua
2987	Tetrachloroethylene (3)	N987841	<0.50	ug/L	EPA 502.2	12/2/98	0.50	83160	ua
2989	Monochlorobenzene (100)	N987841	<0.50	ug/L	EPA 502.2	12/2/98	0.50	83160	ua
2990	Benzene (1)	N987841	<0.50	ug/L	EPA 502.2	12/2/98	0.50	83160	ua
2991	Toluene (1000)	N987841	<0.50	ug/L	EPA 502.2	12/2/98	0.50	83160	ua
2[illegible]	Ethylbenzene (700)	N987841	<0.50	ug/L	EPA 502.2	12/2/98	0.50	83160	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
2996	Styrene (100)	N987841	<0.50	ug/L	EPA 502.2	12/2/98	0.50	83160	ua

Pesticide/PCB Chemical Analysis

62-550.310(2)(c)

PWS029

Parameter ID	Analysis	Sample ID	Result	Unit	Method	Analysis Date/Time	D. L.	LabID	Analyst
2005	Endrin (2)	N987841	<0.020	ug/L	EPA 505	11/23/98	0.020	83160	ua
2010	Lindane (0.2)	N987841	<0.010	ug/L	EPA 505	11/23/98	0.010	83160	ua
2015	Methoxychlor (40)	N987841	<0.070	ug/L	EPA 505	11/23/98	0.070	83160	ua
2020	Toxaphene (3)	N987841	<0.18	ug/L	EPA 505	11/23/98	0.18	83160	ua
2031	Dalapon (200)	N987841	<1.0	ug/L	EPA 515.1	11/30/98	1.0	83160	ua
2032	Diquat (20)	N987841	<0.40	ug/L	EPA 549.1	11/25/98	0.40	83160	ua
2033	Endothall (100)	N987841	<9.0	ug/L	EPA 548	11/30/98	9.0	83160	ua
2034	Glyphosate (700)	N987841	<6.0	ug/L	EPA 547	11/30/98	6.0	83160	ua
2035	Di(2-ethylhexyl) adipate (400)	N987841	<1.6	ug/L	EPA 525.2	12/2/98	1.6	83160	ua
2036	Oxamyl (Vydate) (200)	N987841	<2.0	ug/L	EPA 531.1	12/1/98	2.0	83160	ua
2037	Simazine (4)	N987841	<1.5	ug/L	EPA 505	11/23/98	1.5	83160	ua
2039	Di(2-ethylhexyl) phthalate (6)	N987841	<1.3	ug/L	EPA 525.2	12/2/98	1.3	83160	ua
2040	Picloram (500)	N987841	<0.10	ug/L	EPA 515.1	11/30/98	0.10	83160	ua
2041	Dinoseb (7)	N987841	<0.20	ug/L	EPA 515.1	11/30/98	0.20	83160	ua
2042	Hexachlorocyclopentadiene(50)	N987841	<0.10	ug/L	EPA 505	11/23/98	0.10	83160	ua
2046	Carbofuran (40)	N987841	<2.0	ug/L	EPA 531.1	12/1/98	2.0	83160	ua
2050	Atrazine (3)	N987841	<2.5	ug/L	EPA 505	11/23/98	2.5	83160	ua
2051	Alachlor (2)	N987841	<1.5	ug/L	EPA 505	11/23/98	1.5	83160	ua
65	Heptachlor (0.4)	N987841	<0.030	ug/L	EPA 505	11/23/98	0.030	83160	ua
2067	Heptachlor Epoxide (0.2)	N987841	<0.010	ug/L	EPA 505	11/23/98	0.010	83160	ua
2105	2,4-D (70)	N987841	<0.10	ug/L	EPA 515.1	11/30/98	0.10	83160	ua
2110	2,4,5-TP (Silvex) (50)	N987841	<0.20	ug/L	EPA 515.1	11/30/98	0.20	83160	ua
2274	Hexachlorobenzene (1)	N987841	<0.10	ug/L	EPA 505	11/23/98	0.10	83160	ua
2306	Benzo(a)pyrene (.2)	N987841	<0.20	ug/L	EPA 550	12/2/98	0.20	83160	ua
2326	Pentachlorophenol (1)	N987841	<0.040	ug/L	EPA 515.1	11/30/98	0.040	83160	ua
2383	PCB (0.5)	N987841	<0.10	ug/L	EPA 505	11/23/98	0.10	83160	ua
2931	Dibromochloropropane (.2)	N987841	<0.020	ug/L	EPA 504	11/25/98	0.020	83160	ua
2946	Ethylene Dibromide (0.02)	N987841	<0.020	ug/L	EPA 504	11/25/98	0.020	83160	ua
2959	Chlordane (2)	N987841	<0.020	ug/L	EPA 505	11/23/98	0.020	83160	ua

Unregulated Group I Analysis

62-550.405

PWS035

Parameter ID	Analysis	Sample ID	Result	Unit	Method	Analysis Date/Time	D. L.	LabID	Analyst
2021	Carbaryl	N987841	<2.0	ug/L	EPA 531.1	12/1/98	2.0	83160	ua
2022	Methomyl	N987841	<2.0	ug/L	EPA 531.1	12/1/98	2.0	83160	ua
2043	Aldicarb Sulfoxide	N987841	<2.0	ug/L	EPA 531.1	12/1/98	2.0	83160	ua
2044	Aldicarb Sulfone	N987841	<2.0	ug/L	EPA 531.1	12/1/98	2.0	83160	ua
2045	Metolachlor	N987841	<1.0	ug/L	EPA 507	12/2/98	1.0	83160	ua
47	Aldicarb	N987841	<2.0	ug/L	EPA 531.1	12/1/98	2.0	83160	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
2066	3-Hydroxycarbofuran	N987841	<2.0	ug/L	EPA 531.1	12/1/98	2.0	83160	ua
2077	Propachlor	N987841	<0.20	ug/L	EPA 525.2	12/2/98	0.20	83160	ua
'56	Aldrin	N987841	<0.10	ug/L	EPA 525.2	12/2/98	0.10	83160	ua
2364	Dieldrin	N987841	<0.13	ug/L	EPA 525.2	12/2/98	0.13	83160	ua
2440	Dicamba	N987841	<2.0	ug/L	EPA 515.1	11/30/98	2.0	83160	ua
2595	Metribuzin	N987841	<1.0	ug/L	EPA 525.2	12/2/98	1.0	83160	ua
2076	Butachlor	N987841	<0.10	ug/L	EPA 525.2	12/2/98	0.10	83160	ua

Unregulated Group II Analysis

62-550.410

PWS034

2210	Chloromethane	N987841	<0.5	ug/L	EPA 502.2	12/2/98	0.5	83160	ua
2212	Dichlorodiflouromethane	N987841	<0.5	ug/L	EPA 502.2	12/2/98	0.5	83160	ua
2214	Bromomethane	N987841	<0.5	ug/L	EPA 502.2	12/2/98	0.5	83160	ua
2216	Chloroethane	N987841	<0.5	ug/L	EPA 502.2	12/2/98	0.5	83160	ua
2218	Trichlorofluoromethane	N987841	<0.5	ug/L	EPA 502.2	12/2/98	0.5	83160	ua
2251	Methyl-Tert-Butyl-Ether	N987841	<0.5	ug/L	EPA 502.2	12/2/98	0.5	83160	ua
2408	Dibromomethane	N987841	<0.5	ug/L	EPA 502.2	12/2/98	0.5	83160	ua
2410	1,1-Dichloropropylene	N987841	<0.5	ug/L	EPA 502.2	12/2/98	0.5	83160	ua
2412	1,3-Dichloropropane	N987841	<0.5	ug/L	EPA 502.2	12/2/98	0.5	83160	ua
2413	1,3-Dichloropropene	N987841	<0.5	ug/L	EPA 502.2	12/2/98	0.5	83160	ua
2414	1,2,3-Trichloropropane	N987841	<0.5	ug/L	EPA 502.2	12/2/98	0.5	83160	ua
2416	2,2-Dichloropropane	N987841	<0.5	ug/L	EPA 502.2	12/2/98	0.5	83160	ua
,41	Chloroform	N987841	<0.5	ug/L	EPA 502.2	12/2/98	0.5	83160	ua
2942	Bromoform	N987841	<0.5	ug/L	EPA 502.2	12/2/98	0.5	83160	ua
2943	Bromodichloromethane	N987841	<0.5	ug/L	EPA 502.2	12/2/98	0.5	83160	ua
2944	Dibromochloromethane	N987841	<0.5	ug/L	EPA 502.2	12/2/98	0.5	83160	ua
2965	O-Chlorotoluene	N987841	<0.5	ug/L	EPA 502.2	12/2/98	0.5	83160	ua
2966	P-Chlorotoluene	N987841	<0.5	ug/L	EPA 502.2	12/2/98	0.5	83160	ua
2967	M-Dichlorobenzene	N987841	<0.5	ug/L	EPA 502.2	12/2/98	0.5	83160	ua
2978	1,1-Dichloroethane	N987841	<0.5	ug/L	EPA 502.2	12/2/98	0.5	83160	ua
2986	1,1,1,2-Tetrachloroethane	N987841	<0.5	ug/L	EPA 502.2	12/2/98	0.5	83160	ua
2988	1,1,2,2-Tetrachloroethane	N987841	<0.5	ug/L	EPA 502.2	12/2/98	0.5	83160	ua
2993	Bromobenzene	N987841	<0.5	ug/L	EPA 502.2	12/2/98	0.5	83160	ua

Unregulated Group III Analysis

62-550.415

PWS036 & 037

2282	Dimethylphthalate	N987841	<5.0	ug/L	EPA 625	11/25/98	5.0	83160	ua
2294	Butyl benzyl phthalate	N987841	<5.0	ug/L	EPA 625	11/25/98	5.0	83160	ua
9108	2-Chlorophenol	N987841	<5.0	ug/L	EPA 625	11/25/98	5.0	83160	ua
9115	Phenol	N987841	<5.0	ug/L	EPA 625	11/25/98	5.0	83160	ua
9116	2,4,6-Trichlorophenol	N987841	<5.0	ug/L	EPA 625	11/25/98	5.0	83160	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
	BOD	N987841	1	mg/L	EPA 405.1	11/19/98 9:00	1	84352	ua
	Ammonia-N	N987841	0.10	mg/L	EPA 350.3	11/19/98	0.05	84352	ua
	Nitrogen, Organic	N987841	<0.2	mg/L	Calc.	11/19/98	0.2	84352	ua
	Nitrogen, Total Kjeldahl	N987841	0.27	mg/L	EPA 351.2	11/19/98	0.2	84352	ua
	Orthophosphate	N987841	<0.02	mg/L	EPA 365.2	11/19/98	0.02	84352	ua
	Phosphorus, Total	N987841	<0.02	mg/L	EPA 365.2	11/19/98	0.02	84352	ua
	Calcium	N987841	426	mg/L	EPA 215.1	12/2/98	0.022	84352	ua
	Carbonate, CO3	N987841	0.53	mg/L	SM 4500	12/2/98		84352	ua

EPA 8310 (610)

Parameter ID	Analysis	Sample ID	Result	Unit	Method	Analysis Date/Time	D. L.	LabID	Analyst
	Polyaromatic Hydrocarbons	N987841			EPA 8310			83160	ua
	Naphthalene	N987841	<1.0	ug/L	EPA 8310	11/29/98	1.0	83160	ua
	Phenanthrene	N987841	<1.0	ug/L	EPA 8310	11/29/98	1.0	83160	ua
	Anthracene	N987841	<1.0	ug/L	EPA 8310	11/29/98	1.0	83160	ua
	Total Coliform	N987841	<1	col/100	SM 9222B	11/18/98 15:50	1	84352	ua
	Fecal Coliform	N987841	<1	col/100ml	SM9222D	11/18/98 15:50	1	84352	ua
	Fecal Strep	N987841	<1	col/100ml	SM9230C	11/18/98 15:50	1	84352	ua
	Asbestos	N987841	<0.2352	ms/L	EPA 100.1	11/27/98	0.2352	86457	ua

Field Data

Parameter ID	Analysis	Sample ID	Result	Unit	Method	Analysis Date/Time	D. L.	LabID	Analyst
	pH, Field	N987841	8.00	std unit	EPA 150.1	11/18/98	n/a	84352	ua
	Conductivity	N987841	41,000	umhos/cm	EPA 120.1	11/18/98	1.0	84352	ua
	Water Temperature	N987841	26.5	°C	EPA 170.1	11/18/98		84352	ua

Approved by:

Debra A. Sanders

Debra Sanders
Laboratory Director

Comments:

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

LAB FORMAT FOR REPORTING DRINKING WATER ANALYSES

PUBLIC WATER SYSTEM INFORMATION (to be completed by system or lab)

System Name: Sawgrass / Youngquist.

I.D. #:

Address:

Phone #: 941-489-4444

Type: ( ) Community ( ) Nontransient Noncommunity ( ) Noncommunity

SAMPLE INFORMATION (to be completed by sampler)

Sample Date (MM/DD/YY): 11/18/98 Sample Time: 10:45

Sample Location (be specific): RAW WELL

Sampler Name and Phone: RAY BURROUGHS 941-488-8103

Sampler Signature: [signature]

Title: DRINKING WATER COORDINATOR.

Check Type(s): ( ) Distribution ( ) Recheck of MCL ( ) Resample of Lab Invalidated Sample
( ) Clearance ( ) Thm Max Res Time ( ) Plant Tap
( ) Distrib. entry point (✓) Raw ( ) Comp. of Multiple Sites-Attach a format for each site

LABORATORY CERTIFICATION INFORMATION - ATTACH HRS ANALYTE SHEET

Lab Name: **Sanders Laboratories, Inc.** HRS #: **84352**
Expiration Date: **07/01/99**
Address: **1050 Endeavor Ct. Nokomis, Fl. 34275**
Phone #: **941-488-8103**
Subcontracted Lab Name & HRS #: 83141, 83160, 86457 ATTACH HRS ANALYTE SHEET*

ANALYSIS INFORMATION (to be completed by lab) **SAMPLE NUMBER:** N987841
Date Sample(s) Received: 11-18-98
Group(s) Analyzed and Results attached for compliance with 62-550 F.A.C.:

(✓) Nitrate Only (✓) Nitrite Only (✓) Asbestos Only (✓) Trihalomethanes

Inorganics - (✓) All 17 ( ) Partial
Volatile Organics - (✓) All 21 ( ) Partial
Secondaries - (✓) All 14 ( ) Partial
Pesticides/PCB's - (✓) All 30 ( ) Partial

Group I Unregulated - (✓) All 13 ( ) Partial
Group II Unregulated - (✓) All 23 ( ) Partial
Group III Unregulated - ( ) All 11 (✓) Partial
Radiochemicals - (✓) Single Sample ( ) Quarterly Composite**

*All HRS lab#s and their HRS Analyte Sheet for labs performing the attached water analyses must be provided. Failure to do so will result in rejection of the analyses and possible enforcement against the public water system for failure to sample.

* Provide radiochemical sample dates & locations for each quarter

Reporting Format 62-550.730(1)(b)
Effective Date: January 1995

CERTIFICATION

I, Debra A. Sanders, do HEREBY CERTIFY that all attached analytical data are correct.

Signature ____________________

Title Laboratory Director

Date: 12/10/98

COMPLIANCE INFORMATION (to be completed by State)

Sample Collection Satisfactory: ____________________

Sample Analysis Satisfactory: ____________________

Resample Requested For: ____________________

Reason: ____________________

Person Notified To Resample: ____________________

Date Notified: ____________________

DEP/HRS Reviewing Official: ____________________

awton Chiles
Governor

FLORIDA DEPARTMENT OF
HEALTH

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

LABORATORY: SANDERS LABORATORIES, INC.

CERTIFICATION NUMBER: 84352 EPA: FL00506
DATE: NOVEMBER 20, 1997
SUPERSEDES PREVIOUS ANALYTE SHEET DATED: JANUARY 30, 1997

MICROBIOLOGY	METHODS
Membrane Filter	SM9222B
Multiple Tube Fermentation	SM9221B
Fecal/E. coli	SM9221E
MMO-MUG	
P/A	

PRIMARY INORGANIC

1. METALS	AA(FUR)	ICP	ICP/MS	OTHER
ANTIMONY	SM3113B			
ARSENIC	SM3113B			
BARIUM	SM3113B			
BERYLLIUM				
CADMIUM	SM3113B			
CHROMIUM	SM3113B			
LEAD	SM3113B			
MERCURY				SM3112B
NICKEL				SM3111B
SELENIUM	SM3113B			
SODIUM				SM3111B
THALLIUM	SM3113B			

2. LEAD AND COPPER				
LEAD	SM3113B			
COPPER	SM3113B			

YANIDE	IC	ISE	UV-VIS	OTHER
CYANIDE				

4. NITRATE AND NITRITE				
NITRATE			SM4500NO3-E	
NITRITE			SM4500NO3-E	
TOTAL NO2-NO3			SM4500NO3-E	

5. FLUORIDE				
FLUORIDE		SM4500F C		

6. ASBESTOS				
ASBESTOS				

SECONDARY INORGANIC

	AA(FUR)	ICP	UV-VIS	OTHER
ALUMINUM				SM3111D
CHLORIDE				SM4500Cl- B
COLOR			SM2120B	
COPPER				SM3111B
FLUORIDE				SM4500F C
FOAMING AGENTS				
IRON				SM3111B
MANGANESE				SM3111B
ODOR				SM2150B
pH				150.1
SILVER				SM3111B
SULFATE				375.4
S				160.1
AC				SM3111B

PESTICIDES AND PCB'S	GC	GC/MS	HPLC
1. INSECTICIDES			
ALACHLOR			
ATRAZINE			
CHLORDANE			
ENDRIN			
HEPTACHLOR			
HEPTACHLOR EPOXIDE			
LINDANE			
METHOXYCHLOR			
TOXAPHENE			
HEXACHLOROBENZENE			
HEXACHLOROCYCLOPENTADIENE			
SIMAZINE			
2. HERBICIDES			
2,4-D			
PENTACHLOROPHENOL			
2,4,5-TP (SILVEX)			
DALAPON			
DINOSEB			
PICLORAM			
3. CARBAMATES			
CARBOFURAN			
OXAMYL (VYDATE)			
4. DISINFECTANT BY-PRODUCTS/VOC'S			
1,2-DIBROMO-3-CHLOROPROPANE			
ETHYLENE DIBROMIDE			
5. MISCELLANEOUS SOC'S			
DIQUAT			
ENDOTHALL			
GLYPHOSATE			
6. PCB'S			
AROCHLORS			
DECACHLOROBIPHENYL			
7. ADIPATES AND PHTHALATES			
DI(2-ETHYLHEXYL) ADIPATE			
DI(2-ETHYLHEXYL) PHTHALATE			
8. PAH			
BENZO(a)PYRENE			
DIOXIN			
2,3,7,8-TETRACHLORODIBENZO-p-DIOXIN			

SAFE DRINKING WATER ANALYTE SHEET

HRS-H FORM 1041, JANUARY, 97
(replaces version MARCH, 95 which may be used)

P.O. Box 210, Jacksonville, Florida 32231-0042

Lawton Chiles
Governor

FLORIDA DEPARTMENT OF HEALTH

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

Safe Drinking Water Analyte Sheet
(RADIOCHEMISTRY)

LABORATORY: Florida Radiochemistry Services

CERTIFICATION ID#: 83141
Date: July 1, 1997
Supersedes previous issue dated: 7/1/96

RADIOCHEMISTRY

	Method No.	Publication [XX indicates ANALYTE CERTIFIED]
XX Gross Alpha	900.0	Prescribed Procedures for Measurement of Radioactivity in Drinking Water, EPA-600/4-80-032
XX Gross Beta	900.0	Prescribed Procedures for Measurement of Radioactivity in Drinking Water, EPA-600/4-80-032
XX Radium-226	903.1	Prescribed Procedures for Measurement of Radioactivity in Drinking Water, EPA-600/4-80-032
XX Radium-228	*Alt	Brooks and Blanchard, *(EPA Alternate Approved Procedure)
XX Natural Uranium	908.0	Prescribed Procedures for Measurement of Radioactivity in Drinking Water, EPA-600/4-80-032
___ Radon	___	
___ Tritium	___	
___ Strontium-89	___	
XX Strontium-90	905.0	Prescribed Procedures for Measurement of Radioactivity in Drinking Water, EPA-600/4-80-032
___ Iodine-131	___	
___ Photon Emitters	___	
___ Cesium-134		
___ Cesium-137		
___ Cobalt-60		
___ Barium-133		
___ Zinc-65		

BUREAU OF RADIATION CONTROL • P O BOX 680069 • ORLANDO, FL 32868-0069 • TEL (407) 297-2095

FLORIDA DEPARTMENT OF
HEALTH

Lawton Chiles
Governor

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

LABORATORY: ELAB, INC. D/B/A ENVIROLAB

CERTIFICATION NUMBER: 83160 EPA: FL00020
DATE: MARCH 31, 1998
SUPERSEDES PREVIOUS ANALYTE SHEET DATED: DECEMBER 2, 1997

MICROBIOLOGY

		METHODS
X	Membrane Filter	SM9222B
X	Multiple Tube Fermentation	SM9221B
X	Fecal/E. coli	SM9221E, (1a)
-	MMO-MUG	
-	P/A	

PRIMARY INORGANIC

1. METALS

		AA(FUR)	ICP	ICP/MS	OTHER
X	ANTIMONY	SM3113B			
X	ARSENIC	SM3113B	200.7		
X	BARIUM	SM3113B	200.7		SM3111D
X	BERYLLIUM	SM3113B	200.7		
X	CADMIUM	SM3113B	200.7		
X	CHROMIUM	SM3113B	200.7		
X	LEAD	SM3113B			
X	MERCURY				245.1
X	NICKEL	SM3113B	200.7		
X	SELENIUM	SM3113B			
X	SODIUM				SM3111B
X	THALLIUM	200.9			

2. LEAD AND COPPER

		AA(FUR)	ICP	ICP/MS	OTHER
X	LEAD	SM3113B			
X	COPPER	SM3113B	200.7		SM3111B

3. CYANIDE

		IC	ISE	UV-VIS	OTHER
:	CYANIDE			SM4500CN-E	

4. NITRATE AND NITRITE

		IC	ISE	UV-VIS	OTHER
X	NITRATE	300.0		SM4500NO3 E, 353.2	
X	NITRITE	300.0		SM4500NO3 E, 353.2	
X	TOTAL NO2-NO3	300.0		SM4500NO3 E, 353.2	

5. FLUORIDE

		IC	ISE	UV-VIS	OTHER
X	FLUORIDE	300.0	SM4500F- C		

6. ASBESTOS

-	ASBESTOS				

SECONDARY INORGANIC

		AA(FUR)	ICP	UV-VIS	OTHER
X	ALUMINUM		200.7		SM3111D
X	CHLORIDE				SM4500Cl- C, 300.0
X	COLOR			SM2120B	
X	COPPER	SM3113B	200.7		SM3111B
X	FLUORIDE				300.0, SM4500F- C
X	FOAMING AGENTS			SM5540C	
X	IRON	SM3113B	200.7		SM3111B
X	MANGANESE	SM3113B	200.7		SM3111B
X	ODOR				SM2150B
X	pH				150.1
X	SILVER	SM3113B	200.7		SM3111B
X	SULFATE			375.2	300.0, 375.4
X	TDS				SM2540C
X	ZINC	SM3113B	200.7		SM3111B

PESTICIDES AND PCB'S

		GC	GC/MS	HPLC
	1. INSECTICIDES			
X	ALACHLOR	505, 507		
X	ATRAZINE	505, 507		
X	CHLORDANE	505, 508		
X	ENDRIN	505, 508		
X	HEPTACHLOR	505, 508		
X	HEPTACHLOR EPOXIDE	505, 508		
X	LINDANE	505, 508		
X	METHOXYCHLOR	505, 508		
X	TOXAPHENE	505, 508		
X	HEXACHLOROBENZENE	505, 508		
X	HEXACHLOROCYCLOPENTADIENE	505	525.2	
X	SIMAZINE	505, 507		
	2. HERBICIDES			
X	2,4-D	515.1		
X	PENTACHLOROPHENOL	515.1	525.2	
X	2,4,5-TP (SILVEX)	515.1		
X	DALAPON	515.1		
X	DINOSEB	515.1		
X	PICLORAM	515.1		
	3. CARBAMATES			
X	CARBOFURAN			531.1
X	OXAMYL (VYDATE)			531.1
	4. DISINFECTANT BY-PRODUCTS/VOC'S			
X	1,2-DIBROMO-3-CHLOROPROPANE	504.1		
X	ETHYLENE DIBROMIDE	504.1		
	5. MISCELLANEOUS SOC'S			
X	DIQUAT			549.1
X	ENDOTHALL	548.1		
X	GLYPHOSATE			547
	6. PCB'S			
X	AROCHLORS	505, 508		
-	DECACHLOROBIPHENYL			
	7. ADIPATES AND PHTHALATES			
X	DI(2-ETHYLHEXYL) ADIPATE		525.2	
X	DI(2-ETHYLHEXYL) PHTHALATE		525.2	
	8. PAH			
X	BENZO(a)PYRENE		525.2	
	DIOXIN			
-	2,3,7,8-TETRACHLORODIBENZO-p-DIOXIN			

HRS-H FORM 1041, JANUARY, 97 (replaces version MARCH, 95 which may be used)

SAFE DRINKING WATER ANALYTE SHEET

P.O. Box 210, Jacksonville, Florida 32231-0042

State of Florida
Department of Health

BUREAU OF LABORATORIES
SAFE DRINKING WATER

FLORIDA DEPARTMENT OF HEALTH

1997 - 1998

This is to certify that

86457
ATC Associates - Florida
9955 NW 116 Way, Suite 1
Miami, FL 33178-5126

has complied with Florida Administrative Code 64E-1, Part I, pertaining to safe drinking water testing in the following categories:

Primary Inorganic Contaminants (Asbestos)****************************

Specific certified analytes and methodologies within these categories are listed on the analyte sheets with this laboratory and the Florida Department of Health, Bureau of Laboratories

EFFECTIVE JULY 1, 1997 THROUGH JUNE 30, 1998

Eldert C. Hartwig, Jr., Sc.D., M.P.H.
Bureau Chief, Bureau of Laboratories
Florida Department of Health
DH Form 1629, 3/97
NON-TRANSFERABLE

CERTIFICATE No.: 97167

Sanders Laboratories
Environmental Testing Services

CHAIN-OF-CUSTODY RECORD

INTAKE FORM # 518 745

Page ____ of ____

Client: YOUNGQUIST BROTHERS WELL DRILLING
Address:
Phone: Fax:

Report To:
Bill To:
P.O. #
Project Name
Project Location: SAWGRASS

Sample Supply: GROUNDWATER
Customer Type:
Field Report #:
Kit #
REQUESTED DUE DATE: 12-2-98

Sampled By (PRINT): RAY BURROUGHS
Sampler Signature: [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: PRI & SEC INORG.	BA, RAD 226 & 228	TTHM, VOC'S	PEST & PCB'S	UNREG GRP I, II, III	BOD, NH3, ORG N.	TKN, OP, TPCO	CARBONATE BICARBONATE	*610.	TOT. C	FECAL C & FECAL STREP	(FIELD) PH, COND. TEMP	LAB NUMBER
1	RAW WELL		11/18/98	1045	G	38					X	X	X	X	X	X	X	X	X	X			N98 7841

OUT / DATE	SHIPMENT METHOD RETURNED / DATE	VIA	ITEM #	RELINQUISHED BY / AFFILIATION	DATE	TIME	ACCEPTED BY / AFFILIATION	DATE	TIME
				[signature]	11/18/98	1430	Thecafe Williams	11-18-98	1430

COOLER #

COMMENTS:
* NAPTHALENE
ANTHRACENE
PHENONTHRENE

1050 Endeavor Ct., Nokomis, FL 3427[illegible] • (941) 488-8103 • FAX 484-6774
16880 Gator Road, Fort Myers, FL 339[illegible] (941) 590-0337 • FAX (941) 590-0536

Upper Monitor Zone Water Quality
DZMW-1

INTAKE #: 519770

Sanders Laboratories
Environmental Testing Services

Date *14-Jan-99*

Project Name:	Sawgrass
Project Location:	Dual Zone 1650' Site B
Sample Supply:	Water
Collector:	Noah Olenych
Sample Received Date/Time:	12/21/98 14:50

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	Analyst
	Inorganic Analysis 62-550.310(1) PWS030								
1005	Arsenic (0.05)	N988896	<0.0022	mg/L	EPA 206.2	12/28/98	0.0022	84352	ua
1010	Barium (2)	N988896	0.27	mg/L	EPA 208.2	12/29/98	0.20	84352	ua
1015	Cadmium (0.005)	N988896	0.008	mg/L	EPA 213.1	12/22/98	0.003	84352	ua
1020	Chromium (0.1)	N988896	<0.02	mg/L	EPA 218.1	12/30/98	0.02	84352	ua
1024	Cyanide (0.2)	N988896	<0.0050	mg/L	EPA 335.2	12/31/98	0.0050	83160	ua
1025	Fluoride (4.0)	N988896	1.56	mg/L	EPA 340.2	1/4/99	0.2	84352	ua
1030	Lead (0.015)	N988896	<0.001	mg/L	EPA 239.2	12/29/98	0.001	84352	ua
1035	Mercury (0.002)	N988896	<0.001	mg/L	EPA 245.1	12/29/98	0.001	84352	ua
1036	Nickel (0.1)	N988896	0.047	mg/L	EPA 249.1	12/30/98	0.010	84352	ua
1040	Nitrate (10)	N988896	<0.01	mg/L	EPA 353.2	12/30/98	0.01	84352	ua
1041	Nitrite (1)	N988896	<0.01	mg/L	EPA 354.1	12/23/98	0.01	84352	ua
1045	Selenium (0.05)	N988896	<0.004	mg/L	EPA 270.2	12/23/98	0.004	84352	ua
1052	Sodium (160)	N988896	884	mg/L	EPA 273.1	1/5/99	0.003	84352	ua
1074	Antimony (0.006)	N988896	<5.0	mg/L	EPA 6010	1/7/99	5.0	83160	ua
1075	Beryllium (0.004)	N988896	<1.0	mg/L	EPA 6010	1/7/99	1.0	83160	ua
1085	Thallium (0.002)	N988896	<5.0	mg/L	EPA 6010	1/7/99	5.0	83160	ua
	Secondary Chemical Analysis 62-550.320 PWS031								
1002	Aluminum (0.2)	N988896	<0.2	mg/L	EPA 202.1	12/29/98	0.2	84352	ua
1017	Chloride (250)	N988896	1,650	mg/L	SM4500Cl-B	1/4/99	5	84352	ua
1022	Copper (1.0)	N988896	<0.01	mg/L	EPA 220.1	12/24/98	0.01	84352	ua
1025	Fluoride (2.0)	N988896	1.56	mg/L	EPA 340.2	1/4/99	0.2	84352	ua
1028	Iron (0.3)	N988896	0.098	mg/L	EPA 236.1	1/5/99	0.015	84352	ua
1032	Manganese (0.05)	N988896	0.008	mg/L	EPA 243.1	12/29/98	0.005	84352	ua

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

Rpt form #5; Rev 1/1/96

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)	N988896	<0.01	mg/L	EPA 272.1	12/29/98	0.01	84352	ua
1055	Sulfate	(250)	N988896	786	mg/L	EPA 375.4	1/4/99	5	84352	ua
1095	Zinc	(5.0)	N988896	<0.005	mg/L	EPA 289.1	12/29/98	0.005	84352	ua
[illegible]	Color	(15.0)	N988896	8	PtCo units	EPA 110.3	12/21/98	1	84352	ua
1920	Odor	(3.0)	N988896	6	TON	EPA 140.1	12/21/98	1	84352	ua
1925	pH	(6.5-8.5)	N988896	8.3	std units	EPA 150.1	12/21/98	n/a	84352	ua
1930	Total Dissolved Solids (500)		N988896	3,390	mg/L	EPA 160.1	1/4/99	7	84352	ua
2905	Foaming Agents (1.5)		N988896	0.12	mg/L	EPA 425.1	12/23/98	0.10	83160	ua

Radiochemical Analysis

62-550.310(5)

PWS033

4000	Gross Alpha	N988896	4.3	pCi/L	EPA 900.0	12/29/98	+/-2.7	83141	ua

Trihalomethane Analysis

62-550.310(2)(a)

PWS027

2950	Total THM's (0.10)	N988896	<0.00050	mg/L	EPA 502.2	12/31/98	0.00050	83160	ua

Volatile Organic Analysis

62-550.310(2)(b)

PWS028

2378	1,2,4-Trichlorobenzene (70)	N988896	<0.50	ug/L	EPA 502.2	12/31/98	0.50	83160	ua
2[illegible]	Cis-1,2-Dichloroethylene (70)	N988896	<0.50	ug/L	EPA 502.2	12/31/98	0.50	83160	ua
2[illegible]	Xylenes (Total) (10,000)	N988896	<0.50	ug/L	EPA 502.2	12/31/98	0.50	83160	ua
2964	Dichloromethane (5)	N988896	<0.50	ug/L	EPA 502.2	12/31/98	0.50	83160	ua
2968	O-Dichlorobenzene (600)	N988896	<0.50	ug/L	EPA 502.2	12/31/98	0.50	83160	ua
2969	Para-Dichlorobenzene (75)	N988896	<0.50	ug/L	EPA 502.2	12/31/98	0.50	83160	ua
2976	Vinyl Chloride (1)	N988896	<0.50	ug/L	EPA 502.2	12/31/98	0.50	83160	ua
2977	1,1-Dichloroethylene (7)	N988896	<0.50	ug/L	EPA 502.2	12/31/98	0.50	83160	ua
2979	Trans-1,2-Dichloroethylene(100)	N988896	<0.50	ug/L	EPA 502.2	12/31/98	0.50	83160	ua
2980	1,2-Dichloroethane (3)	N988896	<0.50	ug/L	EPA 502.2	12/31/98	0.50	83160	ua
2981	1,1,1-Trichloroethane (200)	N988896	<0.50	ug/L	EPA 502.2	12/31/98	0.50	83160	ua
2982	Carbon Tetrachloride (3)	N988896	<0.50	ug/L	EPA 502.2	12/31/98	0.50	83160	ua
2983	1,2-Dichloropropane (5)	N988896	<0.50	ug/L	EPA 502.2	12/31/98	0.50	83160	ua
2984	Trichloroethylene (3)	N988896	<0.50	ug/L	EPA 502.2	12/31/98	0.50	83160	ua
2985	1,1,2-Trichloroethane (5)	N988896	<0.50	ug/L	EPA 502.2	12/31/98	0.50	83160	ua
2987	Tetrachloroethylene (3)	N988896	<0.50	ug/L	EPA 502.2	12/31/98	0.50	83160	ua
2989	Monochlorobenzene (100)	N988896	<0.50	ug/L	EPA 502.2	12/31/98	0.50	83160	ua
2990	Benzene (1)	N988896	<0.50	ug/L	EPA 502.2	12/31/98	0.50	83160	ua
2991	Toluene (1000)	N988896	<0.50	ug/L	EPA 502.2	12/31/98	0.50	83160	ua
2992	Ethylbenzene (700)	N988896	<0.50	ug/L	EPA 502.2	12/31/98	0.50	83160	ua
2996	Styrene (100)	N988896	<0.50	ug/L	EPA 502.2	12/31/98	0.50	83160	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

Pesticide/PCB Chemical Analysis

62-550.310(2)(c)

PWS029

Parameter ID	Analysis	Sample ID	Result	Unit	Method	Analysis Date/Time	D. L.	LabID	Analyst
	Endrin (2)	N988896	<0.020	ug/L	EPA 505	12/28/98	0.020	83160	ua
2010	Lindane (0.2)	N988896	<0.010	ug/L	EPA 505	12/28/98	0.010	83160	ua
2015	Methoxychlor (40)	N988896	<0.070	ug/L	EPA 505	12/28/98	0.070	83160	ua
2020	Toxaphene (3)	N988896	<0.18	ug/L	EPA 505	12/28/98	0.18	83160	ua
2031	Dalapon (200)	N988896	<1.0	ug/L	EPA 515.1	12/31/98	1.0	83160	ua
2032	Diquat (20)	N988896	<0.40	ug/L	EPA 549.1	12/28/98	0.40	83160	ua
2033	Endothall (100)	N988896	<9.0	ug/L	EPA 548.1	1/3/99	9.0	83160	ua
2034	Glyphosate (700)	N988896	<6.0	ug/L	EPA 547	12/30/98	6.0	83160	ua
2035	Di(2-ethylhexyl) adipate (400)	N988896	<1.6	ug/L	EPA 525.2	12/30/98	1.6	83160	ua
2036	Oxamyl (Vydate) (200)	N988896	<2.0	ug/L	EPA 531.1	12/29/98	2.0	83160	ua
2037	Simazine (4)	N988896	<1.5	ug/L	EPA 505	12/28/98	1.5	83160	ua
2039	Di(2-ethylhexyl) phthalate (6)	N988896	<1.3	ug/L	EPA 525.2	12/30/98	1.3	83160	ua
2040	Picloram (500)	N988896	<0.10	ug/L	EPA 515.1	12/31/98	0.10	83160	ua
2041	Dinoseb (7)	N988896	<0.20	ug/L	EPA 515.1	12/31/98	0.20	83160	ua
2042	Hexachlorocyclopentadiene(50)	N988896	<0.10	ug/L	EPA 505	12/28/98	0.10	83160	ua
2046	Carbofuran (40)	N988896	<2.0	ug/L	EPA 531.1	12/29/98	2.0	83160	ua
2050	Atrazine (3)	N988896	<2.5	ug/L	EPA 505	12/28/98	2.5	83160	ua
2051	Alachlor (2)	N988896	<1.5	ug/L	EPA 505	12/28/98	1.5	83160	ua
2065	Heptachlor (0.4)	N988896	<0.030	ug/L	EPA 505	12/28/98	0.030	83160	ua
2067	Heptachlor Epoxide (0.2)	N988896	<0.010	ug/L	EPA 505	12/28/98	0.010	83160	ua
	2,4-D (70)	N988896	<0.10	ug/L	EPA 515.1	12/31/98	0.10	83160	ua
2110	2,4,5-TP (Silvex) (50)	N988896	<0.20	ug/L	EPA 515.1	12/31/98	0.20	83160	ua
2274	Hexachlorobenzene (1)	N988896	<0.10	ug/L	EPA 505	12/28/98	0.10	83160	ua
2306	Benzo(a)pyrene (.2)	N988896	<0.20	ug/L	EPA 525.2	12/30/98	0.20	83160	ua
2326	Pentachlorophenol (1)	N988896	<0.040	ug/L	EPA 515.1	12/31/98	0.040	83160	ua
2383	PCB (0.5)	N988896	<0.10	ug/L	EPA 508	12/28/98	0.10	83160	ua
2931	Dibromochloropropane (.2)	N988896	<0.020	ug/L	EPA 504.1	12/25/98	0.020	83160	ua
2946	Ethylene Dibromide (0.02)	N988896	<0.020	ug/L	EPA 504.1	12/25/98	0.020	83160	ua
2959	Chlordane (2)	N988896	<0.020	ug/L	EPA 505	12/28/98	0.020	83160	ua

Unregulated Group I Analysis

62-550.405

PWS035

Parameter ID	Analysis	Sample ID	Result	Unit	Method	Analysis Date/Time	D. L.	LabID	Analyst
2021	Carbaryl	N988896	<2.0	ug/L	EPA 531.1	12/29/98	2.0	83160	ua
2022	Methomyl	N988896	<2.0	ug/L	EPA 531.1	12/29/98	2.0	83160	ua
2043	Aldicarb Sulfoxide	N988896	<2.0	ug/L	EPA 531.1	12/29/98	2.0	83160	ua
2044	Aldicarb Sulfone	N988896	<2.0	ug/L	EPA 531.1	12/29/98	2.0	83160	ua
2045	Metolachlor	N988896	<1.0	ug/L	EPA 525.2	12/30/98	1.0	83160	ua
2047	Aldicarb	N988896	<2.0	ug/L	EPA 531.1	12/29/98	2.0	83160	ua
2066	3-Hydroxycarbofuran	N988896	<2.0	ug/L	EPA 531.1	12/29/98	2.0	83160	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	N988896	<0.20	ug/L	EPA 525.2	12/30/98	0.20	83160	ua
2356	Aldrin	N988896	<0.10	ug/L	EPA 525.2	12/30/98	0.10	83160	ua
2364	Dieldrin	N988896	<0.13	ug/L	EPA 525.2	12/30/98	0.13	83160	ua
[illegible]	Dicamba	N988896	<2.0	ug/L	EPA 515.1	12/31/98	2.0	83160	ua
[illegible]	Metribuzin	N988896	<1.0	ug/L	EPA 525.2	12/30/98	1.0	83160	ua
2076	Butachlor	N988896	<0.10	ug/L	EPA 525.2	12/30/98	0.10	83160	ua

Unregulated Group II Analysis

62-550.410

PWS034

2210	Chloromethane	N988896	<0.50	ug/L	EPA 502.2	12/31/98	0.50	83160	ua
2212	Dichlorodiflouromethane	N988896	<0.50	ug/L	EPA 502.2	12/31/98	0.50	83160	ua
2214	Bromomethane	N988896	<0.50	ug/L	EPA 502.2	12/31/98	0.50	83160	ua
2216	Chloroethane	N988896	<0.50	ug/L	EPA 502.2	12/31/98	0.50	83160	ua
2218	Trichlorofluoromethane	N988896	<0.50	ug/L	EPA 502.2	12/31/98	0.50	83160	ua
2251	Methyl-Tert-Butyl-Ether	N988896	<0.50	ug/L	EPA 502.2	12/31/98	0.50	83160	ua
2408	Dibromomethane	N988896	<0.50	ug/L	EPA 502.2	12/31/98	0.50	83160	ua
2410	1,1-Dichloropropylene	N988896	<0.50	ug/L	EPA 502.2	12/31/98	0.50	83160	ua
2412	1,3-Dichloropropane	N988896	<0.50	ug/L	EPA 502.2	12/31/98	0.50	83160	ua
2413	1,3-Dichloropropene	N988896	<0.50	ug/L	EPA 502.2	12/31/98	0.50	83160	ua
2414	1,2,3-Trichloropropane	N988896	<0.50	ug/L	EPA 502.2	12/31/98	0.50	83160	ua
2416	2,2-Dichloropropane	N988896	<0.50	ug/L	EPA 502.2	12/31/98	0.50	83160	ua
2941	Chloroform	N988896	<0.50	ug/L	EPA 502.2	12/31/98	0.50	83160	ua
2942	Bromoform	N988896	<0.50	ug/L	EPA 502.2	12/31/98	0.50	83160	ua
	Bromodichloromethane	N988896	<0.50	ug/L	EPA 502.2	12/31/98	0.50	83160	ua
2944	Dibromochloromethane	N988896	<0.50	ug/L	EPA 502.2	12/31/98	0.50	83160	ua
2965	O-Chlorotoluene	N988896	<0.50	ug/L	EPA 502.2	12/31/98	0.50	83160	ua
2966	P-Chlorotoluene	N988896	<0.50	ug/L	EPA 502.2	12/31/98	0.50	83160	ua
2967	M-Dichlorobenzene	N988896	<0.50	ug/L	EPA 502.2	12/31/98	0.50	83160	ua
2978	1,1-Dichloroethane	N988896	<0.50	ug/L	EPA 502.2	12/31/98	0.50	83160	ua
2986	1,1,1,2-Tetrachloroethane	N988896	<0.50	ug/L	EPA 502.2	12/31/98	0.50	83160	ua
2988	1,1,2,2-Tetrachloroethane	N988896	<0.50	ug/L	EPA 502.2	12/31/98	0.50	83160	ua
2993	Bromobenzene	N988896	<0.50	ug/L	EPA 502.2	12/31/98	0.50	83160	ua

Unregulated Group III Analysis

62-550.415

PWS036 & 037

2262	Isophorone	N988896	<5.0	ug/L	EPA 625	1/2/99	5.0	83160	ua
2270	2,4-Dinitrotoluene	N988896	<5.0	ug/L	EPA 625	1/2/99	5.0	83160	ua
2282	Dimethylphthalate	N988896	<5.0	ug/L	EPA 625	1/2/99	5.0	83160	ua
2284	Diethylphthalate	N988896	<5.0	ug/L	EPA 625	1/2/99	5.0	83160	ua
2290	Di-n-Butylphthalate	N988896	<5.0	ug/L	EPA 625	1/2/99	5.0	83160	ua
2294	Butyl benzyl phthalate	N988896	<5.0	ug/L	EPA 625	1/2/99	5.0	83160	ua
9089	Di-n-octylphthalate	N988896	<5.0	ug/L	EPA 625	1/2/99	5.0	83160	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	N988896	<5.0	ug/L	EPA 625	1/2/99	5.0	83160	ua
9112	2-Methyl-4,6-dinitophenol	N988896	<20	ug/L	EPA 625	1/2/99	20	83160	ua
9115	Phenol	N988896	<5.0	ug/L	EPA 625	1/2/99	5.0	83160	ua
	BOD	N988896	2.4	mg/L	EPA 405.1	12/21/98 15:00	1	84352	ua
	Ammonia-N	N988896	0.50	mg/L	EPA 350.3	12/30/98	0.05	84352	ua
	Nitrogen, Organic	N988896	0.2	mg/L	EPA 351.2	12/30/98	0.2	84352	ua
	Nitrogen, Total Kjeldahl	N988896	0.68	mg/L	EPA 351.2	12/23/98	0.2	84352	ua
	Orthophosphate	N988896	<0.02	mg/L	EPA 365.2	12/22/98	0.02	84352	ua
	Phosphorus, Total	N988896	0.09	mg/L	EPA 365.2	12/28/98	0.02	84352	ua
	Calcium	N988896	136	mg/L	EPA 215.1	1/4/99	0.4	84352	ua
	Carbonate, CO3	N988896	0.13	mg/L	SM 4500	1/4/99		84352	ua

Parameter ID	Analysis	Sample ID	Result	Unit	Method	Analysis Date/Time	D. L.	LabID	Analyst
	Total Coliform	N988896	<1	col/100ml	SM9222B	12/21/98 15:15	1	84352	ua
	Fecal Coliform	N988896	<1	col/100ml	SM9222D	12/21/98 15:15	1	84352	ua
	Heterotrophic Plate Count	N988896	325	CFU/mL	SM9215B	12/21/98 15:10	1	84352	ua

EPA 8310 (610)

	Naphthalene	N988896	<2.0	ug/L	EPA 610	12/24/98	2.0	83160	ua
	2-Methyl naphthalene	N988896	<1.5	ug/L	EPA 610	12/31/98	1.5	83160	ua
	1-Methyl naphthalene	N988896	<1.5	ug/L	EPA 610	12/24/98	1.5	83160	ua
	Acenaphthylene	N988896	<2.0	ug/L	EPA 610	12/24/98	2.0	83160	ua
	Acenaphthene	N988896	<1.0	ug/L	EPA 610	12/24/98	1.0	83160	ua
	Fluorene	N988896	<1.0	ug/L	EPA 610	12/24/98	1.0	83160	ua
	Phenanthrene	N988896	<1.0	ug/L	EPA 610	12/24/98	1.0	83160	ua
	Anthracene	N988896	<1.0	ug/L	EPA 610	12/24/98	1.0	83160	ua
	Fluoranthene	N988896	<1.0	ug/L	EPA 610	12/24/98	1.0	83160	ua
	Pyrene	N988896	<1.0	ug/L	EPA 610	12/24/98	1.0	83160	ua
	Benzo (a) Anthrancene	N988896	<0.20	ug/L	EPA 610	12/24/98	0.20	83160	ua
	Chrysene	N988896	<1.0	ug/L	EPA 610	12/24/98	1.0	83160	ua
	Benzo (b) Fluoranthene	N988896	<0.10	ug/L	EPA 610	12/24/98	0.10	83160	ua
	Benzo (k) Fluoranthene	N988896	<0.10	ug/L	EPA 610	12/24/98	0.10	83160	ua
	Benzo (a) Pyrene	N988896	<0.20	ug/L	EPA 610	12/24/98	0.20	83160	ua
	Indeno (123) Pyrene	N988896	<0.10	ug/L	EPA 610	12/24/98	0.10	83160	ua
	Dibenzo (a,h) Anthracene	N988896	<0.20	ug/L	EPA 610	12/24/98	0.20	83160	ua
	Benzo (ghi) Perylene	N988896	<1.0	ug/L	EPA 610	12/24/98	1.0	83160	ua
	Asbestos	N988896	<0.2352		EPA 100.1	1/12/99	0.2352	86457	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
	Dioxin Screen	N988896	<4.1	pg/L	EPA 161B	1/10/99	4.1	87424	ua

Approved by:

Debra A. Sanders

Debra Sanders
Laboratory Director

Comments:

Sanders Laboratories
Environmental Testing Services

CHAIN-OF-CUSTODY RECORD

FORM # 519770

Page 1 of 1

Client: Youngquist

Address:

Phone: Fax:

Report To: Troy Moore

Bill To:

P.O. #

Project Name: Dual Zone 1850' Site B

Project Location: Sawgrass

Sample Supply: GW

Customer Type:

Field Report #:

Kit #

REQUESTED DUE DATE: 1-4-99

EPA 610 METHOD

Sampled By (PRINT): NOAH OLENYCH.

Sampler Signature: Noah Olenych

ITEM #	SAMPLE DESCRIPTION / LOCATION	JOB #	Sample DATE	Sample TIME	Sample TYPE	NO. OF CONTAINERS	UNPRESERVED	H_2SO_4	HNO_3	HCL	NaOH, MCAA	Pri/Sec. GA	Rads: 226/228	TTHMS VOC's	Pest/PCBs	Unreg. Gr. I, II, III	BOD, NH_3, ON, TKN	O.P., T.P., Ca	Color, T.C., FC	HPC, Asbestos	Dioxin	Naphthalene, Anthracene, Phenanthrene	LAB NUMBER
1	Sawgrass Shallow Zone B		12-21-98	1045	G	30	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	N98896

OUT / DATE	SHIPMENT METHOD RETURNED / DATE	VIA	ITEM #	RELINQUISHED BY / AFFILIATION	DATE	TIME	ACCEPTED BY / AFFILIATION	DATE	TIME
				Noah Olenych	12-21	1450	W. Bach	12-21-98	1450

COMMENTS:

COOLER #

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

LAB FORMAT FOR REPORTING DRINKING WATER ANALYSES

PUBLIC WATER SYSTEM INFORMATION (to be completed by system or lab)

System Name: Dual Zone Site B Sawgrass

I.D. #: ____________

Address: ____________

____

Phone #: ____________

Type: ( ) Community ( ) Nontransient Noncommunity ( ) Noncommunity

SAMPLE INFORMATION (to be completed by sampler)

Sample Date (MM/DD/YY): 12/21/98 Sample Time: 10:45

Sample Location (be specific): SHALLOW ZONE B 1650'

Sampler Name and Phone: NOAH OLENYCH 941-488-8103

Sampler Signature: ____________

Title: ____________

Check Type(s): ( ) Distribution ( ) Recheck of MCL ( ) Resample of Lab Invalidated Sample
( ) Clearance ( ) Thm Max Res Time ( ) Plant Tap
( ) Distrib. entry point ( ) Raw ( ) Comp. of Multiple Sites-Attach a format for each site

LABORATORY CERTIFICATION INFORMATION - ATTACH HRS ANALYTE SHEET

Lab Name: **Sanders Laboratories, Inc.** HRS #: **84352**
Expiration Date: **07/01/99**
Address: **1050 Endeavor Ct. Nokomis, Fl. 34275**
Phone #: **941-488-8103**
Subcontracted Lab Name & HRS #: 83160, 83141, 86457, 87424 ATTACH HRS ANALYTE SHEET*

ANALYSIS INFORMATION (to be completed by lab) SAMPLE NUMBER: N988896
Date Sample(s) Received: 12/21/98
Group(s) Analyzed and Results attached for compliance with 62-550 F.A.C.:

( ) Nitrate Only	( ) Nitrite Only	(✓) Asbestos Only	(✓) Trihalomethanes
Inorganics - (✓) All 17 ( ) Partial	Volatile Organics - (✓) All 21 ( ) Partial	Secondaries - (✓) All 14 ( ) Partial	Pesticides/PCB's - (✓) All 30 ( ) Partial
Group I Unregulated - (✓) All 13 ( ) Partial	Group II Unregulated - (✓) All 23 ( ) Partial	Group III Unregulated - (✓) All 11 ( ) Partial	Radiochemicals - (✓) Single Sample ( ) Quarterly Composite**

*All HRS lab#s and their HRS Analyte Sheet for labs performing the attached water analyses must be provided. Failure to do so will result in rejection of the analyses and possible enforcement against the public water system for failure to sample.

* Provide radiochemical sample dates & locations for each quarter

Reporting Format 62-550.730(1)(b)
Effective Date: January 1995

CERTIFICATION

I, Debra A. Sanders, do HEREBY CERTIFY that all attached analytical data are correct.

Signature

Title Laboratory Director

Date:

COMPLIANCE INFORMATION (to be completed by State)

Sample Collection Satisfactory:

Sample Analysis Satisfactory:

Resample Requested For:

Reason:

Person Notified To Resample:

Date Notified:

DEP/HRS Reviewing Official:

Lawton Chiles
Governor

FLORIDA DEPARTMENT OF
HEALTH

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

LABORATORY: SANDERS LABORATORIES, INC.

CERTIFICATION NUMBER: 84352 EPA: FL00506
DATE: NOVEMBER 20, 1997
SUPERSEDES PREVIOUS ANALYTE SHEET DATED: JANUARY 30, 1997

MICROBIOLOGY	METHODS
Membrane Filter	SM9222B
Multiple Tube Fermentation	SM9221B
Fecal E. coli	SM9221E
MMO-MUG	
P/A	

PRIMARY INORGANIC

1. METALS	AA(FUR)	ICP	ICP/MS	OTHER
ANTIMONY	SM3113B			
ARSENIC	SM3113B			
BARIUM	SM3113B			
BERYLLIUM				
CADMIUM	SM3113B			
CHROMIUM	SM3113B			
LEAD	SM3113B			
MERCURY				SM3112B
NICKEL				SM3111B
SELENIUM	SM3113B			
SODIUM				SM3111B
THALLIUM	SM3113B			

2. LEAD AND COPPER				
LEAD	SM3113B			
COPPER	SM3113B			

3. CYANIDE	IC	ISE	UV-VIS	OTHER
CYANIDE				

4. NITRATE AND NITRITE			
NITRATE			SM4500NO3-E
NITRITE			SM4500NO3 E
TOTAL NO2-NO3			SM4500NO3 E

5. FLUORIDE			
FLUORIDE		SM4500F C	

6. ASBESTOS				
ASBESTOS				

SECONDARY INORGANIC

	AA(FUR)	ICP	UV-VIS	OTHER
ALUMINUM				SM3111D
CHLORIDE				SM4500CL- B
COLOR			SM2120B	
COPPER				SM3111B
FLUORIDE				SM4500F C
FOAMING AGENTS				
IRON				SM3111B
MANGANESE				SM3111B
ODOR				SM2150B
pH				150 1
SILVER				SM3111B
SULFATE				375 4
TDS				160 1
ZINC				SM3111B

PESTICIDES AND PCB'S	GC	GC/MS	HPLC
1. INSECTICIDES			
ALACHLOR			
ATRAZINE			
CHLORDANE			
ENDRIN			
HEPTACHLOR			
HEPTACHLOR EPOXIDE			
LINDANE			
METHOXYCHLOR			
TOXAPHENE			
HEXACHLOROBENZENE			
HEXACHLOROCYCLOPENTADIENE			
SIMAZINE			
2. HERBICIDES			
2,4-D			
PENTACHLOROPHENOL			
2,4,5-TP (SILVEX)			
DALAPON			
DINOSEB			
PICLORAM			
3. CARBAMATES			
CARBOFURAN			
OXAMYL (VYDATE)			
4. DISINFECTANT BY-PRODUCTS/VOC'S			
1,2-DIBROMO-3-CHLOROPROPANE			
ETHYLENE DIBROMIDE			
5. MISCELLANEOUS SOC'S			
DIQUAT			
ENDOTHALL			
GLYPHOSATE			
6. PCB'S			
AROCHLORS			
DECACHLOROBIPHENYL			
7. ADIPATES AND PHTHALATES			
DI(2-ETHYLHEXYL) ADIPATE			
DI(2-ETHYLHEXYL) PHTHALATE			
8. PAH			
BENZO(a)PYRENE			
DIOXIN			
2,3,7,8-TETRACHLORODIBENZO p-DIOXIN			

P.O. Box 210, Jacksonville, Florida 32231-0042

Lawton Chiles
Governor

FLORIDA DEPARTMENT OF
HEALTH

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

LABORATORY: SANDERS LABORATORIES, INC.

CERTIFICATION NUMBER: 84352 EPA: FL00506
DATE: JANUARY 30, 1997
SUPERSEDES PREVIOUS ANALYTE SHEET DATED: JUNE 17, 1996

OTHER REGULATED CONTAMINANTS

1. VOLATILE ORGANIC COMPOUNDS

GC GC/MS

- TRICHLOROETHYLENE
- TETRACHLOROETHYLENE
- CARBON TETRACHLORIDE
- VINYL CHLORIDE
- 1,1,1-TRICHLOROETHANE
- 1,2-DICHLOROETHANE
- BENZENE
- p-DICHLOROBENZENE
- 1,1-DICHLOROETHYLENE
- cis-1,2-DICHLOROETHYLENE
- 1,2-DICHLOROPROPANE
- ETHYLBENZENE
- CHLOROBENZENE
- o-DICHLOROBENZENE
- STYRENE
- TOLUENE
- trans-1,2-DICHLOROETHYLENE
- TOTAL XYLENES
- DICHLOROMETHANE
- 1,2,4-TRICHLOROBENZENE
- 1,1,2-TRICHLOROETHANE

2. TRIHALOMETHANES

- BROMODICHLOROMETHANE
- BR[illegible]FORM
- C[illegible]ODIBROMOMETHANE
- CHLOROFORM
- TOTAL TRIHALOMETHANES

GROUP I UNREGULATED CONTAMINANTS

1. CARBAMATES

GC GC/MS HPLC

- ALDICARB
- ALDICARB SULFOXIDE
- ALDICARB SULFONE
- CARBARYL
- 3-HYDROXYCARBOFURAN
- METHOMYL

2. HERBICIDES

- LDRIN
- UTACHLOR
- ICAMBA
- IELDRIN
- ETOLACHLOR
- ETRIBUZIN
- ROPACHLOR

GROUP II UNREGULATED CONTAMINANTS

GC GC/MS

- BROMOBENZENE
- BROMODICHLOROMETHANE
- BROMOFORM
- BROMOMETHANE
- CHLOROETHANE
- CHLOROFORM
- CHLOROMETHANE
- DIBROMOCHLOROMETHANE
- DICHLORODIFLUOROMETHANE
- p-CHLOROTOLUENE
- DIBROMOMETHANE
- 1,1-DICHLOROETHANE
- 1,3-DICHLOROPROPENE
- 1,3-DICHLOROPROPANE
- 2,2-DICHLOROPROPANE
- TRICHLOROFLUOROMETHANE
- 1,2,3-TRICHLOROPROPANE
- m-DICHLOROBENZENE
- 1,1,1,2-TETRACHLOROETHANE
- 1,1,2,2-TETRACHLOROETHANE
- METHYL tert-BUTYL ETHER
- 1,1-DICHLOROPROPENE
- o-CHLOROTOLUENE

GROUP III UNREGULATED CONTAMINANTS

1. BASE/NEUTRAL EXTRACTABLES

- BUTYL BENZYL PHTHALATE
- DI-n-BUTYL PHTHALATE
- DIETHYL PHTHALATE
- DIMETHYL PHTHALATE
- 2,4-DINITROTOLUENE
- DI-n-OCTYL PHTHALATE
- ISOPHORONE

2. ACID EXTRACTABLES

- 2-CHLOROPHENOL
- 2-METHYL-4,6-DINITROPHENOL
- PHENOL
- 2,4,6-TRICHLOROPHENOL

P. O. Box 210 • JACKSONVILLE, FLORIDA 32231

State of Florida
Department of Health
BUREAU OF LABORATORIES
SAFE DRINKING WATER

FLORIDA DEPARTMENT OF HEALTH
1997 - 1998

This is to certify that

86457
ATC Associates - Florida
9955 NW 116 Way, Suite 1
Miami, FL 33178-5126

has complied with Florida Administrative Code 64E-1, Part I, pertaining to safe drinking water testing in the following categories:

Primary Inorganic Contaminants (Asbestos)******************************

Specific certified analytes and methodologies within these categories are listed on the analyte sheets with this laboratory and the Florida Department of Health, Bureau of Laboratories

EFFECTIVE JULY 1, 1997 THROUGH JUNE 30, 1998

Eldert C. Hartwig, Jr., Sc.D., M.P.H.
Bureau Chief, Bureau of Laboratories
Florida Department of Health
DH Form 1629, 3/97
NON-TRANSFERABLE

CERTIFICATE No.: 97167

SAFE DRINKING WATER ANALYTE SHEET

HRS STATE OF FLORIDA
DEPARTMENT OF HEALTH AND REHABILITATIVE SERVICES

LABORATORY: TRIANGLE LABORATORIES OF RTP, INC.

CERTIFICATION NUMBER: 87424 EPA: NC00140
DATE: APRIL 19, 1995
SUPERSEDES PREVIOUS ANALYTE SHEET DATED: AUGUST 5, 1993

MICROBIOLOGY	METHODS
_ Membrane Filter	
_ Multiple Tube Fermentation	
_ Fecal/E. coli	
_ MMO-MUG	
_ P/A	

PRIMARY INORGANIC

1. METALS	AA(FUR)	ICP	ICP/MS	OTHER
_ ANTIMONY				
_ ARSENIC				
_ BARIUM				
_ BERYLLIUM				
_ CADMIUM				
_ CHROMIUM				
_ LEAD				
_ MERCURY				
_ NICKEL				
_ SELENIUM				
_ SODIUM				
_ THALLIUM				
2. LEAD AND COPPER				
_ LEAD				
_ COPPER				

3. CYANIDE	IC	ISE	UV-VIS	OTHER
_ CYANIDE				
4. NITRATE AND NITRITE				
_ NITRATE				
_ NITRITE				
_ TOTAL NO2-NO3				
5. FLUORIDE				
_ FLUORIDE				
6. ASBESTOS				
_ ASBESTOS				

SECONDARY INORGANIC

	AA(FUR)	ICP	UV-VIS	OTHER
_ ALUMINUM				
_ CHLORIDE				
_ COLOR				
_ COPPER				
_ FLUORIDE				
_ FOAMING AGENTS				
_ IRON				
_ MANGANESE				
_ ODOR				
_ pH				
_ SILVER				
_ SULFATE				
_ TDS				
_ ZINC				

PESTICIDES AND PCB'S

PESTICIDES AND PCB'S	GC	GC/MS	HPLC
1. INSECTICIDES			
_ ALACHLOR			
_ ATRAZINE			
_ CHLORDANE			
_ ENDRIN			
_ HEPTACHLOR			
_ HEPTACHLOR EPOXIDE			
_ LINDANE			
_ METHOXYCHLOR			
_ TOXAPHENE			
_ HEXACHLOROBENZENE			
_ HEXACHLOROCYCLOPENTADIENE			
_ SIMAZINE			
2. HERBICIDES			
_ 2,4-D			
_ PENTACHLOROPHENOL			
_ 2,4,5-TP (SILVEX)			
_ DALAPON			
_ DINOSEB			
_ PICLORAM			
3. CARBAMATES			
_ CARBOFURAN			
_ OXAMYL (VYDATE)			
4. DISINFECTANT BY-PRODUCTS/VOC'S			
_ 1,2-DIBROMO-3-CHLOROPROPANE			
_ ETHYLENE DIBROMIDE			
5. MISCELLANEOUS SOC'S			
_ DIQUAT			
_ ENDOTHALL			
_ GLYPHOSATE			
6. PCB'S			
_ AROCHLORS			
_ DECACHLOROBIPHENYL			
7. ADIPATES AND PHTHALATES			
_ DI(2-ETHYLHEXYL) ADIPATE			
_ DI(2-ETHYLHEXYL) PHTHALATE			
8. PAH			
_ BENZO(a)PYRENE			
DIOXIN			
X 2,3,7,8-TETRACHLORODIBENZO-p-DIOXIN		1613	

SAFE DRINKING WATER ANALYTE SHEET

HRS STATE OF FLORIDA
DEPARTMENT OF HEALTH AND REHABILITATIVE SERVICES

LABORATORY: TRIANGLE LABORATORIES OF RTP, INC.

CERTIFICATION NUMBER: 87424 EPA: NC00140
DATE: APRIL 19, 1995
SUPERSEDES PREVIOUS ANALYTE SHEET DATED: AUGUST 5, 1993

OTHER REGULATED CONTAMINANTS

1. VOLATILE ORGANIC COMPOUNDS

	GC	GC/MS
_ TRICHLOROETHYLENE		
_ TETRACHLOROETHYLENE		
_ CARBON TETRACHLORIDE		
_ VINYL CHLORIDE		
_ 1,1,1-TRICHLOROETHANE		
_ 1,2-DICHLOROETHANE		
_ BENZENE		
_ p-DICHLOROBENZENE		
_ 1,1-DICHLOROETHYLENE		
_ cis-1,2-DICHLOROETHYLENE		
_ 1,2-DICHLOROPROPANE		
_ ETHYLBENZENE		
_ CHLOROBENZENE		
_ o-DICHLOROBENZENE		
_ STYRENE		
_ TOLUENE		
_ trans-1,2-DICHLOROETHYLENE		
_ TOTAL XYLENES		
_ DICHLOROMETHANE		
_ 1,2,4-TRICHLOROBENZENE		
_ 1,1,2-TRICHLOROETHANE		

2. TRIHALOMETHANES

	GC	GC/MS
_ BROMODICHLOROMETHANE		
_ BROMOFORM		
_ CHLORODIBROMOMETHANE		
_ CHLOROFORM		
_ TOTAL TRIHALOMETHANES		

GROUP I UNREGULATED CONTAMINANTS

1. CARBAMATES

	GC	GC/MS	HPLC
_ ALDICARB			
_ ALDICARB SULFOXIDE			
_ ALDICARB SULFONE			
_ CARBARYL			
_ 3-HYDROXYCARBOFURAN			
_ METHOMYL			

2. HERBICIDES

	GC	GC/MS	HPLC
_ ALDRIN			
_ BUTACHLOR			
_ DICAMBA			
_ DIELDRIN			
_ METOLACHLOR			
_ METRIBUZIN			
PROPACHLOR			

GROUP II UNREGULATED CONTAMINANTS

	GC	GC/MS
_ BROMOBENZENE		
_ BROMODICHLOROMETHANE		
_ BROMOFORM		
_ BROMOMETHANE		
_ CHLOROETHANE		
_ CHLOROFORM		
_ CHLOROMETHANE		
_ DIBROMOCHLOROMETHANE		
_ DICHLORODIFLUOROMETHANE		
_ p-CHLOROTOLUENE		
_ DIBROMOMETHANE		
_ 1,1-DICHLOROETHANE		
_ 1,3-DICHLOROPROPENE		
_ 1,3-DICHLOROPROPANE		
_ 2,2-DICHLOROPROPANE		
_ TRICHLOROFLUOROMETHANE		
_ 1,2,3-TRICHLOROPROPANE		
_ m-DICHLOROBENZENE		
_ 1,1,1,2-TETRACHLOROETHANE		
_ 1,1,2,2,-TETRACHLOROETHANE		
_ METHYL tert-BUTYL ETHER		
_ 1,1-DICHLOROPROPENE		
_ o-CHLOROTOLUENE		

GROUP III UNREGULATED CONTAMINANTS

1. BASE/NEUTRAL EXTRACTABLES

_ BUTYL BENZYL PHTHALATE		
_ DI-n-BUTYL PHTHALATE		
_ DIETHYL PHTHALATE		
_ DIMETHYL PHTHALATE		
_ 2,4-DINITROTOLUENE		
_ DI-n-OCTYL PHTHALATE		
_ ISOPHORONE		

2. ACID EXTRACTABLES

_ 2-CHLOROPHENOL		
_ 2-METHYL-4,6-DINITROPHENOL		
_ PHENOL		
_ 2,4,6-TRICHLOROPHENOL		

FLORIDA DEPARTMENT OF
HEALTH

Lawton Chiles
Governor

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

Safe Drinking Water Analyte Sheet
(RADIOCHEMISTRY)

LABORATORY: Florida Radiochemistry Services

CERTIFICATION ID#: 83141
Date: July 1, 1997
Supersedes previous issue dated 7/1/96

RADIOCHEMISTRY

	Method No.	Publication [XX Indicates ANALYTE CERTIFIED]
XX Gross Alpha	900.0	Prescribed Procedures for Measurement of Radioactivity in Drinking Water, EPA-600/4-80-032
XX Gross Beta	900.0	Prescribed Procedures for Measurement of Radioactivity in Drinking Water, EPA-600/4-80-032
XX Radium-226	903.1	Prescribed Procedures for Measurement of Radioactivity in Drinking Water, EPA-600/4-80-032
XX Radium-228	*Alt	Brooks and Blanchard, *(EPA Alternate Approved Procedure)
XX Natural Uranium	908.0	Prescribed Procedures for Measurement of Radioactivity in Drinking Water, EPA-600/4-80-032
___ Radon	____	
___ Tritium	____	
___ Strontium-89	____	
XX Strontium-90	905.0	Prescribed Procedures for Measurement of Radioactivity in Drinking Water, EPA-600/4-80-032
___ Iodine-131	____	
___ Photon Emitters	____	
___ Cesium-134		
___ Cesium-137		
___ Cobalt-60		
___ Barium-133		
___ Zinc-65		

FLORIDA DEPARTMENT OF
HEALTH

Lawton Chiles
Governor

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

LABORATORY: ELAB, INC. D/B/A ENVIROLAB

CERTIFICATION NUMBER: 83160 EPA: FL00020
DATE: MARCH 31, 1998
SUPERSEDES PREVIOUS ANALYTE SHEET DATED: DECEMBER 2, 1997

	MICROBIOLOGY	METHODS
X	Membrane Filter	SM9222B
X	Multiple Tube Fermentation	SM9221B
X	Fecal/E. coli	SM9221E, (1a)
-	MMO-MUG	
-	P/A	

PRIMARY INORGANIC

	1. METALS	AA(FUR)	ICP	ICP/MS	OTHER
X	ANTIMONY	SM3113B			
X	ARSENIC	SM3113B	200.7		
X	BARIUM	SM3113B	200.7		SM3111D
X	BERYLLIUM	SM3113B	200.7		
X	CADMIUM	SM3113B	200.7		
X	CHROMIUM	SM3113B	200.7		
X	LEAD	SM3113B			
X	MERCURY				245.1
X	NICKEL	SM3113B	200.7		
X	SELENIUM	SM3113B			
X	SODIUM				SM3111B
X	THALLIUM	200.9			

	2. LEAD AND COPPER				
X	LEAD	SM3113B			
X	COPPER	SM3113B	200.7		SM3111B

	3. CYANIDE	IC	ISE	UV-VIS	OTHER
X	CYANIDE			SM4500CN-E	

	4. NITRATE AND NITRITE			
X	NITRATE	300.0		SM4500N03 E, 353.2
X	NITRITE	300.0		SM4500N03 E, 353.2
X	TOTAL NO2-NO3	300.0		SM4500N03 E, 353.2

	5. FLUORIDE			
X	FLUORIDE	300.0	SM4500F- C	

	6. ASBESTOS				
-	ASBESTOS				

SECONDARY INORGANIC

		AA(FUR)	ICP	UV-VIS	OTHER
X	ALUMINUM		200.7		SM3111D
X	CHLORIDE				SM4500Cl- C, 300.0
X	COLOR			SM2120B	
X	COPPER	SM3113B	200.7		SM3111B
X	FLUORIDE				300.0, SM4500F- C
X	FOAMING AGENTS			SM5540C	
X	IRON	SM3113B	200.7		SM3111B
X	MANGANESE	SM3113B	200.7		SM3111B
X	ODOR				SM2150B
X	pH				150.1
X	SILVER	SM3113B	200.7		SM3111B
X	SULFATE			375.2	300.0, 375.4
X	TDS				SM2540C
X	ZINC	SM3113B	200.7		SM3111B

	PESTICIDES AND PCB'S	GC	GC/MS	HPLC
	1. INSECTICIDES			
X	ALACHLOR	505, 507		
X	ATRAZINE	505, 507		
X	CHLORDANE	505, 508		
X	ENDRIN	505, 508		
X	HEPTACHLOR	505, 508		
X	HEPTACHLOR EPOXIDE	505, 508		
X	LINDANE	505, 508		
X	METHOXYCHLOR	505, 508		
X	TOXAPHENE	505, 508		
X	HEXACHLOROBENZENE	505, 508		
X	HEXACHLOROCYCLOPENTADIENE	505	525.2	
X	SIMAZINE	505, 507		
	2. HERBICIDES			
X	2,4-D	515.1		
X	PENTACHLOROPHENOL	515.1	525.2	
X	2,4,5-TP (SILVEX)	515.1		
X	DALAPON	515.1		
X	DINOSEB	515.1		
X	PICLORAM	515.1		
	3. CARBAMATES			
X	CARBOFURAN			531.1
X	OXAMYL (VYDATE)			531.1
	4. DISINFECTANT BY-PRODUCTS/VOC'S			
X	1,2-DIBROMO-3-CHLOROPROPANE	504.1		
X	ETHYLENE DIBROMIDE	504.1		
	5. MISCELLANEOUS SOC'S			
X	DIQUAT			549.1
X	ENDOTHALL	548.1		
X	GLYPHOSATE			547
	6. PCB'S			
X	AROCHLORS	505, 508		
-	DECACHLOROBIPHENYL			
	7. ADIPATES AND PHTHALATES			
X	DI(2-ETHYLHEXYL) ADIPATE		525.2	
X	DI(2-ETHYLHEXYL) PHTHALATE		525.2	
	8. PAH			
X	BENZO(a)PYRENE		525.2	
	DIOXIN			
-	2,3,7,8-TETRACHLORODIBENZO-p-DIOXIN			

HRS-H FORM 1041, JANUARY, 97 SAFE DRINKING WATER ANALYTE SHEET
(replaces version MARCH, 95 which may be used)

P.O. Box 210, Jacksonville, Florida 32231-0042

FLORIDA DEPARTMENT OF
HEALTH

Lawton Chiles
Governor

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

LABORATORY: ELAB, INC. D/B/A ENVIROLAB

CERTIFICATION NUMBER: 83160 EPA: FL00020
DATE: MARCH 31, 1998
SUPERSEDES PREVIOUS ANALYTE SHEET DATED: DECEMBER 2, 1997

OTHER REGULATED CONTAMINANTS

1. VOLATILE ORGANIC COMPOUNDS

		GC	GC/MS
	TRICHLOROETHYLENE	502.2	524.2
	TETRACHLOROETHYLENE	502.2	524.2
	CARBON TETRACHLORIDE	502.2	524.2
	VINYL CHLORIDE	502.2	524.2
	1,1,1-TRICHLOROETHANE	502.2	524.2
	1,2-DICHLOROETHANE	502.2	524.2
	BENZENE	502.2	524.2
	p-DICHLOROBENZENE	502.2	524.2
	1,1-DICHLOROETHYLENE	502.2	524.2
X	cis-1,2-DICHLOROETHYLENE	502.2	524.2
X	1,2-DICHLOROPROPANE	502.2	524.2
X	ETHYLBENZENE	502.2	524.2
X	CHLOROBENZENE	502.2	524.2
X	o-DICHLOROBENZENE	502.2	524.2
X	STYRENE	502.2	524.2
X	TOLUENE	502.2	524.2
X	trans-1,2-DICHLOROETHYLENE	502.2	524.2
X	TOTAL XYLENES	502.2	524.2
X	DICHLOROMETHANE	502.2	524.2
X	1,2,4-TRICHLOROBENZENE	502.2	524.2
X	1,1,2-TRICHLOROETHANE	502.2	524.2

2. TRIHALOMETHANES

		GC	GC/MS
X	BROMODICHLOROMETHANE	502.2	524.2
X	BROMOFORM	502.2	524.2
X	CHLORODIBROMOMETHANE	502.2	524.2
X	CHLOROFORM	502.2	524.2
X	TOTAL TRIHALOMETHANES	502.2	524.2

GROUP I UNREGULATED CONTAMINANTS

1. CARBAMATES

		GC	GC/MS	HPLC
X	ALDICARB			531.1
X	ALDICARB SULFOXIDE			531.1
X	ALDICARB SULFONE			531.1
X	CARBARYL			531.1
X	3-HYDROXYCARBOFURAN			531.1
X	METHOMYL			531.1

2. HERBICIDES

		GC	GC/MS	HPLC
X	ALDRIN	508	525.2	———
X	BUTACHLOR	507	525.2	———
X	DICAMBA	515.1	———	———
X	DIELDRIN	508	525.2	———
X	METOLACHLOR	507	525.2	———
X	METRIBUZIN	507	525.2	———
·	PROPACHLOR	508	525.2	———

GROUP II UNREGULATED CONTAMINANTS

		GC	GC/MS
X	BROMOBENZENE	502.2	524.2
X	BROMODICHLOROMETHANE	502.2	524.2
X	BROMOFORM	502.2	524.2
X	BROMOMETHANE	502.2	524.2
X	CHLOROETHANE	502.2	524.2
X	CHLOROFORM	502.2	524.2
X	CHLOROMETHANE	502.2	524.2
X	DIBROMOCHLOROMETHANE	502.2	524.2
X	DICHLORODIFLUOROMETHANE	502.2	524.2
X	p-CHLOROTOLUENE	502.2	524.2
X	DIBROMOMETHANE	502.2	524.2
X	1,1-DICHLOROETHANE	502.2	524.2
X	1,3-DICHLOROPROPENE	502.2	524.2
X	1,3-DICHLOROPROPANE	502.2	524.2
X	2,2-DICHLOROPROPANE	502.2	524.2
X	TRICHLOROFLUOROMETHANE	502.2	524.2
X	1,2,3-TRICHLOROPROPANE	502.2	524.2
X	m-DICHLOROBENZENE	502.2	524.2
X	1,1,1,2-TETRACHLOROETHANE	502.2	524.2
X	1,1,2,2-TETRACHLOROETHANE	502.2	524.2
X	METHYL tert-BUTYL ETHER	502.2	524.2
X	1,1-DICHLOROPROPENE	502.2	524.2
X	o-CHLOROTOLUENE	502.2	524.2

GROUP III UNREGULATED CONTAMINANTS

1. BASE/NEUTRAL EXTRACTABLES

X	BUTYL BENZYL PHTHALATE	———	625
X	DI-n-BUTYL PHTHALATE	———	625
X	DIETHYL PHTHALATE	———	625
X	DIMETHYL PHTHALATE	———	625
X	2,4-DINITROTOLUENE	———	625
X	DI-n-OCTYL PHTHALATE	———	625
X	ISOPHORONE	———	625

2. ACID EXTRACTABLES

X	2-CHLOROPHENOL	———	625
X	2-METHYL-4,6-DINITROPHENOL	———	625
X	PHENOL	———	625
X	2,4,6-TRICHLOROPHENOL	———	625

Lower Monitor Zone Water Quality
DZMW-1

INTAKE #: 519769

So
L
Date 14-

DZMW-1 Lower

Project Name: Sawgrass
Project Location: Dual Zone 1950' Site A
Sample Supply: Water
Collector: Noah Olenych
Sample Received Date/Time: 12/21/98 14:40

Youngquist Brothe. .nc.
15465 Pine Ridge Road

Fort Myers, FL 33908-

RECEIVED

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)	N988895	<0.0022	mg/L	EPA 206.2	12/28/98	0.0022	84352	ua
1010	Barium	(2)	N988895	0.490	mg/L	EPA 208.2	12/29/98	0.200	84352	ua
1015	Cadmium	(0.005)	N988895	0.007	mg/L	EPA 213.1	12/22/98	0.003	84352	ua
1020	Chromium	(0.1)	N988895	<0.02	mg/L	EPA 218.1	12/22/98	0.02	84352	ua
1024	Cyanide	(0.2)	N988895	<0.0050	mg/L	EPA 335.2	12/31/98	0.0050	83160	ua
5	Fluoride	(4.0)	N988895	1.06	mg/L	EPA 340.2	1/4/99	0.2	84352	ua
030	Lead	(0.015)	N988895	<0.001	mg/L	EPA 239.2	12/28/98	0.001	84352	ua
1035	Mercury	(0.002)	N988895	<0.001	mg/L	EPA 245.1	12/29/98	0.001	84352	ua
1036	Nickel	(0.1)	N988895	0.156	mg/L	EPA 249.1	12/29/98	0.010	84352	ua
1040	Nitrate	(10)	N988895	<0.01	mg/L	EPA 353.2	12/30/98	0.01	84352	ua
1041	Nitrite	(1)	N988895	<0.01	mg/L	EPA 354.1	12/23/98	0.01	84352	ua
1045	Selenium	(0.05)	N988895	<0.004	mg/L	EPA 270.2	12/23/98	0.004	84352	ua
1052	Sodium	(160)	N988895	4,237	mg/L	EPA 273.1	1/5/99	0.003	84352	ua
1074	Antimony	(0.006)	N988895	<5.0	mg/L	EPA 204.2	1/7/99	5.0	83160	ua
1075	Beryllium	(0.004)	N988895	<1.0	mg/L	EPA 210.2	1/7/99	1.0	83160	ua
1085	Thallium	(0.002)	N988895	<5.0	mg/L	EPA 279.2	1/7/99	5.0	83160	ua
				Secondary Chemical Analysis 62-550.320 PWS031						
1002	Aluminum	(0.2)	N988895	<0.2	mg/L	EPA 202.1	12/29/98	0.2	84352	ua
1017	Chloride	(250)	N988895	8,070	mg/L	SM4500CI-B	1/4/99	5	84352	ua
1022	Copper	(1.0)	N988895	0.023	mg/L	EPA 220.1	12/24/98	0.010	84352	ua
1025	Fluoride	(2.0)	N988895	1.06	mg/L	EPA 340.2	1/4/99	0.2	84352	ua
1028	Iron	(0.3)	N988895	0.462	mg/L	EPA 236.1	1/5/99	0.015	84352	ua
1032	Manganese	(0.05)	N988895	0.008	mg/L	EPA 243.1	12/29/98	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)	N988895	0.032	mg/L	EPA 272.1	12/29/98	0.010	84352	ua
1055	Sulfate (250)	N988895	986	mg/L	EPA 375.4	1/4/99	5	84352	ua
1095	Zinc (5.0)	N988895	<0.005	mg/L	EPA 289.1	12/29/98	0.005	84352	ua
	Color (15.0)	N988895	37	PtCo units	EPA 110.3	12/21/98	1	84352	ua
1920	Odor (3.0)	N988895	6	TON	EPA 140.1	12/22/98	1	84352	ua
1925	pH (6.5-8.5)	N988895	7.44	std units	EPA 150.1	12/21/98	n/a	84352	ua
1930	Total Dissolved Solids (500)	N988895	15,560	mg/L	EPA 160.1	1/4/99	7	84352	ua
2905	Foaming Agents (1.5)	N988895	0.33	mg/L	EPA 425.1	12/23/98	0.05	83160	ua

Radiochemical Analysis

62-550.310(5)

PWS033

Parameter ID	Analysis	Sample ID	Result	Unit	Method	Analysis Date/Time	D. L.	LabID	Analyst
4000	Gross Alpha	N988895	11.1	pCi/L	EPA 900.0	1/6/99	+/-3.8	83141	ua
4020	Radium 226	N988895	6.6	pCi/L	EPA 903.1	1/6/99	+/-0.4	83141	ua
4030	Radium 228	N988895	<0.8	pCi/L	Brks/Blnchrd	1/6/99	+/-0.5	83141	ua

Trihalomethane Analysis

62-550.310(2)(a)

PWS027

Parameter ID	Analysis	Sample ID	Result	Unit	Method	Analysis Date/Time	D. L.	LabID	Analyst
2950	Total THM's (0.10)	N988895	<0.00050	mg/L	EPA 502.2	12/30/98	0.00050	83160	ua

Volatile Organic Analysis

62-550.310(2)(b)

PWS028

Parameter ID	Analysis	Sample ID	Result	Unit	Method	Analysis Date/Time	D. L.	LabID	Analyst
2378	1,2,4-Trichlorobenzene (70)	N988895	<0.50	ug/L	EPA 502.2	12/30/98	0.50	83160	ua
2380	Cis-1,2-Dichloroethylene (70)	N988895	<0.50	ug/L	EPA 502.2	12/30/98	0.50	83160	ua
2955	Xylenes (Total) (10,000)	N988895	<0.50	ug/L	EPA 502.2	12/30/98	0.50	83160	ua
2964	Dichloromethane (5)	N988895	<0.50	ug/L	EPA 502.2	12/30/98	0.50	83160	ua
2968	O-Dichlorobenzene (600)	N988895	<0.50	ug/L	EPA 502.2	12/30/98	0.50	83160	ua
2969	Para-Dichlorobenzene (75)	N988895	<0.50	ug/L	EPA 502.2	12/30/98	0.50	83160	ua
2976	Vinyl Chloride (1)	N988895	<0.50	ug/L	EPA 502.2	12/30/98	0.50	83160	ua
2977	1,1-Dichloroethylene (7)	N988895	<0.50	ug/L	EPA 502.2	12/30/98	0.50	83160	ua
2979	Trans-1,2-Dichloroethylene(100)	N988895	<0.50	ug/L	EPA 502.2	12/30/98	0.50	83160	ua
2980	1,2-Dichloroethane (3)	N988895	<0.50	ug/L	EPA 502.2	12/30/98	0.50	83160	ua
2981	1,1,1-Trichloroethane (200)	N988895	<0.50	ug/L	EPA 502.2	12/30/98	0.50	83160	ua
2982	Carbon Tetrachloride (3)	N988895	<0.50	ug/L	EPA 502.2	12/30/98	0.50	83160	ua
2983	1,2-Dichloropropane (5)	N988895	<0.50	ug/L	EPA 502.2	12/30/98	0.50	83160	ua
2984	Trichloroethylene (3)	N988895	<0.50	ug/L	EPA 502.2	12/30/98	0.50	83160	ua
2985	1,1,2-Trichloroethane (5)	N988895	<0.50	ug/L	EPA 502.2	12/30/98	0.50	83160	ua
2987	Tetrachloroethylene (3)	N988895	<0.50	ug/L	EPA 502.2	12/30/98	0.50	83160	ua
2989	Monochlorobenzene (100)	N988895	<0.50	ug/L	EPA 502.2	12/30/98	0.50	83160	ua
2990	Benzene (1)	N988895	<0.50	ug/L	EPA 502.2	12/30/98	0.50	83160	ua
2991	Toluene (1000)	N988895	<0.50	ug/L	EPA 502.2	12/30/98	0.50	83160	ua
2992	Ethylbenzene (700)	N988895	<0.50	ug/L	EPA 502.2	12/30/98	0.50	83160	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
2996	Styrene (100)	N988895	<0.50	ug/L	EPA 502.2	12/30/98	0.50	83160	ua

Pesticide/PCB Chemical Analysis

62-550.310(2)(c)

PWS029

Parameter ID	Analysis	Sample ID	Result	Unit	Method	Analysis Date/Time	D. L.	LabID	Analyst
2005	Endrin (2)	N988895	<0.50	ug/L	EPA 505	12/28/98	0.020	83160	ua
2010	Lindane (0.2)	N988895	<0.010	ug/L	EPA 505	12/28/98	0.010	83160	ua
2015	Methoxychlor (40)	N988895	<0.070	ug/L	EPA 508	12/28/98	0.070	83160	ua
2020	Toxaphene (3)	N988895	<0.18	ug/L	EPA 508	12/28/98	0.18	83160	ua
2031	Dalapon (200)	N988895	<1.0	ug/L	EPA 515.1	12/31/98	1.0	83160	ua
2032	Diquat (20)	N988895	<0.40	ug/L	EPA 549.1	12/28/98	0.40	83160	ua
2033	Endothall (100)	N988895	<9.0	ug/L	EPA 548.1	1/3/99	9.0	83160	ua
2034	Glyphosate (700)	N988895	<6.0	ug/L	EPA 547	12/30/98	6.0	83160	ua
2035	Di(2-ethylhexyl) adipate (400)	N988895	<6.0	ug/L	EPA 525.2	12/30/98	6.0	83160	ua
2036	Oxamyl (Vydate) (200)	N988895	<2.0	ug/L	EPA 531.1	12/29/98	2.0	83160	ua
2037	Simazine (4)	N988895	<1.5	ug/L	EPA 507	12/28/98	1.5	83160	ua
2039	Di(2-ethylhexyl) phthalate (6)	N988895	<1.6	ug/L	EPA 525.2	12/30/98	1.6	83160	ua
2040	Picloram (500)	N988895	<0.10	ug/L	EPA 515.1	12/31/98	0.10	83160	ua
2041	Dinoseb (7)	N988895	<0.20	ug/L	EPA 515.1	12/31/98	0.20	83160	ua
2042	Hexachlorocyclopentadiene(50)	N988895	<0.10	ug/L	EPA 505	12/28/98	0.10	83160	ua
2046	Carbofuran (40)	N988895	<2.0	ug/L	EPA 531.1	12/29/98	2.0	83160	ua
2050	Atrazine (3)	N988895	<2.5	ug/L	EPA 505	12/28/98	2.5	83160	ua
2051	Alachlor (2)	N988895	<1.5	ug/L	EPA 505	12/28/98	1.5	83160	ua
2[illegible]	Heptachlor (0.4)	N988895	<0.030	ug/L	EPA 505	12/28/98	0.030	83160	ua
20[illegible]	Heptachlor Epoxide (0.2)	N988895	<0.010	ug/L	EPA 505	12/28/98	0.010	83160	ua
2105	2,4-D (70)	N988895	<0.10	ug/L	EPA 515.1	12/31/98	0.10	83160	ua
2110	2,4,5-TP (Silvex) (50)	N988895	<0.20	ug/L	EPA 515.1	12/31/98	0.20	83160	ua
2274	Hexachlorobenzene (1)	N988895	<0.10	ug/L	EPA 508	12/28/98	0.10	83160	ua
2306	Benzo(a)pyrene (.2)	N988895	<0.20	ug/L	EPA 550	12/30/98	0.20	83160	ua
2326	Pentachlorophenol (1)	N988895	<0.040	ug/L	EPA 515.1	12/31/98	0.040	83160	ua
2383	PCB (0.5)	N988895	<0.10	ug/L	EPA 508	12/28/98	0.10	83160	ua
2931	Dibromochloropropane (.2)	N988895	<0.020	ug/L	EPA 504	12/25/98	0.020	83160	ua
2946	Ethylene Dibromide (0.02)	N988895	<0.020	ug/L	EPA 504	12/25/98	0.020	83160	ua
2959	Chlordane (2)	N988895	<0.020	ug/L	EPA 505	12/28/98	0.020	83160	ua

Unregulated Group I Analysis

62-550.405

PWS035

Parameter ID	Analysis	Sample ID	Result	Unit	Method	Analysis Date/Time	D. L.	LabID	Analyst
2021	Carbaryl	N988895	<2.0	ug/L	EPA 531.1	12/29/98	2.0	83160	ua
2022	Methomyl	N988895	<2.0	ug/L	EPA 531.1	12/29/98	2.0	83160	ua
2043	Aldicarb Sulfoxide	N988895	<2.0	ug/L	EPA 531.1	12/29/98	2.0	83160	ua
2044	Aldicarb Sulfone	N988895	<2.0	ug/L	EPA 531.1	12/29/98	2.0	83160	ua
2045	Metolachlor	N988895	<1.0	ug/L	EPA 525.2	12/30/98	1.0	83160	ua
2047	Aldicarb	N988895	<2.0	ug/L	EPA 531.1	12/29/98	2.0	83160	ua

Parameter ID	Analysis	Sample ID	Result	Unit	Method	Analysis Date/Time	D. L.	LabID	Analyst
2066	3-Hydroxycarbofuran	N988895	<2.0	ug/L	EPA 531.1	12/29/98	2.0	83160	ua
2077	Propachlor	N988895	<0.20	ug/L	EPA 525.2	12/30/98	0.20	83160	ua
2356	Aldrin	N988895	<0.10	ug/L	EPA 525.2	12/29/98	0.10	83160	ua
[illegible]	Dieldrin	N988895	<0.13	ug/L	EPA 525.2	12/30/98	0.13	83160	ua
2440	Dicamba	N988895	<2.0	ug/L	EPA 515.1	12/31/98	2.0	83160	ua
2595	Metribuzin	N988895	<1.0	ug/L	EPA 525.2	12/30/98	1.0	83160	ua
2076	Butachlor	N988895	<0.10	ug/L	EPA 525.2	12/30/98	0.10	83160	ua

Unregulated Group II Analysis

62-550.410

PWS034

Parameter ID	Analysis	Sample ID	Result	Unit	Method	Analysis Date/Time	D. L.	LabID	Analyst
2210	Chloromethane	N988895	<0.50	ug/L	EPA 502.2	12/30/98	0.50	83160	ua
2212	Dichlorodiflouromethane	N988895	<0.50	ug/L	EPA 502.2	12/30/98	0.50	83160	ua
2214	Bromomethane	N988895	<0.50	ug/L	EPA 502.2	12/30/98	0.50	83160	ua
2216	Chloroethane	N988895	<0.50	ug/L	EPA 502.2	12/30/08	0.50	83160	ua
2218	Trichlorofluoromethane	N988895	<0.50	ug/L	EPA 502.2	12/30/98	0.50	83160	ua
2251	Methyl-Tert-Butyl-Ether	N988895	<0.50	ug/L	EPA 502.2	12/30/98	0.50	83160	ua
2408	Dibromomethane	N988895	<0.50	ug/L	EPA 502.2	12/30/98	0.50	83160	ua
2410	1,1-Dichloropropylene	N988895	<0.50	ug/L	EPA 502.2	12/30/98	0.50	83160	ua
2412	1,3-Dichloropropane	N988895	<0.50	ug/L	EPA 502.2	12/30/98	0.50	83160	ua
2413	1,3-Dichloropropene	N988895	<0.50	ug/L	EPA 502.2	12/30/98	0.50	83160	ua
2414	1,2,3-Trichloropropane	N988895	<0.50	ug/L	EPA 502.2	12/30/98	0.50	83160	ua
2416	2,2-Dichloropropane	N988895	<0.50	ug/L	EPA 502.2	12/30/98	0.50	83160	ua
[illegible]	Chloroform	N988895	<0.50	ug/L	EPA 502.2	12/30/98	0.50	83160	ua
[illegible]	Bromoform	N988895	<0.50	ug/L	EPA 502.2	12/30/98	0.50	83160	ua
2943	Bromodichloromethane	N988895	<0.50	ug/L	EPA 502.2	12/30/98	0.50	83160	ua
2944	Dibromochloromethane	N988895	<0.50	ug/L	EPA 502.2	12/30/98	0.50	83160	ua
2965	O-Chlorotoluene	N988895	<0.50	ug/L	EPA 502.2	12/30/98	0.50	83160	ua
2966	P-Chlorotoluene	N988895	<0.50	ug/L	EPA 502.2	12/30/98	0.50	83160	ua
2967	M-Dichlorobenzene	N988895	<0.50	ug/L	EPA 502.2	12/30/98	0.50	83160	ua
2978	1,1-Dichloroethane	N988895	<0.50	ug/L	EPA 502.2	12/30/98	0.50	83160	ua
2986	1,1,1,2-Tetrachloroethane	N988895	<0.50	ug/L	EPA 502.2	12/30/98	0.50	83160	ua
2988	1,1,2,2-Tetrachloroethane	N988895	<0.50	ug/L	EPA 502.2	12/30/98	0.50	83160	ua
2993	Bromobenzene	N988895	<0.50	ug/L	EPA 502.2	12/30/98	0.50	83160	ua

Unregulated Group III Analysis

62-550.415

PWS036 & 037

Parameter ID	Analysis	Sample ID	Result	Unit	Method	Analysis Date/Time	D. L.	LabID	Analyst
2262	Isophorone	N988895	<5.0	ug/L	EPA 625	1/2/99	5.0	83160	ua
2270	2,4-Dinitrotoluene	N988895	<5.0	ug/L	EPA 625	1/2/99	5.0	83160	ua
2282	Dimethylphthalate	N988895	<5.0	ug/L	EPA 625	1/2/99	5.0	83160	ua
2284	Diethylphthalate	N988895	<5.0	ug/L	EPA 625	1/2/99	5.0	83160	ua
2290	Di-n-Butylphthalate	N988895	<5.0	ug/L	EPA 625	1/2/99	5.0	83160	ua
2294	Butyl benzyl phthalate	N988895	<5.0	ug/L	EPA 625	1/2/99	5.0	83160	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
9089	Di-n-octylphthalate	N988895	<5.0	ug/L	EPA 625	1/2/99		5.0	83160	ua
9108	2-Chlorophenol	N988895	<5.0	ug/L	EPA 625	1/2/99		5.0	83160	ua
9112	2-Methyl-4,6-dinitophenol	N988895	<20	ug/L	EPA 625	1/2/99		20	83160	ua
	Phenol	N988895	<5.0	ug/L	EPA 625	1/2/99		5.0	83160	ua
9116	2,4,6-Trichlorophenol	N988895	<5.0	ug/L	EPA 625	1/2/99		5.0	83160	ua
	BOD	N988895	3.7	mg/L	EPA 405.1	12/21/98	15:00	1	84352	ua
	Ammonia-N	N988895	0.26	mg/L	EPA 350.3	12/30/98		0.05	84352	ua
	Nitrogen, Organic	N988895	5.42	mg/L	EPA 351.2	12/30/98		0.2	84352	ua
	Nitrogen, Total Kjeldahl	N988895	5.68	mg/L	EPA 351.2	12/30/98		0.2	84352	ua
	Orthophosphate	N988895	<0.02	mg/L	EPA 365.2	12/22/98		0.02	84352	ua
	Phosphorus, Total	N988895	0.10	mg/L	EPA 365.2	12/28/98		0.02	84352	ua
	Calcium	N988895	2.60	mg/L	EPA 215.1	1/4/99		0.40	84352	ua

Parameter ID	Analysis	Sample ID	Result	Unit	Method	Analysis Date/Time	D. L.	LabID	Analyst
	Carbonate, CO3	N988895	0.27	mg/L	SM 4500	1/4/99		84352	ua
	Total Coliform	N988895	<1	col/100ml	SM9222B	12/21/98	15:15 1	84352	ua
	Fecal Coliform	N988895	<1	col/100ml	SM9222D	12/21/98	15:15 1	84352	ua
	Heterotrophic Plate Count	N988895	300	CFU/mL	SM9215B	12/21/98	15:10 1	84352	ua

EPA 8310 (610)

	Naphthalene	N988895	<2.0	ug/L	EPA 610	12/24/98	2.0	83160	ua
	2-Methyl naphthalene	N988895	<1.5	ug/L	EPA 610	12/24/98	1.5	83160	ua
	1-Methyl naphthalene	N988895	<1.5	ug/L	EPA 610	12/24/98	1.5	83160	ua
	Acenaphthylene	N988895	<2.0	ug/L	EPA 610	12/24/98	2.0	83160	ua
	Acenaphthene	N988895	<1.0	ug/L	EPA 610	12/24/98	1.0	83160	ua
	Fluorene	N988895	<1.0	ug/L	EPA 610	12/24/98	1.0	83160	ua
	Phenanthrene	N988895	<1.0	ug/L	EPA 610	12/24/98	1.0	83160	ua
	Anthracene	N988895	<1.0	ug/L	EPA 610	12/24/98	1.0	83160	ua
	Fluoranthene	N988895	<1.0	ug/L	EPA 610	12/24/98	1.0	83160	ua
	Pyrene	N988895	<1.0	ug/L	EPA 610	12/24/98	1.0	83160	ua
	Benzo (a) Anthrancene	N988895	<0.20	ug/L	EPA 610	12/24/98	0.20	83160	ua
	Chrysene	N988895	<1.0	ug/L	EPA 610	12/24/98	1.0	83160	ua
	Benzo (b) Fluoranthene	N988895	<0.10	ug/L	EPA 610	12/24/98	0.10	83160	ua
	Benzo (k) Fluoranthene	N988895	<.010	ug/L	EPA 610	12/24/98	0.10	83160	ua
	Benzo (a) Pyrene	N988895	<0.20	ug/L	EPA 610	12/24/98	0.20	83160	ua
	Indeno (123) Pyrene	N988895	<0.10	ug/L	EPA 610	12/24/98	0.10	83160	ua
	Dibenzo (a,h) Anthracene	N988895	<.020	ug/L	EPA 610	12/24/98	0.20	83160	ua
	Benzo (ghi) Perylene	N988895	<1.0	ug/L	EPA 610	12/24/98	1.0	83160	ua
	Asbestos	N988895	<0.2352	ms/L	EPA 100.1	1/12/99	0.2352	86457	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
	Dioxin Screen	N988895	<4.6	pg/L	EPA 161B	1/10/99	4.6	87424	ua

Approved by:

Debra A. Sanders

Debra Sanders
Laboratory Director

Comments:

LAB FORMAT FOR REPORTING DRINKING WATER ANALYSES

PUBLIC WATER SYSTEM INFORMATION (to be completed by system or lab)

System Name: Dual Zone Site A. Sawgrass

I.D. #: ____________

Address: ____________

____

Phone #: ____________

Type: ( ) Community ( ) Nontransient Noncommunity ( ) Noncommunity

SAMPLE INFORMATION (to be completed by sampler)

Sample Date (MM/DD/YY): 12 21 98 Sample Time: 09:55

Sample Location (be specific): Zone A. 1950'

Sampler Name and Phone: Noah Olenych. 941-488-8103

Sampler Signature: ____________

Title: ____________

Check Type(s): ( ) Distribution ( ) Recheck of MCL ( ) Resample of Lab Invalidated Sample
( ) Clearance ( ) Thm Max Res Time ( ) Plant Tap
( ) Distrib. entry point ( ) Raw ( ) Comp. of Multiple Sites-Attach a format for each site

LABORATORY CERTIFICATION INFORMATION - ATTACH HRS ANALYTE SHEET

Lab Name: **Sanders Laboratories, Inc.** HRS #: **84352**

Expiration Date: **07/01/99**

Address: **1050 Endeavor Ct. Nokomis, Fl. 34275**

Phone #: **941-488-8103**

Subcontracted Lab Name & HRS #: 83160, 83141, 86457, 87424 ATTACH HRS ANALYTE SHEET*

ANALYSIS INFORMATION (to be completed by lab) SAMPLE NUMBER: N988895

Date Sample(s) Received: 12/21/98

Group(s) Analyzed and Results attached for compliance with 62-550 F.A.C.:

( ) Nitrate Only ( ) Nitrite Only (✓) Asbestos Only (✓) Trihalomethanes

Inorganics - (✓) All 17 ( ) Partial	Volatile Organics - (✓) All 21 ( ) Partial	Secondaries - (✓) All 14 ( ) Partial	Pesticides/PCB's - (✓) All 30 ( ) Partial
Group I Unregulated - (✓) All 13 ( ) Partial	Group II Unregulated - (✓) All 23 ( ) Partial	Group III Unregulated - (✓) All 11 ( ) Partial	Radiochemicals - (✓) Single Sample ( ) Quarterly Composite**

*All HRS lab#s and their HRS Analyte Sheet for labs performing the attached water analyses must be provided. Failure to do so will result in rejection of the analyses and possible enforcement against the public water system for failure to sample.

* Provide radiochemical sample dates & locations for each quarter

Reporting Format 62-550.730(1)(b)
Effective Date: January 1995

CERTIFICATION

I, Debra A. Sanders, do HEREBY CERTIFY that all attached analytical data are correct.

Signature

Title Laboratory Director

Date:

COMPLIANCE INFORMATION (to be completed by State)

Sample Collection Satisfactory:

Sample Analysis Satisfactory:

Resample Requested For:

Reason:

Person Notified To Resample:

Date Notified:

DEP/HRS Reviewing Official:

Lawton Chiles
Governor

FLORIDA DEPARTMENT OF HEALTH

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

LABORATORY: SANDERS LABORATORIES, INC.

CERTIFICATION NUMBER: 84352 EPA: FL00506
DATE: NOVEMBER 20, 1997
SUPERSEDES PREVIOUS ANALYTE SHEET DATED: JANUARY 30, 1997

MICROBIOLOGY	METHODS
Membrane Filter	SM9222B
Multiple Tube Fermentation	SM9221B
FecalIE. coli	SM9221E
MMO-MUG	
P/A	

PRIMARY INORGANIC

1. METALS	AA(FUR)	ICP	ICP/MS	OTHER
ANTIMONY	SM3113B			
ARSENIC	SM3113B			
BARIUM	SM3113B			
BERYLLIUM				
CADMIUM	SM3113B			
CHROMIUM	SM3113B			
LEAD	SM3113B			
MERCURY				SM3112B
NICKEL				SM3111B
SELENIUM	SM3113B			
SODIUM				SM3111B
THALLIUM	SM3113B			

2. LEAD AND COPPER				
LEAD	SM3113B			
COPPER	SM3113B			

3. CYANIDE	IC	ISE	UV-VIS	OTHER
CYANIDE				

4. NITRATE AND NITRITE				
NITRATE			SM4500NO3-E	
NITRITE			SM4500NO3 E	
TOTAL NO2-NO3			SM4500NO3 E	

5. FLUORIDE				
FLUORIDE		SM4500F C		

6. ASBESTOS				
ASBESTOS				

SECONDARY INORGANIC

	AA(FUR)	ICP	UV-VIS	OTHER
ALUMINUM				SM3111D
CHLORIDE				SM4500Cl- B
COLOR			SM2120B	
COPPER				SM3111B
FLUORIDE				SM4500F C
FOAMING AGENTS				
IRON				SM3111B
MANGANESE				SM3111B
ODOR				SM2150B
pH				150 1
SILVER				SM3111B
SULFATE				375.4
TDS				160 1
Z				SM3111B

PESTICIDES AND PCB'S	GC	GC/MS	HPLC
1. INSECTICIDES			
ALACHLOR			
ATRAZINE			
CHLORDANE			
ENDRIN			
HEPTACHLOR			
HEPTACHLOR EPOXIDE			
LINDANE			
METHOXYCHLOR			
TOXAPHENE			
HEXACHLOROBENZENE			
HEXACHLOROCYCLOPENTADIENE			
SIMAZINE			
2. HERBICIDES			
2,4-D			
PENTACHLOROPHENOL			
2,4,5-TP (SILVEX)			
DALAPON			
DINOSEB			
PICLORAM			
3. CARBAMATES			
CARBOFURAN			
OXAMYL (VYDATE)			
4. DISINFECTANT BY-PRODUCTS/VOC'S			
1,2-DIBROMO-3 CHLOROPROPANE			
ETHYLENE DIBROMIDE			
5. MISCELLANEOUS SOC'S			
DIQUAT			
ENDOTHALL			
GLYPHOSATE			
6. PCB'S			
AROCHLORS			
DECACHLOROBIPHENYL			
7. ADIPATES AND PHTHALATES			
DI(2 ETHYLHEXYL) ADIPATE			
DI(2 ETHYLHEXYL) PHTHALATE			
8. PAH			
BENZO(a)PYRENE			
DIOXIN			
2,3,7,8-TETRACHLORODIBENZO p-DIOXIN			

SAFE DRINKING WATER ANALYTE SHEET

HRS-H FORM 1041, JANUARY, 97
(replaces version MARCH, 95 which may be used)

P.O. Box 210, Jacksonville, Florida 32231-0042

FLORIDA DEPARTMENT OF HEALTH

Lawton Chiles
Governor

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

ABORATORY: SANDERS LABORATORIES, INC.

CERTIFICATION NUMBER: 84352 EPA: FL00506
DATE: JANUARY 30, 1997
SUPERSEDES PREVIOUS ANALYTE SHEET DATED: JUNE 17, 1996

OTHER REGULATED CONTAMINANTS

1. VOLATILE ORGANIC COMPOUNDS

	GC	GC/MS
_ TRICHLOROETHYLENE		
_ TETRACHLOROETHYLENE		
_ CARBON TETRACHLORIDE		
_ VINYL CHLORIDE		
_ 1,1,1-TRICHLOROETHANE		
_ 1,2-DICHLOROETHANE		
_ BENZENE		
_ p-DICHLOROBENZENE		
_ 1,1-DICHLOROETHYLENE		
_ cis-1,2-DICHLOROETHYLENE		
_ 1,2-DICHLOROPROPANE		
_ ETHYLBENZENE		
_ CHLOROBENZENE		
_ o-DICHLOROBENZENE		
_ STYRENE		
_ TOLUENE		
_ trans-1,2-DICHLOROETHYLENE		
_ TOTAL XYLENES		
_ DICHLOROMETHANE		
_ 1,2,4-TRICHLOROBENZENE		
_ 1,1,2-TRICHLOROETHANE		

2. TRIHALOMETHANES

_ BROMODICHLOROMETHANE		
_ B OFORM		
_ C RODIBROMOMETHANE		
CHLOROFORM		
TOTAL TRIHALOMETHANES		

GROUP I UNREGULATED CONTAMINANTS

1. CARBAMATES

	GC	GC/MS	HPLC
ALDICARB			
ALDICARB SULFOXIDE			
ALDICARB SULFONE			
CARBARYL			
3-HYDROXYCARBOFURAN			
METHOMYL			

2. HERBICIDES

LDRIN			
UTACHLOR			
ICAMBA			
IELDRIN			
ETOLACHLOR			
ETRIBUZIN			
ROPACHLOR			

GROUP II UNREGULATED CONTAMINANTS

	GC	GC/MS
_ BROMOBENZENE		
_ BROMODICHLOROMETHANE		
_ BROMOFORM		
_ BROMOMETHANE		
_ CHLOROETHANE		
_ CHLOROFORM		
_ CHLOROMETHANE		
_ DIBROMOCHLOROMETHANE		
_ DICHLORODIFLUOROMETHANE		
_ p-CHLOROTOLUENE		
_ DIBROMOMETHANE		
_ 1,1-DICHLOROETHANE		
_ 1,3-DICHLOROPROPENE		
_ 1,3-DICHLOROPROPANE		
_ 2,2-DICHLOROPROPANE		
_ TRICHLOROFLUOROMETHANE		
_ 1,2,3-TRICHLOROPROPANE		
_ m-DICHLOROBENZENE		
_ 1,1,1,2-TETRACHLOROETHANE		
_ 1,1,2,2-TETRACHLOROETHANE		
_ METHYL tert-BUTYL ETHER		
_ 1,1-DICHLOROPROPENE		
_ o-CHLOROTOLUENE		

GROUP III UNREGULATED CONTAMINANTS

1. BASE/NEUTRAL EXTRACTABLES

_ BUTYL BENZYL PHTHALATE		
_ DI-n-BUTYL PHTHALATE		
_ DIETHYL PHTHALATE		
_ DIMETHYL PHTHALATE		
_ 2,4-DINITROTOLUENE		
_ DI-n-OCTYL PHTHALATE		
_ ISOPHORONE		

2. ACID EXTRACTABLES

_ 2-CHLOROPHENOL		
_ 2-METHYL-4,6-DINITROPHENOL		
_ PHENOL		
_ 2,4,6-TRICHLOROPHENOL		

F 11041, JANUARY, 97 SAFE DRINKING WATER ANALYTE SHEET
(... version MARCH, 95 which may be used)

P. O. Box 210 • JACKSONVILLE, FLORIDA 32231

State of Florida
Department of Health
BUREAU OF LABORATORIES
SAFE DRINKING WATER

FLORIDA DEPARTMENT OF HEALTH
1997 - 1998

This is to certify that

86457
ATC Associates - Florida
9955 NW 116 Way, Suite 1
Miami, FL 33178-5126

has complied with Florida Administrative Code 64E-1, Part I, pertaining to safe drinking water testing in the following categories:

Primary Inorganic Contaminants (Asbestos)****************************

Specific certified analytes and methodologies within these categories are listed on the analyte sheets with this laboratory and the Florida Department of Health, Bureau of Laboratories

EFFECTIVE JULY 1, 1997 THROUGH JUNE 30, 1998

Eldert C. Hartwig, Jr., Sc.D., M.P.H.
Bureau Chief, Bureau of Laboratories
Florida Department of Health
DH Form 1629, 3/97
NON-TRANSFERABLE

CERTIFICATE No.: 97167

SAFE DRINKING WATER ANALYTE SHEET

HRS STATE OF FLORIDA DEPARTMENT OF HEALTH AND REHABILITATIVE SERVICES

LABORATORY: TRIANGLE LABORATORIES OF RTP, INC.

CERTIFICATION NUMBER: 87424 EPA: NC00140
DATE: APRIL 19, 1995
SUPERSEDES PREVIOUS ANALYTE SHEET DATED: AUGUST 5, 1993

MICROBIOLOGY

	METHODS
_ Membrane Filter	
_ Multiple Tube Fermentation	
_ Fecal/E. coli	
_ MMO-MUG	
_ P/A	

PRIMARY INORGANIC

1. METALS	AA(FUR)	ICP	ICP/MS	OTHER
_ ANTIMONY				
_ ARSENIC				
_ BARIUM				
_ BERYLLIUM				
_ CADMIUM				
_ CHROMIUM				
_ LEAD				
_ MERCURY				
_ NICKEL				
_ SELENIUM				
_ SODIUM				
_ THALLIUM				
2. LEAD AND COPPER				
_ LEAD				
_ COPPER				
3. CYANIDE	IC	ISE	UV-VIS	OTHER
_ CYANIDE				
4. NITRATE AND NITRITE				
_ NITRATE				
_ NITRITE				
_ TOTAL NO2-NO3				
5. FLUORIDE				
_ FLUORIDE				
6. ASBESTOS				
_ ASBESTOS				

SECONDARY INORGANIC

	AA(FUR)	ICP	UV-VIS	OTHER
_ ALUMINUM				
_ CHLORIDE				
_ COLOR				
_ COPPER				
_ FLUORIDE				
_ FOAMING AGENTS				
_ IRON				
_ MANGANESE				
_ ODOR				
_ pH				
_ SILVER				
_ SULFATE				
_ TDS				
_ ZINC				

PESTICIDES AND PCB'S

	GC	GC/MS	HPLC
1. INSECTICIDES			
_ ALACHLOR			
_ ATRAZINE			
_ CHLORDANE			
_ ENDRIN			
_ HEPTACHLOR			
_ HEPTACHLOR EPOXIDE			
_ LINDANE			
_ METHOXYCHLOR			
_ TOXAPHENE			
_ HEXACHLOROBENZENE			
_ HEXACHLOROCYCLOPENTADIENE			
_ SIMAZINE			
2. HERBICIDES			
_ 2,4-D			
_ PENTACHLOROPHENOL			
_ 2,4,5-TP (SILVEX)			
_ DALAPON			
_ DINOSEB			
_ PICLORAM			
3. CARBAMATES			
_ CARBOFURAN			
_ OXAMYL (VYDATE)			
4. DISINFECTANT BY-PRODUCTS/VOC'S			
_ 1,2-DIBROMO-3-CHLOROPROPANE			
_ ETHYLENE DIBROMIDE			
5. MISCELLANEOUS SOC'S			
_ DIQUAT			
_ ENDOTHALL			
_ GLYPHOSATE			
6. PCB'S			
_ AROCHLORS			
_ DECACHLOROBIPHENYL			
7. ADIPATES AND PHTHALATES			
_ DI(2-ETHYLHEXYL) ADIPATE			
_ DI(2-ETHYLHEXYL) PHTHALATE			
8. PAH			
_ BENZO(a)PYRENE			
DIOXIN			
X 2,3,7,8-TETRACHLORODIBENZO-p-DIOXIN		1613	

SAFE DRINKING WATER ANALYTE SHEET

HRS STATE OF FLORIDA
DEPARTMENT OF HEALTH AND REHABILITATIVE SERVICES

LABORATORY: TRIANCLE LABORATORIES OF RTP, INC.

CERTIFICATION NUMBER: 87424 EPA: NC00140
DATE: APRIL 19, 1995
SUPERSEDES PREVIOUS ANALYTE SHEET DATED: AUGUST 5, 1993

OTHER REGULATED CONTAMINANTS

1. VOLATILE ORGANIC COMPOUNDS

	GC	GC/MS
_ TRICHLOROETHYLENE		
_ TETRACHLOROETHYLENE		
_ CARBON TETRACHLORIDE		
_ VINYL CHLORIDE		
_ 1,1,1-TRICHLOROETHANE		
_ 1,2-DICHLOROETHANE		
_ BENZENE		
_ p-DICHLOROBENZENE		
_ 1,1-DICHLOROETHYLENE		
_ cis-1,2-DICHLOROETHYLENE		
_ 1,2-DICHLOROPROPANE		
_ ETHYLBENZENE		
_ CHLOROBENZENE		
_ o-DICHLOROBENZENE		
_ STYRENE		
_ TOLUENE		
_ trans-1,2-DICHLOROETHYLENE		
_ TOTAL XYLENES		
_ DICHLOROMETHANE		
_ 1,2,4-TRICHLOROBENZENE		
_ 1,1,2-TRICHLOROETHANE		

2. TRIHALOMETHANES

	GC	GC/MS
_ BROMODICHLOROMETHANE		
_ BROMOFORM		
_ CHLORODIBROMOMETHANE		
_ CHLOROFORM		
_ TOTAL TRIHALOMETHANES		

GROUP I UNREGULATED CONTAMINANTS

1. CARBAMATES

	GC	GC/MS	HPLC
_ ALDICARB			
_ ALDICARB SULFOXIDE			
_ ALDICARB SULFONE			
_ CARBARYL			
_ 3-HYDROXYCARBOFURAN			
_ METHOMYL			

2. HERBICIDES

	GC	GC/MS	HPLC
_ ALDRIN			
_ BUTACHLOR			
_ DICAMBA			
_ DIELDRIN			
_ METOLACHLOR			
METRIBUZIN			
'ROPACHLOR			

GROUP II UNREGULATED CONTAMINANTS

	GC	GC/MS
_ BROMOBENZENE		
_ BROMODICHLOROMETHANE		
_ BROMOFORM		
_ BROMOMETHANE		
_ CHLOROETHANE		
_ CHLOROFORM		
_ CHLOROMETHANE		
_ DIBROMOCHLOROMETHANE		
_ DICHLORODIFLUOROMETHANE		
_ p-CHLOROTOLUENE		
_ DIBROMOMETHANE		
_ 1,1-DICHLOROETHANE		
_ 1,3-DICHLOROPROPENE		
_ 1,3-DICHLOROPROPANE		
_ 2,2-DICHLOROPROPANE		
_ TRICHLOROFLUOROMETHANE		
_ 1,2,3-TRICHLOROPROPANE		
_ m-DICHLOROBENZENE		
_ 1,1,1,2-TETRACHLOROETHANE		
_ 1,1,2,2,-TETRACHLOROETHANE		
_ METHYL tert-BUTYL ETHER		
_ 1,1-DICHLOROPROPENE		
_ o-CHLOROTOLUENE		

GROUP III UNREGULATED CONTAMINANTS

1. BASE/NEUTRAL EXTRACTABLES

_ BUTYL BENZYL PHTHALATE		
_ DI-n-BUTYL PHTHALATE		
_ DIETHYL PHTHALATE		
_ DIMETHYL PHTHALATE		
_ 2,4-DINITROTOLUENE		
_ DI-n-OCTYL PHTHALATE		
_ ISOPHORONE		

2. ACID EXTRACTABLES

_ 2-CHLOROPHENOL		
_ 2-METHYL-4,6-DINITROPHENOL		
_ PHENOL		
_ 2,4,6-TRICHLOROPHENOL		

Lawton Chiles
Governor

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

Safe Drinking Water Analyte Sheet
(RADIOCHEMISTRY)

LABORATORY: Florida Radiochemistry Services

CERTIFICATION ID#: 83141
Date: July 1, 1997
Supersedes previous issue dated 7/1/96

RADIOCHEMISTRY

	Method No.	Publication [XX Indicates ANALYTE CERTIFIED]
XX Gross Alpha	900.0	Prescribed Procedures for Measurement of Radioactivity in Drinking Water, EPA-600/4-80-032
XX Gross Beta	900.0	Prescribed Procedures for Measurement of Radioactivity in Drinking Water, EPA-600/4-80-032
XX Radium-226	903.1	Prescribed Procedures for Measurement of Radioactivity in Drinking Water, EPA-600/4-80-032
XX Radium-228	*Alt	Brooks and Blanchard, *(EPA Alternate Approved Procedure)
XX Natural Uranium	908.0	Prescribed Procedures for Measurement of Radioactivity in Drinking Water, EPA-600/4-80-032
___ Radon	___	
___ Tritium	___	
___ Strontium-89	___	
XX Strontium-90	905.0	Prescribed Procedures for Measurement of Radioactivity in Drinking Water, EPA-600/4-80-032
___ Iodine-131	___	
___ Photon Emitters	___	
___ Cesium-134		
___ Cesium-137		
___ Cobalt-60		
___ Barium-133		
___ Zinc-65		

FLORIDA DEPARTMENT OF HEALTH

Lawton Chiles
Governor

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

LABORATORY: ELAB, INC. D/B/A ENVIROLAB

CERTIFICATION NUMBER: 83160 EPA: FL00020
DATE: MARCH 31, 1998
SUPERSEDES PREVIOUS ANALYTE SHEET DATED: DECEMBER 2, 1997

	MICROBIOLOGY	METHODS
X	Membrane Filter	SM9222B
X	Multiple Tube Fermentation	SM9221B
X	Fecal/E. coli	SM9221E, (1a)
-	MMO-MUG	
-	P/A	

PRIMARY INORGANIC

	1. METALS	AA(FUR)	ICP	ICP/MS	OTHER
X	ANTIMONY	SM3113B			
X	ARSENIC	SM3113B	200.7		
X	BARIUM	SM3113B	200.7		SM3111D
X	BERYLLIUM	SM3113B	200.7		
X	CADMIUM	SM3113B	200.7		
X	CHROMIUM	SM3113B	200.7		
X	LEAD	SM3113B			
X	MERCURY				245.1
X	NICKEL	SM3113B	200.7		
X	SELENIUM	SM3113B			
X	SODIUM				SM3111B
X	THALLIUM	200.9			

	2. LEAD AND COPPER	AA(FUR)	ICP	ICP/MS	OTHER
X	LEAD	SM3113B			
X	COPPER	SM3113B	200.7		SM3111B

	3. CYANIDE	IC	ISE	UV-VIS	OTHER
X	CYANIDE			SM4500CN-E	

	4. NITRATE AND NITRITE			
X	NITRATE	300.0		SM4500NO3 E, 353.2
X	NITRITE	300.0		SM4500NO3 E, 353.2
X	TOTAL NO2-NO3	300.0		SM4500NO3 E, 353.2

	5. FLUORIDE			
X	FLUORIDE	300.0	SM4500F- C	

	6. ASBESTOS				
-	ASBESTOS				

SECONDARY INORGANIC

		AA(FUR)	ICP	UV-VIS	OTHER
X	ALUMINUM		200.7		SM3111D
X	CHLORIDE				SM4500Cl- C, 300.0
X	COLOR			SM2120B	
X	COPPER	SM3113B	200.7		SM3111B
X	FLUORIDE				300.0, SM4500F- C
X	FOAMING AGENTS			SM5540C	
X	IRON	SM3113B	200.7		SM3111B
X	MANGANESE	SM3113B	200.7		SM3111B
X	ODOR				SM2150B
X	pH				150.1
X	SILVER	SM3113B	200.7		SM3111B
X	SULFATE			375.2	300.0, 375.4
X	TDS				SM2540C
X	ZINC	SM3113B	200.7		SM3111B

	PESTICIDES AND PCB'S	GC	GC/MS	HPLC
	1. INSECTICIDES			
X	ALACHLOR	505, 507		
X	ATRAZINE	505, 507		
X	CHLORDANE	505, 508		
X	ENDRIN	505, 508		
X	HEPTACHLOR	505, 508		
X	HEPTACHLOR EPOXIDE	505, 508		
X	LINDANE	505, 508		
X	METHOXYCHLOR	505, 508		
X	TOXAPHENE	505, 508		
X	HEXACHLOROBENZENE	505, 508		
X	HEXACHLOROCYCLOPENTADIENE	505	525.2	
X	SIMAZINE	505, 507		
	2. HERBICIDES			
X	2,4-D	515.1		
X	PENTACHLOROPHENOL	515.1	525.2	
X	2,4,5-TP (SILVEX)	515.1		
X	DALAPON	515.1		
X	DINOSEB	515.1		
X	PICLORAM	515.1		
	3. CARBAMATES			
X	CARBOFURAN			531.1
X	OXAMYL (VYDATE)			531.1
	4. DISINFECTANT BY-PRODUCTS/VOC'S			
X	1,2-DIBROMO-3-CHLOROPROPANE	504.1		
X	ETHYLENE DIBROMIDE	504.1		
	5. MISCELLANEOUS SOC'S			
X	DIQUAT			549.1
X	ENDOTHALL	548.1		
X	GLYPHOSATE			547
	6. PCB'S			
X	AROCHLORS	505, 508		
-	DECACHLOROBIPHENYL			
	7. ADIPATES AND PHTHALATES			
X	DI(2-ETHYLHEXYL) ADIPATE		525.2	
X	DI(2-ETHYLHEXYL) PHTHALATE		525.2	
	8. PAH			
X	BENZO(a)PYRENE		525.2	
	DIOXIN			
-	2,3,7,8-TETRACHLORODIBENZO-p-DIOXIN			

HRS-H FORM 1041, JANUARY, 97
(replaces version MARCH, 95 which may be used)

SAFE DRINKING WATER ANALYTE SHEET

P.O. Box 210, Jacksonville, Florida 32231-0042

FLORIDA DEPARTMENT OF
HEALTH

Lawton Chiles
Governor

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

LABORATORY: ELAB, INC. D/B/A ENVIROLAB

CERTIFICATION NUMBER: 83160 EPA: FL00020
DATE: MARCH 31, 1998
SUPERSEDES PREVIOUS ANALYTE SHEET DATED: DECEMBER 2, 1997

OTHER REGULATED CONTAMINANTS

1. VOLATILE ORGANIC COMPOUNDS

		GC	GC/MS
X	TRICHLOROETHYLENE	502.2	524.2
X	TETRACHLOROETHYLENE	502.2	524.2
X	CARBON TETRACHLORIDE	502.2	524.2
X	VINYL CHLORIDE	502.2	524.2
X	1,1,1-TRICHLOROETHANE	502.2	524.2
X	1,2-DICHLOROETHANE	502.2	524.2
X	BENZENE	502.2	524.2
X	p-DICHLOROBENZENE	502.2	524.2
X	1,1-DICHLOROETHYLENE	502.2	524.2
X	cis-1,2-DICHLOROETHYLENE	502.2	524.2
X	1,2-DICHLOROPROPANE	502.2	524.2
X	ETHYLBENZENE	502.2	524.2
X	CHLOROBENZENE	502.2	524.2
X	o-DICHLOROBENZENE	502.2	524.2
X	STYRENE	502.2	524.2
	TOLUENE	502.2	524.2
X	trans-1,2-DICHLOROETHYLENE	502.2	524.2
X	TOTAL XYLENES	502.2	524.2
X	DICHLOROMETHANE	502.2	524.2
X	1,2,4-TRICHLOROBENZENE	502.2	524.2
X	1,1,2-TRICHLOROETHANE	502.2	524.2

2. TRIHALOMETHANES

		GC	GC/MS
X	BROMODICHLOROMETHANE	502.2	524.2
X	BROMOFORM	502.2	524.2
X	CHLORODIBROMOMETHANE	502.2	524.2
X	CHLOROFORM	502.2	524.2
X	TOTAL TRIHALOMETHANES	502.2	524.2

GROUP I UNREGULATED CONTAMINANTS

1. CARBAMATES

		GC	GC/MS	HPLC
X	ALDICARB			531.1
X	ALDICARB SULFOXIDE			531.1
X	ALDICARB SULFONE			531.1
X	CARBARYL			531.1
X	3-HYDROXYCARBOFURAN			531.1
X	METHOMYL			531.1

2. HERBICIDES

X	ALDRIN	508	525.2	———
X	BUTACHLOR	507	525.2	———
X	DICAMBA	515.1	———	———
X	DIELDRIN	508	525.2	———
X	METOLACHLOR	507	525.2	———
X	METRIBUZIN	507	525.2	———
	PROPACHLOR	508	525.2	———

GROUP II UNREGULATED CONTAMINANTS

		GC	GC/MS
X	BROMOBENZENE	502.2	524.2
X	BROMODICHLOROMETHANE	502.2	524.2
X	BROMOFORM	502.2	524.2
X	BROMOMETHANE	502.2	524.2
X	CHLOROETHANE	502.2	524.2
X	CHLOROFORM	502.2	524.2
X	CHLOROMETHANE	502.2	524.2
X	DIBROMOCHLOROMETHANE	502.2	524.2
X	DICHLORODIFLUOROMETHANE	502.2	524.2
X	p-CHLOROTOLUENE	502.2	524.2
X	DIBROMOMETHANE	502.2	524.2
X	1,1-DICHLOROETHANE	502.2	524.2
X	1,3-DICHLOROPROPENE	502.2	524.2
X	1,3-DICHLOROPROPANE	502.2	524.2
X	2,2-DICHLOROPROPANE	502.2	524.2
X	TRICHLOROFLUOROMETHANE	502.2	524.2
X	1,2,3-TRICHLOROPROPANE	502.2	524.2
X	m-DICHLOROBENZENE	502.2	524.2
X	1,1,1,2-TETRACHLOROETHANE	502.2	524.2
X	1,1,2,2-TETRACHLOROETHANE	502.2	524.2
X	METHYL tert-BUTYL ETHER	502.2	524.2
X	1,1-DICHLOROPROPENE	502.2	524.2
X	o-CHLOROTOLUENE	502.2	524.2

GROUP III UNREGULATED CONTAMINANTS

1. BASE/NEUTRAL EXTRACTABLES

X	BUTYL BENZYL PHTHALATE	———	625
X	DI-n-BUTYL PHTHALATE	———	625
X	DIETHYL PHTHALATE	———	625
X	DIMETHYL PHTHALATE	———	625
X	2,4-DINITROTOLUENE	———	625
X	DI-n-OCTYL PHTHALATE	———	625
X	ISOPHORONE	———	625

2. ACID EXTRACTABLES

X	2-CHLOROPHENOL	———	625
X	2-METHYL-4,6-DINITROPHENOL	———	625
X	PHENOL	———	625
X	2,4,6-TRICHLOROPHENOL	———	625

Sanders Laboratories
Environmental Testing Services

CHAIN-OF-CUSTODY RECORD

INTAKE FORM # 519769

Page 1 of 1

Client Youngquist

Address

Phone ______ Fax ______

Report To: Troy Moore

Bill To:

P.O. #

Project Name Dual ZONE 1950' Site A,

Project Location: Sawgrass.

Sample Supply: G.W.

Customer Type:

Field Report #:

Kit #

REQUESTED DUE DATE: 1-4-99

Sampled By (PRINT) NOAH OLENYCH.

Sampler Signature Noah Olenych

ITEM #	SAMPLE DESCRIPTION / LOCATION	JOB #	Sample DATE	Sample TIME	Sample TYPE	NO. OF CONTAINERS	PRESERVATIVES: UNPRESERVED	H_2SO_4	HNO_3	HCL	NaOH, MCAA	Primary/Secondary	GA, RADS 226/228	TTHMS/VOC'S	Pest's PCBs	UNREG. GRP I, II, III	BOD, NH_3, O.N.	TKN, O.P., T.P.	$CaCO_3$, T.C., Fe, Ca	HOC, NAPTHALENE,	ANTHRACENE, PHENANTHRENE	ASBESTOS, DIOXIN	LAB NUMBER
1	Sawgrass Deep Zone A 1950'		12-21-98	0855	G	30	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	N98 8895

EPA 610 ME

OUT / DATE	SHIPMENT METHOD RETURNED / DATE	VIA	ITEM #	RELINQUISHED BY / AFFILIATION	DATE	TIME	ACCEPTED BY / AFFILIATION	DATE	TIME
				Noah Olenych	12-21-98	1440	S. Beck	12-21-98	14:40

COMMENTS:

COOLER #

Appendix F

Lithology
CW-1

WELL:	City of Sunrise Concentrate Injection Well (CW-1)
TOTAL DEPTH:	3,400 feet
COUNTY:	Broward
LOCATION:	Sunrise Wastewater Treatment Facility
OWNER:	City of Sunrise
DRILLER:	Youngquist Brothers, Inc.
DATE DRILLED:	August 24 through December 9, 1998

HYDROLOGIC UNITS

0 to 120 feet	Surficial Aquifer
120 to 1,020 feet	Upper Confining Unit
1,020 to 2,105	Upper Floridan Aquifer
2,105 to 2,305	Middle Confining Unit
2,305 to 3,084+	Lower Floridan Aquifer

LITHOLOGIC FORMATION	
0-68	SANDSTONE 80%: Color- Grayish orange (10 YR 7/4) to Pale yellowish brown (10 YR 6/2), Texture-wackestone to grainstone, Grains-medium fine sand size subrounded quartz, Cement/Matrix- lime mud and recrystallized lime mud, Porosity- moderate to high, Permeability-moderate to high, Accessories- n/a, Structures-casts, Hardness-moderate, Fossils-diverse pelecypoda/gastropoda. SHELL 20%: Color- Very pale orange (10 YR 8/2), Texture-unconsolidated whole pieces to fragments, Grains- <1mm to whole shells, Cement/Matrix-none, Porosity- n/a, Permeability- n/a, Accessories- n/a, Structures- n/a, Hardness-moderate, Fossils- diverse pelecypoda/gastropoda.
68-120	LIMESTONE 70%: Color-Medium gray (N5), Texture-biogenic packstone, Grains-medium sand size, Cement/Matrix-calcitic mud, Porosity-moderate to high, Permeability- moderate, Accessories- n/a, Structures- solution features, Hardness-moderate to high, Fossils- diverse pelecypoda/gastropoda. LIMESTONE 30%: Color-White (N9) to Pinkish Gray (5 YR 8/1), Texture- bimodal grainstone, Grains- fine sand size, Cement/Matrix-recrystallized lime mud, Porosity- low to moderate, vuggy, Permeability-moderate, Accessories-none, Structures- solution features, Hardness-moderately hard, Fossils- diverse pelecypoda/gastropoda.
120-150	SILT 50%: Color- Olive gray (5Y 4/1), Texture- unconsolidated mud, Grains- silt size, Cement/Matrix- n/a, Porosity-low, Permeability- low, Accessories- phosphatic sand, Structures- none, Hardness-soft, Fossils- diverse pelecypoda/gastropoda.

	<u>SHELL 50%</u>: Color-White (N7) and Black (N1), Texture- unconsolidated fragments, Grains- medium sand size to >3mm, Cement/Matrix- n/a, Porosity- n/a, Permeability- n/a, Accessories- n/a, Structures- n/a, Hardness- moderately hard, Fossils- diverse pelecypoda/gastropoda.
150-190	<u>LIMESTONE 50%</u>: Color-Medium gray (N5), Texture-biogenic packstone, Grains-medium sand size to pebbles, Cement/Matrix-calcitic mud, Porosity-moderate to high, Permeability- moderate, Accessories- n/a, Structures- n/a, Hardness-moderate to high, Fossils- diverse pelecypoda/gastropoda. <u>LIMESTONE 25%</u>: Color-White (N9) to Pinkish Gray (5 YR 8/1), Texture- bimodal grainstone, Grains- fine sand size, Cement/Matrix-recrystallized lime mud, Porosity- low to moderate, vuggy, Permeability-moderate, Accessories-none, Structures-solution features, Hardness-moderately hard, Fossils- diverse pelecypoda/gastropoda. <u>SHELL 25%</u>: Color-Med. light gray (N6) to Grayish black (N2), Texture- unconsolidated fragments, Grains- coarse sand size to >5mm, Cement/Matrix- n/a, Porosity-n/a, Permeability- n/a, Accessories- n/a, Structures- n/a, Hardness- soft to moderately hard, Fossils- diverse pelecypoda/gastropoda.
190-220	<u>CLAY 50%</u>: Color-Dark greenish gray (5 GY 4/1), Texture-unconsolidated terrigenous clay/mud, Grains- clay size, Cement/Matrix-none, Porosity-low, Permeability-low, Accessories-n/a, Structures-n/a, Hardness-soft, Fossils-mollusca, bryzoa, cnidarians. <u>LIMESTONE 25%</u>: Color-Light olive gray (5Y 6/1), Texture-biogenic packstone, Grains-medium to coarse sand size, Cement/Matrix-calcitic mud, Porosity-moderate, Permeability- moderate to low, Accessories- n/a, Structures- n/a, Hardness-moderate, Fossils- diverse pelecypoda/gastropoda. <u>SHELL 25%</u>: Color-Very light gray (N8) to Medium gray (N5), Texture- unconsolidated fragments, Grains- coarse sand size to >3mm, Cement/Matrix- n/a, Porosity-n/a, Permeability- n/a, Accessories- n/a, Structures- n/a, Hardness- soft to moderately hard, Fossils- diverse pelecypoda/gastropoda.
220-250	<u>SILT 50%</u>: Color- Medium light gray (N5), Texture- unconsolidated mud, Grains-silt size quartz, Cement/Matrix- none, Porosity-low, Permeability- low, Accessories- n/a, Structures- n/a, Hardness-soft, Fossils-none. <u>SHELL 50%</u>: Color-Yellowish gray (5Y 7/2), Texture- unconsolidated fragments, Grains-granules to >10 mm (whole pieces), Cement/Matrix- n/a, Porosity- n/a, Permeability- n/a, Accessories- n/a, Structures- n/a, Hardness- soft to moderately hard, Fossils- diverse pelecypoda/gastropoda.

250-475	<u>CLAYEY SILT 100%</u>: Color-Grayish olive green (5 GY 3/2), Texture- unconsolidated mud, Grains-silt to clay size carbonate grading to quartz with depth, Cement/Matrix-none, Porosity-low, Permeability- low, Accessories- shell fragments, Structures- n/a, Hardness-soft, Fossils-none.
475-650	<u>LIMESTONE 60%</u>: Color-Light olive gray (5Y 6/1) to Yellowish gray (5Y 8/1), Texture-micritic packstone, Grains-medium fine sand size, Cement/Matrix-calcitic mud, Porosity-moderate low, Permeability- low, Accessories- n/a, Structures- n/a, Hardness- moderate soft, Fossils-pelecypoda. <u>SILTSTONE 20%</u>: Color- Greenish gray (5GY 6/1) , Texture- mudstone, Grains-silt size, Cement/Matrix- calcitic mud, Porosity- low, Permeability-low, Accessories-n/a, Structures- n/a, Hardness-moderate soft, Fossils-none . <u>BIOTICS 20%</u>: Color- Light olive gray (5Y 6/1) to Yellowish gray (5Y 8/1), Texture-unconsolidated fragments, Grains- coarse sand size to >3mm, Cement/Matrix-n/a, Porosity- n/a, Permeability- n/a, Accessories- n/a, Structures-none, Hardness-moderate, Fossils-assorted molusca.
650-950	<u>CLAY 75%</u>: Color-Light olive gray (5Y 6/1) to Yellowish gray (5Y 8/1, Texture-terrigenous mudstone, can be layered, clay shows no structure on examination, Plastic deformation, very soft, Grains-contains lithics of limestone, sand and shell, possibly from contamination, poor to moderately indurated, Plastic deformation, contains zones of montmorillonite. <u>LIMESTONE 15%</u>: Color-Light olive gray (5Y 6/1) to Yellowish gray (5Y 8/1), Texture-micritic packstone, Grains-medium fine sand size, Cement/Matrix-calcitic mud, Porosity-moderate low, Permeability- low, Accessories- n/a, Structures- n/a, Hardness- moderate soft, Fossils- diverse pelecypoda/gastropoda. <u>SILTSTONE 5%</u>: Color- Greenish gray (5GY 6/1) , Texture- mudstone, Grains-silt size, Cement/Matrix- calcitic mud, Porosity- low, Permeability-low, Accessories-n/a, Structures- n/a, Hardness-moderate soft, Fossils-none . <u>BIOTICS 5%</u>: Color- Light olive gray (5Y 6/1) to Yellowish gray (5Y 8/1), Texture-unconsolidated fragments, Grains- coarse sand size to >3mm, Cement/Matrix-n/a, Porosity- n/a, Permeability- n/a, Accessories- n/a, Structures-none, Hardness-moderate, Fossils-assorted molusca.
950-1005	<u>CLAY 50%</u>: Color-Dark greenish gray (5 GY 4/1), Texture-unconsolidated terrigenous clay/mud, Grains- clay size, Cement/Matrix-none, Porosity-low, Permeability-low, Accessories-n/a, Structures-n/a, Hardness-soft, Fossils-mollusca, bryzoa, cnidarians.

	<u>LIMESTONE 25%</u>: Color-Light olive gray (5Y 6/1), Texture-biogenic packstone, Grains-medium to coarse sand size, Cement/Matrix-calcitic mud, Porosity-moderate, Permeability- moderate to low, Accessories- n/a, Structures- n/a, Hardness-moderate, Fossils-mollusca, bryzoa, cnidarians. <u>SHELL 25%</u>: Color-Very light gray (N8) to Medium gray (N5), Texture- unconsolidated fragments, Grains- coarse sand size to >3mm, Cement/Matrix- n/a, Porosity-n/a, Permeability- n/a, Accessories- n/a, Structures- n/a, Hardness- soft to moderately hard, Fossils-mollusca, bryzoa, cnidarians.
1005-1110	<u>LIMESTONE 90%</u>: Color- tan to very pale orange - with gray Texture - complexly interbedded, argillaceous limestone, recrystallized. Limestone is generally medium gray to white, poor to moderately indurated, mudstones and wackestones. Porosity is low. Grains include minor fossil debris, and peloids, cemented with abundant pore filling calcite spar cement (porosity reducing), moderately cemented, porosity is present. Abundant quartz and phosphate, poorly sorted, rounded to angular. (clear tan rhombs, can make up as much as 40% of total volume), cemented with abundant pore filling calcite spar cement (porosity reducing), moderately cemented, porosity is present. <u>SHELL 10%</u>: Color-Very light gray (N8) to Medium gray (N5), Texture- unconsolidated fragments, Grains- coarse sand size to >3mm, Cement/Matrix- n/a, Porosity-n/a, Permeability- n/a, Accessories- n/a, Structures- n/a, Hardness- soft to moderately hard, Fossils-mollusca.
1110-1240	<u>LIMESTONE 100%:</u> Color - white to medium gray, Texture - moderately indurated boundstones to wackstones, locally grades to packstone and grainstone. Grains - contains minor phosphate nodules. Porosity - some bioclasts are represented as moldic porosity, and high secondary porosity and permeability are present (intergranular, interparticle and moldic). Locally the rock is recrystallized. Well indurated, and contains coarse spar cement (reducing). Biotics include reef fauna assemblage (diverse mollusk, forams, bryozoan, corals, and echinoids).
1240-1460	<u>LIMESTONE 85%:</u> Color - very pale orange, Texture -recrystallized grainstone. Grains are sand size and biota remnants including algae and foraminifer. Unit is moderately cemented, but poorly indurated. Intergranular porosity is moderate to high. Porosity reduction by cementation is common. <u>LIMESTONE 10%:</u> Color - white to medium gray, Texture - moderately indurated boundstones to wackstones, locally grades to packstone. Porosity - minor bioclasts are represented as moldic porosity, low secondary porosity and permeability are present (intergranular, interparticle and moldic). Locally the rock is recrystallized. Well indurated, and contains coarse spar cement (reducing).

	Biotics include reef fauna assemblage (diverse mollusk, foram, bryozoan, corals, echinoids). Possibly contamination during drilling. <u>LIMESTONE 5%:</u> Color - medium gray, Texture - moderately indurated wackstones, locally grades to packstone. Porosity - minor, low secondary porosity and permeability are present Locally the rock is recrystallized. Well indurated.
1460-1630	<u>LIMESTONE 30%:</u> Color - very pale orange to light gray, Texture - moderately indurated wackstones, locally grades to packstone. Porosity - minor, low secondary porosity and permeability are present Locally the rock is recrystallized. Well indurated. <u>LIMESTONE 70%:</u> Color - pale orange, Texture -recrystallized grainstone. Grains are sand size and biota remnants including algae and foraminifer. Unit is moderately cemented, but poorly indurated. Intergranular porosity is moderate to high. Porosity reduction by cementation is common.
1630-2000	<u>LIMESTONE 40%:</u> Color - very pale orange to light gray, Texture - moderately indurated wackstones, locally grades to packstone. Porosity - minor, low secondary porosity and permeability are present Locally the rock is recrystallized. Well indurated. <u>LIMESTONE 40%:</u> Color - pale orange, Texture -recrystallized grainstone. Grains are sand size and biota remnants including algae and foraminifer. Unit is moderately cemented, but poorly indurated. Intergranular porosity is moderate to high. Porosity reduction by cementation is common. <u>LIMESTONE 20%:</u> Color - pale orange to pale yellow orange foram packstone. Highly recrystallized, well cemented, but poorly indurated. Porosity is moderate due to carbonate sand content. Porosity is high. Cement is zoned. Contains abundant forams.
2000-2040	<u>LIMESTONE 90%:</u> Color - very pale orange to white, Texture – well indurated wackestone to packstone. Porosity - minor, low secondary porosity and permeability are present Locally the rock is recrystallized. <u>LIMESTONE 10%:</u> Color - pale orange, Texture -recrystallized grainstone. Grains are sand size and biota remnants including algae and foraminifer. Unit is moderately cemented, but poorly indurated. Intergranular porosity is moderate to high. Porosity reduction

2040-2060	<u>LIMESTONE 100%:</u> Color - pale orange to pale yellow orange foram packstone. Highly recrystallized, well cemented, but poorly indurated. Porosity is moderate due to carbonate sand content. Cement is zoned. Contains abundant forams.
2060-2110	<u>LIMESTONE 90%:</u> Color - very pale orange to white, Texture – well indurated wackestone to packstone. Porosity - minor, low secondary porosity and permeability are present Locally the rock is recrystallized. <u>LIMESTONE 10%:</u> Color - pale orange, Texture -recrystallized grainstone. Grains are sand size and biota remnants including algae and foraminifer. Unit is moderately cemented, but poorly indurated. Intergranular porosity is moderate to high. Porosity reduction
2110-2250	<u>LIMESTONE 80%:</u> Color – White to light gray to very pale orange, Texture -recrystallized grainstone. Grains are fine to medium sand, and biota remnants including algae and foraminifer. Unit is moderately cemented, and moderately indurated. Intergranular and moldic porosity is moderate to high. <u>LIMESTONE 20%:</u> Color - very pale orange to white, Texture – well indurated wackestone. Porosity - minor, low secondary porosity and permeability are present Locally the rock is recrystallized.
2250-2270	<u>LIMESTONE 100%:</u> Color – white to very light gray packstone. Recrystallized, well cemented, and well indurated. Porosity is moderate due to carbonate sand content. Cement is zoned.
2270-2290	<u>LIMESTONE 80%:</u> Color – White to light gray to very pale orange, Texture -recrystallized grainstone. Grains are fine to medium sand, and biota remnants including algae and foraminifer. Unit is moderately cemented, and moderately indurated. Intergranular and moldic porosity is moderate to high. <u>LIMESTONE 20%:</u> Color - very pale orange to white, Texture – well indurated wackestone. Porosity - minor, low secondary porosity and permeability are present Locally the rock is recrystallized.
2290-2320	<u>DOLOSTONE 100%:</u> Color - Light brownish gray to brownish gray, Texture – crystalline, well indurated, well cemented, Porosity – intercrystalline, Fossils – none.
2320-2410	<u>LIMESTONE 70%:</u> Color – White to light gray to very pale orange, Texture -recrystallized grainstone. Grains are fine to medium sand, and biota remnants including algae and foraminifer. Unit is moderately cemented, and moderately indurated. Intergranular and moldic porosity is moderate to high.

	<u>LIMESTONE 10%:</u> Color - very pale orange to white, Texture – well indurated wackestone. Porosity - minor, low secondary porosity and permeability are present Locally the rock is recrystallized. <u>DOLOSTONE 20%:</u> Color - Light brownish gray to brownish gray, Texture – crystalline, well indurated, well cemented, Porosity – intercrystalline, Fossils – none.
2410-2730	<u>DOLOSTONE 80%:</u> Color – dark yellowish orange, Texture – crystalline, well indurated, well cemented, Locally sucrosic, Porosity – intercrystalline, Fossils – none. <u>LIMESTONE 15%:</u> Color – White to light gray to very pale orange, Texture -recrystallized grainstone. Grains are fine to medium sand, and biota remnants including algae and foraminifer. Unit is moderately cemented, and moderately indurated. Intergranular and moldic porosity is moderate to high. <u>LIMESTONE 5%:</u> Color - very pale orange to white, Texture – well indurated wackestone. Porosity - minor, low secondary porosity and permeability are present Locally the rock is recrystallized.
2730-2810	<u>LIMESTONE 15%:</u> Color – Dark gray to black, Texture -recrystallized mudstone. Unit is well cemented, and indurated. Well cemented, crystalline, Porosity is low. <u>LIMESTONE 45%:</u> Color - very pale orange to white, Texture – well indurated wackestone. Porosity - minor, low secondary porosity and permeability are present Locally the rock is recrystallized. <u>DOLOSTONE 40%:</u> Color – dark yellowish orange, Texture – crystalline, well indurated, well cemented, Locally sucrosic, Porosity – intercrystalline, Fossils – none.
2810-2900	<u>DOLOSTONE 80%:</u> Color – dark yellowish orange, Texture – crystalline, well indurated, well cemented, Locally sucrosic, Porosity – intercrystalline, Fossils – none. <u>LIMESTONE 15%:</u> Color – White to light gray to very pale orange, Texture -recrystallized grainstone. Grains are fine to medium sand, and biota remnants including algae and foraminifer. Unit is moderately cemented, and moderately indurated. Intergranular and moldic porosity is moderate to high. <u>LIMESTONE 5%:</u> Color - very pale orange to white, Texture – well indurated wackestone. Porosity - minor, low secondary porosity and permeability are present Locally the rock is recrystallized.

2900-3020	<u>DOLOSTONE 10%:</u> Color – dark yellowish orange, Texture – crystalline, well indurated, well cemented, Locally sucrosic, Porosity – intercrystalline, Fossils – none. <u>LIMESTONE 45%:</u> Color – White to light gray to very pale orange, Texture -recrystallized grainstone. Grains are fine to medium sand, and biota remnants including algae and foraminifer. Unit is moderately cemented, and moderately indurated. Intergranular and moldic porosity is moderate to high. <u>LIMESTONE 45%:</u> Color - very pale orange to white, Texture – well indurated wackestone. Porosity - minor, low secondary porosity and permeability are present Locally the rock is recrystallized.
3020-3080	<u>DOLOSTONE 40%:</u> Color – dark yellowish orange, Texture – crystalline, well indurated, well cemented, Locally sucrosic, Porosity – intercrystalline, Fossils – none. <u>LIMESTONE 30%:</u> Color – White to light gray to very pale orange, Texture -recrystallized grainstone. Grains are fine to medium sand, and biota remnants including algae and foraminifer. Unit is moderately cemented, and moderately indurated. Intergranular and moldic porosity is moderate to high. <u>LIMESTONE 30%:</u> Color - very pale orange to white, Texture – well indurated wackestone. Porosity - minor, low secondary porosity and permeability are present Locally the rock is recrystallized.
3080-3400	<u>DOLOSTONE 90%:</u> Color – dark yellowish orange, Texture – crystalline, well indurated, well cemented, Locally sucrosic, Porosity – intercrystalline, Fossils – none. <u>LIMESTONE 10%:</u> Color - very pale orange to white, Texture – well indurated wackestone. Porosity - minor, low secondary porosity and permeability are present Locally the rock is recrystallized.

Lithology
DZMW-1

WELL:	City of Sunrise Dual Zone Monitor Well (DZMW-1)
TOTAL DEPTH:	1,980 feet
COUNTY:	Broward
LOCATION:	Sunrise Wastewater Treatment Facility
OWNER:	City of Sunrise
DRILLER:	Youngquist Brothers, Inc.
DATE DRILLED:	August 24 through December 9, 1998,

HYDROLOGIC UNITS

0 to 120 feet	Surficial Aquifer
120 to 1,020 feet	Upper Confining Unit
1,020 to 1,980	Upper Floridan Aquifer Middle Confining Unit

LITHOLOGIC FORMATION	
0-68	<u>SANDSTONE 80%</u>: Color- Grayish orange (10 YR 7/4) to Pale yellowish brown (10 YR 6/2), Texture-wackestone to grainstone, Grains-medium fine sand size subrounded quartz, Cement/Matrix- lime mud and recrystallized lime mud, Porosity-moderate to high, Permeability-moderate to high, Accessories- n/a, Structures-casts, Hardness-moderate, Fossils-diverse pelecypoda/gastropoda. <u>SHELL 20%</u>: Color- Very pale orange (10 YR 8/2), Texture-unconsolidated whole pieces to fragments, Grains- <1mm to whole shells, Cement/Matrix-none, Porosity-n/a, Permeability- n/a, Accessories- n/a, Structures- n/a, Hardness-moderate, Fossils- diverse pelecypoda/gastropoda.
68-120	<u>LIMESTONE 70%</u>: Color-Medium gray (N5), Texture-biogenic packstone, Grains-medium sand size, Cement/Matrix-calcitic mud, Porosity-moderate to high, Permeability-moderate, Accessories- n/a, Structures- solution features, Hardness-moderate to high, Fossils- diverse pelecypoda/gastropoda. <u>LIMESTONE 30%</u>: Color-White (N9) to Pinkish Gray (5 YR 8/1), Texture- bimodal grainstone, Grains- fine sand size, Cement/Matrix-recrystallized lime mud, Porosity- low to moderate, vuggy, Permeability-moderate, Accessories-none, Structures-solution features, Hardness-moderately hard, Fossils- diverse pelecypoda/gastropoda.
120-150	<u>SILT 50%</u>: Color- Olive gray (5Y 4/1), Texture- unconsolidated mud, Grains- silt size, Cement/Matrix- n/a, Porosity-low, Permeability- low, Accessories-phosphatic sand, Structures- none, Hardness-soft, Fossils- diverse pelecypoda/gastropoda.

	<u>SHELL 50%</u>: Color-White (N7) and Black (N1), Texture- unconsolidated fragments, Grains- medium sand size to >3mm, Cement/Matrix- n/a, Porosity- n/a, Permeability- n/a, Accessories- n/a, Structures- n/a, Hardness- moderately hard, Fossils- diverse pelecypoda/gastropoda.
150-190	<u>LIMESTONE 50%</u>: Color-Medium gray (N5), Texture-biogenic packstone, Grains-medium sand size to pebbles, Cement/Matrix-calcitic mud, Porosity-moderate to high, Permeability- moderate, Accessories- n/a, Structures- n/a, Hardness- moderate to high, Fossils- diverse pelecypoda/gastropoda. <u>LIMESTONE 25%</u>: Color-White (N9) to Pinkish Gray (5 YR 8/1), Texture- bimodal grainstone, Grains- fine sand size, Cement/Matrix-recrystallized lime mud, Porosity- low to moderate, vuggy, Permeability-moderate, Accessories-none, Structures- solution features, Hardness-moderately hard, Fossils- diverse pelecypoda/gastropoda. <u>SHELL 25%</u>: Color-Med. light gray (N6) to Grayish black (N2), Texture- unconsolidated fragments, Grains- coarse sand size to >5mm, Cement/Matrix- n/a, Porosity- n/a, Permeability- n/a, Accessories- n/a, Structures- n/a, Hardness- soft to moderately hard, Fossils- diverse pelecypoda/gastropoda.
190-220	<u>CLAY 50%</u>: Color-Dark greenish gray (5 GY 4/1), Texture-unconsolidated terrigenous clay/mud, Grains- clay size, Cement/Matrix-none, Porosity-low, Permeability-low, Accessories-n/a, Structures-n/a, Hardness-soft, Fossils- mollusca, bryozoa, cnidarians. <u>LIMESTONE 25%</u>: Color-Light olive gray (5Y 6/1), Texture-biogenic packstone, Grains- medium to coarse sand size, Cement/Matrix-calcitic mud, Porosity-moderate, Permeability- moderate to low, Accessories- n/a, Structures- n/a, Hardness- moderate, Fossils- diverse pelecypoda/gastropoda. <u>SHELL 25%</u>: Color-Very light gray (N8) to Medium gray (N5), Texture- unconsolidated fragments, Grains- coarse sand size to >3mm, Cement/Matrix- n/a, Porosity- n/a, Permeability- n/a, Accessories- n/a, Structures- n/a, Hardness- soft to moderately hard, Fossils- diverse pelecypoda/gastropoda.
220-250	<u>SILT 50%</u>: Color- Medium light gray (N5), Texture- unconsolidated mud, Grains-silt size quartz, Cement/Matrix- none, Porosity-low, Permeability- low, Accessories- n/a, Structures- n/a, Hardness-soft, Fossils-none. <u>SHELL 50%</u>: Color-Yellowish gray (5Y 7/2), Texture- unconsolidated fragments, Grains- granules to >10 mm (whole pieces), Cement/Matrix- n/a, Porosity- n/a, Permeability- n/a, Accessories- n/a, Structures- n/a, Hardness- soft to moderately hard, Fossils- diverse pelecypoda/gastropoda.

250-475	<u>CLAYEY SILT 100%</u>: Color-Grayish olive green (5 GY 3/2), Texture- unconsolidated mud, Grains-silt to clay size carbonate grading to quartz with depth, Cement/Matrix-none, Porosity-low, Permeability- low, Accessories- shell fragments, Structures- n/a, Hardness-soft, Fossils-none.
475-650	<u>LIMESTONE 60%</u>: Color-Light olive gray (5Y 6/1) to Yellowish gray (5Y 8/1), Texture-micritic packstone, Grains-medium fine sand size, Cement/Matrix-calcitic mud, Porosity-moderate low, Permeability- low, Accessories- n/a, Structures- n/a, Hardness- moderate soft, Fossils-pelecypoda. <u>SILTSTONE 20%</u>: Color- Greenish gray (5GY 6/1), Texture- mudstone, Grains-silt size, Cement/Matrix- calcitic mud, Porosity- low, Permeability-low, Accessories-n/a, Structures- n/a, Hardness-moderate soft, Fossils-none. <u>BIOTICS 20%</u>: Color- Light olive gray (5Y 6/1) to Yellowish gray (5Y 8/1), Texture-unconsolidated fragments, Grains- coarse sand size to >3mm, Cement/Matrix-n/a, Porosity- n/a, Permeability- n/a, Accessories- n/a, Structures-none, Hardness-moderate, Fossils-assorted mollusca.
650-950	<u>CLAY 75%:</u> Color-Light olive gray (5Y 6/1) to Yellowish gray (5Y 8/1, Texture-terrigenous mudstone, can be layered, clay shows no structure on examination, Plastic deformation, very soft, Grains-contains lithics of limestone, sand and shell, possibly from contamination, poor to moderately indurated, Plastic deformation, contains zones of montmorillonite. <u>LIMESTONE 15%</u>: Color-Light olive gray (5Y 6/1) to Yellowish gray (5Y 8/1), Texture-micritic packstone, Grains-medium fine sand size, Cement/Matrix-calcitic mud, Porosity-moderate low, Permeability- low, Accessories- n/a, Structures- n/a, Hardness- moderate soft, Fossils- diverse pelecypoda/gastropoda. <u>SILTSTONE 5%</u>: Color- Greenish gray (5GY 6/1), Texture- mudstone, Grains-silt size, Cement/Matrix- calcitic mud, Porosity- low, Permeability-low, Accessories-n/a, Structures- n/a, Hardness-moderate soft, Fossils-none. <u>BIOTICS 5%</u>: Color- Light olive gray (5Y 6/1) to Yellowish gray (5Y 8/1), Texture-unconsolidated fragments, Grains- coarse sand size to >3mm, Cement/Matrix-n/a, Porosity- n/a, Permeability- n/a, Accessories- n/a, Structures-none, Hardness-moderate, Fossils-assorted mollusca.
950-1005	<u>CLAY 50%</u>: Color-Dark greenish gray (5 GY 4/1), Texture-unconsolidated terrigenous clay/mud, Grains- clay size, Cement/Matrix-none, Porosity-low, Permeability-low, Accessories-n/a, Structures-n/a, Hardness-soft, Fossils-mollusca, bryozoa, cnidarians.

	<u>LIMESTONE 25%</u>: Color-Light olive gray (5Y 6/1), Texture-biogenic packstone, Grains-medium to coarse sand size, Cement/Matrix-calcitic mud, Porosity-moderate, Permeability- moderate to low, Accessories- n/a, Structures- n/a, Hardness-moderate, Fossils-mollusca, bryozoa, cnidarians. <u>SHELL 25%</u>: Color-Very light gray (N8) to Medium gray (N5), Texture- unconsolidated fragments, Grains- coarse sand size to >3mm, Cement/Matrix- n/a, Porosity-n/a, Permeability- n/a, Accessories- n/a, Structures- n/a, Hardness- soft to moderately hard, Fossils-mollusca, bryozoa, cnidarians.
1005-1110	<u>LIMESTONE 90%</u>: Color- tan to very pale orange - with gray Texture - complexly interbedded, argillaceous limestone, recrystallized. Limestone is generally medium gray to white, poor to moderately indurated, mudstones and wackestones. Porosity is low. Grains include minor fossil debris, and peloids, cemented with abundant pore filling calcite spar cement (porosity reducing), moderately cemented, porosity is present. Abundant quartz and phosphate, poorly sorted, rounded to angular (clear tan rhombs, can make up as much as 40% of total volume), cemented with abundant pore filling calcite spar cement (porosity reducing), moderately cemented, porosity is present. <u>SHELL 10%</u>: Color-Very light gray (N8) to Medium gray (N5), Texture- unconsolidated fragments, Grains- coarse sand size to >3mm, Cement/Matrix- n/a, Porosity-n/a, Permeability- n/a, Accessories- n/a, Structures- n/a, Hardness- soft to moderately hard, Fossils-mollusca.
1110-1240	<u>LIMESTONE 100%:</u> Color - white to medium gray, Texture - moderately indurated boundstones to wackestones, locally grades to packstone and grainstone. Grains - contains minor phosphate nodules. Porosity - some bioclasts are represented as moldic porosity, and high secondary porosity and permeability are present (intergranular, interparticle and moldic). Locally the rock is recrystallized. Well indurated, and contains coarse spar cement (reducing). Biotics include reef fauna assemblage (diverse mollusk, forams, bryozoans, corals, and echinoids).
1240-1460	<u>LIMESTONE 85%:</u> Color - very pale orange, Texture -recrystallized grainstone. Grains are sand size and biota remnants including algae and foraminifer. Unit is moderately cemented, but poorly indurated. Intergranular porosity is moderate to high. Porosity reduction by cementation is common. <u>LIMESTONE 10%:</u> Color - white to medium gray, Texture - moderately indurated boundstones to wackestones, locally grades to packstone. Porosity - minor bioclasts are represented as moldic porosity, low secondary porosity and permeability are present (intergranular, interparticle and moldic). Locally the rock is recrystallized. Well indurated, and contains coarse spar cement (reducing).

	Biotics include reef fauna assemblage (diverse mollusk, foram, bryozoan, corals, echinoids). Possibly contamination during drilling. <u>LIMESTONE 5%:</u> Color - medium gray, Texture - moderately indurated wackestones, locally grades to packstone. Porosity - minor, low secondary porosity and permeability are present Locally the rock is recrystallized. Well indurated.
1460-1630	<u>LIMESTONE 30%:</u> Color - very pale orange to light gray, Texture - moderately indurated wackestones, locally grades to packstone. Porosity - minor, low secondary porosity and permeability are present Locally the rock is recrystallized. Well indurated. <u>LIMESTONE 70%:</u> Color - pale orange, Texture -recrystallized grainstone. Grains are sand size and biota remnants including algae and foraminifer. Unit is moderately cemented, but poorly indurated. Intergranular porosity is moderate to high. Porosity reduction by cementation is common.
1630-1980	<u>LIMESTONE 40%:</u> Color - very pale orange to light gray, Texture - moderately indurated wackestones, locally grades to packstone. Porosity - minor, low secondary porosity and permeability are present Locally the rock is recrystallized. Well indurated. <u>LIMESTONE 40%:</u> Color - pale orange, Texture -recrystallized grainstone. Grains are sand size and biota remnants including algae and foraminifer. Unit is moderately cemented, but poorly indurated. Intergranular porosity is moderate to high. Porosity reduction by cementation is common. <u>LIMESTONE 20%:</u> Color - pale orange to pale yellow orange foram packstone. Highly recrystallized, well cemented, but poorly indurated. Porosity is moderate due to carbonate sand content. Porosity is high. Cement is zoned. Contains abundant forams.

Appendix G

MONTGOMERY WATSON

Video Surveys
CW-1

Video Survey
CW-1
Open Hole 1,032 to 2,103 feet bpl

MONTGOMERY WATSON

CW-1 VIDEO SURVEY

DATE(S): 9/22/98

CITY OF SUNRISE **CONCENTRATE WELL NO. 1**

JOB NUMBER 1324024.264701

CONTRACTOR: Youngquist Brothers, Inc.

PROJECT MANAGER: Helen V. Hickman

COUNTY: Broward
OWNER: City of Sunrise

VIDEO CONTRACTOR: Florida Geophysical
TOTAL DEPTH: 2105

DESCRIPTION OF OPERATIONS: Video logging of the pilot hole to 2105 feet below pad level.

DEPTH IN FEET		OBSERVATIONS
From	To	
1,032.0		Broken formation. Bit fracturing evident below casing.
1,034.0		Bedding - Open
1,036.0	1,038.0	Vertical fracture
1,039.0		Very broken
1,040.0		Cavern
1,042.0	1,074.0	Bedding/DBL Borehole
1,045.0		Vuggy, possibly due to variable cementation.
1,052.9		Stop to clear hole
1,060.0	1,074.0	Smooth DBL Borehole
1,074.0		Single, DBL borehole ends.
1,080.0		Very vuggy (small irregular)
1,096.0		Large vugs, possibly due to variable cementation.
1,101.0		Large bedding (open)
1,103.0		Tight, gauge hole.
1,118.0		Stop to clear hole
1,124.0		Vuggy - irregular
1,142.0	1,153.0	Bedding - Tight
1,154.0		Rough hole - small vugs, possibly due to variable cementation.
1,181.0		Bedding, tight
1,193.0		Bedding - nondescript

DEPTH IN FEET		OBSERVATIONS
From	To	
1,212.0		Bedding - mostly nondescript - gauge
1,237.0	1,245.0	Vuggy
1,255.0		Bedding, backshore laminations.
1,271.0		Smooth gauge
1,325.0		Vuggy - bedding
1,326.0		Gauge hole - some vugs
1,344.0		Small vugs, possibly due to variable cementation.
1,351.0		Bedding
1,356.0	1,370.0	Bedding - smooth, gauge, nondescript
1,390.0		Vuggy, pocked, some bedding
1,420.0		Bedding, tight backshore laminations.
1,430.0		Bedding - Open
1,477.0		Bedding - Tight Hole is gauge, round, mostly tight
1,493.0		Minor vugs
1,545.0		Bedding, Tight Hole is gauge, round, mostly tight
1,562.0		Very round - Bedding, mostly tight
1,601.0	1,611.0	Bedding
1,619.0		Round but rough
1,648.0		Vuggy
1,655.0		Vuggy
1,670.0	1,685.0	Large vuggy
1,687.0		Bedding
1,696.0		Smooth, Tight Hole is gauge, round, mostly tight
1,702.0		Vuggy, possibly due to variable cementation.
1,714.0		Bedding
1,726.0		Smooth
1,738.0		Smooth w/ bedding
1,753.0	1,793.0	Vuggy w/ bedding - Round
1,798.0		Bedding
1,814.0		Bedding - Open
1,828.0		Bedding - Open
1,836.0		Bedding - Open
1,844.0		Bedding - Open
1,849.0		Bedding - Open
1,873.0		Bedding

DEPTH IN FEET		OBSERVATIONS
From	To	
1,893.0		Smooth
1,910.0		Bedding
1,920.0		Tight gauge hole - nondescript
1,922.0		Vuggy
1,924.0		Vuggy
1,929.0	1,932.0	Bedding
1,934.0		Bedding
1,939.0		Clear hole
1,944.0		Vuggy
1,945.0		Bedding
1,950.0		Bedding
1,951.0		Bedding
1,956.0		Vuggy (Very cloudy)
1,962.0		Tight gauge hole
1,965.0		Vuggy w/ bedding
1,970.0		Round - chalky white
1,984.0		Open bedding
1,998.0		Open bedding
2,015.0		Vuggy w/ open bedding
2,040.0		Minor bedding - tight
2,043.0		Vuggy
2,047.0		Bedding w/ vugs
2,050.0	2,059.0	Tight gauge hole
2,059.0		Bedding (observed at 2,059 on second pass,
		likely same as 2,062 bedding plane)
2,062.0		Bedding
2,060.0	2,068.0	Tight hole
2,070.0	2,079.0	Tight gauge hole
2,080.0	2,090.0	Tight gauge hole
2,090.0	2,097.0	Tight hole
2,100.0	2,103.0	Tight hole

Video Survey
CW-1
Open Hole 2,018 to 3,084 feet bpl

MONTGOMERY WATSON

CW-1 VIDEO SURVEY

DATE(S): 10/15/98

CITY OF SUNRISE **CONCENTRATE WELL NO. 1**

JOB NUMBER 1324024.264701

CONTRACTOR: Youngquist Brothers, Inc.

PROJECT MANAGER: Helen V. Hickman

COUNTY: Broward
OWNER: City of Sunrise

VIDEO CONTRACTOR: Florida Geophysical
TOTAL DEPTH: 3084

DESCRIPTION OF OPERATIONS: Video logging of the pilot hole to 3084 feet below pad level.

DEPTH IN FEET		OBSERVATIONS
From	To	
2,010	2,018	34" casing.
2,018	2,024	Cement plug.
2,024	2,030	Very Broken - cement and formation.
2,030	2,037	Clean break - gauge and smooth hole, slightly scalloped.
	2,037	Closed bedding features.
2,037	2,077	Gauge borehole, small vugs, irregular and few.
	2,046	Bedding.
	2,051	Solution enhanced bedding, possible grey limestone interval.
	2,076	Closed bedding - thin bedset features - laminated.
2,077	2,079	Slightly irregular borehole.
2,079	2,088	Gauge and smooth, some small vugs.
2,088		Laminations, possibly algal - supratidal - confining.
	2,093	Open bedding.
		Mostly smooth gauge hole.
2,094	2,157	Smooth gauge hole, some small irregular vugs of variable consistency, covering
		5%-30% of the borehole wall.
		Minor closed bedding/ lamination zones.
2,157	2,170	As above, possible sequences.
2,170	2,196	As 2094.
	2,196	Possible algal laminations, confining.

DEPTH IN FEET		OBSERVATIONS
From	To	
2,197	2,219	Smooth gauge hole, some small irregular vugs of variable consistency.
2,219	2,225	Tighter hole, possible dolomitization,
2,225	2,285	Gauge, smooth, minor vugs.
	2,271	Gray layer.
2,285	2,318	Large vugs, some limestone some dolostone.
	2,295	Possible fracture.
	2,316	
2,318		Smooth gauge borehole, Limestone, chalky.
		Caliper stripes visible in soft limestone.
2,353	2,358	large vugs, still soft limestone.
	2,360	Dark spot 2'. Low visibility.
		No visibility.
2,363	2,388	Smooth, gauge, still very soft.
2,390	2,399	large vugs.
	2,403	large vugs, borehole wall is very dark.
		Rough borehole.
	2,430	large vugs.
		Broken
	2,437	Open and broken. High permeability.
2,437	2,446	Appears to have been broken by bit action.
	2,457	Open bedding.
2,457		Very rough, large cavities, soft and hard formation,
		Dark borehole.
	2,473	Dark borehole, open bedding.
2,480	2,503	Smoother, more regular, only occasional broken zones.
2,504		Broken by drilling action. Open bedding, very rough wall.
		Hard, irregular borehole.
	2,522	Large open bedding , 2524', 2526', 2531'.
2,535	2,546	Mostly smooth.
2,546	2,550	Broken formation, open bedding.
2,560	2,590	Soft, scalloped, somewhat irregular.
		minor vugs.
	2,590	Algal Laminations
	2,595	Open bedding.

DEPTH IN FEET		OBSERVATIONS
From	To	
2,600	2,607	More Vugs.
2,608		Smooth again, still soft with vugs.
2,616	2,618	Open bedding.
2,621		Gauge hole, some vugs.
	2,633	Possible fracture
	2,638	Smooth hole, lots of vugs.
		Very irregular borehole.
	2,670	Large vugs. Appear to be A-B depositional sequences. 1
2,677		Limited vugs, smooth borehole.
	2,690	Vugs increasing.
2,707		Very smooth, closed bedding. sequence # #2
	2,718	More irregular.
	2,722	Large vugs
	2,725	Open bedding.
2,729		Open bedding.
2,733		Tight and smooth. #3
	2,738	more vugs.
2,744		Tight and smooth. #4
	2,747	More Vugs.
2,755	2,762	#5
2,762	2,770	#6
2,770	2,773	#7
2,743	2,778	#8
2,781	2,789	#9
2,789	2,797	#10 algal laminations.
2,797	2,806	Open bedding.
	2,820	Possible healed fracture.
		Sequences are continuing on a 5' to 12' scale.
2,837	2,900	Dark, slightly irregular borehole.
		scalloped, mostly gauge.
	2,900	Fracture.
2,902		Hole has become egg shaped., Wall is smooth, 15% vugs.
	2,928	Less Vugs.
	2,938	More vugs. Possible faint sequence development.

DEPTH IN FEET		OBSERVATIONS
From	To	
	2,945	Smooth borehole wall.
2,945	2,910	Sequences are continuing on a 3' to 5' scale.
	3,013	Formation is broken, open bedding.
	3,018	Dolostone.
		Tight and gauge.
	3,035	Dolostone.
	3,037	Dolostone.
	3,039	Limestone
	3,050	Heavily cemented interval. Crystalline.
	3,058	Smooth borehole wall.
	3,060	Dolostone.
3,060	3,069	Smooth borehole wall.
	3,069	Dolostone.
	3,077	TD
		Sequences encountered appear to be shallowing upward,
		tidal to supra-tidal sequences.

Video Survey
CW-1
Open Hole 3,047 to 3,400 feet bpl

MONTGOMERY WATSON

CW-1 VIDEO SURVEY

DATE(S): 11/20/98

CITY OF SUNRISE **CONCENTRATE WELL NO. 1**

JOB NUMBER 1324024.264701

CONTRACTOR: Youngquist Brothers, Inc.

PROJECT MANAGER: Helen V. Hickman

COUNTY: Broward
OWNER: City of Sunrise

VIDEO CONTRACTOR: Florida Geophysical
TOTAL DEPTH: 3400

DESCRIPTION OF OPERATIONS: Video logging of the pilot hole to 3400 feet below pad level.

DEPTH IN FEET		OBSERVATIONS
From	To	
3,032		20" casing. (Depths based on camera view)
3,042		24" casing.
3,044		Smooth gauge hole - minor vugs
3,056		Bedding plane
3,078		Relatively gauge hole w/ some organic debris
3,100		Bedding plane
3,102		Relatively gauge hole - bedding and fractures
3,129		Cavernous zone
3,135		Relatively tight formation w/ some fracturing
3,139		Cavernous zone
3,142		Boulders around jagged hole
3,149		Large boulder partially filling borehole
3,152		Gauge hole
3,156	3,158	Bedding plane
3,159		Tight gauge hole
3,165		Some fractures
3,170		Very tight
3,185		Gauge hole w/ fractures
3,186		Material from bridge plug on borehole wall
3,189		Tight, relatively gauge hole

DEPTH IN FEET		OBSERVATIONS
From	To	
3,208		Bedding plane - Minor wash-out w/ bridge plug material
3,215		Smooth gauge hole
3,240		Bedding plane
3,245		Minor cavernous zone
3,248		Gauge hole
3,303		Bedding plane
3,308		Rough borehole
3,318		Less rough w/ fractures
3,324		Tight gauge hole
3,367		Hole rougher w/ fractures
3,374		Close to gauge
3,400		TD

Video Survey
CW-1
24-inch Final Casing

MONTGOMERY WATSON

CW-1 VIDEO SURVEY

DATE(S): 11/15/98

CITY OF SUNRISE **CONCENTRATE WELL NO. 1**

JOB NUMBER 1324024.264701

CONTRACTOR: Youngquist Brothers, Inc.

PROJECT MANAGER: Helen V. Hickman

COUNTY: Broward
OWNER: City of Sunrise

VIDEO CONTRACTOR: Florida Geophysical
TOTAL DEPTH: 2110

DESCRIPTION OF OPERATIONS: Video logging of the 24-inch diameter final casing

DEPTH IN FEET		
Weld	**Pause**	**OBSERVATIONS**
		The video log was performed from the surface to total depth in stages due to
		cloudiness in the water. The welds were initially observed during the down
		pass, then each weld was looked at in detail using the side view lens during
		the trip out of the well.
		The following is a list of the depths of each weld and the depths at which the
		camera was stopped to allow the water to clear.
		The majority of the welds appear to be lacking full penetration in sections - this is
		seen as a small gap at the joint. This does not mean that the weld is
		inadequate in any way, it is a visual measure of how much metal has
		penetrated through the weld joint into the inside of the casing.
		The following is a qualitative measure of the weld penetration
		Excellent - 100 percent full penetration welds - the welds tend to
		"disappear" showing a smooth and continuous pipe.
		Good - greater than 50 percent full penetration.
		Fair - Less than 50 percent full penetration.
33		Excellent weld
53		Excellent weld

DEPTH IN FEET		
Weld	Pause	OBSERVATIONS
89		Excellent weld
108		Excellent weld
147		Fair weld
188		Excellent weld
	200	Stop to allow casing to be flushed clear with water.
228		Excellent weld
267		Excellent weld
305		Good weld
326		Excellent weld
367		Good weld
407		Excellent weld
448		Excellent weld
489		Good weld
530		Excellent weld
566		Excellent weld
	600	Stop to allow casing to be flushed clear with water.
602		Good weld
645		Excellent weld
681		
722		Excellent weld
764		Excellent weld
806		Excellent weld
846		Excellent weld
887		Excellent weld
928		Excellent weld
	1000	Stop to allow casing to be flushed clear with water.
970		Excellent weld
1012		Excellent weld
1055		Excellent weld
1096		
1139		
1182		Excellent weld
	1200	Stop to allow casing to be flushed clear with water.
1225		
1267		

DEPTH IN FEET		
Weld	Pause	OBSERVATIONS
1309		
1351		
1432		Good weld
1473		
1512		
1552		
1591		
1633		
1675		
	1700	Stop to allow casing to be flushed clear with water.
1713		
1736		
1752		
1794		
1831		
1872		
1913		
1953		
1996		
	2000	Stop to allow casing to be flushed clear with water.
2038		Good weld
2075		
2118		
2154		
2194		
2235		Good weld
2274		
2313		
2354		
2394		
	2400	Stop to allow casing to be flushed clear with water.
2433		Fair weld
2476		
2517		
2558		

DEPTH IN FEET		OBSERVATIONS
Weld	Pause	
2595		
2635		Fair weld
2676		
2719		
2756		
2795		
2835		
2876		
2917		
2954		Good weld
2995		
3032		Packer - observed both top and bottom - clean and smooth.
3039		Total depth

Video Survey
CW-1
20-inch Injection Tubing

MONTGOMERY WATSON

CW-1 VIDEO SURVEY

DATE(S): 12/16/98

CITY OF SUNRISE **CONCENTRATE WELL NO. 1**

JOB NUMBER 1324024.264701

CONTRACTOR: Youngquist Brothers, Inc.

PROJECT MANAGER: Helen Hickman

COUNTY: Broward
OWNER: City of Sunrise

VIDEO CONTRACTOR: Florida Geophysical
TOTAL DEPTH: 3,047

DESCRIPTION OF OPERATIONS: Video logging of the 20-inch diameter liner

DEPTH IN FEET		
Weld	**Other**	**OBSERVATIONS**
		The video log was performed from the surface, through the packer, and down to
		the bottom of the 24-inch diameter casing. The welds were initially observed
		during the downpass, then each weld was looked at in detail using the side
		view lens during the trip out of the well.
		The following is a list of the depths of each weld
	0	Flange - water very clear.
28		
71		
111		
153		
195		
237		
227		
319		
359		
401		
441		
483		
523		

DEPTH IN FEET		OBSERVATIONS
Weld	Other	
564		
607		
649		
687		
725		
767		
809		
852		
887		
929		
971		
1009		
1051		
1089		
1131		
1170		
1213		
1254		
1296		
1339		
1383		
1421		
1464		
1504		
1547		
1587		
1627		
1666		
1711		
1751		
1791		
1833		
1874		
1915		
1954		

DEPTH IN FEET		OBSERVATIONS
Weld	Other	
1997		
2039		
2081		
2122		
2164		
2205		
2246		
2288		
2330		
2372		
2413		
2456		
2496		
2535		
2577		
2618		
2662		
2701		
2744		
2786		
2828		
2870		
2909		
2953		
2995		
	3037	Bottom of 20-inch diameter tubing
	3047	Bottom of 24-inch diameter casing

Video Surveys
DZMW-1

MONTGOMERY WATSON

DZMW-1 VIDEO SURVEY

DATE(S): 1/5/99

CITY OF SUNRISE **DUAL ZONE MONITOR WELL NO. 1**

JOB NUMBER 1324024.264701

CONTRACTOR: Youngquist Brothers, Inc.

PROJECT MANAGER: Helen V. Hickman

COUNTY: Broward
OWNER: City of Sunrise

VIDEO CONTRACTOR: Florida Geophysical
TOTAL DEPTH: 1,980

DESCRIPTION OF OPERATIONS: Video logging of the 6 5/8-inch diameter monitor casing

DEPTH IN FEET		
Weld	**Other**	**OBSERVATIONS**
		The video log was performed from the surface to the bottom of the casing and
		includes the 12-inch diameter open hole, lower monitor interval. The casing
		welds were initially observed during the down pass, then each weld was
		looked at in detail using the side view lens during the trip out of the well.
		The following is a list of the depths of each weld
		Water is very clear - well is flowing.
		Walls of casing have a black hydrogen sulfide film - very dificult to see weld
		with side view
35		
73		
109		
148		
184		
221		
259		
298		
341		
378		
421		

DEPTH IN FEET		OBSERVATIONS
Weld	Other	
458		
495		
577		
616		
656		
688		
726		
761		
798		
838		
876		
914		
951		
988		
1030		
1070		
1106		
1149		
1187		
1228		
1263		
1304		
1345		
1386		
1426		
1467		
1508		
1549		
1585		
1626		
1666		
1708		
1747		
1788		
1829		

DEPTH IN FEET		OBSERVATIONS
Weld	Other	
1870		
1907		
1948		
	1956	Bottom of 6 5/8-inch casing.
		Borehole is relatively smooth and gauge in diameter to the bottom of the well.
		Groove seen along one side of the open hole.
	1981	Total depth of the well - bottom of monitoring interval.
		Loose debris at base of well.

Appendix H

MONTGOMERY WATSON

Core Descriptions
CW-1

MONTGOMERY WATSON

WELL # CW-1 CORE DESCRIPTION

DATE(S): 9/9/98

CITY OF SUNRISE **WTP CW-1 WELL**

JOB NUMBER 1324024
COST CODE 264701

CONTRACTOR: Youngquist

TOTAL DEPTH: 1,753 feet
COUNTY: Broward
OWNER: City of Sunrise
DRILLING METHOD: Rough Cut
DRILLER(S): Troy Moore
DATUM POINT: Pad level
DATUM POINT ELEVATION: 6.0 NGVD
HYDROLOGIC UNITS: Upper Floridan
% RECOVERY 33 %
CORED INTERVAL 1,743-1,753

DEPTH (feet below pad)			DEPTH INTERVAL	DESCRIPTION	DRILLING COMMENTS
1,743	to	1,743.8	0.8	LIMESTONE: Color: very pale orange, Texture: Grainstone, Grains: minor quartz sand, abundant foraminifera and algal remnants. Cement/Matrix: calcite with recrystallized limemud matrix, poorly cemented. Porosity: moderate. Permeability: moderate. Hardness: moderately soft. Fossils: abundant foraminifera.	Penetration rate = 30 seconds/foot. Weight on bit = 0-5 K. RPM of kelly = 60. Pump pressure held at a constant of 70-85 psi.
1,743.8	to	1,744	0.2	LIMESTONE, Color: medium gray, well indurated wackstones, locally grades to packstone. Some bioclasts are represented as moldic porosity, low secondary porosity and permeability are present (intergranular, interparticle and moldic). Locally the rock is recrystalized. Well indurated. Biotics include foram.	Penetration rate = 30 seconds/foot. Weight on bit = 0-5 K. RPM of kelly = 60. Pump pressure held at a constant of 70-85 psi.
1,744	to	1,746.5	2.5	LIMESTONE: Color: very pale orange, Texture: Grainstone, Grains: minor quartz sand, abundant foraminifera and algal remnants. Cement/Matrix: calcite with recrystallized limemud matrix, poorly cemented. Porosity: moderate. Permeability: moderate. Hardness: moderately soft. Fossils: abundant foraminifera.	Penetration rate = 30 seconds/foot. Weight on bit = 0-5 K. RPM of kelly = 60. Pump pressure held at a constant of 70-85 psi.
1,746.5	to	1,753	6.5	NO RECOVERY	Penetration rate = 30 seconds/foot. Weight on bit = 0-5 K. RPM of kelly = 60. Pump pressure held at a constant of 70-85 psi.

Description by M.R.S

MONTGOMERY WATSON

WELL # CW-1 CORE DESCRIPTION

DATE(S): 9/10/98

CITY OF SUNRISE **WTP CW-1 WELL**

JOB NUMBER 1324024
COST CODE 264701

CONTRACTOR: Youngquist

TOTAL DEPTH:	1965 feet
COUNTY:	Broward
OWNER:	City of Sunrise
DRILLING METHOD:	Carbide Aggressive Drilling
DRILLER(S):	Troy Moore
DATUM POINT:	Pad level
DATUM POINT ELEVATION:	6.0 NGVD
HYDROLOGIC UNITS:	Upper Floridan
% RECOVERY	100 %
CORED INTERVAL	1955-1965

DEPTH (feet below pad)			DEPTH INTERVAL	DESCRIPTION	DRILLING COMMENTS
1955	to	1959.5	4.5	LIMESTONE: Color: very pale orange, Texture: wackestone/Mudstone, Grains: minor quartz sand and foraminifera. Cement/Matrix: calcite with recrystallized limemud matrix, poorly cemented. Porosity: low. Permeability: moderate. Hardness: moderately soft. Fossils: abundant forams, all are recrystallized and filled with cement.	Penetration rate = 0.5-2 minute/foot. Weight on bit = 0-4 K. RPM of kelly = 36. Pump pressure held at a constant of 60 psi.
1959.5	to	1961.5	2	LIMESTONE: Color: very pale orange and gray, Texture: Laminated algal Boundstone – (wackestone/mudstone), Black to gray algal laminations resulting from supra tidal deposition are present in the unit, Grains: minor quartz sand and carbonate sand. Cement/Matrix: calcite with recrystallized limemud matrix, poorly cemented. Porosity: low. Permeability: low. Hardness: moderately soft. Fossils: abundant forams, all are recrystallized and filled with cement.	Penetration rate = 0.5-2 minute/foot. Weight on bit = 0-4 K. RPM of kelly = 36. Pump pressure held at a constant of 60 psi.
1961.5	to	1965	3.5	LIMESTONE: Color: very pale orange, Texture: wackestone/Mudstone, Grains: minor quartz sand and foraminifera. Cement/Matrix: calcite with recrystallized limemud matrix, poorly cemented. Porosity: low. Permeability: moderate. Hardness: moderately soft. Fossils: abundant forams, all are recrystallized and filled with cement.	Penetration rate = 0.5-2 minute/foot. Weight on bit = 0-4 K. RPM of kelly = 36. Pump pressure held at a constant of 60 psi.

Description by M.R.S

MONTGOMERY WATSON

WELL # CW-1 CORE DESCRIPTION

DATE(S): 9/10/98

CITY OF SUNRISE | **WTP CW-1 WELL**

JOB NUMBER 1324024
COST CODE 264701

CONTRACTOR: Youngquist

TOTAL DEPTH:	2040 feet
COUNTY:	Broward
OWNER:	City of Sunrise
DRILLING METHOD:	Carbide Aggressive Drilling
DRILLER(S):	Troy Moore
DATUM POINT:	Pad level
DATUM POINT ELEVATION:	6.0 NGVD
HYDROLOGIC UNITS:	Upper Floridan
% RECOVERY	40 %
CORED INTERVAL	2030-2040

DEPTH (feet below pad)			DEPTH INTERVAL	DESCRIPTION	DRILLING COMMENTS
2030	to	2034	4	LIMESTONE: Color: very pale orange, Texture: wackestone/Mudstone, Grains: minor quartz sand and foraminifera. Cement/Matrix: calcite with recrystallized limemud matrix, poorly cemented. Porosity: low. Permeability: moderate. Hardness: moderately soft. Fossils: abundant forams, all are recrystallized and filled with cement.	Penetration rate = 0.5-2 minute/foot. Weight on bit = 0-4 K. RPM of kelly = 40. Pump pressure held at a constant of 60 psi.
2034	to	2040	6	No Recovery	Penetration rate = 0.5-2 minute/foot. Weight on bit = 0-4 K. RPM of kelly = 36. Pump pressure held at a constant of 60 psi.

Description by M.R.S

MONTGOMERY WATSON

WELL # CW-1 CORE DESCRIPTION

DATE(S): 9/11/98

CITY OF SUNRISE **WTP CW-1 WELL**

JOB NUMBER 1324024
COST CODE 264701

CONTRACTOR: Youngquist

TOTAL DEPTH:	2087	feet
COUNTY:	Broward	
OWNER:	City of Sunrise	
DRILLING METHOD:	Carbide Aggressive Drilling	
DRILLER(S):	Troy Moore	
DATUM POINT:	Pad level	
DATUM POINT ELEVATION:	6.0 NGVD	
HYDROLOGIC UNITS:	Upper Floridan	
% RECOVERY	90 %	
CORED INTERVAL	2077-2087	

DEPTH (feet below pad)			DEPTH INTERVAL	DESCRIPTION	DRILLING COMMENTS
2077	to	2077.8	0.8	LIMESTONE: Color: very pale orange and gray, Texture: Laminated algal Boundstone – (wackestone/mudstone), Black to gray algal laminations resulting from supra tidal deposition are present in the unit, Grains: minor quartz sand and carbonate sand. Cement/Matrix: calcite with recrystallized limemud matrix, poorly cemented. Porosity: low. Permeability: low. Hardness: moderately soft. Fossils: abundant forams, all are recrystallized and filled with cement.	Penetration rate = 0-10 minute/foot. Weight on bit = 0-4 K. RPM of kelly = 50-70. Pump pressure held at a constant of 70-110 psi.
2077.8	to	2081.3	3.5	LIMESTONE: Color: very pale orange, Texture: wackestone/Mudstone, Grains: minor quartz sand and foraminifera. Cement/Matrix: calcite with recrystallized limemud matrix, poorly cemented. Porosity: low. Permeability: moderate. Hardness: moderately soft. Fossils: abundant forams, all are recrystallized and filled with cement.	Penetration rate = 0-10 minute/foot. Weight on bit = 0-4 K. RPM of kelly = 50-70. Pump pressure held at a constant of 70-110 psi.

Description by M.R.S

2081.3	to	2082.1	0.8	LIMESTONE: Color: very pale orange and gray, Texture: Laminated algal Boundstone – (wackestone/mudstone), Black to gray algal laminations resulting from supra tidal deposition are present in the unit, Grains: minor quartz sand and carbonate sand. Cement/Matrix: calcite with recrystallized limemud matrix, poorly cemented. Porosity: low. Permeability: low. Hardness: moderately soft. Fossils: abundant forams, all are recrystallized and filled with cement.	Penetration rate = 0-10 minute/foot. Weight on bit = 0-4 K. RPM of kelly = 50-70. Pump pressure held at a constant of 70-110 psi.
2082.1	to	2082.7	0.6	LIMESTONE: Color: very pale orange, Texture: wackestone/Mudstone, Grains: minor quartz sand and foraminifera. Cement/Matrix: calcite with recrystallized limemud matrix, poorly cemented. Porosity: low. Permeability: moderate. Hardness: moderately soft. Fossils: abundant forams, all are recrystallized and filled with cement.	Penetration rate = 0-10 minute/foot. Weight on bit = 0-4 K. RPM of kelly = 50-70. Pump pressure held at a constant of 70-110 psi.
2082.7	to	2084.2	1.5	LIMESTONE: Color: very pale orange and gray, Texture: Laminated algal Boundstone – (wackestone/mudstone), Black to gray algal laminations resulting from supra tidal deposition are present in the unit, Grains: minor quartz sand and carbonate sand. Cement/Matrix: calcite with recrystallized limemud matrix, poorly cemented. Porosity: low. Permeability: low. Hardness: moderately soft. Fossils: abundant forams, all are recrystallized and filled with cement.	Penetration rate = 0-10 minute/foot. Weight on bit = 0-4 K. RPM of kelly = 50-70. Pump pressure held at a constant of 70-110 psi.
2084.2	to	2086	1.8	LIMESTONE: Color: very pale orange, Texture: wackestone/Mudstone, Grains: minor quartz sand and foraminifera. Cement/Matrix: calcite with recrystallized limemud matrix, poorly cemented. Porosity: low. Permeability: moderate. Hardness: moderately soft. Fossils: abundant forams, all are recrystallized and filled with cement.	Penetration rate = 0-10 minute/foot. Weight on bit = 0-4 K. RPM of kelly = 50-70. Pump pressure held at a constant of 70-110 psi.
2086	to	2087	1.0	No Recovery	Penetration rate = 0-10 minute/foot. Weight on bit = 0-4 K. RPM of kelly = 50-70. Pump pressure held at a constant of 70-110 psi.

Description by M.R.S

MONTGOMERY WATSON

WELL # CW-1 CORE DESCRIPTION

DATE(S): 10/8/98

CITY OF SUNRISE

WTP CW-1 WELL

JOB NUMBER 1324024
COST CODE 264701

CONTRACTOR: Youngquist

TOTAL DEPTH: 2147' feet
COUNTY: Broward
OWNER: City of Sunrise
DRILLING METHOD: Carbide Aggressive Drilling
DRILLER(S): Troy Moore
DATUM POINT: Pad level
DATUM POINT ELEVATION: 6.0 NGVD
HYDROLOGIC UNITS: Upper Floridan
% RECOVERY 4%
CORED INTERVAL 2135-2147

DEPTH (feet below pad)			DEPTH INTERVAL	DESCRIPTION	DRILLING COMMENTS
2135.0	to	2135.5	0.5	LIMESTONE: Color: Pale yellowish orange to white, Texture: wackestone/Mudstone, Grains: minor quartz sand and molusca. Cement/Matrix: calcite with recrystallized limemud matrix, poorly cemented. Porosity: low. Permeability: moderate. Hardness: moderately soft. Fossils: few.	RPM=36 <1 min/ft WOB=0-7K 105-115 psi
2135.5	to	2147.0	11.5	No Recovery	

* Recovery percentage based on 10 foot core as required by specifications.

Description by M.R.S

MONTGOMERY WATSON

WELL # CW-1 CORE DESCRIPTION

DATE(S): 10/9/98

CITY OF SUNRISE **WTP CW-1 WELL**

JOB NUMBER 1324024
COST CODE 264701

CONTRACTOR: Youngquist

TOTAL DEPTH:	2221 feet
COUNTY:	Broward
OWNER:	City of Sunrise
DRILLING METHOD:	Carbide Aggressive Drilling
DRILLER(S):	Troy Moore
DATUM POINT:	Pad level
DATUM POINT ELEVATION:	6.0 NGVD
HYDROLOGIC UNITS:	Upper Floridan
% RECOVERY	40%
CORED INTERVAL	2201-2221

DEPTH (feet below pad)			DEPTH INTERVAL	DESCRIPTION	DRILLING COMMENTS
2201	to	2205	4.0	LIMESTONE: Color: Pale yellowish orange to white, Texture: wackestone/Mudstone, Grains: minor quartz sand and molusca. Cement/Matrix: calcite with recrystallized limemud matrix, poorly cemented. Porosity: low. Permeability: moderate. Hardness: moderately soft. Fossils: few.	RPM=32-34 1-4 min/ft WOB=1-5K 110-120 psi
2205	to	2206	1.0	LIMESTONE: Color: very pale orange/pale yellowish orange to white,, Texture: Laminated algal Boundstone – (wackestone/mudstone), Black to gray algal laminations resulting from supra tidal deposition are present in the unit, Grains: minor quartz sand and carbonate sand. Cement/Matrix: calcite with recrystallized limemud matrix, poorly cemented. Porosity: low. Permeability: low. Hardness: moderately soft. Fossils: abundant forams, all are recrystallized and filled with cement.	RPM=34 1-2 min/ft WOB=3K 110 psi
2206	to	2221	1.0	No Recovery	

* Recovery percentage based on 10 foot core as required by specifications.

Description by M.R.S

MONTGOMERY WATSON

WELL # CW-1 CORE DESCRIPTION

DATE(S): 10/9/98

CITY OF SUNRISE **WTP CW-1 WELL**

JOB NUMBER 1324024
COST CODE 264701

CONTRACTOR: Youngquist

TOTAL DEPTH:	2307.5	feet
COUNTY:	Broward	
OWNER:	City of Sunrise	
DRILLING METHOD:	Carbide Aggressive Drilling	
DRILLER(S):	Troy Moore	
DATUM POINT:	Pad level	
DATUM POINT ELEVATION:	6.0 NGVD	
HYDROLOGIC UNITS:	Upper Floridan	
% RECOVERY	90%	
CORED INTERVAL	2295-2307.5	

DEPTH (feet below pad)			DEPTH INTERVAL	DESCRIPTION	DRILLING COMMENTS
2295	to	2296	1.0	DOLOSTONE: Color: pale yellowish brown. Texture: crystalline - subhedral, non-planar massive dolomite. Porosity: none. Permeability: none. Hardness: very hard. Fossils: none.	RPM=36 88 min/ft WOB=2K 80-90 psi
2296	to	2296.7	0.7	DOLOSTONE: Color: dark yellowish orange. Texture: crystalline planar to non-planar dolomite (70%/30%). Porosity: low, intercrystalline. Permeability: none. Hardness: moderately to very hard. Structures: possible relict bedding. Fossils: none.	RPM=36 15 min/ft WOB=2K 110 psi
2296.7	to	2298.5	1.8	DOLOSTONE: Color: dark yellowish orange. Texture: crystalline planar to non-planar dolomite (70%/30%) sucrosic. Porosity: low, intercrystalline, vug. Permeability: none. Hardness: moderately to very hard. Structures: possible relict bedding. Fossils: none.	RPM=36-55 7-21 min/ft WOB=6-8K 110 psi
2298.5	to	2299.5	1.0	DOLOSTONE: Color: pale yellowish brown. Texture: crystalline - subhedral, non-planar massive dolomite. Porosity: none. Permeability: none. Hardness: very hard. Fossils: none.	RPM=55-56 14-21 min/ft WOB=4-8K 110 psi
2299.5	to	2301.0	1.5	DOLOSTONE: Color: dark yellowish orange. Texture: crystalline planar to non-planar dolomite (70%/30%). Porosity: low, intercrystalline. Permeability: none. Hardness: moderately to very hard. Structures: possible relict bedding. Fossils: none.	RPM=55-56 2-14 min/ft WOB=4-8K 110 psi

Description by M.R.S

2301.0	to	2301.5	0.5	DOLOSTONE: Color: pale yellowish brown. Texture: crystalline - subhedral, non-planar massive dolomite. Porosity: none. Permeability: none. Hardness: very hard. Fossils: none.	RPM=55-78 2-52 min/ft WOB=4-8K 110 psi
2301.5	to	2303.0	1.5	DOLOSTONE: Color: dark yellowish orange. Texture: crystalline planar to non-planar dolomite (70%/30%). Porosity: low, intercrystalline. Permeability: none. Hardness: moderately to very hard. Structures: possible relict bedding. Fossils: none.	RPM=55-83 2-52 min/ft WOB=4-12K 110 psi
2303.0	to	2303.7	0.7	DOLOSTONE: Color: pale yellowish brown. Texture: crystalline - subhedral, non-planar massive dolomite. Porosity: none. Permeability: none. Hardness: very hard. Fossils: none.	RPM=83 12-14 min/ft WOB=8-12K 110-120 psi
2303.7	to	2304.2	0.5	DOLOSTONE: Color: dark yellowish orange. Texture: crystalline planar to non-planar dolomite (70%/30%) sucrosic. Porosity: low, intercrystalline, vug. Permeability: none. Hardness: moderately to very hard. Structures: possible relict bedding. Fossils: none.	RPM=83 12-19 min/ft WOB=8-9K 110psi
2304.2	to	2307.5	3.3	No Recovery	

* Recovery percentage based on 10 foot core as required by specifications.

Description by M.R.S

MONTGOMERY WATSON

WELL # CW-1 CORE DESCRIPTION

DATE(S): 10/12/98

CITY OF SUNRISE **WTP CW-1 WELL**

JOB NUMBER 1324024
COST CODE 264701

CONTRACTOR: Youngquist

TOTAL DEPTH:	3044	feet
COUNTY:	Broward	
OWNER:	City of Sunrise	
DRILLING METHOD:	Carbide Aggressive Drilling	
DRILLER(S):	Troy Moore	
DATUM POINT:	Pad level	
DATUM POINT ELEVATION:	6.0 NGVD	
HYDROLOGIC UNITS:	Upper Floridan	
% RECOVERY	65%	
CORED INTERVAL	3024-3044	

DEPTH (feet below pad)			DEPTH INTERVAL	DESCRIPTION	DRILLING COMMENTS
3024	to	3025	1.0	DOLOMITIC LIMESTONE: Color: Pale yellowish orange to white, Texture: wackestone/Mudstone with dolomitic laminations, Grains: minor quartz sand, xenotopoc dolomite, and molusca. Cement/Matrix: calcite with recrystallized limemud and dolomite matrix, poorly cemented. Porosity: low. Permeability: moderate. Hardness: moderately soft. Fossils: few.	RPM=17 16 min/ft WOB=1K 85 psi
3025	to	3026.7	1.7	LIMESTONE: Color: very pale orange/pale yellowish orange to white,, Texture: Minor laminated mudstone – (wackestone/mudstone), Black to gray laminations resulting from supra tidal deposition are present in the unit, Grains: minor quartz sand and carbonate sand. Cement/Matrix: calcite with recrystallized limemud matrix, poorly cemented. Porosity: low. Permeability: low. Hardness: moderately soft. Fossils: few mollusca.	RPM=17-21 13-16 min/ft WOB=1K 85 psi
3026.7	to	3027.1	0.4	DOLOMITIC LIMESTONE: Color: Pale yellowish orange to white, Texture: wackestone/Mudstone with dolomitic laminations, Grains: minor quartz sand, xenotopoc dolomite, and molusca. Cement/Matrix: calcite with recrystallized limemud and dolomite matrix, poorly cemented. Porosity: low. Permeability: moderate. Hardness: moderately soft. Fossils: few.	RPM=67 5 min/ft WOB=10K 85 psi

Description by M.R.S

3027.1	to	3028.3	1.2	LIMEY DOLOSTONE: Color: dark yellowish orange to pale yellowish orange. Texture: crystalline planar to non-planar dolomite, moderately laminated. Contains recrystalized limestone layers. Porosity: low, intercrystalline. Permeability: none. Hardness: moderately to very hard. Structures: possible relict bedding. Fossils: none.	RPM=67 12 min/ft WOB=10K 100 psi
3028.3	to	3029.0	0.7	LIMESTONE: Color: Pale yellowish orange to white, Texture: wackestone/Mudstone, Grains: minor quartz sand and molusca. Cement/Matrix: calcite with recrystallized limemud matrix, poorly cemented. Porosity: low. Permeability: moderate. Hardness: moderately soft. Fossils: few.	RPM=67 3 min/ft WOB=6K 140 psi
3029.0	to	3029.2	0.2	DOLOSTONE: Color: dark yellowish orange. Texture: crystalline planar to non-planar dolomite (70%/30%). Porosity: low, intercrystalline. Permeability: none. Hardness: moderately to very hard. Structures: possible relict bedding. Fossils: none.	RPM=67 3 min/ft WOB=6K 140 psi
3029.2	to	3029.9	0.7	LIMESTONE: Color: very pale orange/pale yellowish orange to white,, Texture: Minor laminated mudstone – (wackestone/mudstone), Black to gray laminations resulting from supra tidal deposition are present in the unit, Grains: minor quartz sand and carbonate sand. Cement/Matrix: calcite with recrystallized limemud matrix, poorly cemented. Porosity: low. Permeability: low. Hardness: moderately soft. Fossils: few mollusca.	RPM=67 4 min/ft WOB=5K 140 psi
3029.9	to	3030.3	0.4	DOLOSTONE: Color: dark yellowish orange. Texture: crystalline planar to non-planar dolomite (70%/30%). Porosity: low, intercrystalline. Permeability: none. Hardness: moderately to very hard. Structures: possible relict bedding. Fossils: none.	RPM=67 4 min/ft WOB=5K 140 psi
3030.3	to	3031.2	0.9	DOLOMITIC LIMESTONE: Color: Pale yellowish orange to white, Texture: wackestone/Mudstone with dolomitic laminations, Grains: minor quartz sand, xenotopoc dolomite, and molusca. Cement/Matrix: calcite with recrystallized limemud and dolomite matrix, poorly cemented. Porosity: low. Permeability: moderate. Hardness: moderately soft. Fossils: few.	RPM=67 3 min/ft WOB=4K 150 psi
3031.2	to	3044.0	12.8	No Recovery	

* Recovery percentage based on 10 foot core as required by specifications.

Description by M.R.S

Ardaman & Associates, Inc.

Geotechnical, Environmental and
Materials Consultants

April 26, 1998
File Number 98-041

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

Attention: Mr. Edward McCullers

Subject: Laboratory Tests, Rock Core Specimens, City of Sunrise Injection Well CW-1

Gentlemen:

As requested, permeability, unconfined compression and specific gravity tests have been completed on 15 core samples provided for testing by your firm from the City of Sunrise Injection Well CW-1. The permeability tests were performed in general accordance with ASTM Standard D 5084 "Measurement of Hydraulic Conductivity of Saturated Porous Materials Using a Flexible-Wall Permeameter" using 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 some of the core 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 typically too short to obtain separate vertically and horizontally oriented specimens. Accordingly, the vertical permeability tests were typically performed first on specimens maintained at the as-received diameter and cut to lengths of 6.3 to 12.4 cm. After completing the vertical permeability tests, horizontal permeability specimens were typically obtained by coring 5.1 cm diameter cylinders from the vertical specimens. The horizontal specimens were then trimmed to lengths of 5.6 to 8.5 cm to provide flat, parallel ends. Since the vertical permeability test specimens typically 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 sample lengths were long enough to obtain separate horizontally oriented specimens from Core No. 3/2,040 feet and Core No. 8/3,304 feet.

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 70 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 150 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 total 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 total porosities are presented in Table 1.

Unconfined Compression Tests

Sufficient sample lengths were provided to perform unconfined compression tests on 13 of the 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 11.4 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 axial deformation of 0.013 cm/minute. The specimens failed between 2 and 9 minutes in compliance with the ASTM D 2938 criteria of between 2 and 15 minutes. The unconfined compressive strengths and Young's modulus determined from the tests are summarized in Table 2. The stress-strain curves are presented in Figures 1 through 5.

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
Helen Modesko

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Youngquist Brothers, Inc.
File Number 98-050
April 26, 1999

Table 1

PERMEABILITY TEST RESULTS
CITY OF SUNRISE INJECTION WELL CW-1 CORE SAMPLES

Core No.	Depth (feet)	Test Specimen Orientation	D-5084 Test Method*	G_s	Initial Conditions: Length (cm)	Initial Conditions: Diameter (cm)	Initial Conditions: w_c (%)	Initial Conditions: γ_d (lb/ft³)	Initial Conditions: n	$\bar{\sigma}_c$ (lb/in²)	u_b (lb/in²)	B Factor (%)	Average Hydraulic Gradient	Final Conditions: w_c (%)	Final Conditions: γ_d (lb/ft³)	Final Conditions: S (%)	Hydraulic Conductivity k_{20} (cm/sec)
1	1745	Vertical	A	2.75	10.65	9.68	23.8	100.6	0.41	20	70	95**	0.4	23.4†	100.6	91	3.8×10^{-3}
		Horizontal	A		8.53	5.10	22.2	102.5	0.40	20	70	96	0.4	23.4	102.5	96	4.4×10^{-3}
2	1955	Vertical	A	2.72	7.90	9.69	24.2	97.7	0.43	20	70	90**	0.3	24.5†	97.7	91	2.8×10^{-3}
		Horizontal	A		7.27	5.09	23.9	99.1	0.42	20	70	96	0.4	24.5	99.1	94	6.2×10^{-3}
	1959	Vertical	A	2.71	12.40	9.77	26.9	95.1	0.44	20	70	98	0.8	27.0†	95.1	94	4.3×10^{-4}
		Horizontal	C		7.42	5.09	26.5	96.1	0.43	20	80	94**	2.5	27.0	96.1	96	1.1×10^{-3}
	1964	Vertical	C	2.70	9.48	9.45	24.5	101.4	0.40	20	80	90**	1.9	24.5†	101.4	100	4.0×10^{-5}
		Horizontal	A		7.34	5.09	24.4	99.9	0.41	20	80	98	29	24.5	99.9	96	3.0×10^{-5}
3	2040	Vertical	C	2.72	6.30	4.97	18.6	101.9	0.40	20	80	58**	2.9	19.7	101.9	81	4.0×10^{-4}
		Horizontal	C		7.02	5.10	22.2	104.5	0.38	20	80	93**	2.8	22.2	104.5	97	5.6×10^{-4}
4	2078	Vertical	A	2.71	11.40	9.47	20.8	106.3	0.37	20	80	89**	4.8	20.9†	106.3	98	1.9×10^{-5}
		Horizontal	A		5.99	5.07	20.9	107.7	0.36	20	80	96	16	20.9	107.7	99	2.1×10^{-5}
	2079	Vertical	–	2.73	Insufficient Sample for Permeability Test												
		Horizontal	–														
	2080	Vertical	C	2.72	10.85	9.11	25.3	100.3	0.41	20	80	97	1.7	25.4†	100.3	100	1.2×10^{-4}
		Horizontal	C		5.58	5.10	25.3	99.8	0.41	20	80	89**	3.3	25.4	99.8	98	1.8×10^{-4}
6	2205	Vertical	A	2.74	11.76	9.60	23.6	99.8	0.42	20	80	98	4.5	23.9†	99.8	92	6.1×10^{-6}
		Horizontal	A		6.47	5.09	23.7	101.7	0.41	20	80	95**	34	23.9	101.7	96	2.9×10^{-5}
	2206	Vertical	A	2.74	9.33	9.55	15.7	117.1	0.32	20	80	80**	9	15.8†	117.1	84	3.3×10^{-6}
		Horizontal	A		6.96	5.09	15.6	115.9	0.32	20	80	93**	18	15.8	115.9	81	4.3×10^{-6}
7	2298	Vertical	A	2.84	9.14	10.07	1.2	171.1	0.03	20	170	84**	32	1.2†	171.1	92	1.6×10^{-8}
		Horizontal	A		7.16	5.11	1.0	171.1	0.03	20	170	96	35	1.2	171.1	92	6.3×10^{-9}
	2301	Vertical	A	2.86	10.36	10.05	2.3	166.3	0.07	20	170	79**	43	2.4†	166.3	95	1.0×10^{-8}
		Horizontal	A		7.32	5.11	2.4	166.0	0.07	20	170	88**	38	2.4	166.0	92	1.4×10^{-8}
8	3025	Vertical	A	2.87	8.58	10.05	2.2	165.2	0.08	20	170	95**	30	2.5†	165.2	85	1.1×10^{-9}
		Horizontal	A		6.97	5.11	2.4	167.3	0.07	20	170	95**	40	2.5	167.3	100	8.1×10^{-9}
	3027	Vertical	A	2.73	7.79	9.30	14.2	123.1	0.28	20	80	96	6.2	14.2	123.1	100	8.4×10^{-5}
	3034	Vertical	A	2.73	7.72	9.87	12.3	124.6	0.27	20	80	97	15	12.8	124.6	95	2.3×10^{-4}
		Horizontal	A		6.64	5.06	14.2	121.7	0.29	20	80	96	16	14.3	121.7	97	8.4×10^{-5}

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

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

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

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

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Youngquist Brothers, Inc.
File Number 98-041
April 26, 1999

Table 2

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

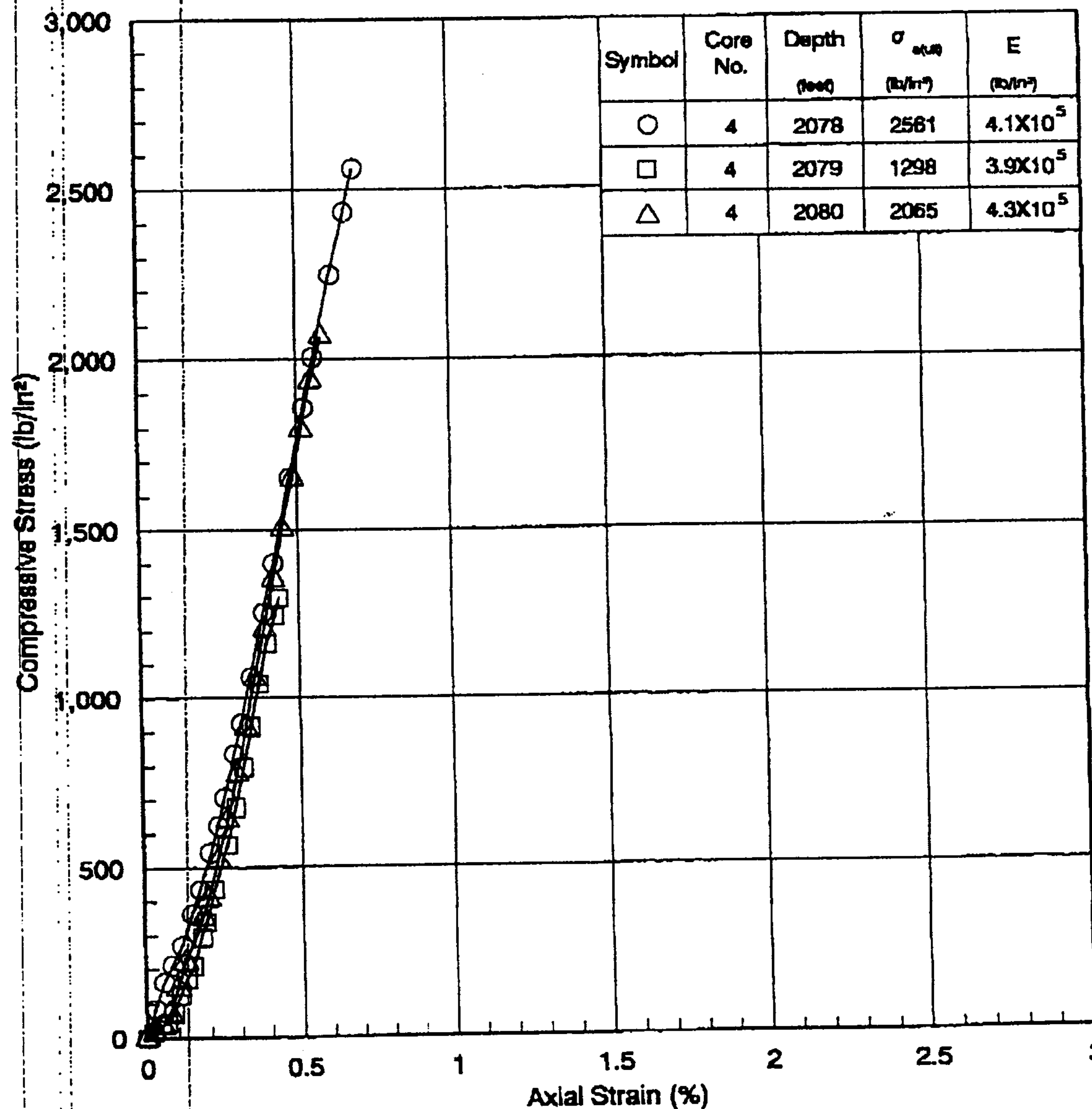
Core No.	Depth (feet)	Specimen Dimensions			w_c (%)	γ_d (lb/ft³)	Loading Rate (cm/min)	t_f (min)	Unconfined Compressive Strength σ_c(ult) (lb/in²)		Young's Modulus E(lb/in²)**
		Length L (cm)	Diameter D (cm)	L/D					Measured	Corrected*	
1	1745	10.17	5.08	2.01	0.1	106.3	0.013	4.4	1648	1649	4.1×10^5
2	1955	10.78	5.05	2.13	0.2	100.3	0.013	4.7	1723	1736	4.4×10^5
	1959	10.98	5.09	2.16	0.2	99.0	0.013	4.9	1693	1708	3.7×10^5
	1964	11.35	5.08	2.23	0.2	102.0	0.013	4.0	1606	1627	4.5×10^5
4	2078	9.26	5.11	1.81	0.2	107.1	0.013	5.7	2581	2529	4.1×10^5
	2079	10.36	5.06	2.05	0.3	101.0	0.013	4.2	1298	1302	3.9×10^5
	2080	10.53	5.11	2.06	0.2	103.0	0.013	4.8	2065	2072	4.3×10^5
6	2205	6.92	3.26	2.12	0.1	105.8	0.013	2.4	1615	1626	5.3×10^5
	2206	7.49	3.28	2.28	0.2	123.4	0.013	3.9	3060	3106	7.0×10^5
7	2298	7.51	3.27	2.30	0.2	170.2	0.013	9.0	16,175	16,433	1.3×10^6
	2301	7.80	3.27	2.38	0.4	162.6	0.013	5.2	9124	9304	1.3×10^6
8	3025	7.68	3.29	2.33	0.1	121.9	0.013	4.0	4851	4936	9.0×10^5
	3034	9.51	5.09	1.87	0.1	122.4	0.013	5.9	3551	3521	5.5×10^5

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.

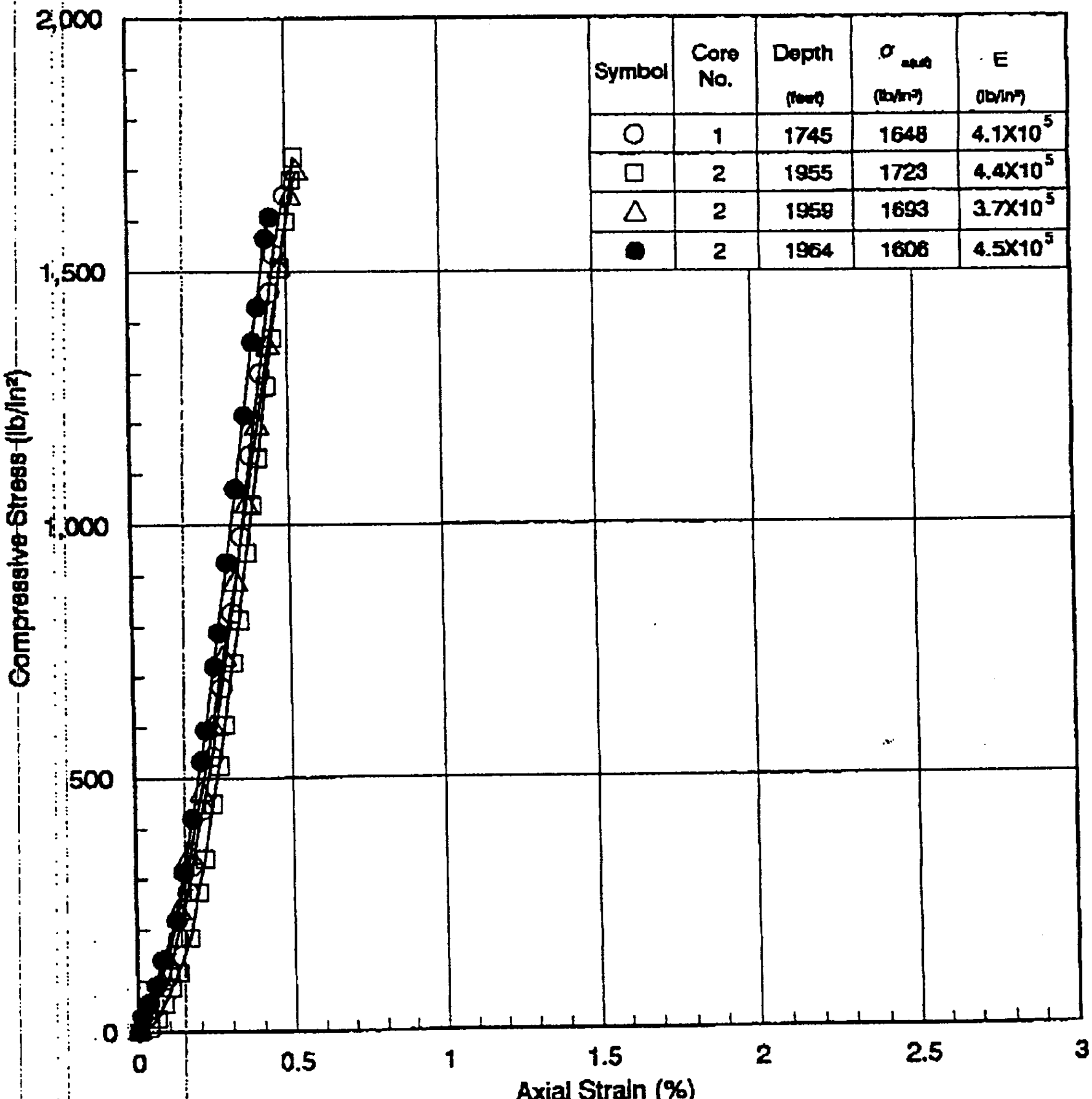
D:\ALI\98-041 YOUNG.002.wpd



Symbol	Core No.	Depth (feet)	$\sigma_{a(ult)}$ (lb/in²)	E (lb/in²)
○	4	2078	2561	$4.1X10^5$
□	4	2079	1298	$3.9X10^5$
△	4	2080	2065	$4.3X10^5$

UNCONFINED COMPRESSION TESTS

Ardaman & Associates, Inc. Geotechnical, Environmental and Materials Consultants		
SUNRISE INJECTION WELL CW-1		
YOUNGQUIST BROTHERS, INC.		
DRAWN BY: SA	CHECKED BY: SA	DATE: 04-26-99
FILE NO.: 96-041	APPROVED BY:	FIGURE: 2



Symbol	Core No.	Depth (feet)	σ_{ult} (lb/in²)	E (lb/in²)
○	1	1745	1648	4.1×10^5
□	2	1955	1723	4.4×10^5
△	2	1959	1693	3.7×10^5
●	2	1964	1606	4.5×10^5

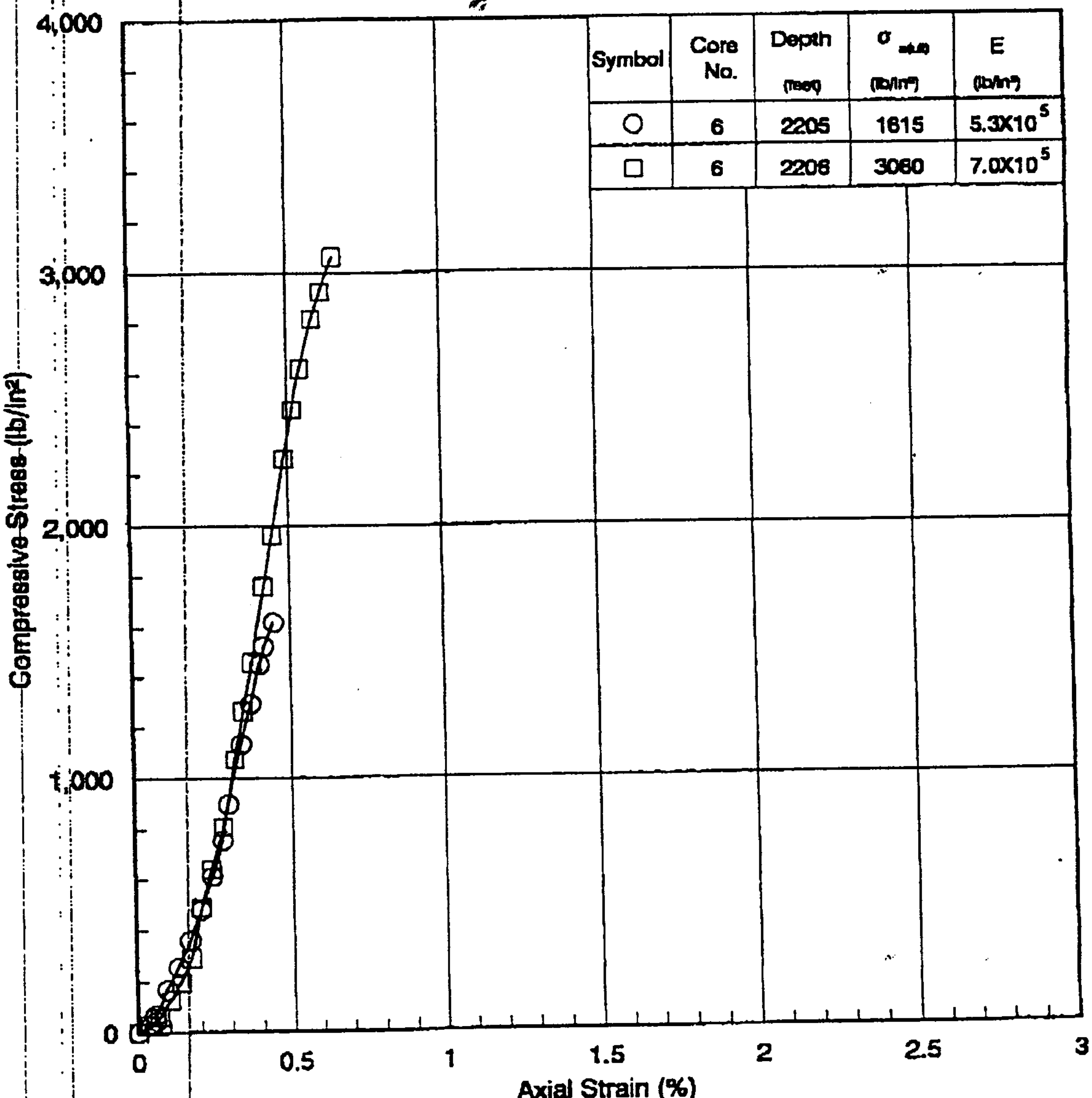
UNCONFINED COMPRESSION TESTS

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

SUNRISE INJECTION WELL CW-1

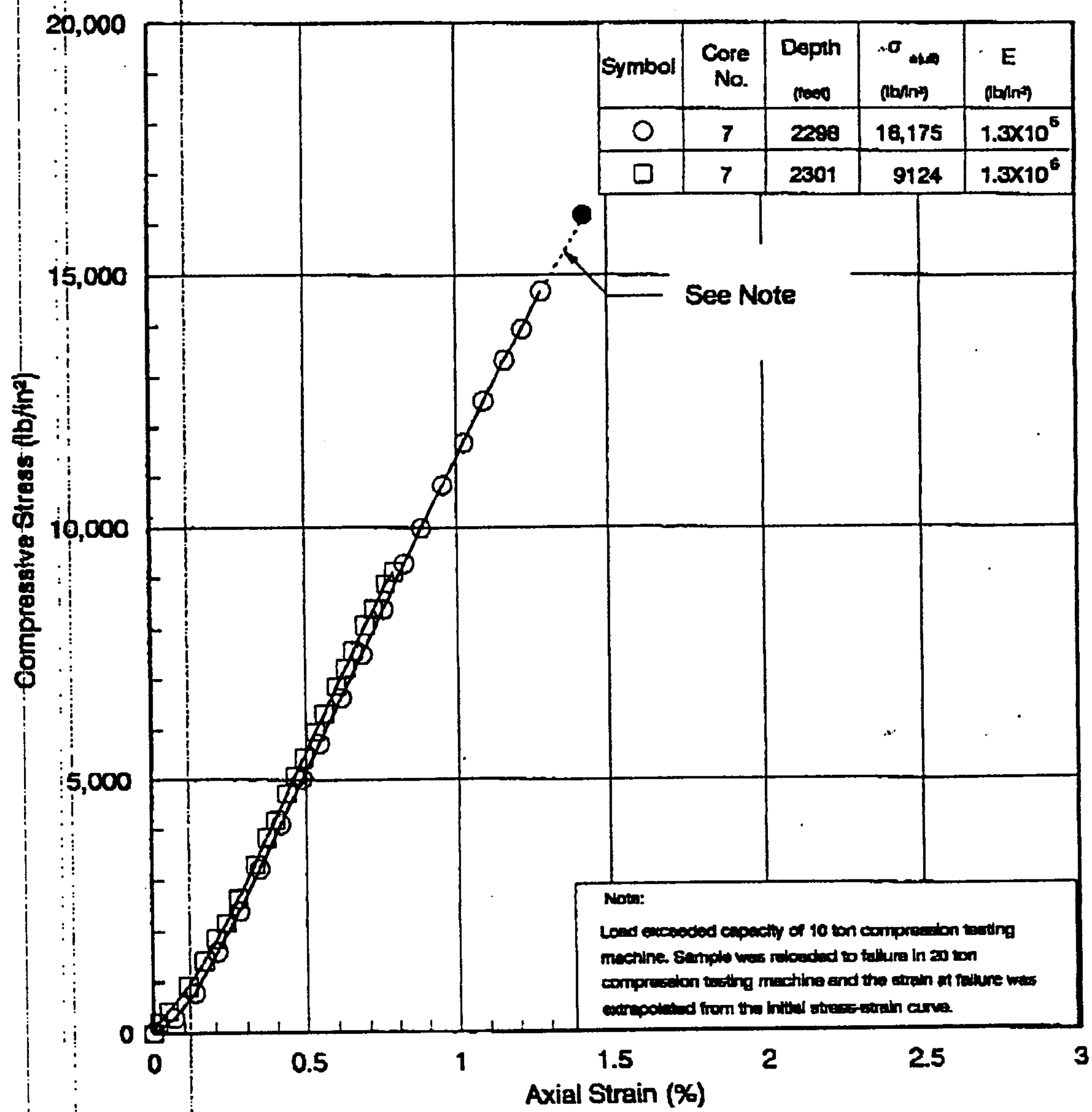
YOUNGQUIST BROTHERS, INC.

DRAWN BY: SA	CHECKED BY: SA	DATE: 04-26-99
FILE NO.: 98-041	APPROVED BY:	FIGURE: 1



UNCONFINED COMPRESSION TESTS

Ardaman & Associates, Inc. Geotechnical, Environmental and Materials Consultants	
SUNRISE INJECTION WELL CW-1	
YOUNGQUIST BROTHERS, INC.	
DRAWN BY: SA	CHECKED BY: SA
DATE: 04-26-99	FILE NO.: 98-041
APPROVED BY:	FIGURE: 3



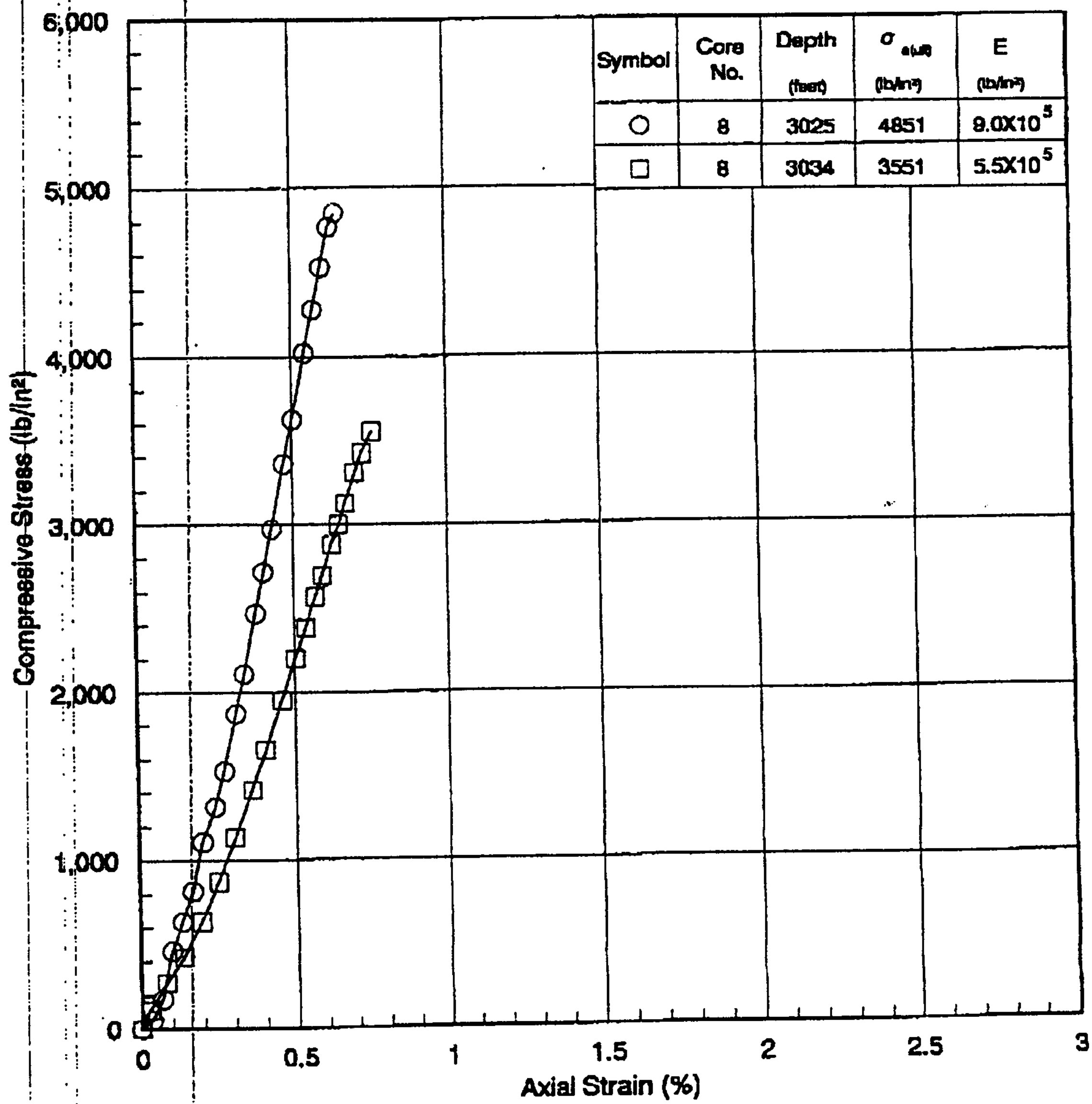
UNCONFINED COMPRESSION TESTS

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

SUNRISE INJECTION WELL CW-1

YOUNGQUIST BROTHERS, INC.

DRAWN BY: SA	CHECKED BY: SA	DATE: 04-26-99
FILE NO.: 98-041	APPROVED BY:	FIGURE: 4



UNCONFINED COMPRESSION TESTS

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

SUNRISE INJECTION WELL CW-1

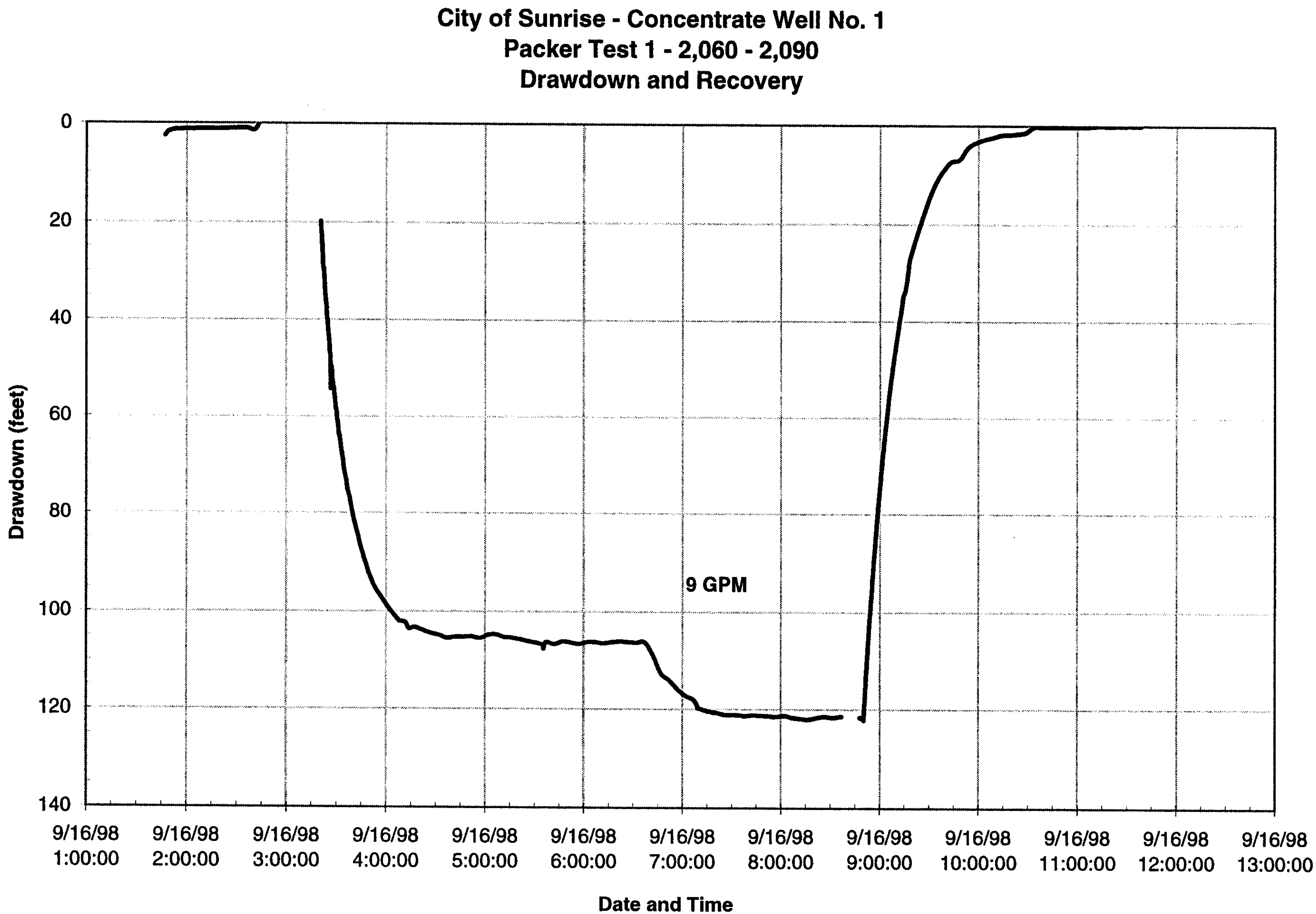
YOUNGQUIST BROTHERS, INC.

DRAWN BY: SA	CHECKED BY: SA	DATE: 04-26-99
FILE NO.: 98-041	APPROVED BY:	FIGURE: 5

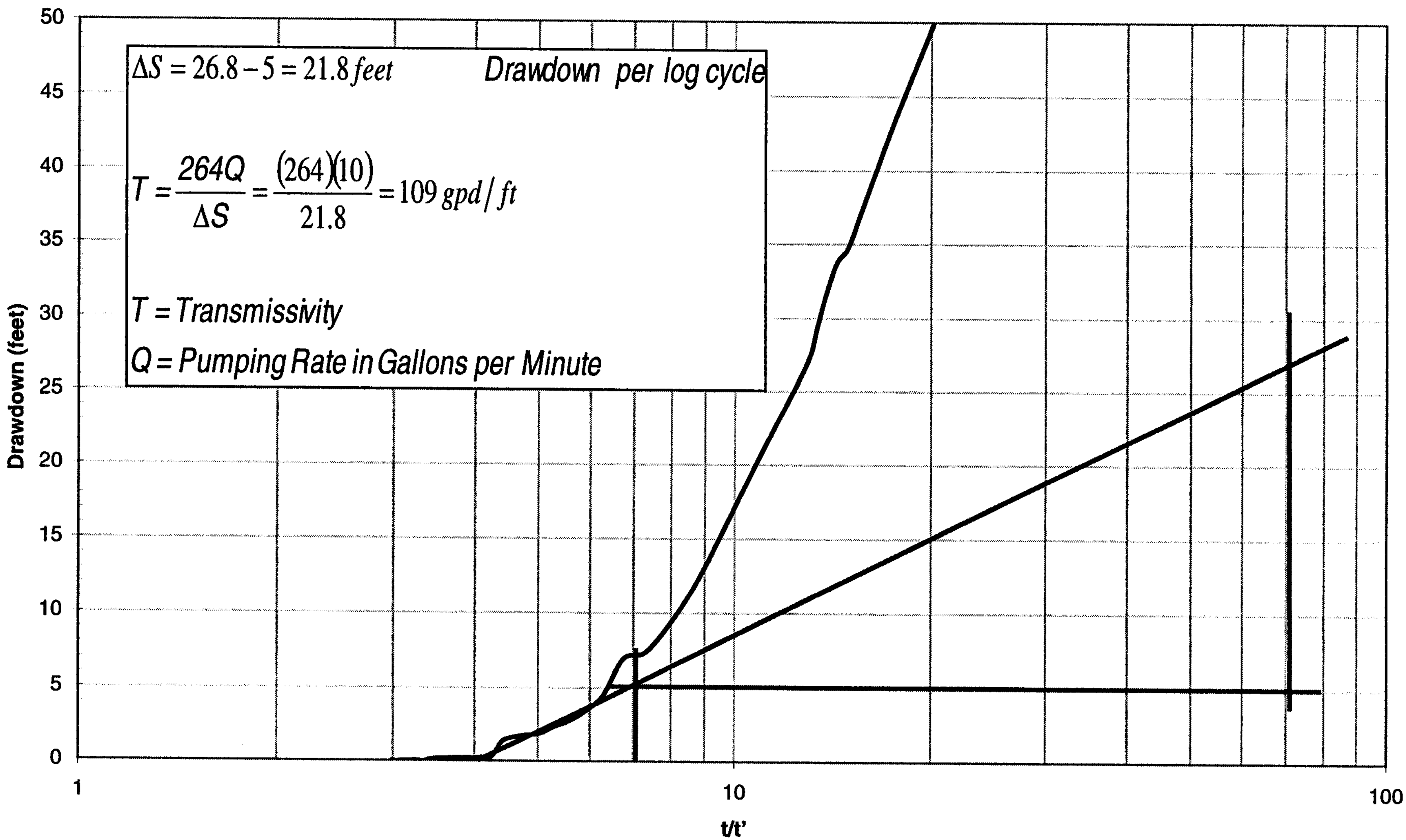
Appendix I

MONTGOMERY WATSON

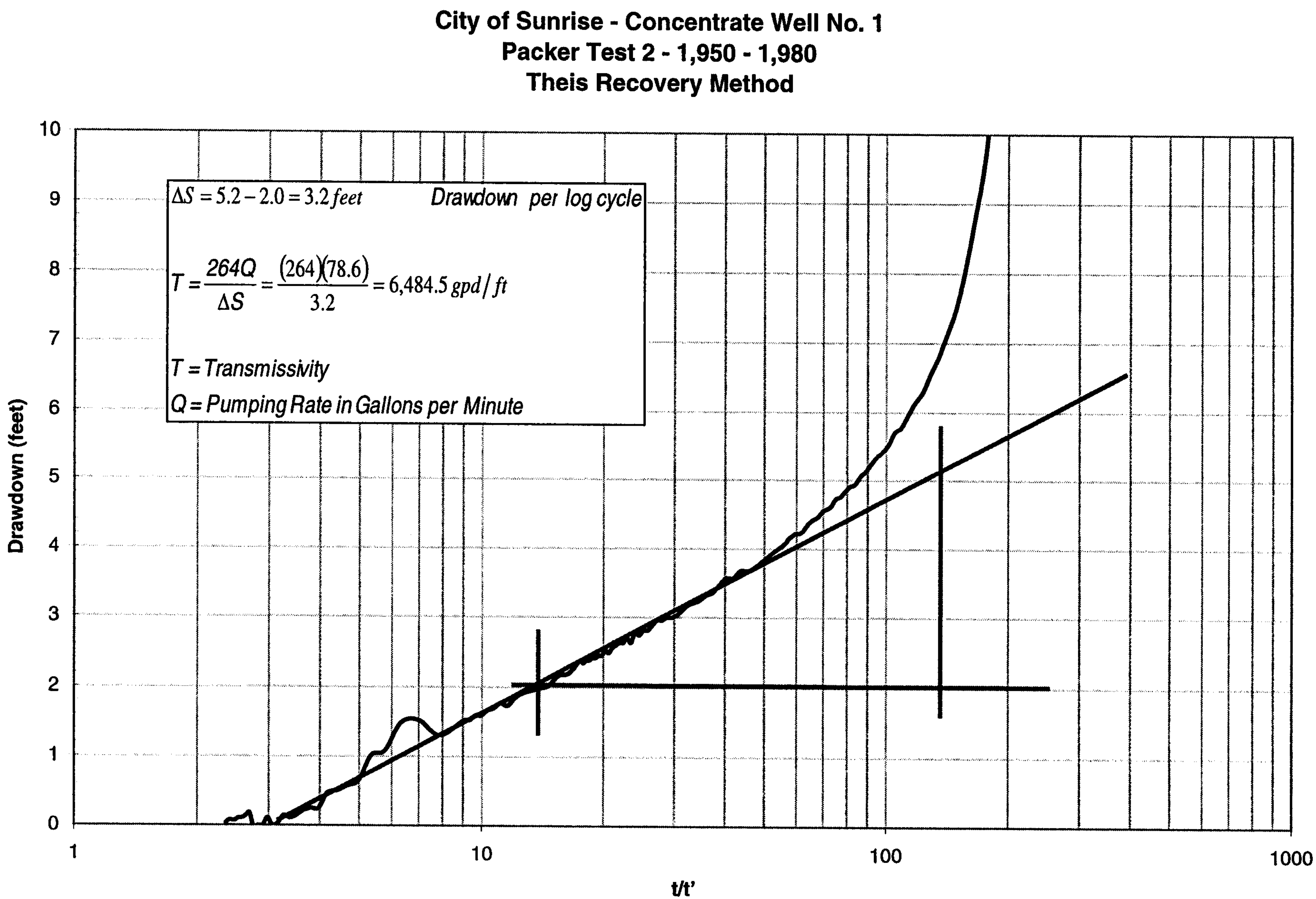
Packer Test 1
CW-1
2,060 to 2,090 feet bpl


City of Sunrise - Concentrate Well No. 1
Packer Test 1 - 2,060 - 2,090
Drawdown and Recovery
Drawdown (feet)
0
20
40
60
80
100
120
140
9 GPM
9/16/98 1:00:00
9/16/98 2:00:00
9/16/98 3:00:00
9/16/98 4:00:00
9/16/98 5:00:00
9/16/98 6:00:00
9/16/98 7:00:00
9/16/98 8:00:00
9/16/98 9:00:00
9/16/98 10:00:00
9/16/98 11:00:00
9/16/98 12:00:00
9/16/98 13:00:00
Date and Time

City of Sunrise - Concentrate Well No. 1
Packer Test 1 - 2,060 - 2,090
Theis Recovery Method

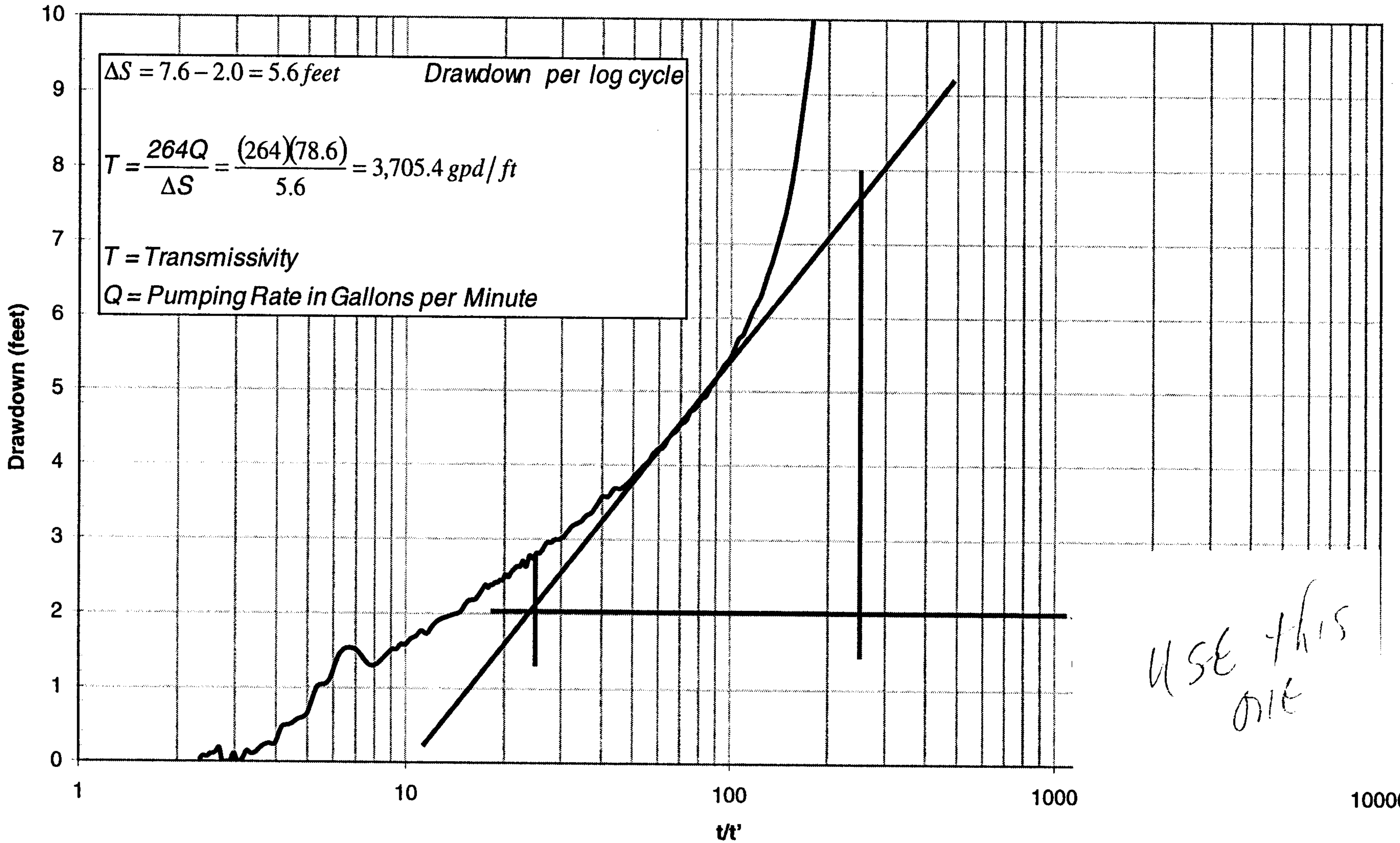


Packer Test 2
CW-1
1,950 to 1,980 feet bpl



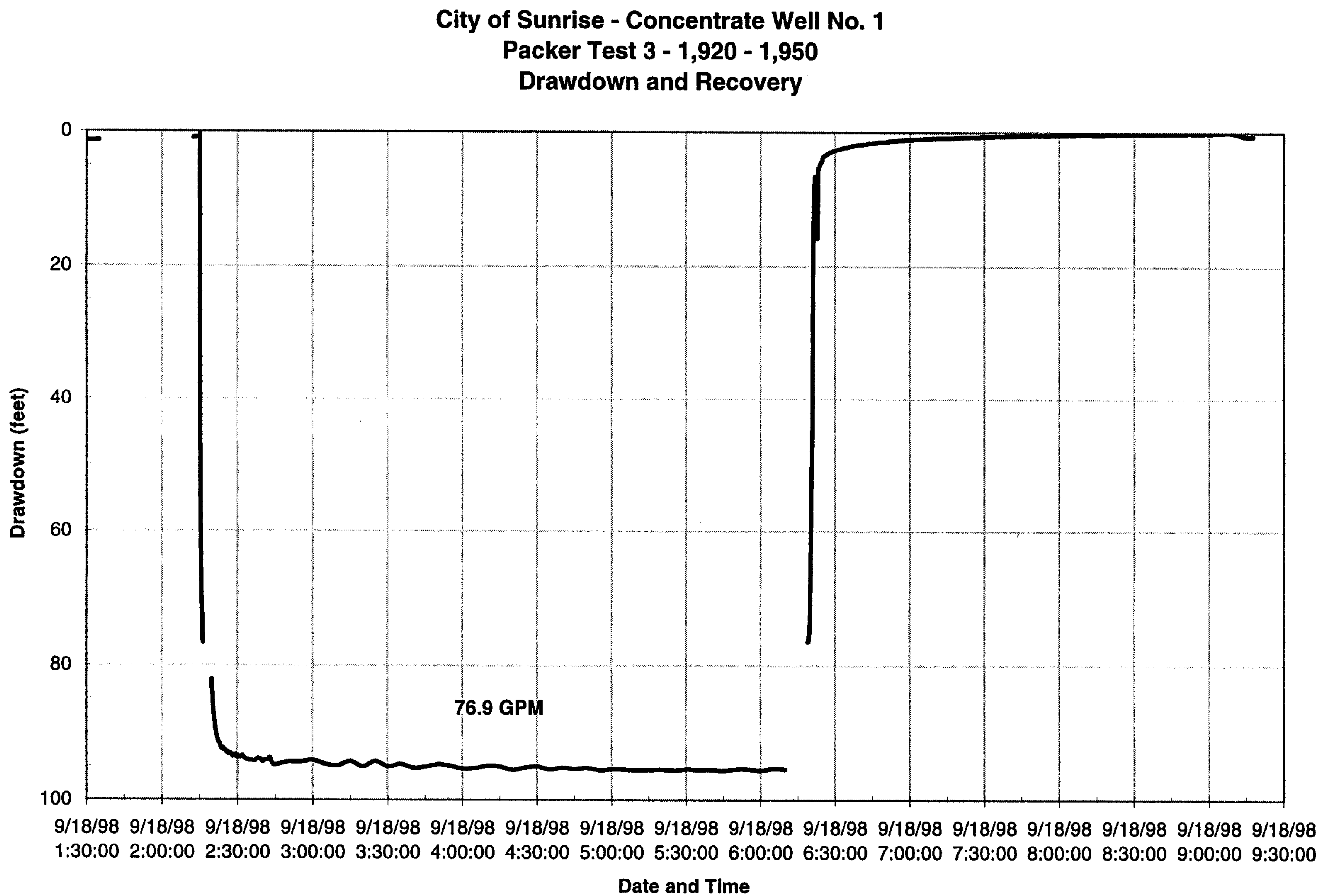
City of Sunrise - Concentrate Well No. 1
Packer Test 2 - 1,950 - 1,980
Theis Recovery Method
$\Delta S = 5.2 - 2.0 = 3.2\,feet$ Drawdown per log cycle
$T = \frac{264Q}{\Delta S} = \frac{(264)(78.6)}{3.2} = 6{,}484.5\,gpd/ft$
T = Transmissivity
Q = Pumping Rate in Gallons per Minute
Drawdown (feet)
t/t'
0
1
2
3
4
5
6
7
8
9
10
1
10
100
1000

City of Sunrise - Concentrate Well No. 1
Packer Test 2 - 1,950 - 1,980
Theis Recovery Method

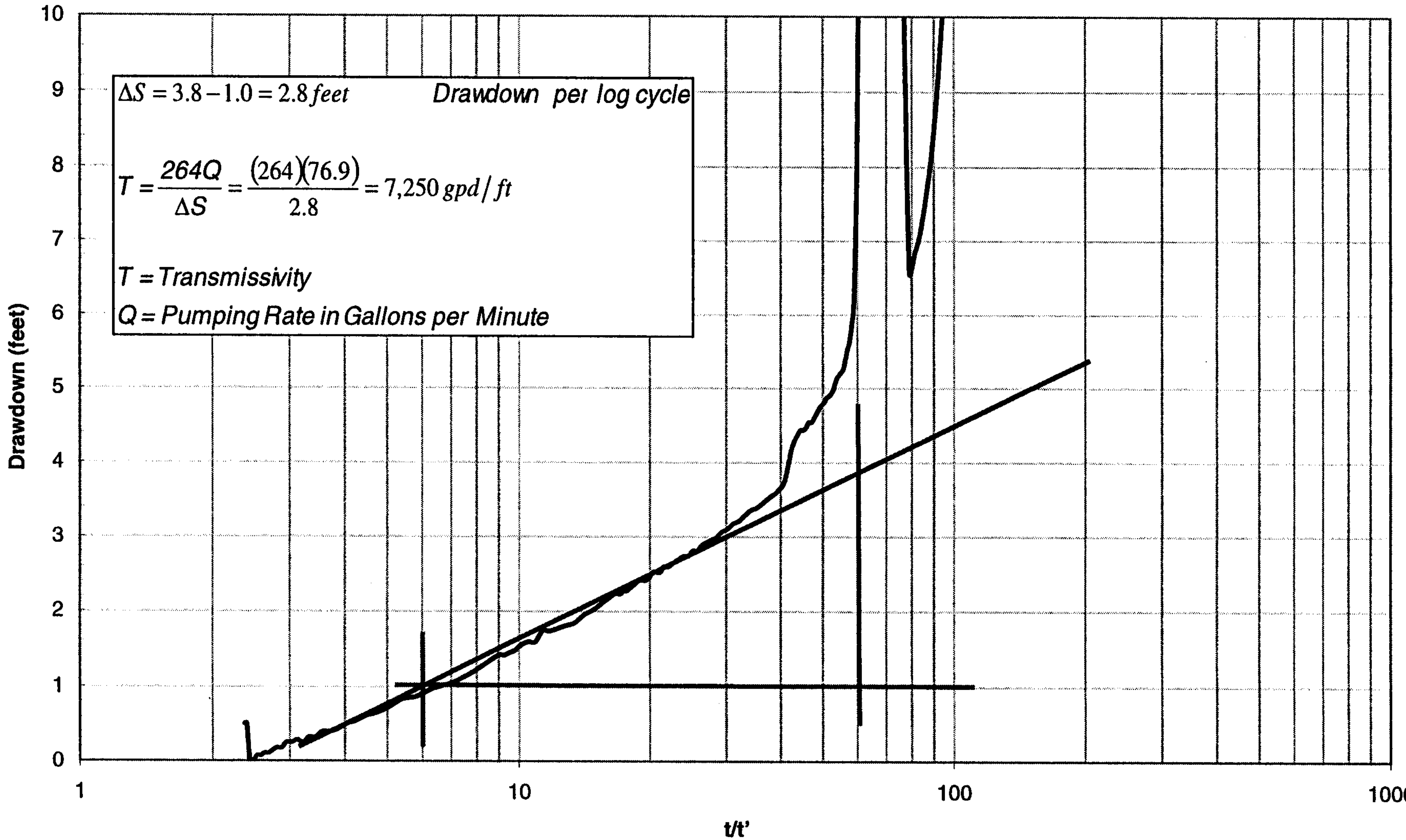


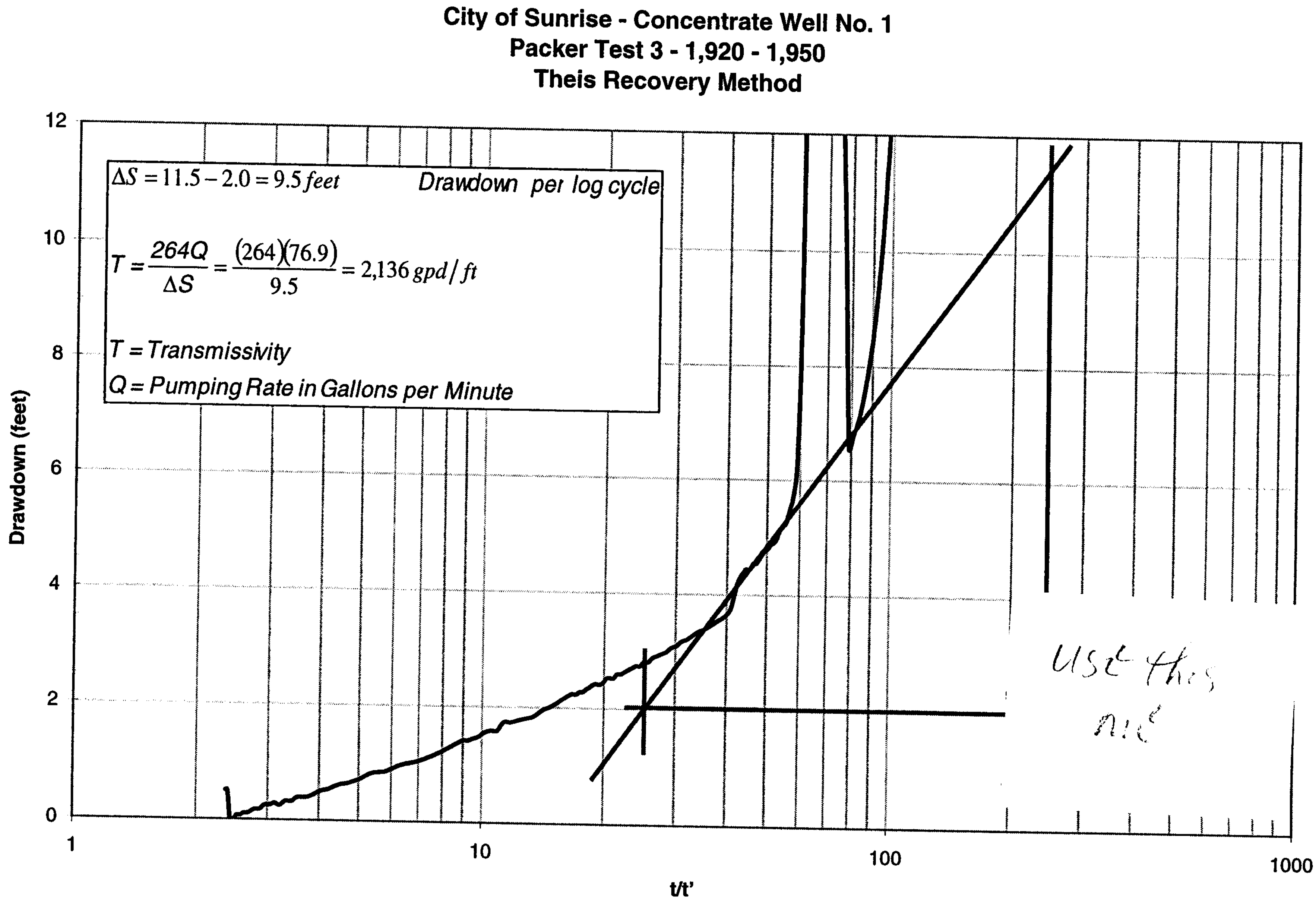
Use this one

Packer Test 3
CW-1
1,920 to 1,950 feet bpl

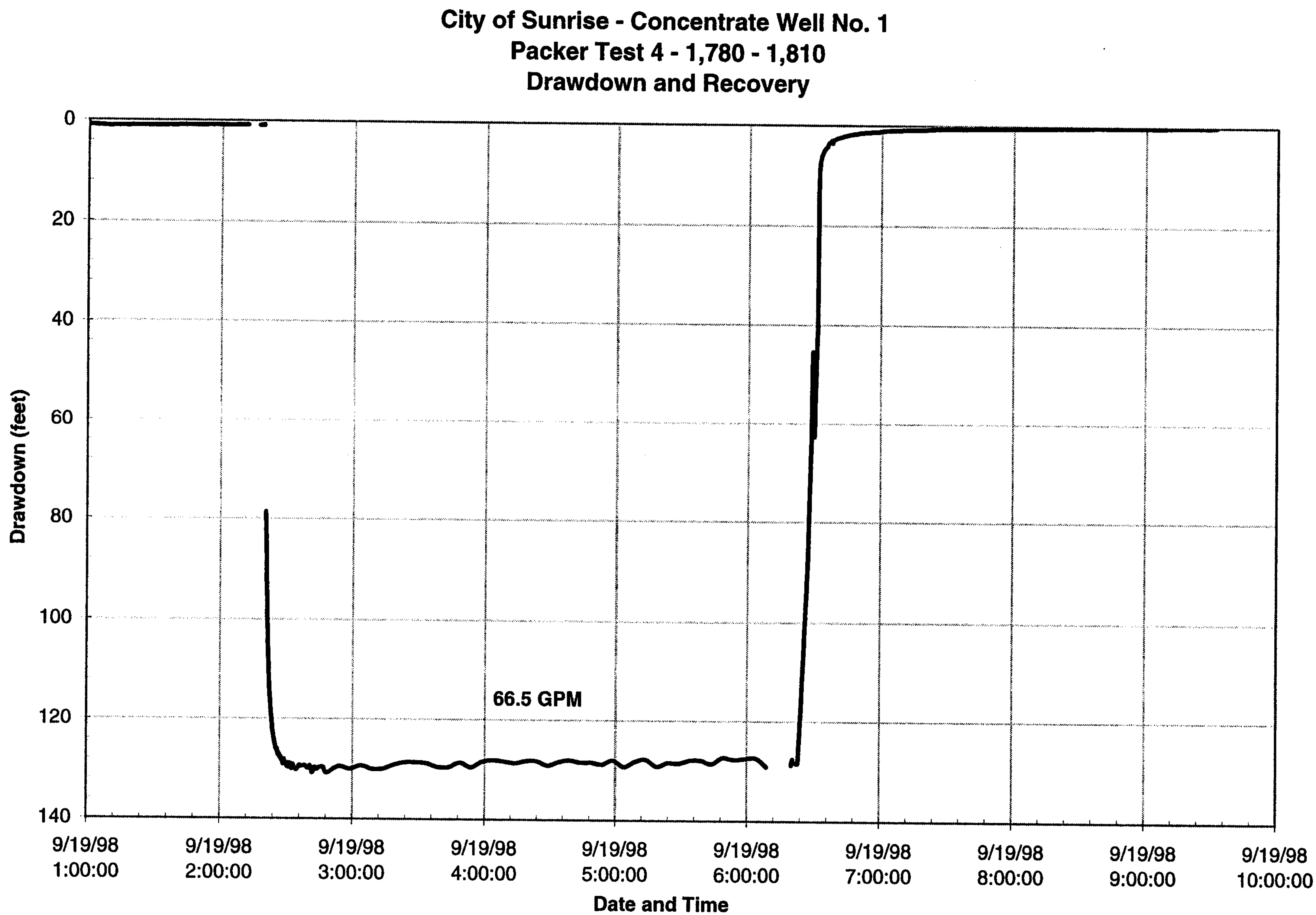

City of Sunrise - Concentrate Well No. 1
Packer Test 3 - 1,920 - 1,950
Drawdown and Recovery
0
20
40
60
80
100
Drawdown (feet)
76.9 GPM
9/18/98 1:30:00
9/18/98 2:00:00
9/18/98 2:30:00
9/18/98 3:00:00
9/18/98 3:30:00
9/18/98 4:00:00
9/18/98 4:30:00
9/18/98 5:00:00
9/18/98 5:30:00
9/18/98 6:00:00
9/18/98 6:30:00
9/18/98 7:00:00
9/18/98 7:30:00
9/18/98 8:00:00
9/18/98 8:30:00
9/18/98 9:00:00
9/18/98 9:30:00
Date and Time

City of Sunrise - Concentrate Well No. 1
Packer Test 3 - 1,920 - 1,950
Theis Recovery Method

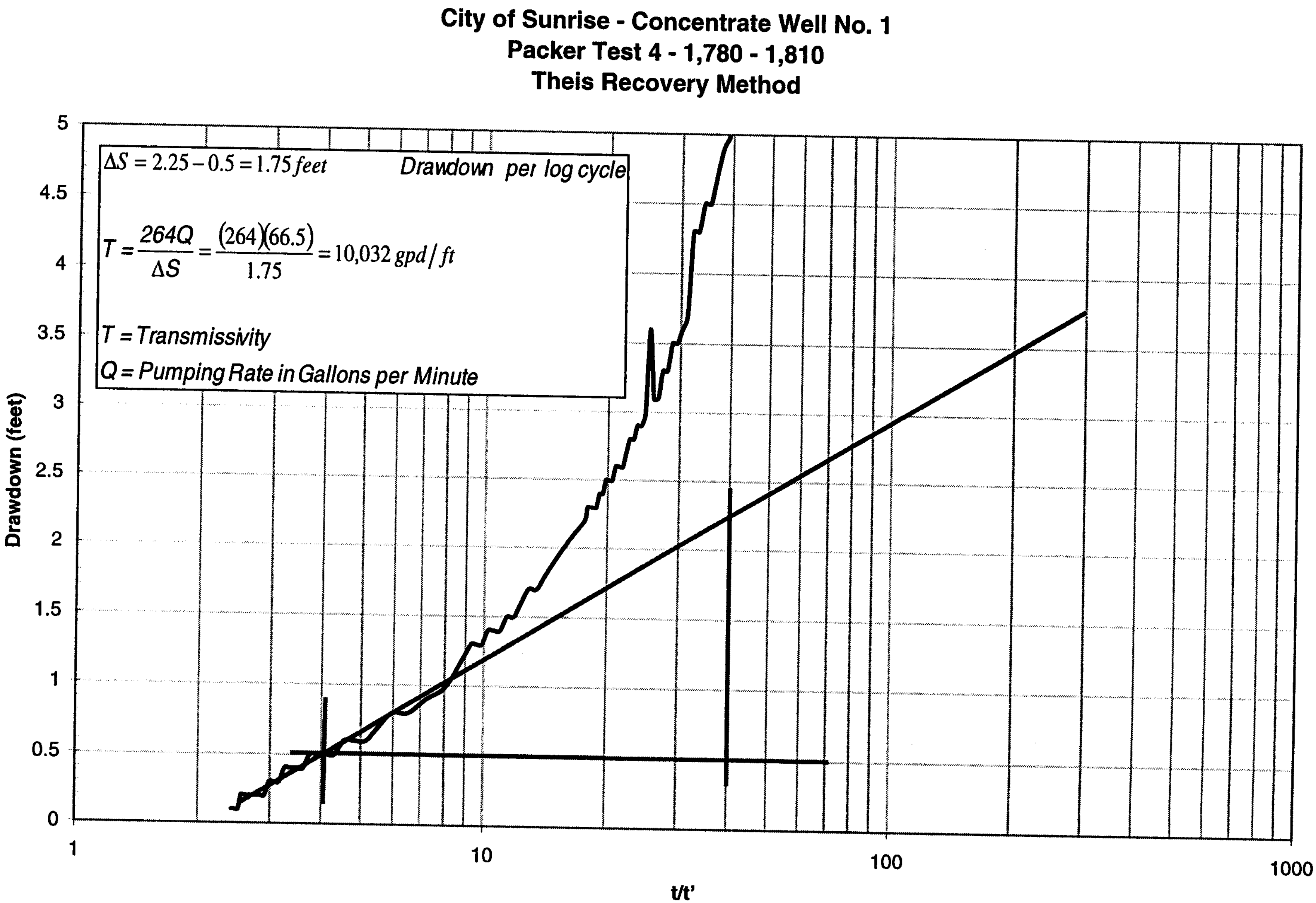



City of Sunrise - Concentrate Well No. 1
Packer Test 3 - 1,920 - 1,950
Theis Recovery Method
$\Delta S = 11.5 - 2.0 = 9.5\,feet$
Drawdown per log cycle
$T = \frac{264Q}{\Delta S} = \frac{(264)(76.9)}{9.5} = 2{,}136\,gpd/ft$
T = Transmissivity
Q = Pumping Rate in Gallons per Minute
Drawdown (feet)
t/t'
0
2
4
6
8
10
12
1
10
100
1000
Use this one

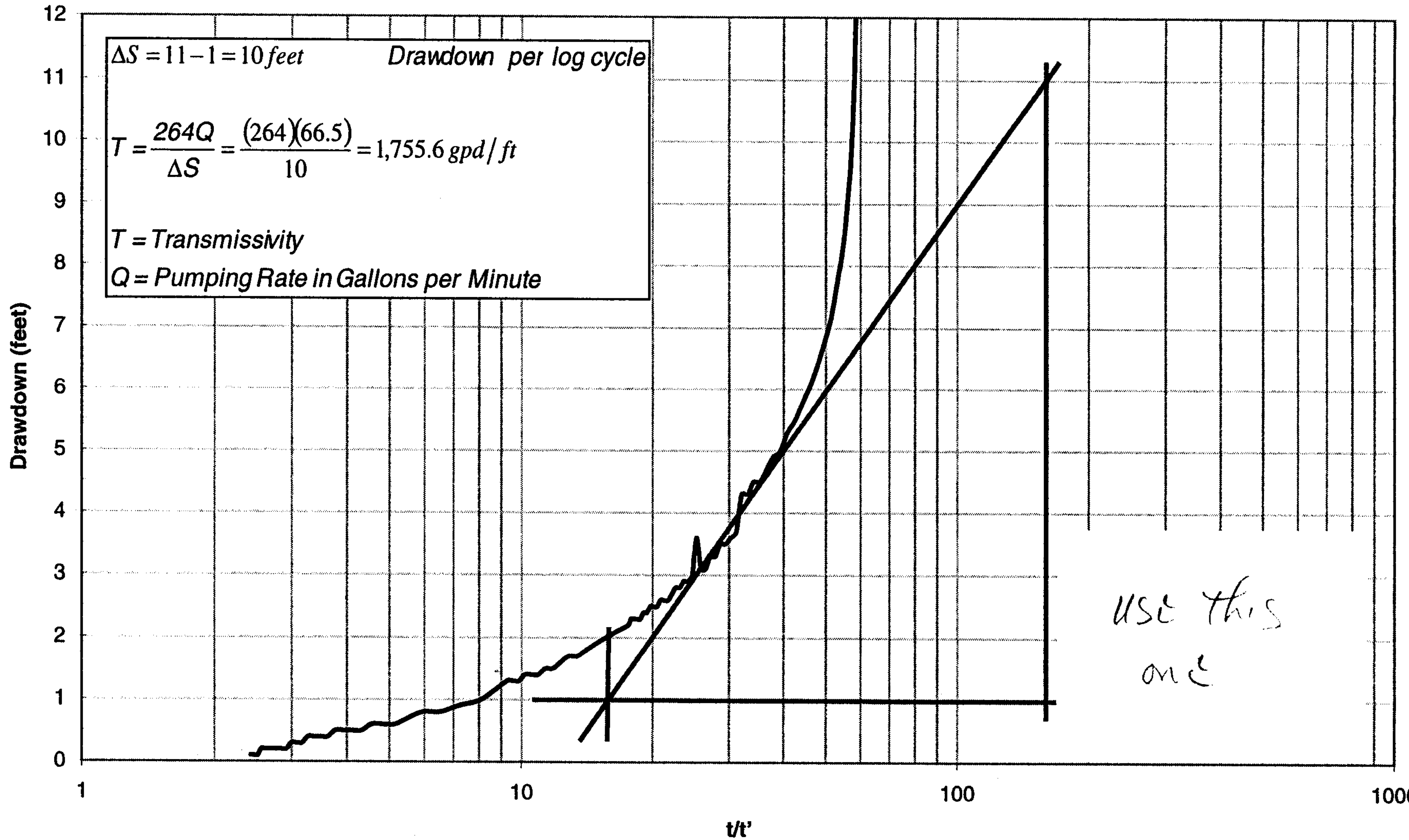
Packer Test 4
CW-1
1,780 to 1,810 feet bpl



City of Sunrise - Concentrate Well No. 1
Packer Test 4 - 1,780 - 1,810
Drawdown and Recovery
Drawdown (feet)
0
20
40
60
80
100
120
140
66.5 GPM
9/19/98 1:00:00
9/19/98 2:00:00
9/19/98 3:00:00
9/19/98 4:00:00
9/19/98 5:00:00
9/19/98 6:00:00
9/19/98 7:00:00
9/19/98 8:00:00
9/19/98 9:00:00
9/19/98 10:00:00
Date and Time

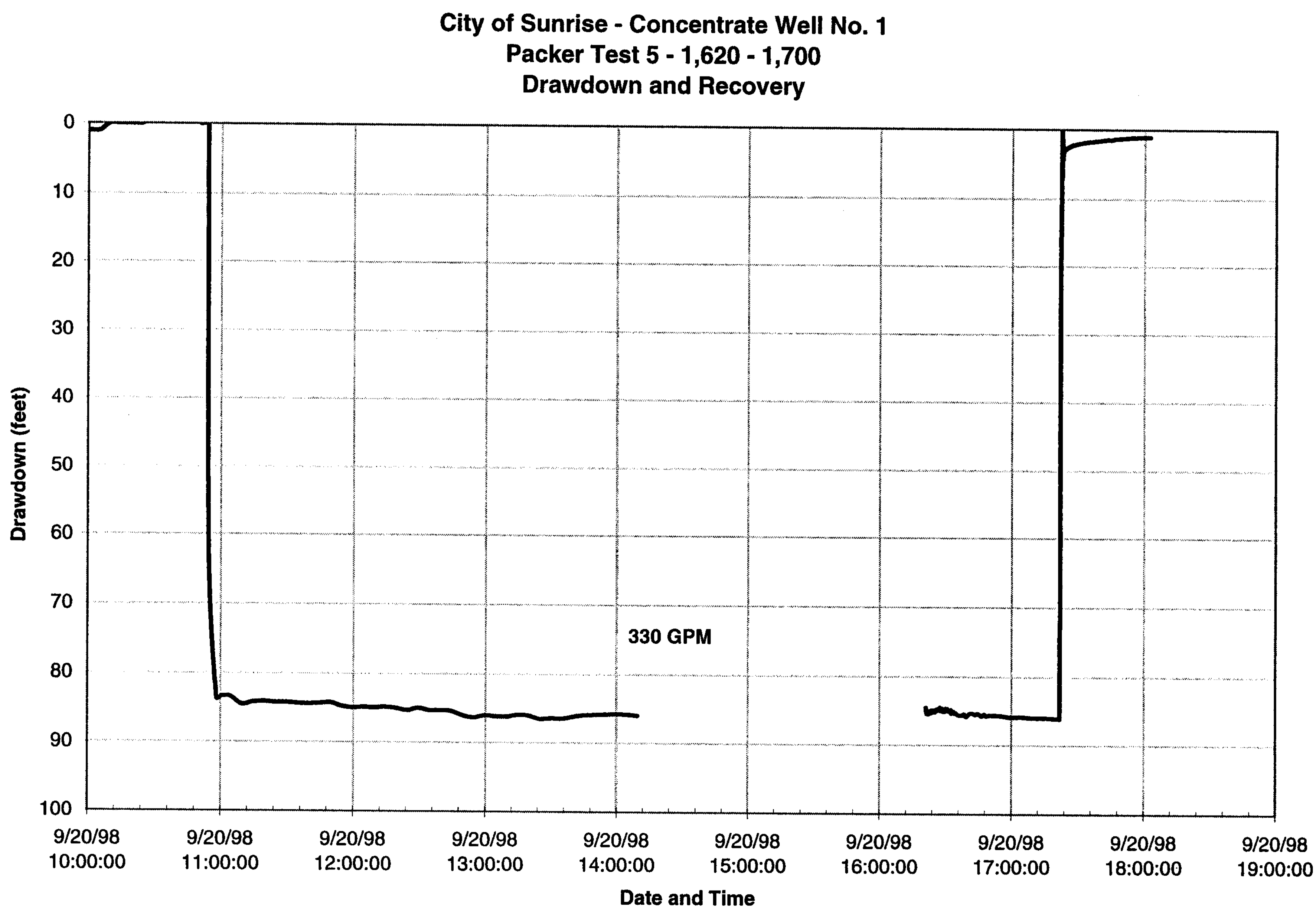

City of Sunrise - Concentrate Well No. 1
Packer Test 4 - 1,780 - 1,810
Theis Recovery Method
$\Delta S = 2.25 - 0.5 = 1.75\,feet$
Drawdown per log cycle
$T = \frac{264Q}{\Delta S} = \frac{(264)(66.5)}{1.75} = 10{,}032\ gpd/ft$
T = Transmissivity
Q = Pumping Rate in Gallons per Minute
Drawdown (feet)
t/t'
0
0.5
1
1.5
2
2.5
3
3.5
4
4.5
5
1
10
100
1000

City of Sunrise - Concentrate Well No. 1
Packer Test 4 - 1,780 - 1,810
Theis Recovery Method

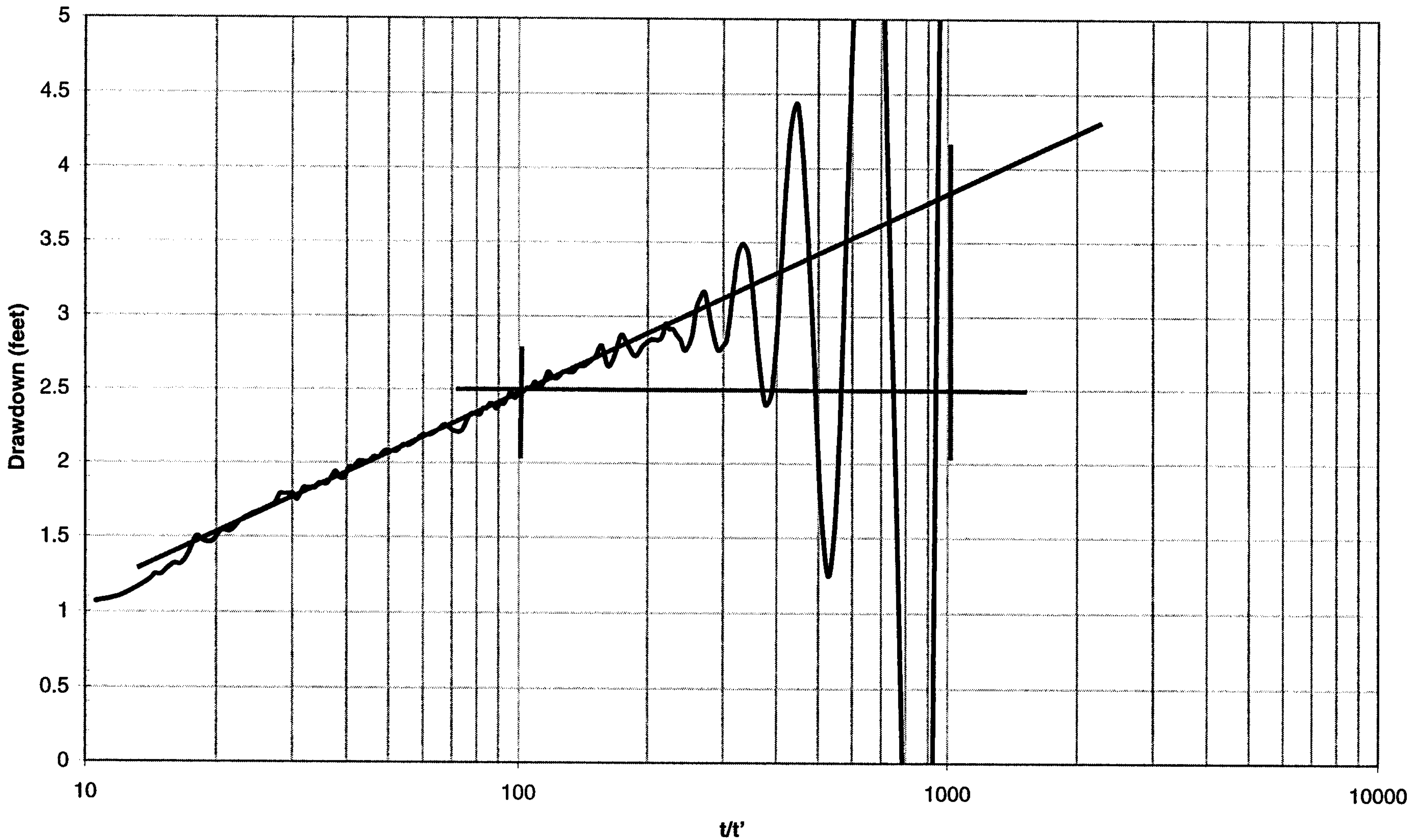


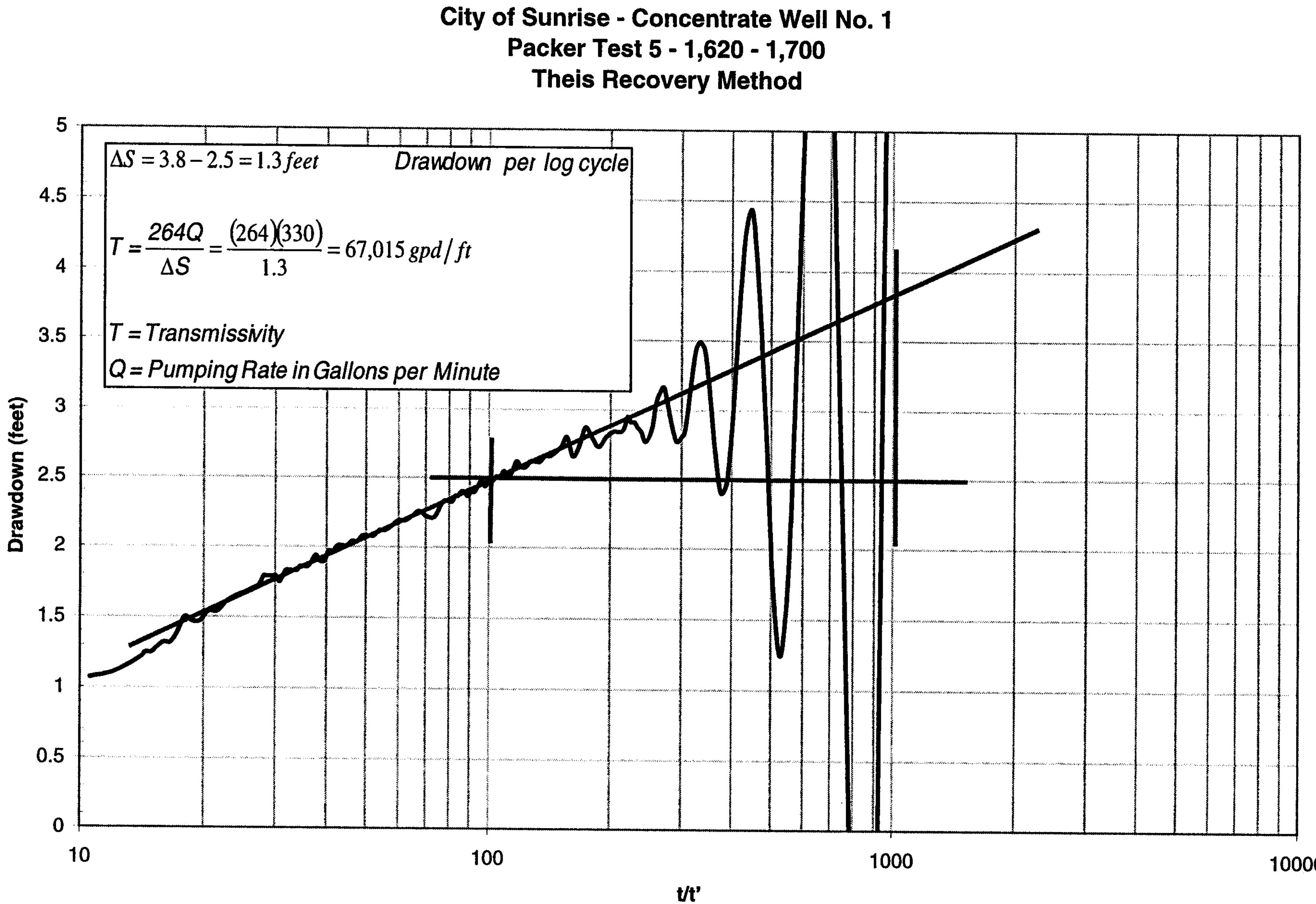
use this one

Packer Test 5
CW-1
1,620 to 1,700 feet bpl

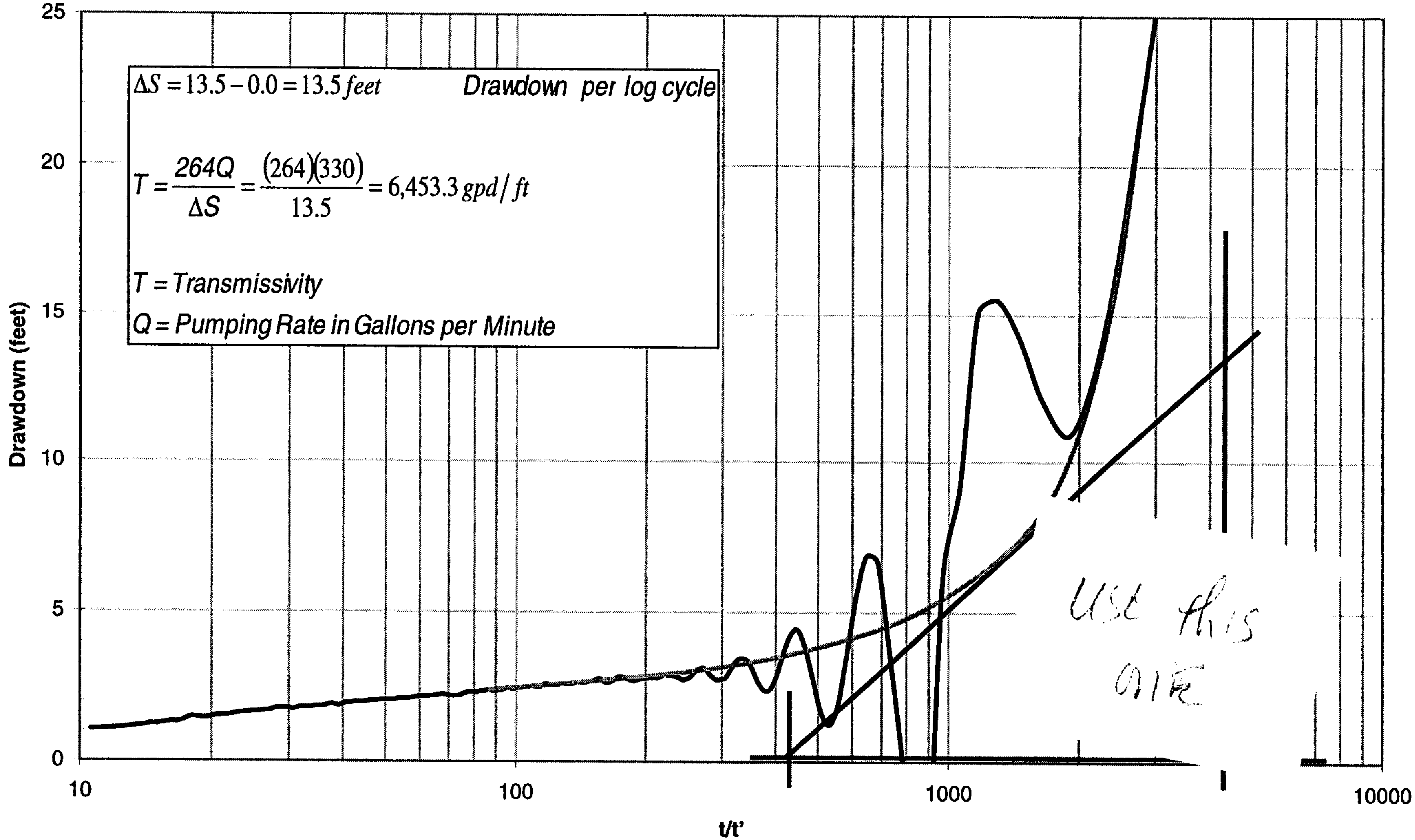

City of Sunrise - Concentrate Well No. 1
Packer Test 5 - 1,620 - 1,700
Drawdown and Recovery
Drawdown (feet)
0
10
20
30
40
50
60
70
80
90
100
330 GPM
9/20/98 10:00:00
9/20/98 11:00:00
9/20/98 12:00:00
9/20/98 13:00:00
9/20/98 14:00:00
9/20/98 15:00:00
9/20/98 16:00:00
9/20/98 17:00:00
9/20/98 18:00:00
9/20/98 19:00:00
Date and Time

City of Sunrise - Concentrate Well No. 1
Packer Test 5 - 1,620 - 1,700
Theis Recovery Method

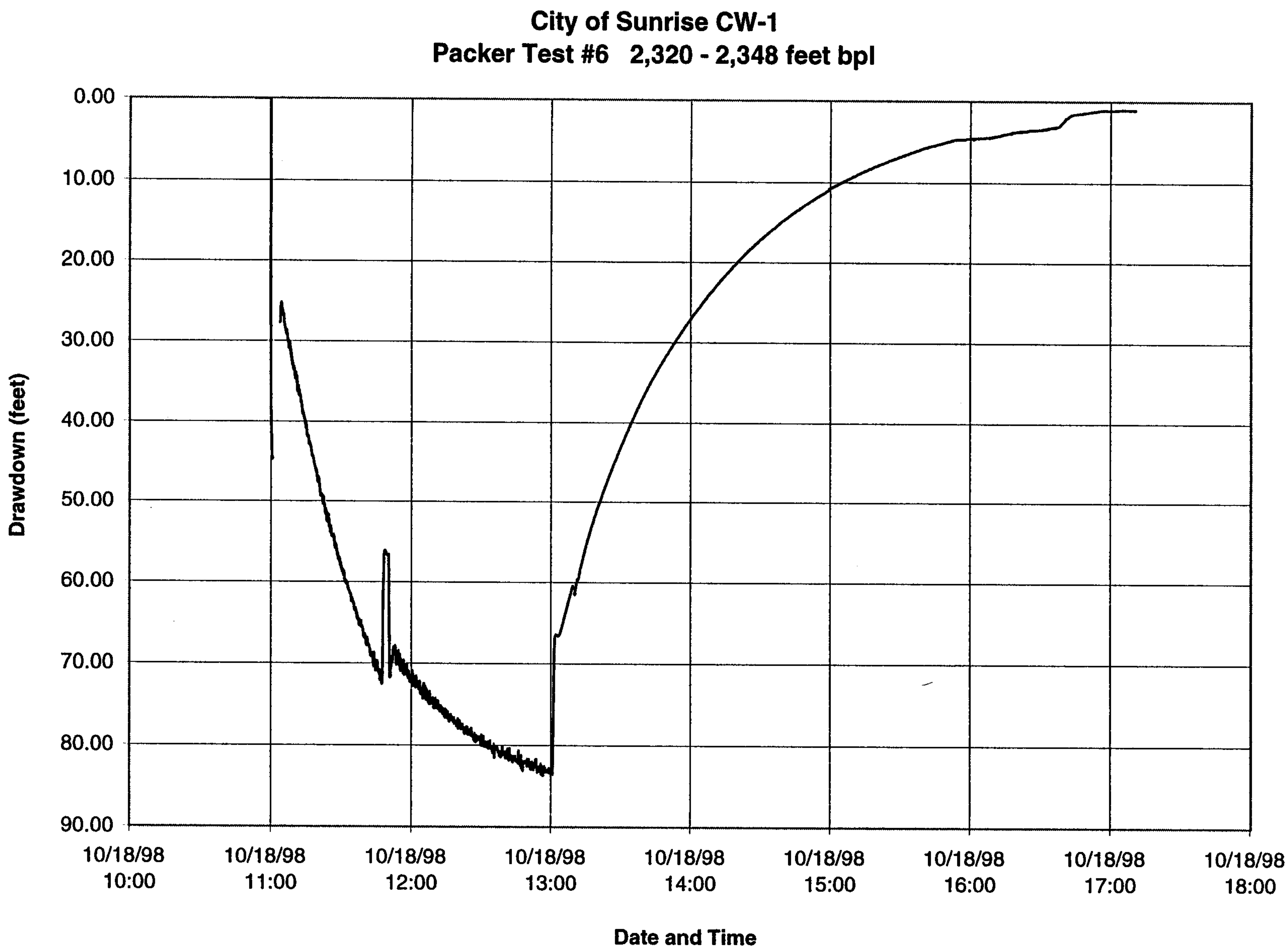



City of Sunrise - Concentrate Well No. 1
Packer Test 5 - 1,620 - 1,700
Theis Recovery Method
$\Delta S = 3.8 - 2.5 = 1.3\,feet$ Drawdown per log cycle
$T = \frac{264Q}{\Delta S} = \frac{(264)(330)}{1.3} = 67{,}015\ gpd/ft$
T = Transmissivity
Q = Pumping Rate in Gallons per Minute
Drawdown (feet)
t/t'
0
0.5
1
1.5
2
2.5
3
3.5
4
4.5
5
10
100
1000
10000

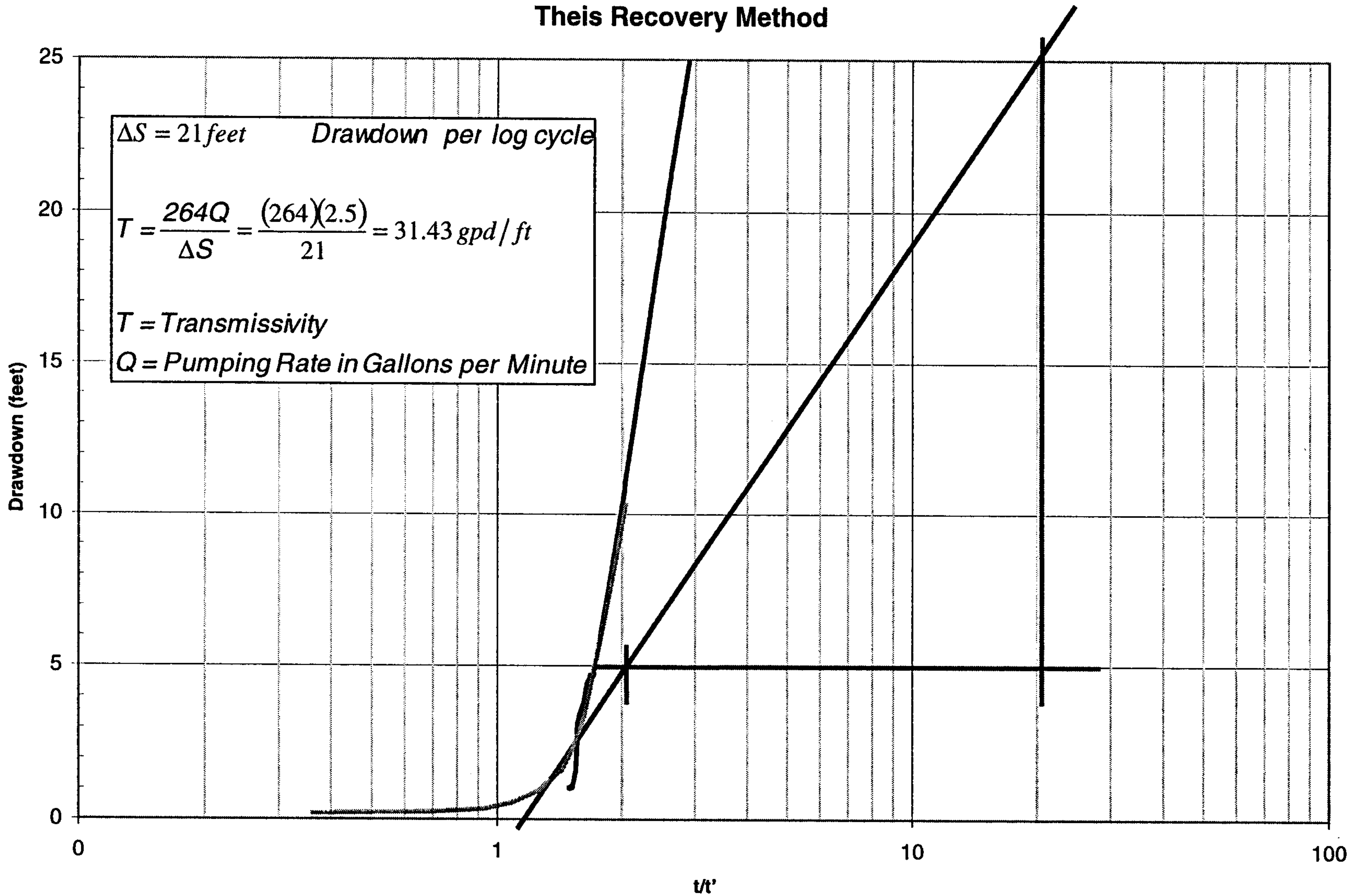
City of Sunrise - Concentrate Well No. 1
Packer Test 5 - 1,620 - 1,700
Theis Recovery Method



Packer Test 6
CW-1
2,320 to 2,348 feet bpl


City of Sunrise CW-1
Packer Test #6 2,320 - 2,348 feet bpl
Drawdown (feet)
0.00
10.00
20.00
30.00
40.00
50.00
60.00
70.00
80.00
90.00
10/18/98 10:00
10/18/98 11:00
10/18/98 12:00
10/18/98 13:00
10/18/98 14:00
10/18/98 15:00
10/18/98 16:00
10/18/98 17:00
10/18/98 18:00
Date and Time

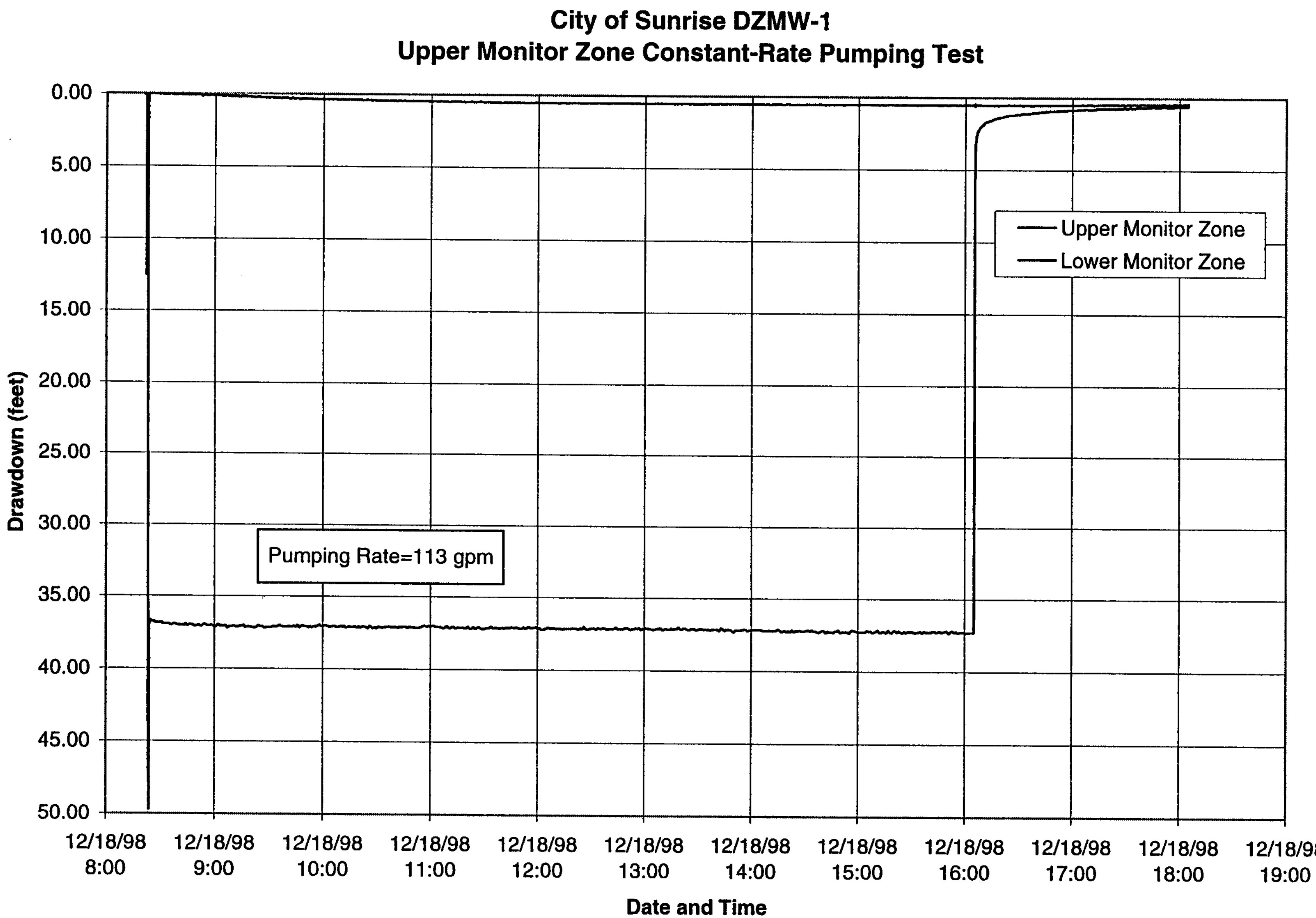
City of Sunrise - Concentrate Well No. 1
Packer Test 6 - 2,320 - 2,348
Theis Recovery Method

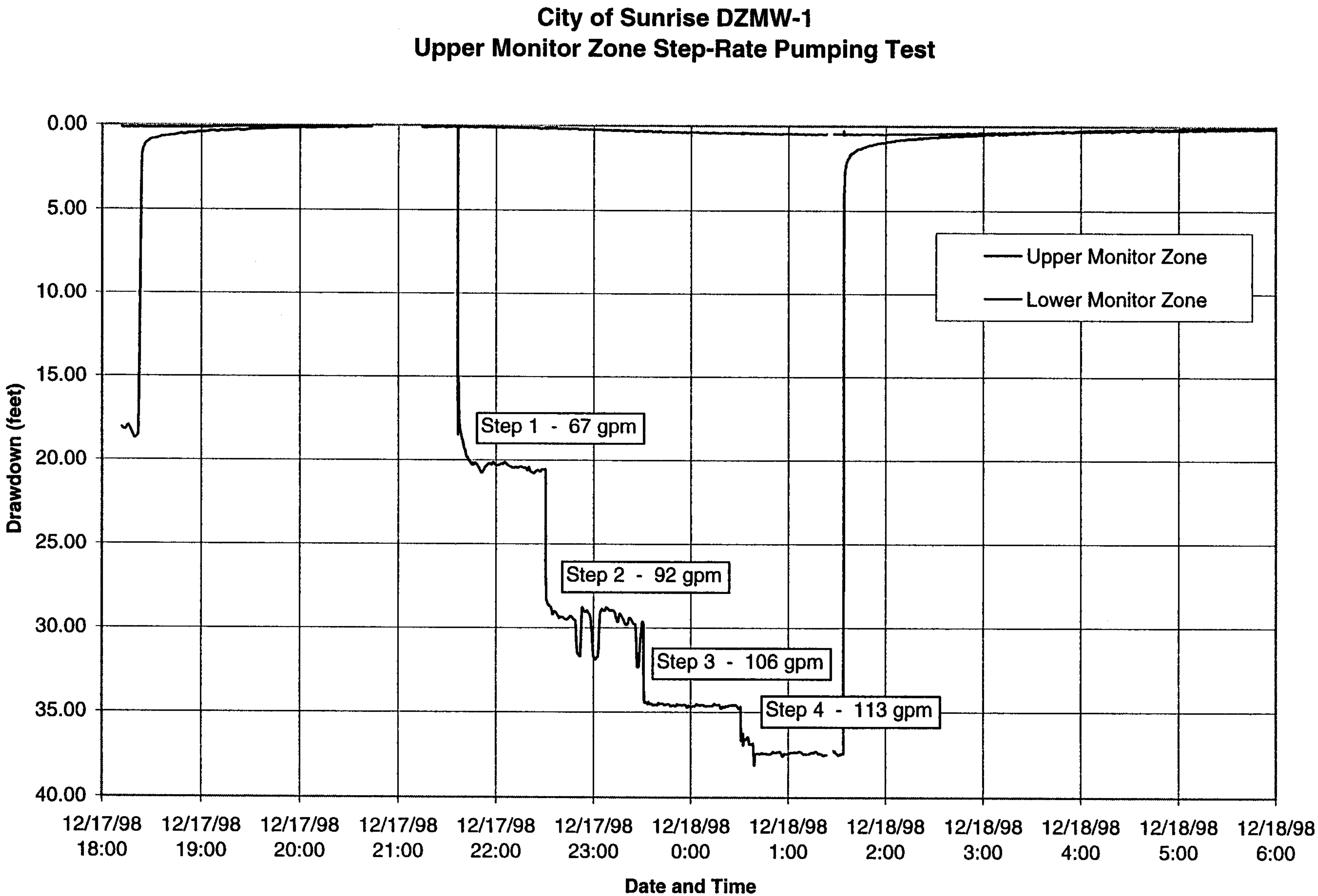


Appendix J

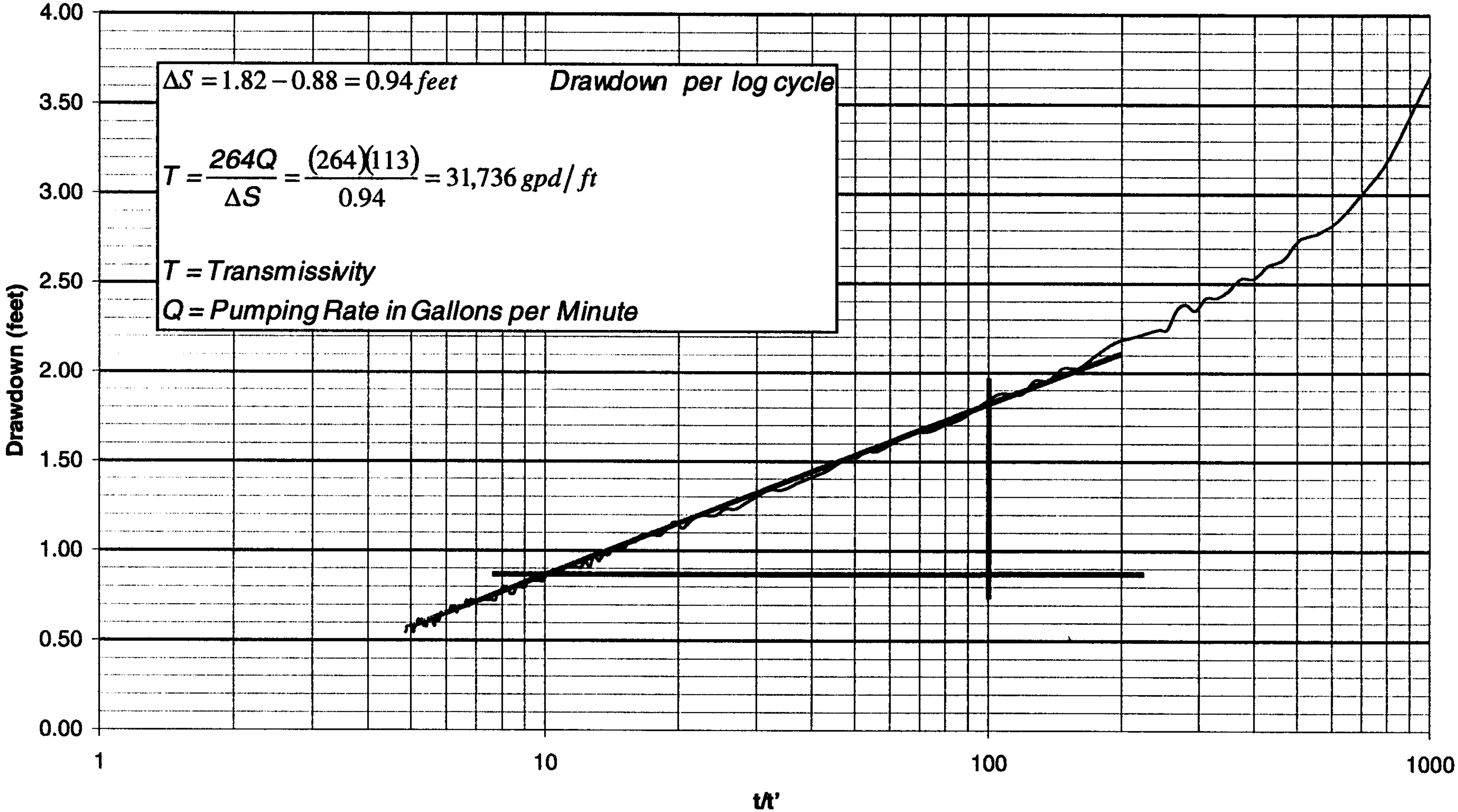
MONTGOMERY WATSON

Monitor Well Pump Test Data
Upper Monitor Zone

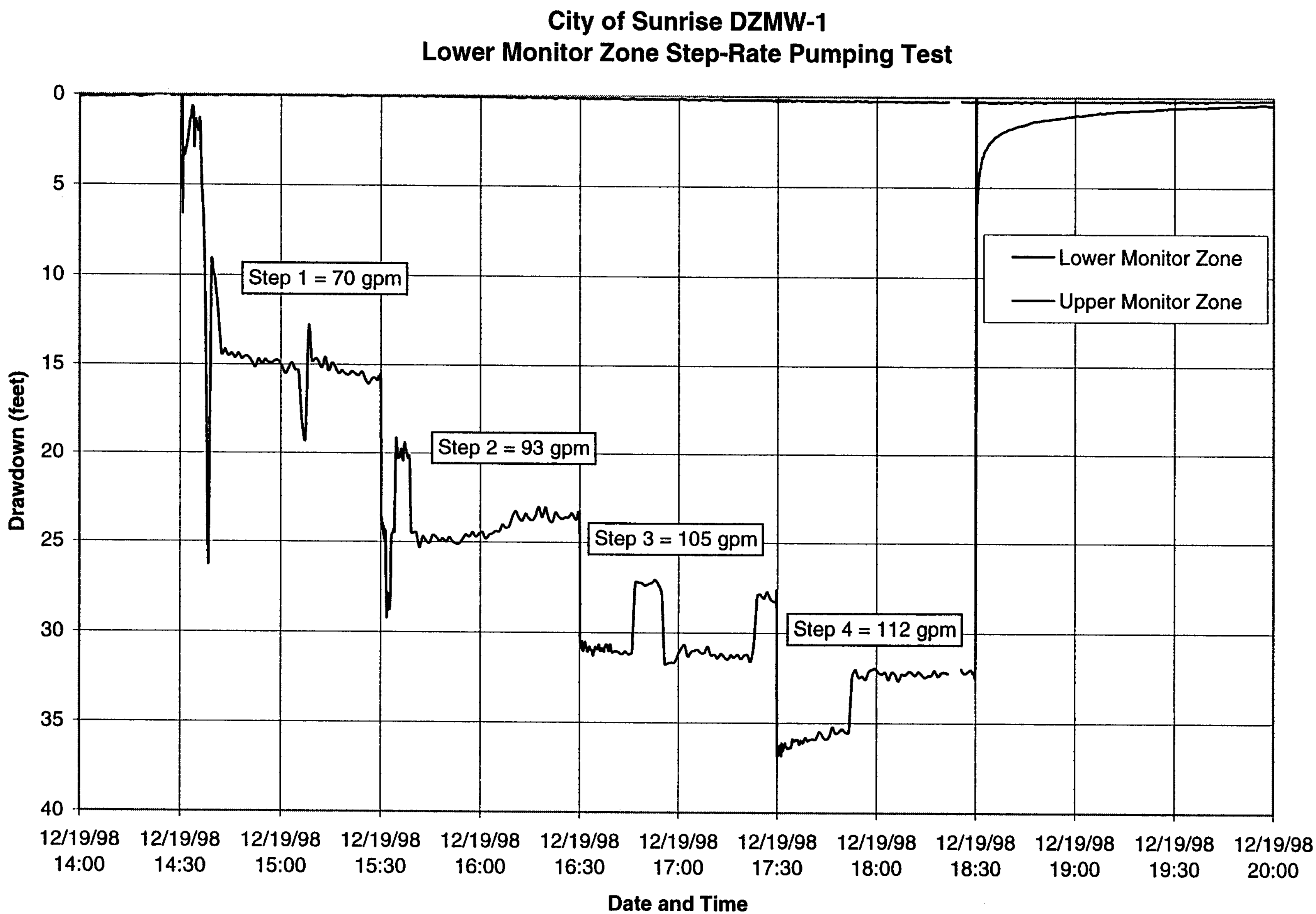

City of Sunrise DZMW-1
Upper Monitor Zone Constant-Rate Pumping Test
Drawdown (feet)
0.00
5.00
10.00
15.00
20.00
25.00
30.00
35.00
40.00
45.00
50.00
Upper Monitor Zone
Lower Monitor Zone
Pumping Rate=113 gpm
12/18/98 8:00
12/18/98 9:00
12/18/98 10:00
12/18/98 11:00
12/18/98 12:00
12/18/98 13:00
12/18/98 14:00
12/18/98 15:00
12/18/98 16:00
12/18/98 17:00
12/18/98 18:00
12/18/98 19:00
Date and Time

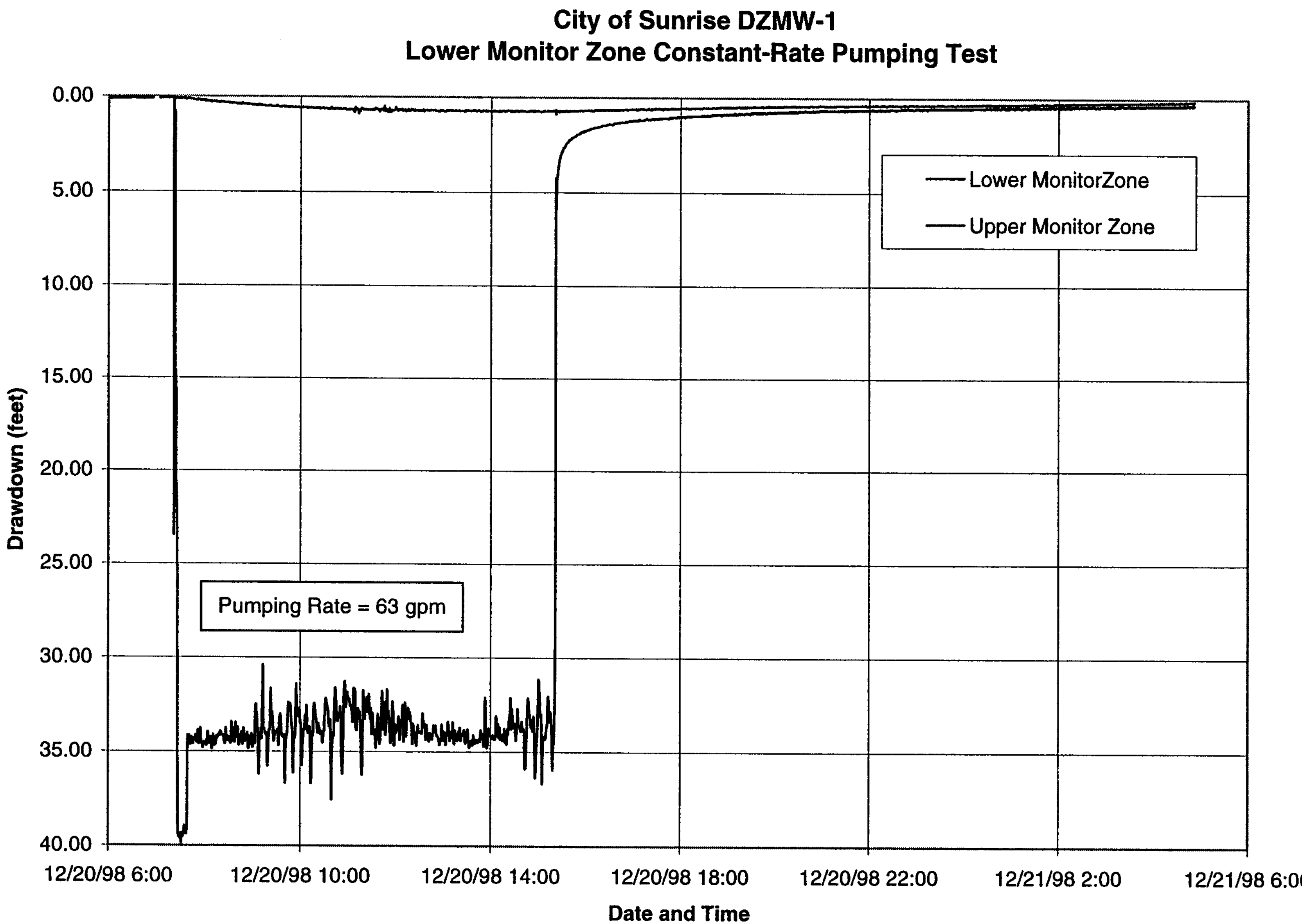

City of Sunrise DZMW-1
Upper Monitor Zone Step-Rate Pumping Test
Drawdown (feet)
0.00
5.00
10.00
15.00
20.00
25.00
30.00
35.00
40.00
Upper Monitor Zone
Lower Monitor Zone
Step 1 - 67 gpm
Step 2 - 92 gpm
Step 3 - 106 gpm
Step 4 - 113 gpm
12/17/98 18:00
12/17/98 19:00
12/17/98 20:00
12/17/98 21:00
12/17/98 22:00
12/17/98 23:00
12/18/98 0:00
12/18/98 1:00
12/18/98 2:00
12/18/98 3:00
12/18/98 4:00
12/18/98 5:00
12/18/98 6:00
Date and Time

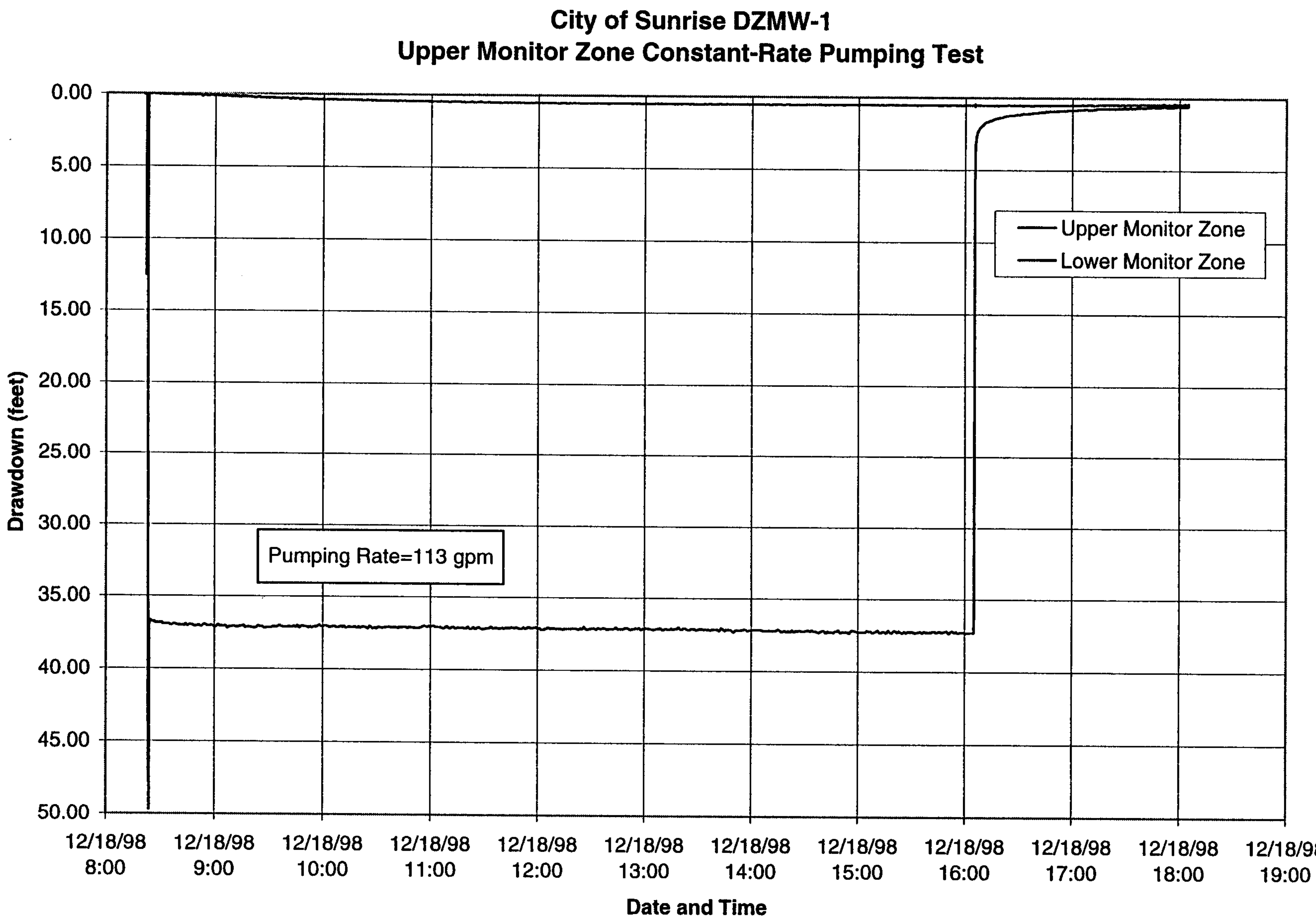
City of Sunrise DZMW-1
Upper Zone Constant-Rate Pumping Test
Theis Recovery Method

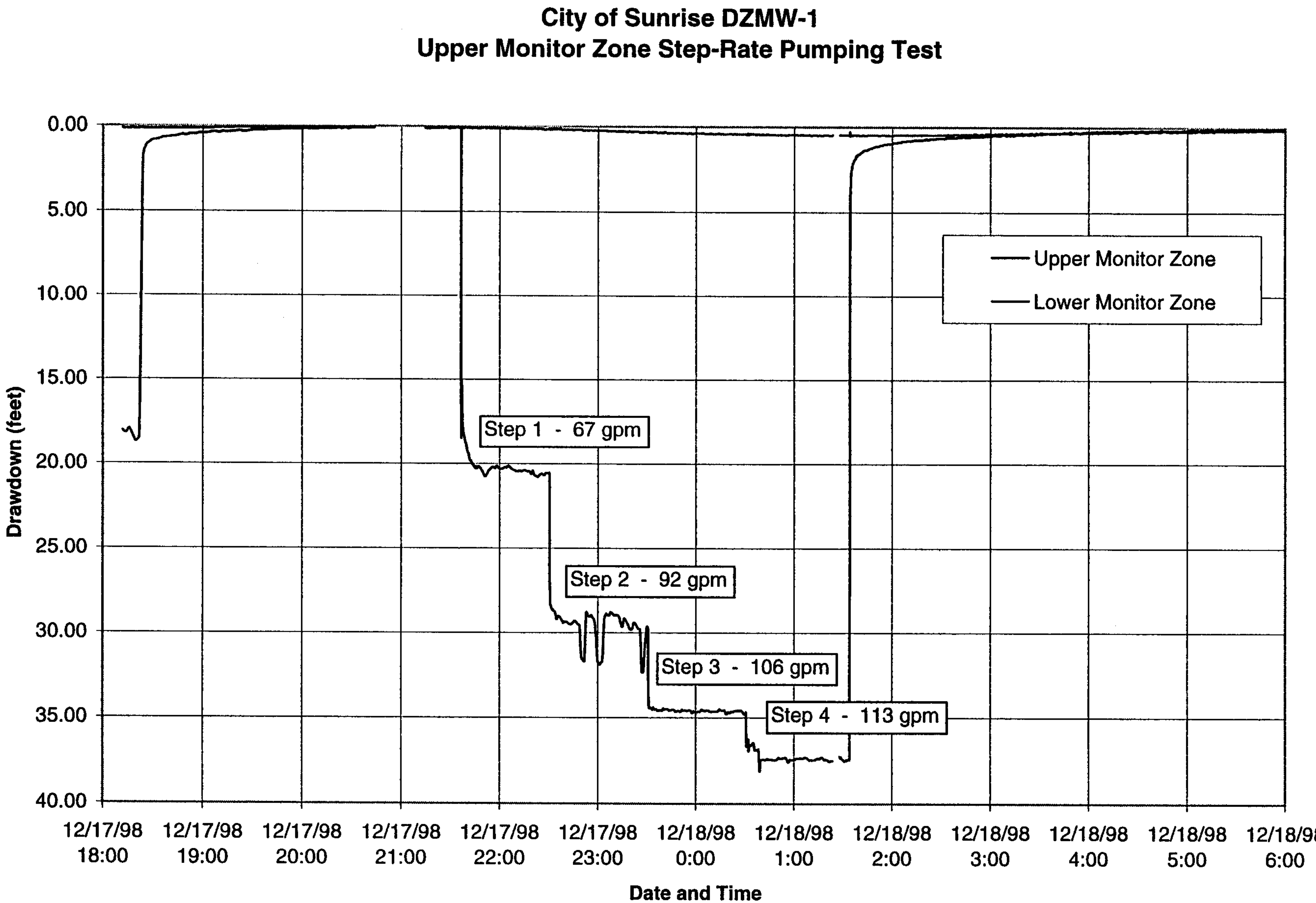


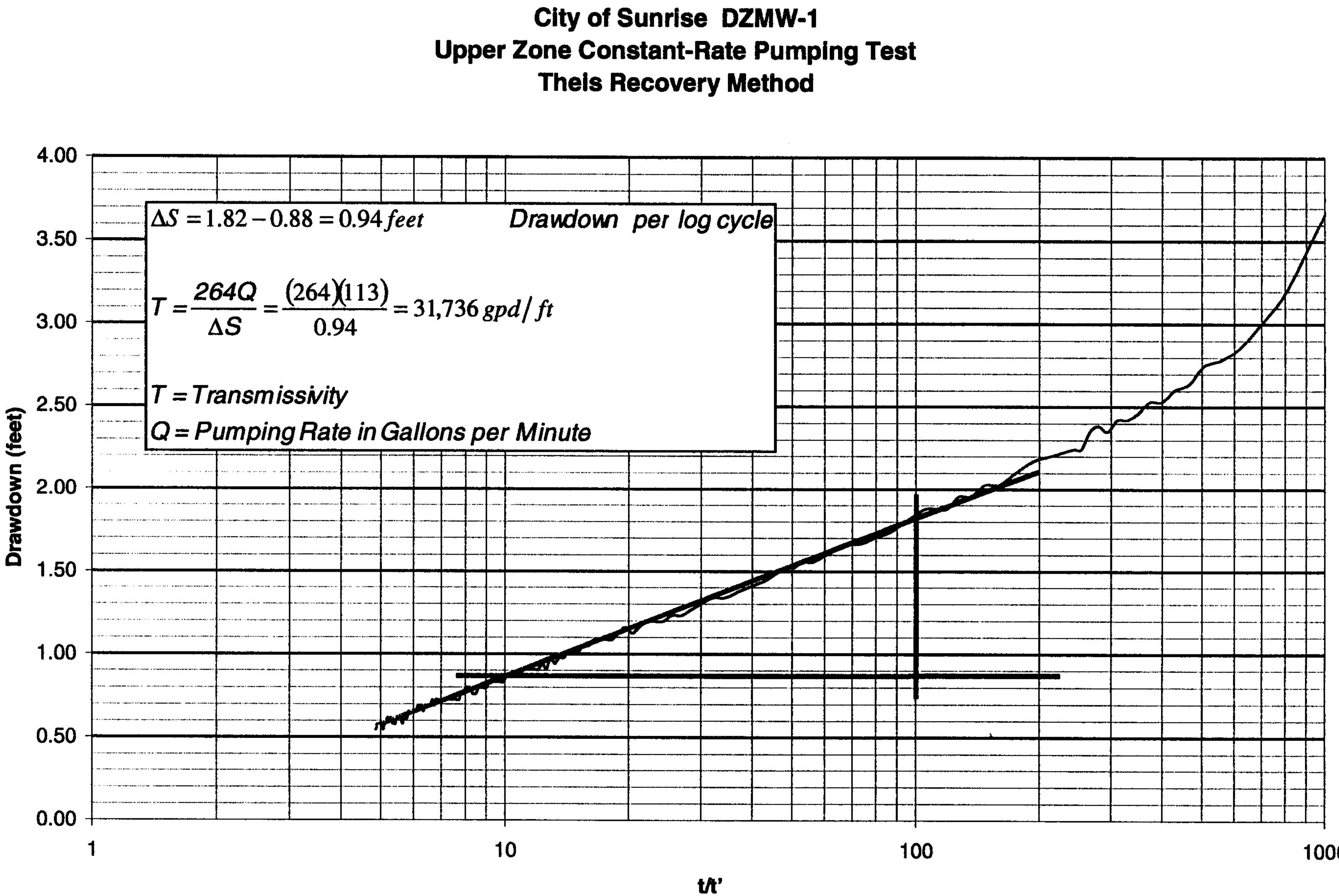
Monitor Well Pump Test Data
Lower Monitor Zone

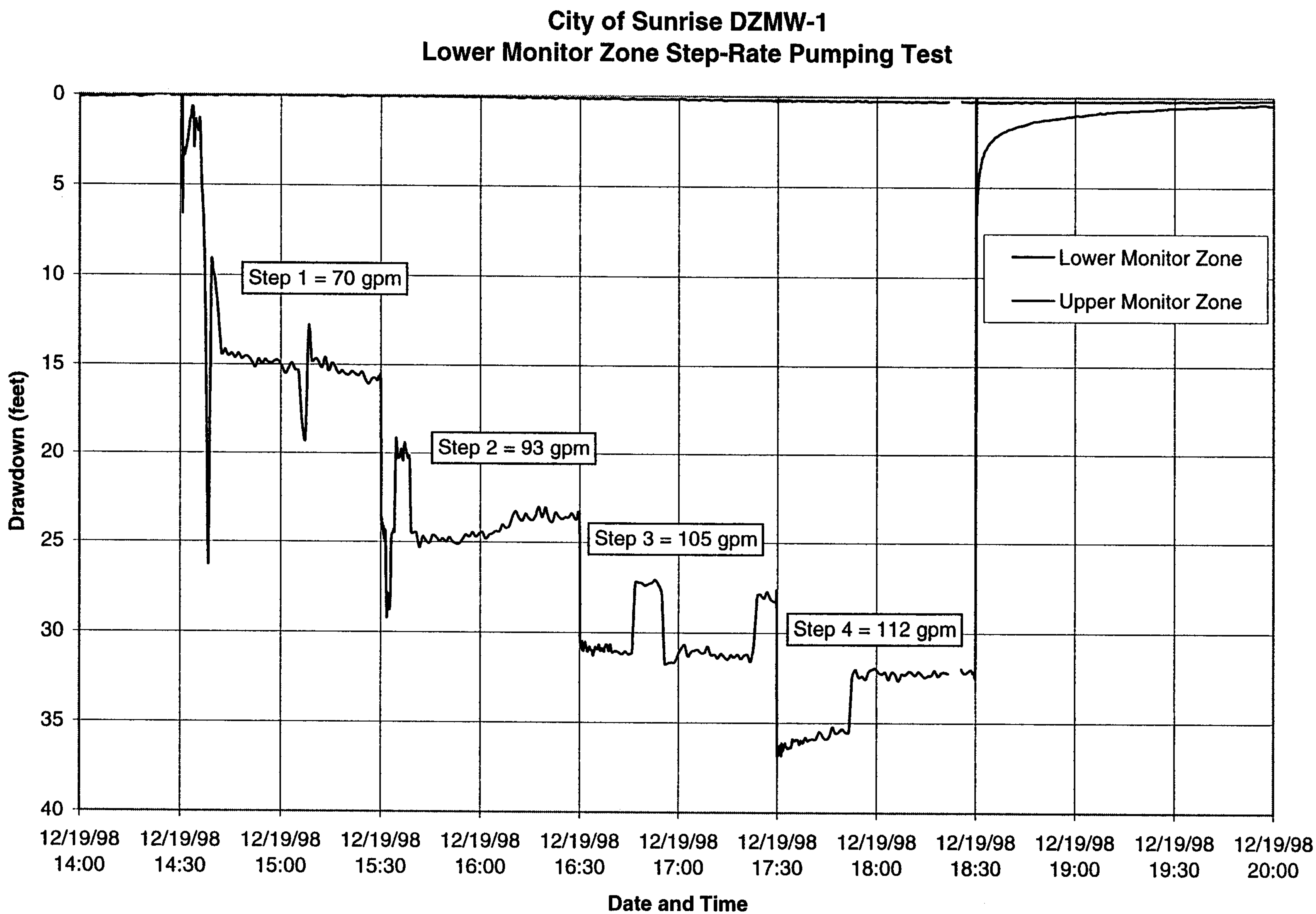

City of Sunrise DZMW-1
Lower Monitor Zone Step-Rate Pumping Test
Drawdown (feet)
0
5
10
15
20
25
30
35
40
Step 1 = 70 gpm
Step 2 = 93 gpm
Step 3 = 105 gpm
Step 4 = 112 gpm
Lower Monitor Zone
Upper Monitor Zone
12/19/98 14:00
12/19/98 14:30
12/19/98 15:00
12/19/98 15:30
12/19/98 16:00
12/19/98 16:30
12/19/98 17:00
12/19/98 17:30
12/19/98 18:00
12/19/98 18:30
12/19/98 19:00
12/19/98 19:30
12/19/98 20:00
Date and Time


City of Sunrise DZMW-1
Lower Monitor Zone Constant-Rate Pumping Test
Drawdown (feet)
0.00
5.00
10.00
15.00
20.00
25.00
30.00
35.00
40.00
12/20/98 6:00
12/20/98 10:00
12/20/98 14:00
12/20/98 18:00
12/20/98 22:00
12/21/98 2:00
12/21/98 6:00
Date and Time
Lower MonitorZone
Upper Monitor Zone
Pumping Rate = 63 gpm

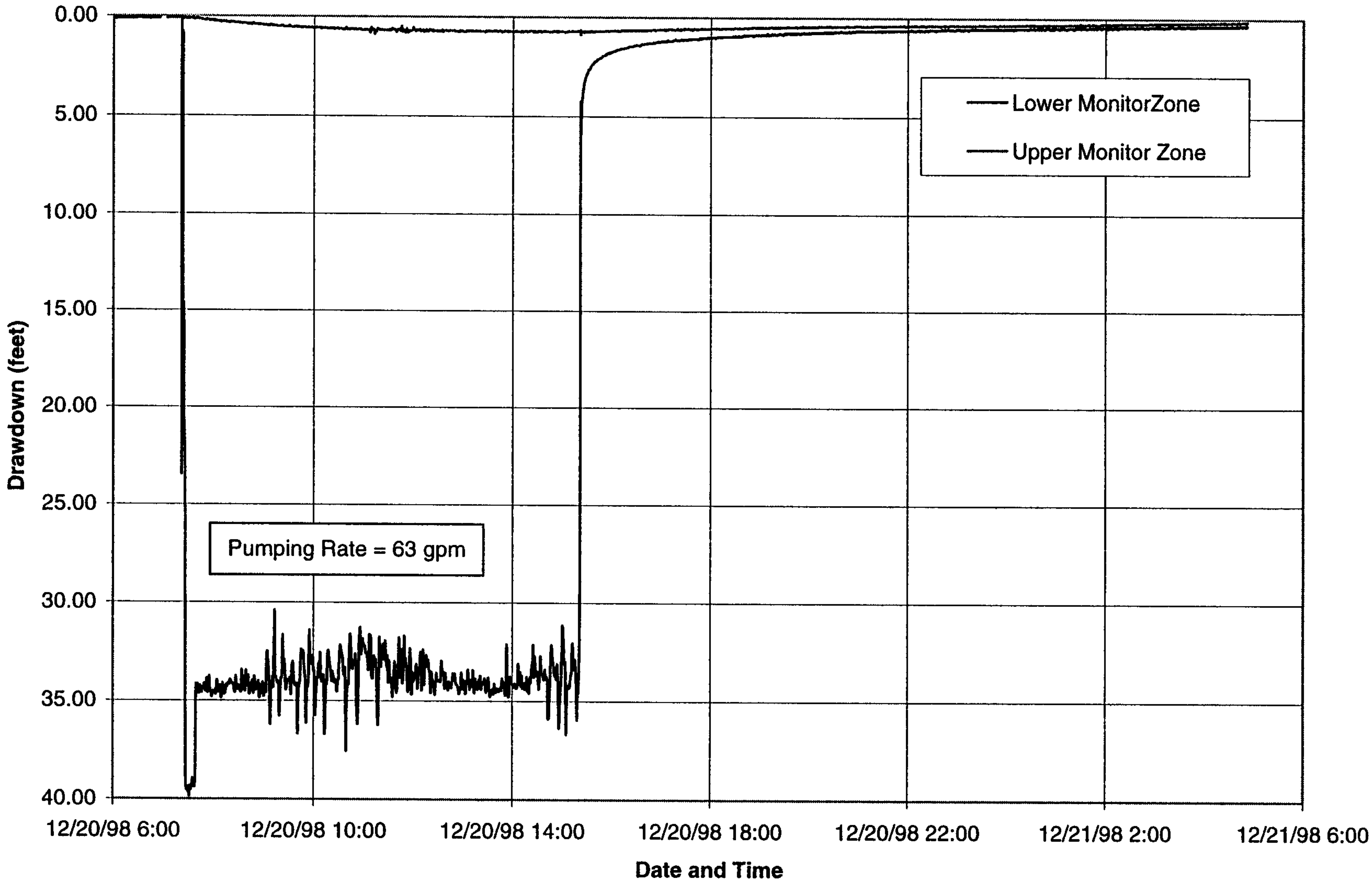

City of Sunrise DZMW-1
Upper Monitor Zone Constant-Rate Pumping Test
Drawdown (feet)
0.00
5.00
10.00
15.00
20.00
25.00
30.00
35.00
40.00
45.00
50.00
Upper Monitor Zone
Lower Monitor Zone
Pumping Rate=113 gpm
12/18/98 8:00
12/18/98 9:00
12/18/98 10:00
12/18/98 11:00
12/18/98 12:00
12/18/98 13:00
12/18/98 14:00
12/18/98 15:00
12/18/98 16:00
12/18/98 17:00
12/18/98 18:00
12/18/98 19:00
Date and Time

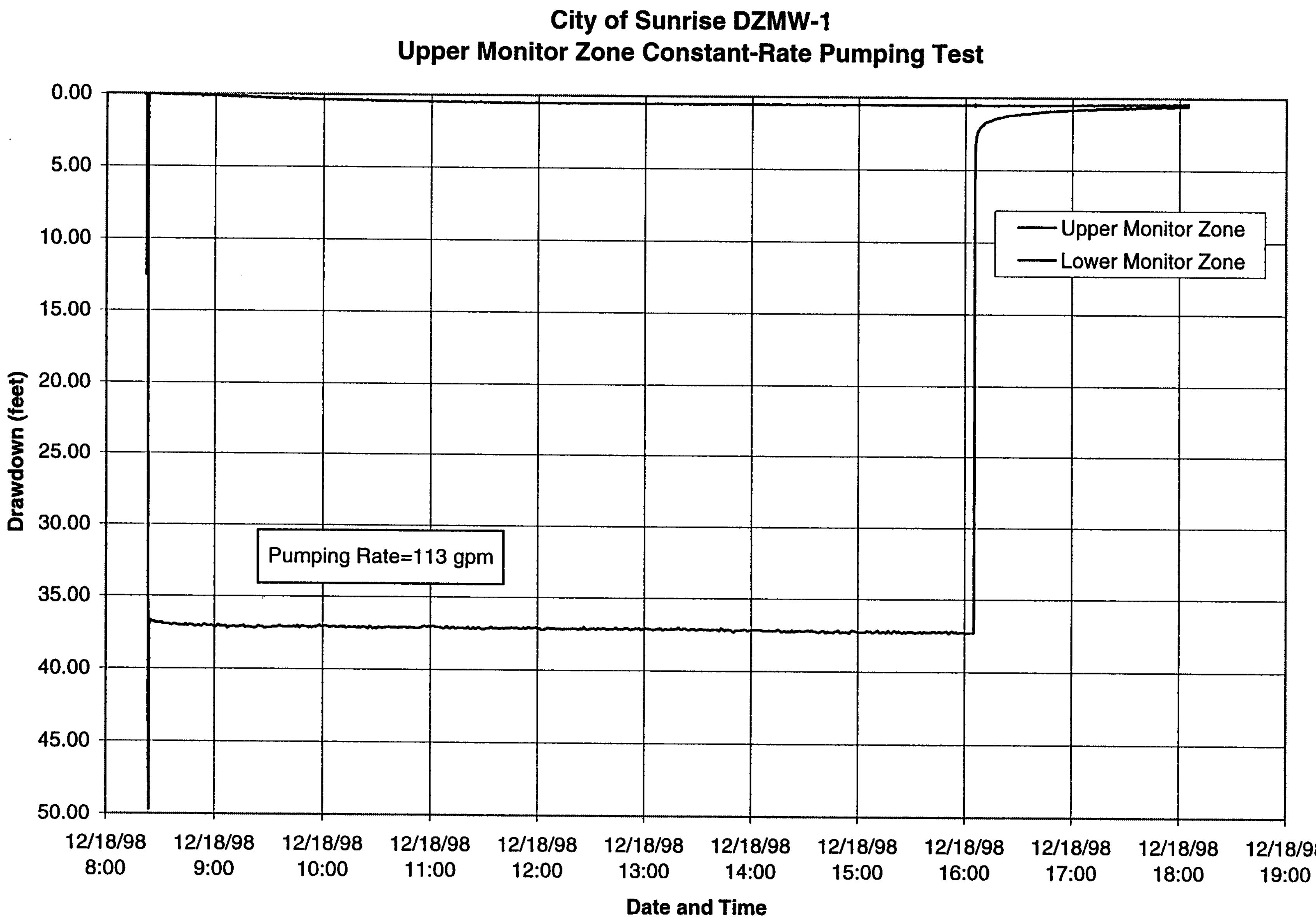

City of Sunrise DZMW-1
Upper Monitor Zone Step-Rate Pumping Test
Upper Monitor Zone
Lower Monitor Zone
Step 1 - 67 gpm
Step 2 - 92 gpm
Step 3 - 106 gpm
Step 4 - 113 gpm
Drawdown (feet)
0.00
5.00
10.00
15.00
20.00
25.00
30.00
35.00
40.00
12/17/98 18:00
12/17/98 19:00
12/17/98 20:00
12/17/98 21:00
12/17/98 22:00
12/17/98 23:00
12/18/98 0:00
12/18/98 1:00
12/18/98 2:00
12/18/98 3:00
12/18/98 4:00
12/18/98 5:00
12/18/98 6:00
Date and Time


City of Sunrise DZMW-1
Upper Zone Constant-Rate Pumping Test
Theis Recovery Method
$\Delta S = 1.82 - 0.88 = 0.94\,feet$
Drawdown per log cycle
$T = \frac{264Q}{\Delta S} = \frac{(264)(113)}{0.94} = 31{,}736\ gpd/ft$
T = Transmissivity
Q = Pumping Rate in Gallons per Minute
Drawdown (feet)
4.00
3.50
3.00
2.50
2.00
1.50
1.00
0.50
0.00
1
10
100
1000
t/t'

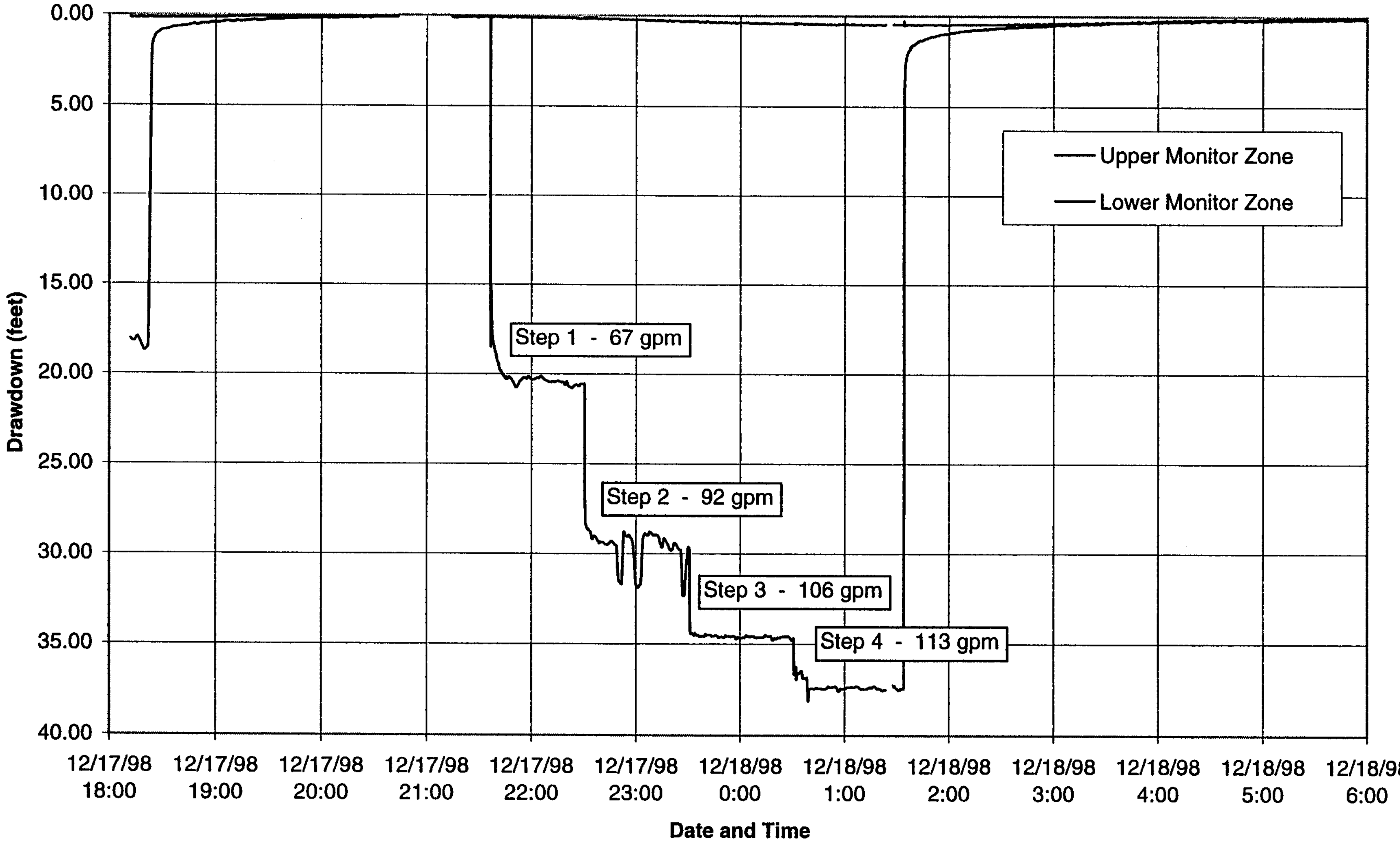

City of Sunrise DZMW-1
Lower Monitor Zone Step-Rate Pumping Test
Drawdown (feet)
0
5
10
15
20
25
30
35
40
Step 1 = 70 gpm
Step 2 = 93 gpm
Step 3 = 105 gpm
Step 4 = 112 gpm
Lower Monitor Zone
Upper Monitor Zone
12/19/98 14:00
12/19/98 14:30
12/19/98 15:00
12/19/98 15:30
12/19/98 16:00
12/19/98 16:30
12/19/98 17:00
12/19/98 17:30
12/19/98 18:00
12/19/98 18:30
12/19/98 19:00
12/19/98 19:30
12/19/98 20:00
Date and Time

City of Sunrise DZMW-1
Lower Monitor Zone Constant-Rate Pumping Test

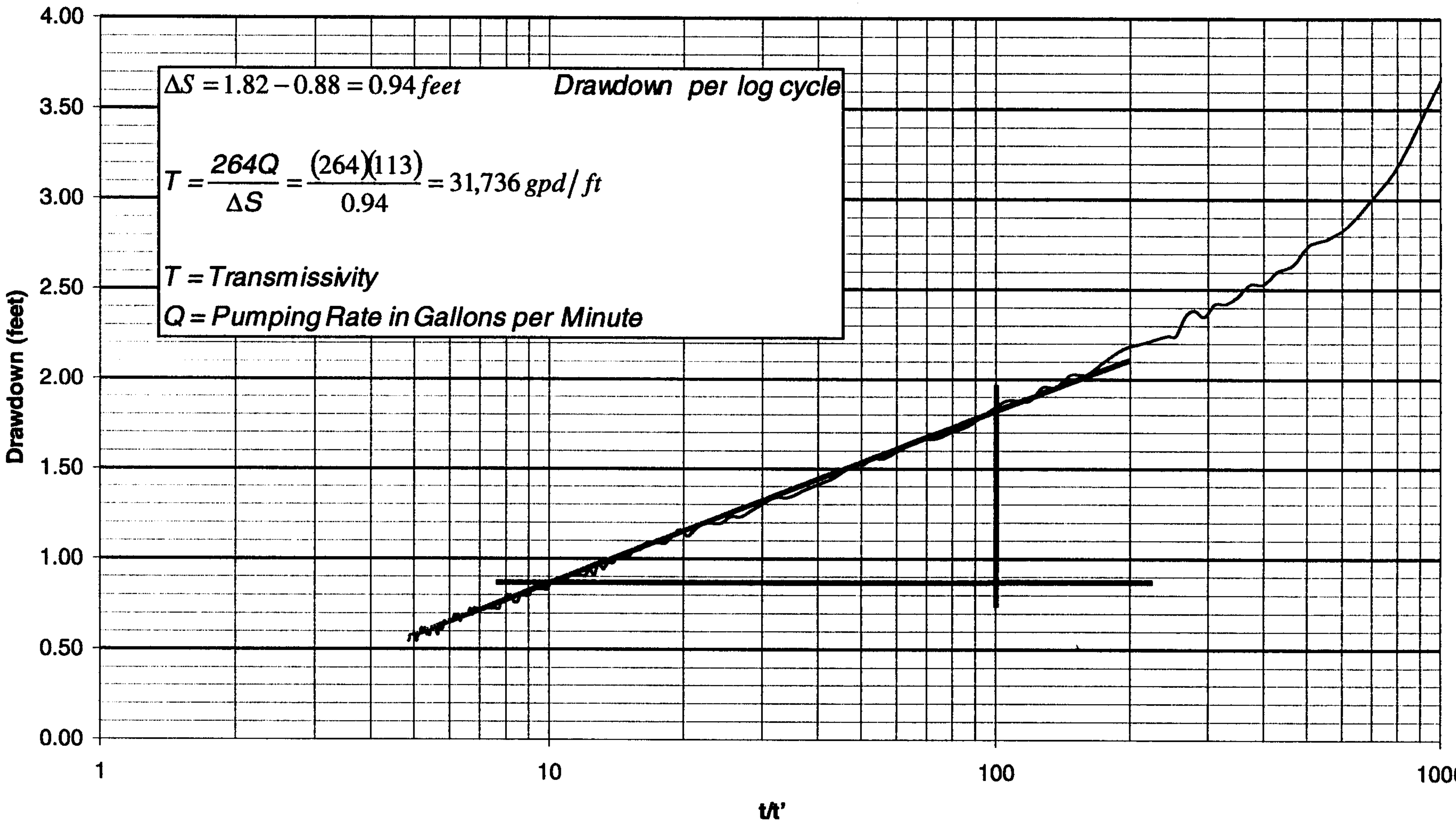



City of Sunrise DZMW-1
Upper Monitor Zone Constant-Rate Pumping Test
Drawdown (feet)
0.00
5.00
10.00
15.00
20.00
25.00
30.00
35.00
40.00
45.00
50.00
Upper Monitor Zone
Lower Monitor Zone
Pumping Rate=113 gpm
12/18/98 8:00
12/18/98 9:00
12/18/98 10:00
12/18/98 11:00
12/18/98 12:00
12/18/98 13:00
12/18/98 14:00
12/18/98 15:00
12/18/98 16:00
12/18/98 17:00
12/18/98 18:00
12/18/98 19:00
Date and Time

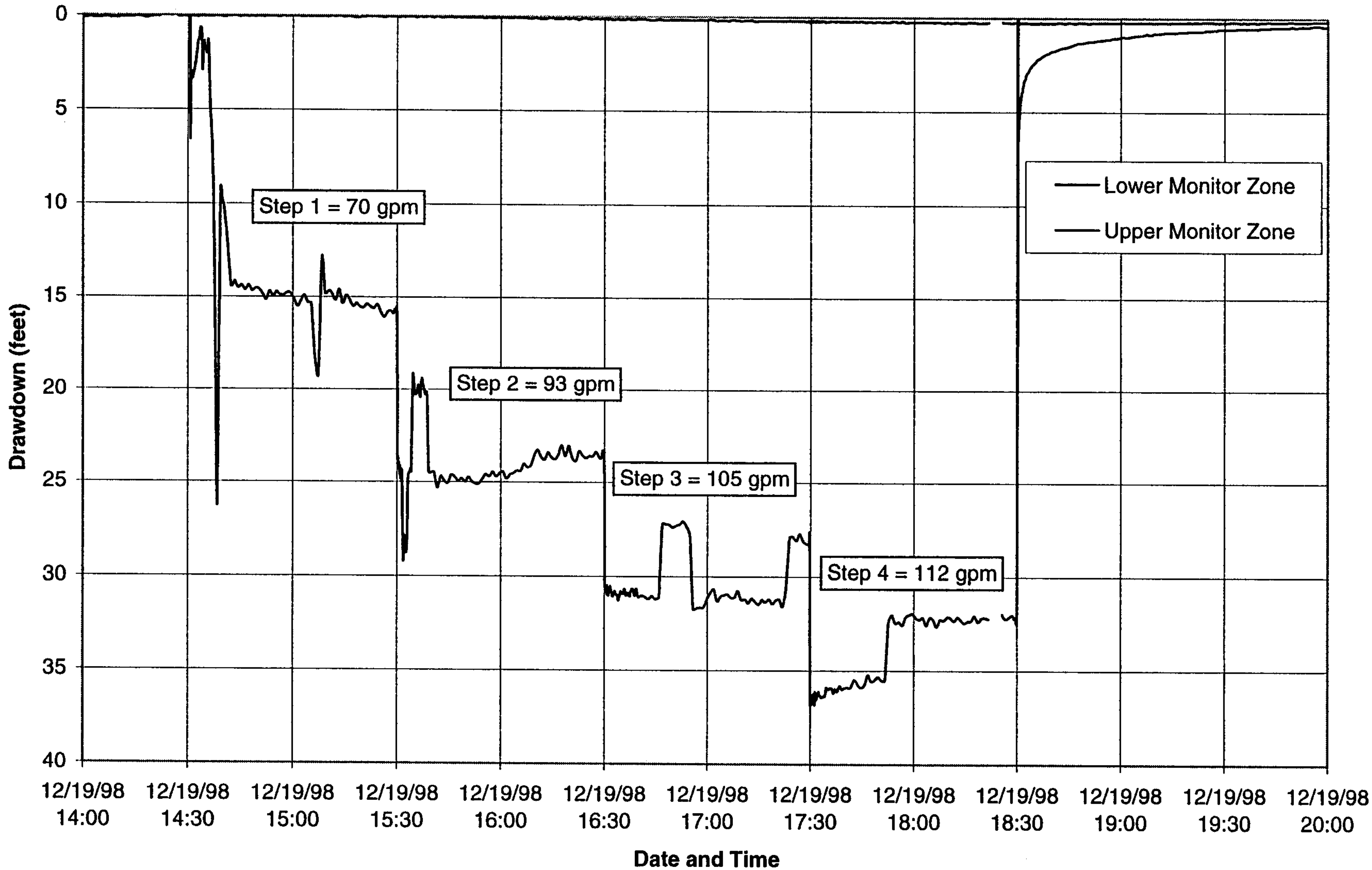
City of Sunrise DZMW-1
Upper Monitor Zone Step-Rate Pumping Test

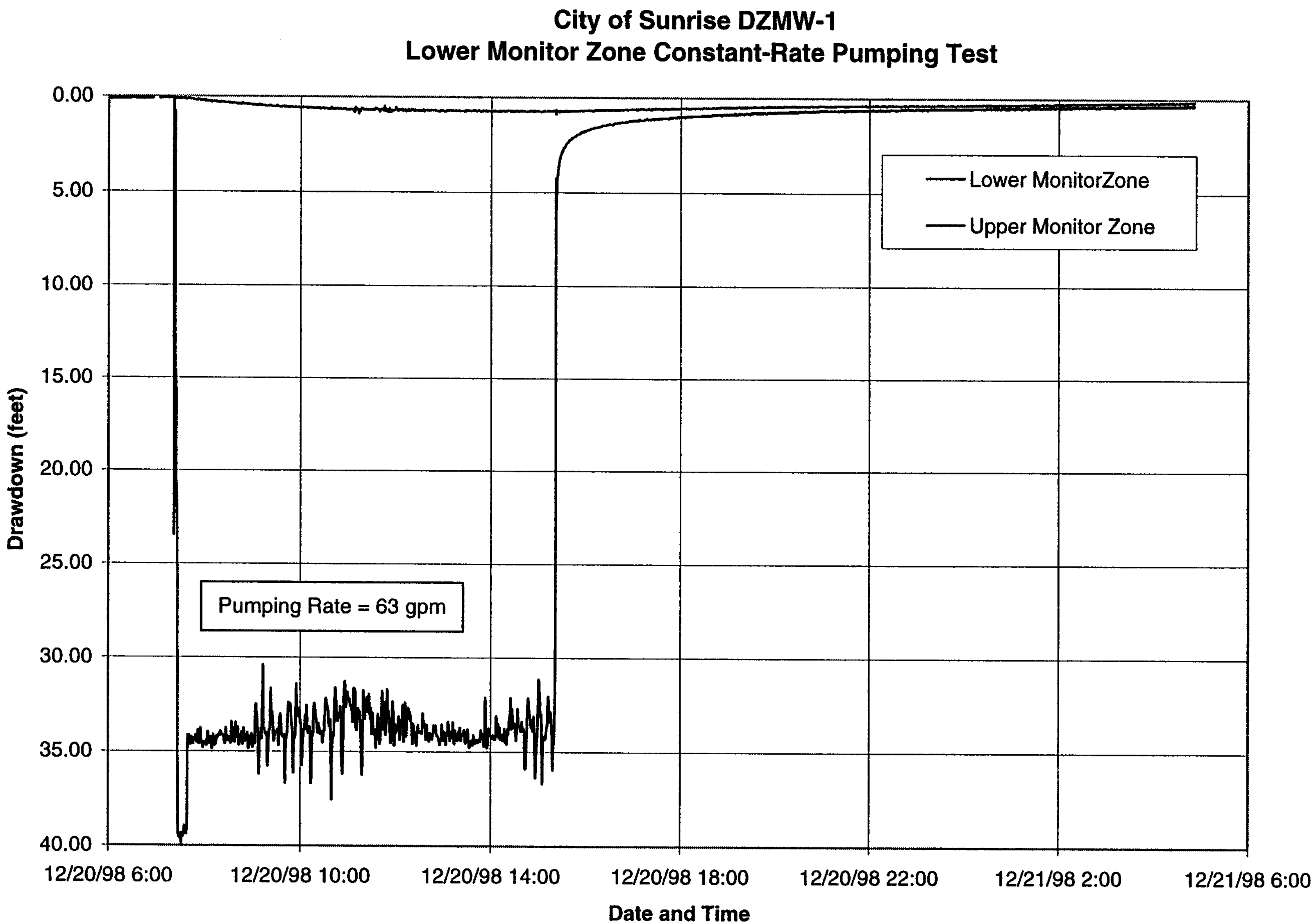


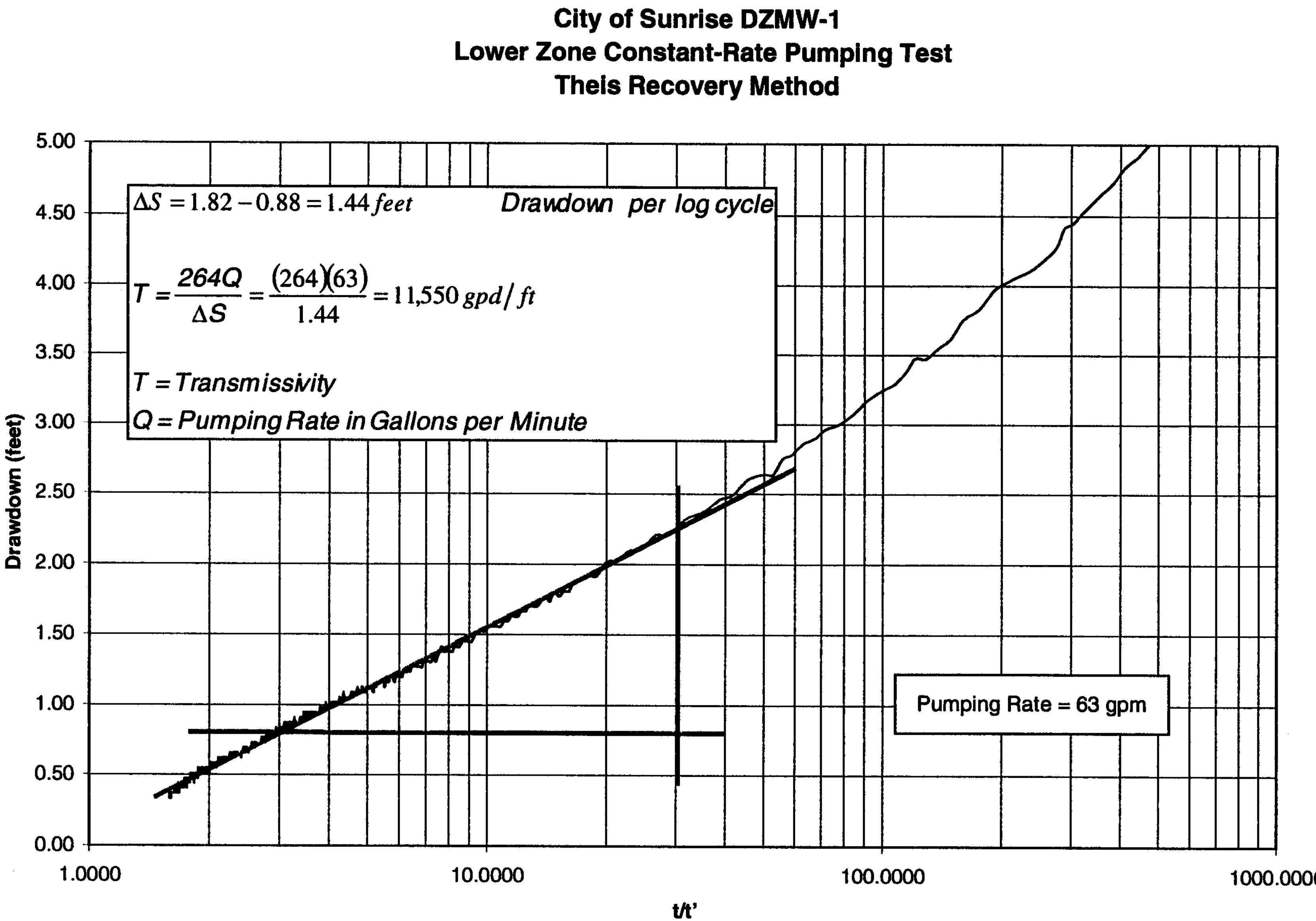
City of Sunrise DZMW-1
Upper Zone Constant-Rate Pumping Test
Theis Recovery Method



City of Sunrise DZMW-1
Lower Monitor Zone Step-Rate Pumping Test



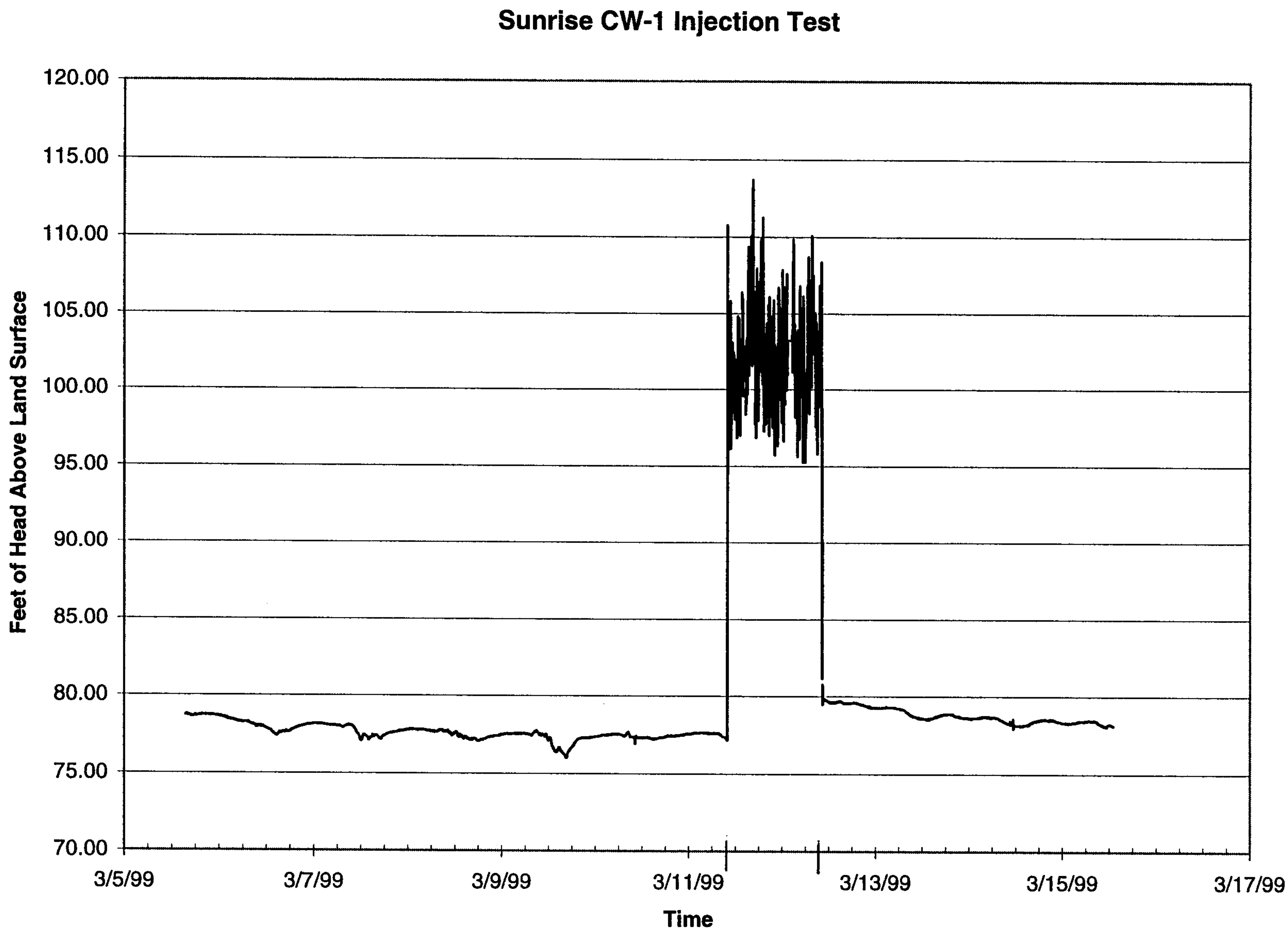

City of Sunrise DZMW-1
Lower Monitor Zone Constant-Rate Pumping Test
Drawdown (feet)
0.00
5.00
10.00
15.00
20.00
25.00
30.00
35.00
40.00
Lower MonitorZone
Upper Monitor Zone
Pumping Rate = 63 gpm
12/20/98 6:00
12/20/98 10:00
12/20/98 14:00
12/20/98 18:00
12/20/98 22:00
12/21/98 2:00
12/21/98 6:00
Date and Time


City of Sunrise DZMW-1
Lower Zone Constant-Rate Pumping Test
Theis Recovery Method
$\Delta S = 1.82 - 0.88 = 1.44\, feet$
Drawdown per log cycle
$T = \frac{264Q}{\Delta S} = \frac{(264)(63)}{1.44} = 11{,}550\, gpd/ft$
T = Transmissivity
Q = Pumping Rate in Gallons per Minute
Pumping Rate = 63 gpm
Drawdown (feet)
5.00
4.50
4.00
3.50
3.00
2.50
2.00
1.50
1.00
0.50
0.00
1.0000
10.0000
100.0000
1000.0000
t/t'

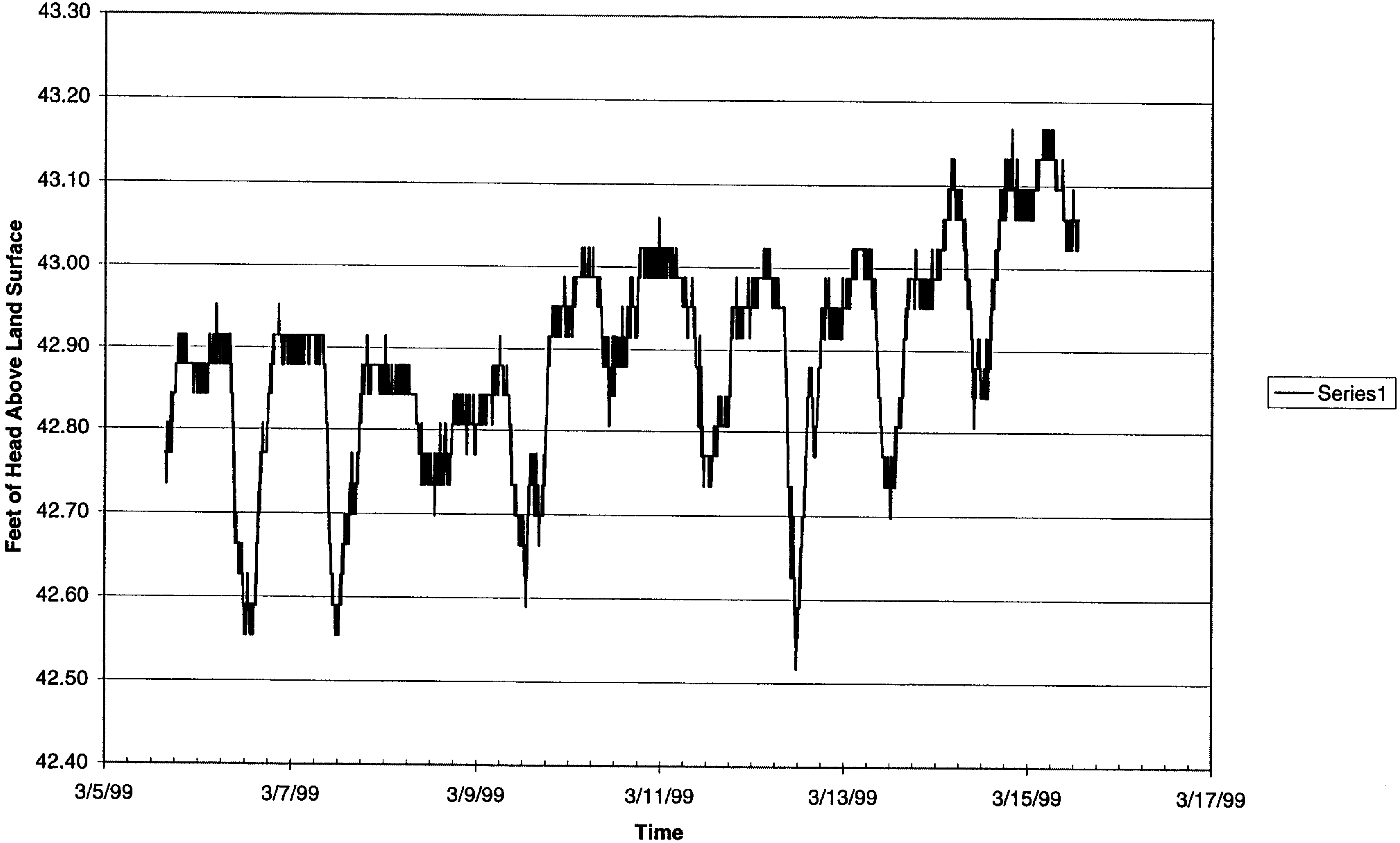
Appendix K

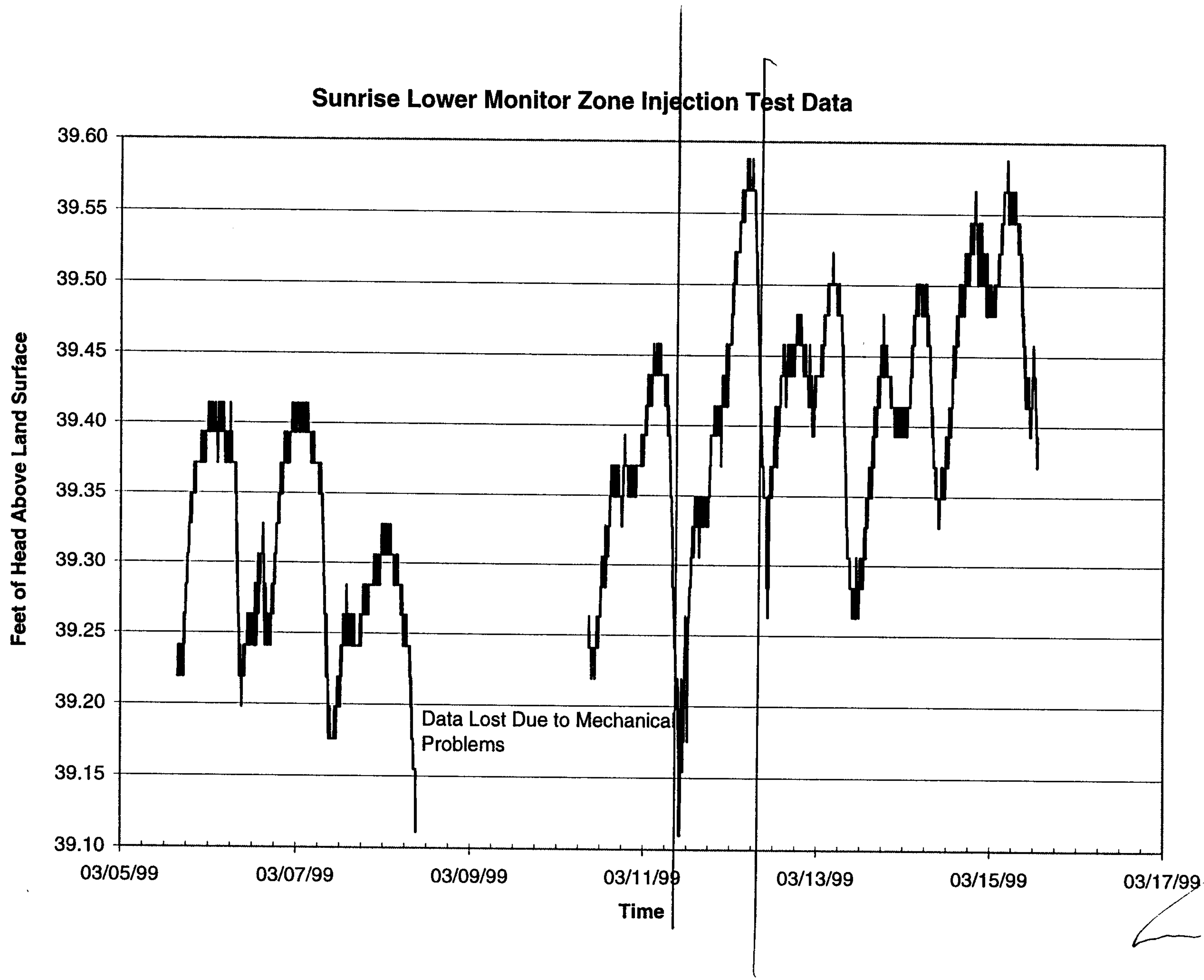
MONTGOMERY WATSON

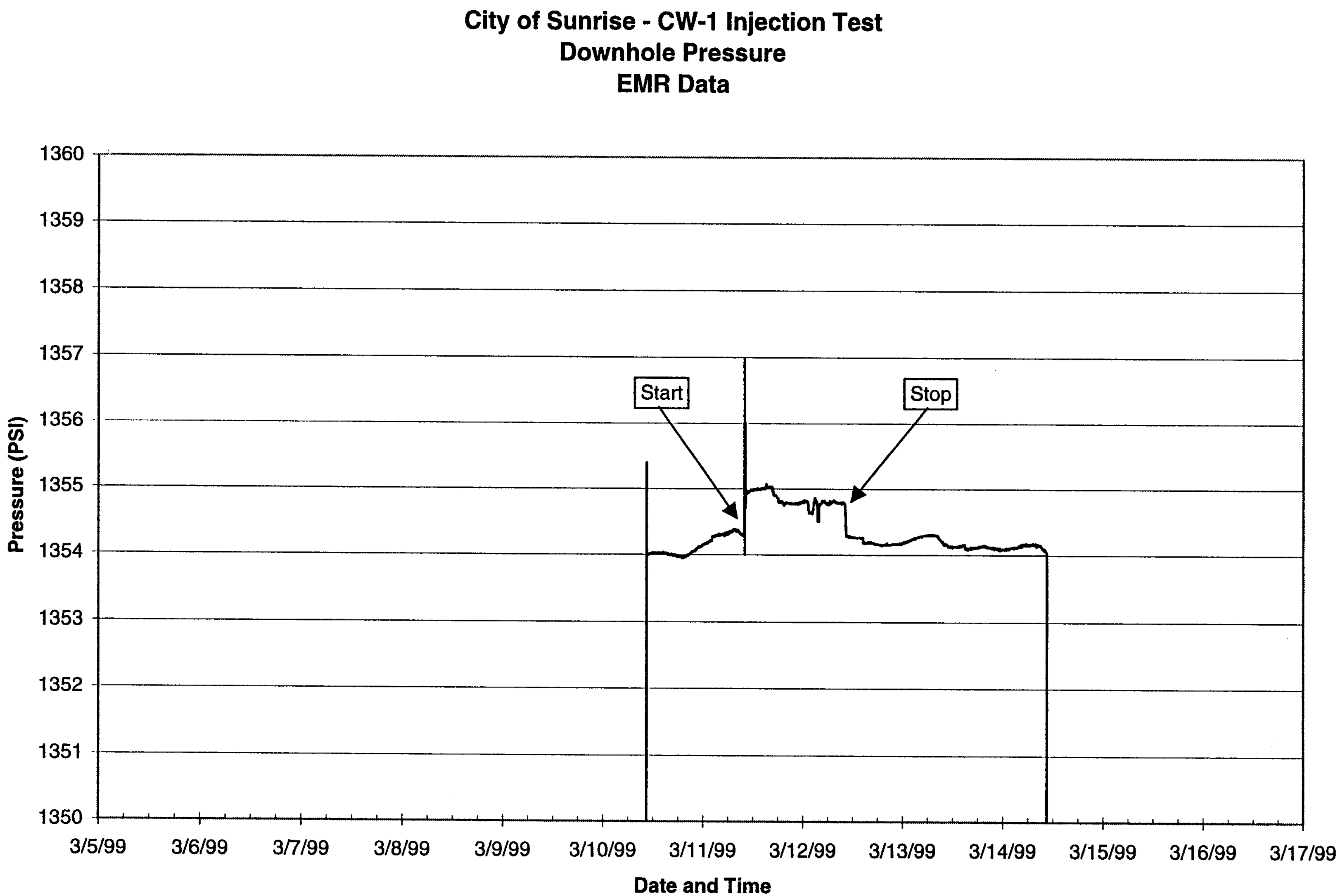
Injection Test Data

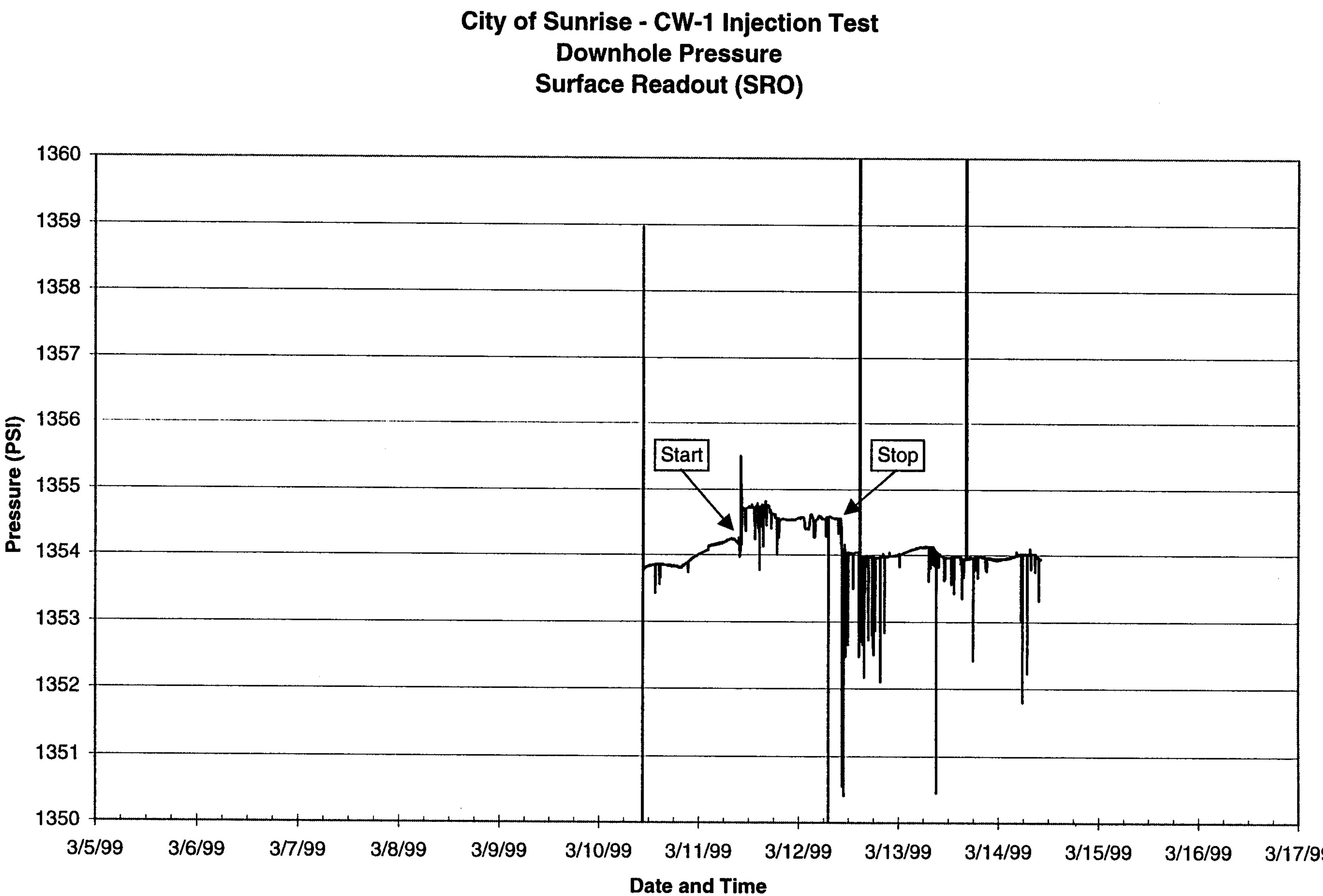

Sunrise CW-1 Injection Test
Feet of Head Above Land Surface
120.00
115.00
110.00
105.00
100.00
95.00
90.00
85.00
80.00
75.00
70.00
3/5/99
3/7/99
3/9/99
3/11/99
3/13/99
3/15/99
3/17/99
Time

Sunrise Upper Monitor Zone Injection Test Data




Sunrise Lower Monitor Zone Injection Test Data
Feet of Head Above Land Surface
39.60
39.55
39.50
39.45
39.40
39.35
39.30
39.25
39.20
39.15
39.10
Data Lost Due to Mechanical Problems
03/05/99
03/07/99
03/09/99
03/11/99
03/13/99
03/15/99
03/17/99
Time


City of Sunrise - CW-1 Injection Test
Downhole Pressure
EMR Data
1360
1359
1358
1357
1356
1355
1354
1353
1352
1351
1350
Pressure (PSI)
Start
Stop
3/5/99
3/6/99
3/7/99
3/8/99
3/9/99
3/10/99
3/11/99
3/12/99
3/13/99
3/14/99
3/15/99
3/16/99
3/17/99
Date and Time



City of Sunrise - CW-1 Injection Test
Downhole Pressure
Surface Readout (SRO)
Pressure (PSI)
1360
1359
1358
1357
1356
1355
1354
1353
1352
1351
1350
Start
Stop
3/5/99
3/6/99
3/7/99
3/8/99
3/9/99
3/10/99
3/11/99
3/12/99
3/13/99
3/14/99
3/15/99
3/16/99
3/17/99
Date and Time

MONTGOMERY WATSON

CW-1 INJECTION TEST WORKSHEET

DATE(S): 3/11-12/1999

CITY OF SUNRISE WTP INJECTION WELL SYSTEM

JOB NUMBER 1324024.24458800

CONTRACTOR: Youngquist Brothers, Inc.

COUNTY: Broward

OWNER: City of Sunrise

TIME	ELAPSED TIME	CW-1 DOWNHOLE PRESSURE	TOTALIZER	INJECTION FLOW RATE	WELLHEAD PRESSURE	ANNULUS PRESSURE	UPPER MONITOR ZONE PRESSURE	LOWER MONITOR ZONE PRESSURE	IW-2 WELLHEAD PRESSURE	COMMENTS
955	-5	1354.16			70.17	22	42.81	39.18		
959	-1									Starting Test
1007	7	1354.55		6,700 gpm	96.15		42.84	39.13		
1008	8	1354.54		6,600gpm		22				CW-1 Flow Meter Down
1011	11	1354.64		6,700 gpm	91.20	22	42.80	39.25		
1022	22	1354.70		6,700 gpm	94.46	22	42.84	39.13		
1028	28									
1030	30		312,404	6,625 gpm						
1044	44	1354.69			91.06	22	42.81	39.15		
1053	53	1354.68		6,657 gpm	90.97	23	42.81	39.15		
										log 422 valve on CW-1 opened
1100	60		465,000	6300 gpm						Plant is sending water to IW-3.
1105	65	1354.51			91.35	23	42.77	39.15		Flow has dtopped.
1118	78	1354.70	564,000	6,300 gpm		23				
1132	92	1354.71		6,430 gpm		23				

Observers' Initials MRS, TGU, NAJ.

TIME	ELAPSED TIME	CW-1 DOWNHOLE PRESSURE	TOTALIZER	INJECTION FLOW RATE	WELLHEAD PRESSURE	ANNULUS PRESSURE	UPPER MONITOR ZONE PRESSURE	LOWER MONITOR ZONE PRESSURE	IW-2 WELLHEAD PRESSURE	COMMENTS
1145	105	1354.68	651,000			23				
1200	120	1354.71	830,125	6,428 gpm						
1215	135	1354.72			93.16			39.18		
1230	150	1354.72	1,053,266	6,379 gpm			42.77			
1300	180	1354.72				23				
1315	195	1354.73				23				
1330	210	1354.73	1,422,000	6,100 gpm						
1345	225			6,500 gpm		23			33.6	
1406	246	1354.73	2,077,000						33.6	
1424	264			6,235 gpm	95.86	23	42.77	39.33		
1430	270	1354.73	2,225,000			23				
1444	284	1354.73			92.18	23	42.77	39.37		
1500	300	1354.74			94.88	23				Spoke with Tom about
		1354.76	2,511,000			23				increasing the Flow.
1515	315	1354.75	2,974,000	6,264 gpm	99.95	23	42.84	39.35	33.7	
1535	335	1354.76	3,222,000		97.96		42.84	39.35		
1545	345	1354.76		6,314 gpm	100.88	23	42.84	39.35		
1600	360	1354.83		6,551 gpm		22				
1620	380	1354.75		6,004 gpm		27.5			33.5	
1633	393									
1737	457	1354.64				22				
1832	512	1354.56				21				
2000	600	1354.56	3,798,000	5,543 gpm		20.5				

Observers' Initials MRS, TGU, NAJ.

WRTC_INJECTION TEST WORKSHEET (REV 4/16/97)

TIME	ELAPSED TIME	CW-1 DOWNHOLE PRESSURE	TOTALIZER	INJECTION FLOW RATE	WELLHEAD PRESSURE	ANNULUS PRESSURE	UPPER MONITOR ZONE PRESSURE	LOWER MONITOR ZONE PRESSURE	IW-2 WELLHEAD PRESSURE	COMMENTS
2100	660	1354.53	4,195,000	5,854 gpm	97.81	20	42.95	39.39		
2140	700	1354.54	4,276,000	5,805 gpm	93.84	19.75	42.98	39.41		
2245	765	1354.54			89.33	19.75	42.95	39.43		
2255	775		4,768,000	5,805 gpm						
2350	830	1354.56			98.36	19	42.95	39.46		
0100	900		5,162,000	5,854						
0102	902	1354.57			95.83	19	42.95	39.50		
0110	910		5,469,000	5,953						
0200	960	1354.40			85.65	18	42.99	39.52		
0210	970		5,787,000	4,936						Arrived Unit was off-pressed
0220	980		5,791,000	3394-4674						[power]. Shut off automatically
			5,803,000							low battery light on, not charging
0246	1006		5,820,000	5395-6264						Turned on
0248	1008		5,827,000	6,379						Plant increased flows
			5,841,000	6,428						
0250	1010		5,855,000	6,625						Shut off
0253	1013		Called MRS - will continue taking hourly readings, power and fuses ok.							
0318	1038		6,040,500	6,674						
0330	1050	1354.56			94.60	18	43.02	39.57		
0400	1080	1354.37			88.61	18	42.99	39.57		
0411	1091		6,377,050	6,264						
0500	1140	1354.59			97.74	17.5	42.99	39.57		
0508	1148		6,734,098							

Observers' Initials MRS, TGU, NAJ.

TIME	ELAPSED TIME	CW-1 DOWNHOLE PRESSURE	TOTALIZER	INJECTION FLOW RATE	WELLHEAD PRESSURE	ANNULUS PRESSURE	UPPER MONITOR ZONE PRESSURE	LOWER MONITOR ZONE PRESSURE	IW-2 WELLHEAD PRESSURE	COMMENTS
0556	1196		7,034,770							
0606	1206	1354.54			91.57	17	42.99	39.57		
0703	1263	1354.57	7,408,570	6,838	91.53	16.5	42.95	39.54		
0719	1279		7,598,850							Turn on
0725	1285		7,636,650							Shut off automatically
0746	1306	1354.58			102.94	16.5	42.95	39.48		
0754	1314		7,813,550	5,756						Turn on
0756	1316		7,827,226	6,838						
0757	1317		7,834,064	6,838						
										Shut off automatically
0830	1350	1354.56	8,049,455	6,527						
0930	1410		8,433,455	6,400					33.33	
1000	1440	1354.55	8,625,455		93.91	16.5	42.69	39.31		
1013	1453		8,709,955							Starting to shut down
1014	1	1354.44			88.78		42.66	39.31		
1025	11	1354.05	8,739,955	0	68.27		42.66	39.33		
1027	13	1354.05			72.73		42.69	39.31		

Appendix L

Pressure Test Data
CW-1

MONTGOMERY WATSON

CW-1 PRESSURE TEST DATA

DATE(S): November 9, 1998

CITY OF SUNRISE **SAWGRASS CONCENTRATE WELL NO. 1**

JOBNUMBER 1324024.26470100

CONTRACTOR: Youngquist Brothers, Inc.

PROJECT MANAGER: Helen Hickman

COUNTY: Broward

OWNER: City of Sunrise

DESCRIPTION OF OPERATIONS: Pressure Test 24-inch casing

START TIME: 9:21

FINISH TIME: 10:21

CASING SIZE: 24-inch dia.

GAGE SERIAL NUMBER: 2708412

INITIAL PRESSURE: 159.5 psi

TIME	TOTAL MINUTES	PRESSURE	COMMENTS
9:21	0	159.5	Start test. DEP witness present.
9:31	10	159.5	
9:36	15	159.5	
9:41	20	159	
9:46	25	159	
9:51	30	159	
9:56	35	159	
10:01	40	159	
10:06	45	159	
10:11	50	159	
10:16	55	159	
10:21	60	159	Test complete.
10:27		159	Depressurizing casing.
10:40		0	46 gallons of water drained off.

Witnessed By:

J.P.Listick, P.G., FDEP

Certified By: M Randal Skinner

M Randal Skinner, P.G., Hydrologist

MONTGOMERY WATSON

CW-1 PRESSURE TEST DATA

DATE(S): November 17, 1998

CITY OF SUNRISE **SAWGRASS CONCENTRATE WELL NO. 1**

JOBNUMBER 1324024.26470100

CONTRACTOR: Youngquist Brothers, Inc.

PROJECT MANAGER: Helen Hickman

COUNTY: Broward
OWNER: City of Sunrise

DESCRIPTION OF OPERATIONS: Pressure test of annular space between 24-inch casing and 20-inch injection tubing

START TIME: 8:45
FINISH TIME: 9:45
CASING SIZE: 24- and 20-inch
GAGE SERIAL NUMBER: 2708412

INITIAL PRESSURE: 157 psi

TIME	TOTAL MINUTES	ANNULUS PRESSURE	COMMENTS
8:45	0:00	157	
8:50	0:05	157	
8:55	0:10	156.75	
9:00	0:15	156.5	
9:05	0:20	156.5	
9:10	0:25	156.5	
9:15	0:30	156.5	
9:20	0:35	156.5	
9:25	0:40	156	
9:30	0:45	156	
9:35	0:50	156	
9:40	0:55	156	
9:45	1:00	156	

Witnessed By: ______________________
J.P.Listick, P.G., FDEP

Certified By: M Randal Skinner
M Randal Skinner, P.G., Hydrologist

Pressure Test Data
DZMW-1

MONTGOMERY WATSON

DZMW-1 PRESSURE TEST DATA

DATE(S): December 2, 1998

CITY OF SUNRISE **SAWGRASS CONCENTRATE WELL NO. 1**

JOBNUMBER 1324024.26470100

CONTRACTOR: Youngquist Brothers, Inc.

PROJECT MANAGER: Helen Hickman

COUNTY: Broward
OWNER: City of Sunrise

DESCRIPTION OF OPERATIONS: Pressure Test 14-inch casing

START TIME: 19:30
FINISH TIME: 20:30
CASING SIZE: 14-inch dia.
GAGE SERIAL NUMBER: 2708412

INITIAL PRESSURE: 154 psi

TIME	TOTAL MINUTES	PRESSURE	COMMENTS
19:30	0	154	
19:35	5	153	
19:40	10	153	
19:45	15	152	
19:50	20	152	
19:55	25	151	
20:00	30	151	
20:05	35	150	
20:10	40	150	
20:15	45	150	
20:20	50	150	
20:25	55	150	
20:30	60	149.5	Pass Pressure test @ 3.0% loss.
			Recover 8 gallons of fluid.

Witnessed By: M Randal Skinner
M Randal Skinner, P.G., Hydrologist

Certified By: M Randal Skinner
M Randal Skinner, P.G., Hydrologist

Observers' Initials MRS

MONTGOMERY WATSON

DZMW-1 PRESSURE TEST DATA

DATE(S): December 10, 1998

CITY OF SUNRISE

SAWGRASS CONCENTRATE WELL NO. 1

JOBNUMBER 1324024.26470100

CONTRACTOR: Youngquist Brothers, Inc.

PROJECT MANAGER: Helen Hickman

COUNTY: Broward

OWNER: City of Sunrise

DESCRIPTION OF OPERATIONS: Pressure Test 6-inch casing

START TIME: 19:30

FINISH TIME: 20:30

CASING SIZE: 6-inch dia.

GAGE SERIAL NUMBER: 2708412

INITIAL PRESSU 151 psi

TIME	TOTAL MINUTES	PRESSURE	PACKER PRESSURE	COMMENTS
2:30	0	151	211	
2:35	5	151	211	
2:40	10	151	211	
2:45	15	150.5	211	
2:50	20	150.5	211	
2:55	25	150	211	
3:00	30	150	211	
3:05	35	149.5	211	
3:10	40	150	211	
3:15	45	150	211	
3:20	50	150.5	211	
3:25	55	150.5	211	
3:30	60	151	211	Pass Pressure test @ 0.0% loss.

Witnessed By: M Randal Skinner

M Randal Skinner, P.G., Hydrologist

Certified By: M Randal Skinner

M Randal Skinner, P.G., Hydrologist

Observers' I
Initials MRS

WRTC_PTD

Appendix M

MONTGOMERY WATSON

CW-1 Final Casing Video