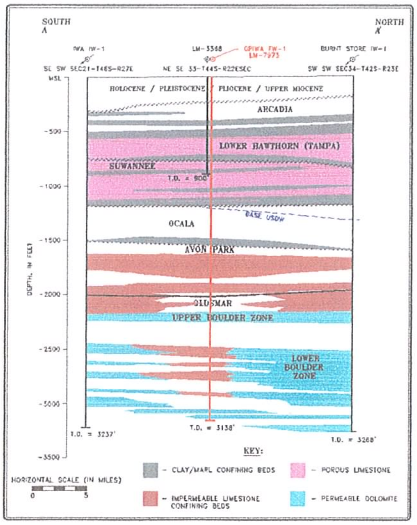
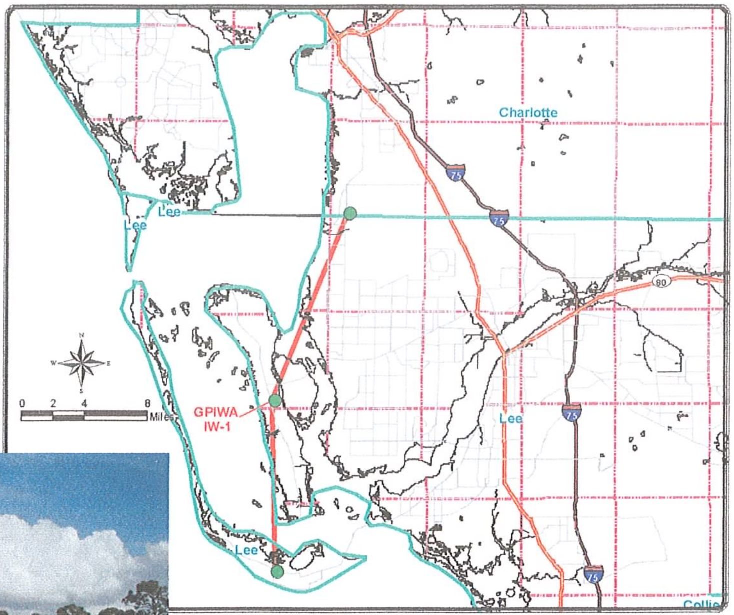
Completion Report for:
GREATER PINE ISLAND WATER ASSOCIATION CLASS I INJECTION WELL SYSTEM VOLUME I



Greater Pine Island Water Association, Inc.



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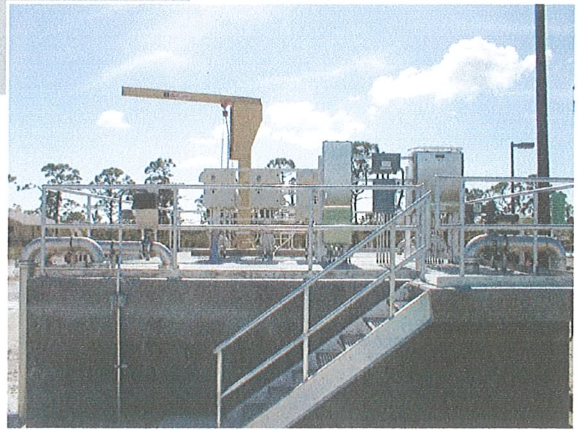

January, 2005

COMPLETION REPORT FOR
GREATER PINE ISLAND WATER ASSOCIATION CLASS I INJECTION WELL SYSTEM, PINE ISLAND, LEE COUNTY, FLORIDA

Prepared for:

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January, 2005

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Project Number
01-04409.01

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I. CONCLUSIONS AND RECOMMENDATIONS

A. Conclusions

The following conclusions are made as a result of the drilling and initial testing undertaken as part of the Greater Pine Island Water Association (GPIWA) injection well (IW) system installation:

- The GPIWA Class I injection well (LM-7973) was permitted for, and is intended to ultimately be used for, disposal of up to a combined four million (MG) gallons per day (gpd) of reverse osmosis concentrate from the GPIWA water treatment plant and treated wastewater from the Lee County Utilities (LCU) wastewater treatment plant (WWTP).

- The well was constructed with a 18-inch outside diameter, 0.375 inch wall thickness, steel injection casing, a permanent tubing packer, and a 13.375-inch outside diameter fiberglass tubing.

- A corrosion-prevention fluid (Baracor 100) was emplaced in the annulus between the fiberglass tubing and the steel injection casing.

- Total depth of the injection well is 3138 feet below pad level (BPL); the open-hole portion of the well extends from 1955 feet to total depth.

- The injection zone is the highly permeable, fractured and cavernous, "Boulder Zone" of the (Early Eocene-age) Oldsmar formation. Two permeable zones are present in the open-hole section of the well. These are from approximately 1975 to 2250 feet and from approximately 3015 to 3125 feet BPL.

- The upper permeable zone has a calculated transmissivity of about 100,000 gallons per day per foot (gpd/ft); the lower zone has a calculated transmissivity of about 150,000 gpd/ft. Together these zones are capable of disposing of the design injection volume of 4.0 MGD. Singularly, neither zone would be capable of accepting that volume without unacceptable high injection pressures.

- The base of the underground source of drinking water (USDW) at the site was determined to occur at an approximate depth of 1217 feet BPL.

- A dual zone monitoring well (LM-7974) was constructed approximately 100 feet northeast of the injection well.

- The two zones to be monitored by the dual zone monitoring well are the Late Eocene age (33 to 47 million years ago) Ocala formation between the depths of 1295 and 1470 feet BPL (approximately 485 feet above the top of the injection zone) and the lower part of the Oligocene age (29 to 37 mya) Suwannee formation between the depths of 985 and 1049 feet (approximately 900 feet above the top of the injection zone).

- Surface facilities at the site include two cement well pads (IW and DZMW), an injection pumping system, a 450 gallon annular fluid tank, an emergency generator, and various control and monitoring systems.

B. Recommendations

The following recommendations are made as a result of the drilling and initial testing undertaken as part of the GPIWA injection well system installation:

- A request should be submitted to the Florida Department of Environmental Protection (FDEP) to begin operational testing for the GPIWA injection well system.

- Those parameters delineated in the supporting documentation for the construction permit application, and included by reference in the limiting conditions of the FDEP Class I construction permit, should be monitored at the required frequencies during the operational testing period as indicated herein.

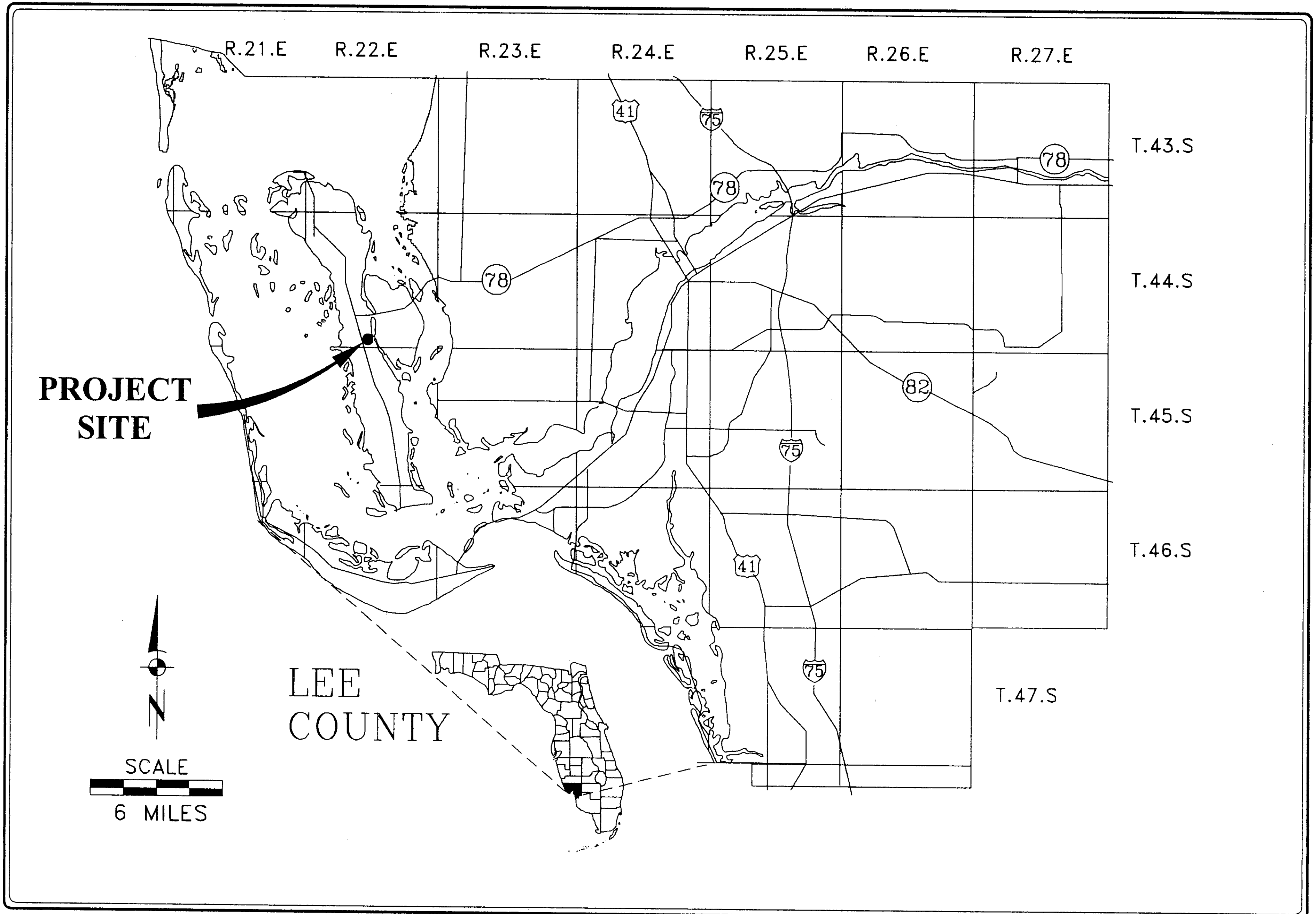
II. INTRODUCTION

This report describes the installation and testing of the Class I injection well (LM-7973) and the dual zone monitoring well (LM-7974) at the GPIWA reverse osmosis (RO) water treatment plant (WTP) site in western Lee County, Florida. A general site location map is provided as Figure 2-1. A site map showing the location of the injection well system relative to the WTP is provided as Figure 2-2.

The wells were constructed in conformance with the well specifications prepared as part of the supporting documentation (WRS, 2003) submitted to the Florida Department of Environmental Protection (FDEP) along with the Underground Injection Control (UIC) permit application. The FDEP UIC Class I well construction permit (166871-001-UC) was issued on December 17, 2003. A copy of this permit, along with copies of the South Florida Water Management District (SFWMD) drilling permits, is included in Appendix A of this report.

The purpose of the injection well (IW) is to dispose of up to a combined volume of 4 MGD of RO concentrate generated by the WTP and reuse quality wastewater from the LCU Pine Island WWTP. RO concentrate is classified as an industrial waste and therefore requires a discharge permit. Underground injection, via a tubing and packer injection well, must be into a permeable zone isolated by upper confinement from the base of any underground source of drinking water (USDW). The USDW is defined as having a total dissolved solids (TDS) concentration less than 10,000 milligrams per liter (mg/l).

Prior to commencement of drilling of the IW and the dual zone monitoring wells (DZMW), a well prognosis was prepared for each well. A copy of these well prognoses is provided in Appendix B of this report. Anticipated stratigraphic tops, lithologic and water sample collection procedures, and potential zones for packer testing and coring were delineated.



Water Resource Solutions	PROJECT NAME: GPIWA IW	DWG. NUMBER: A-014409PA2-2
	PROJECT NUMBER: 01-04409.HO	DATE: 01/26/05

FIGURE 2-1. MAP SHOWING LOCATION OF GPIWA WATER TREATMENT PLANT SITE.

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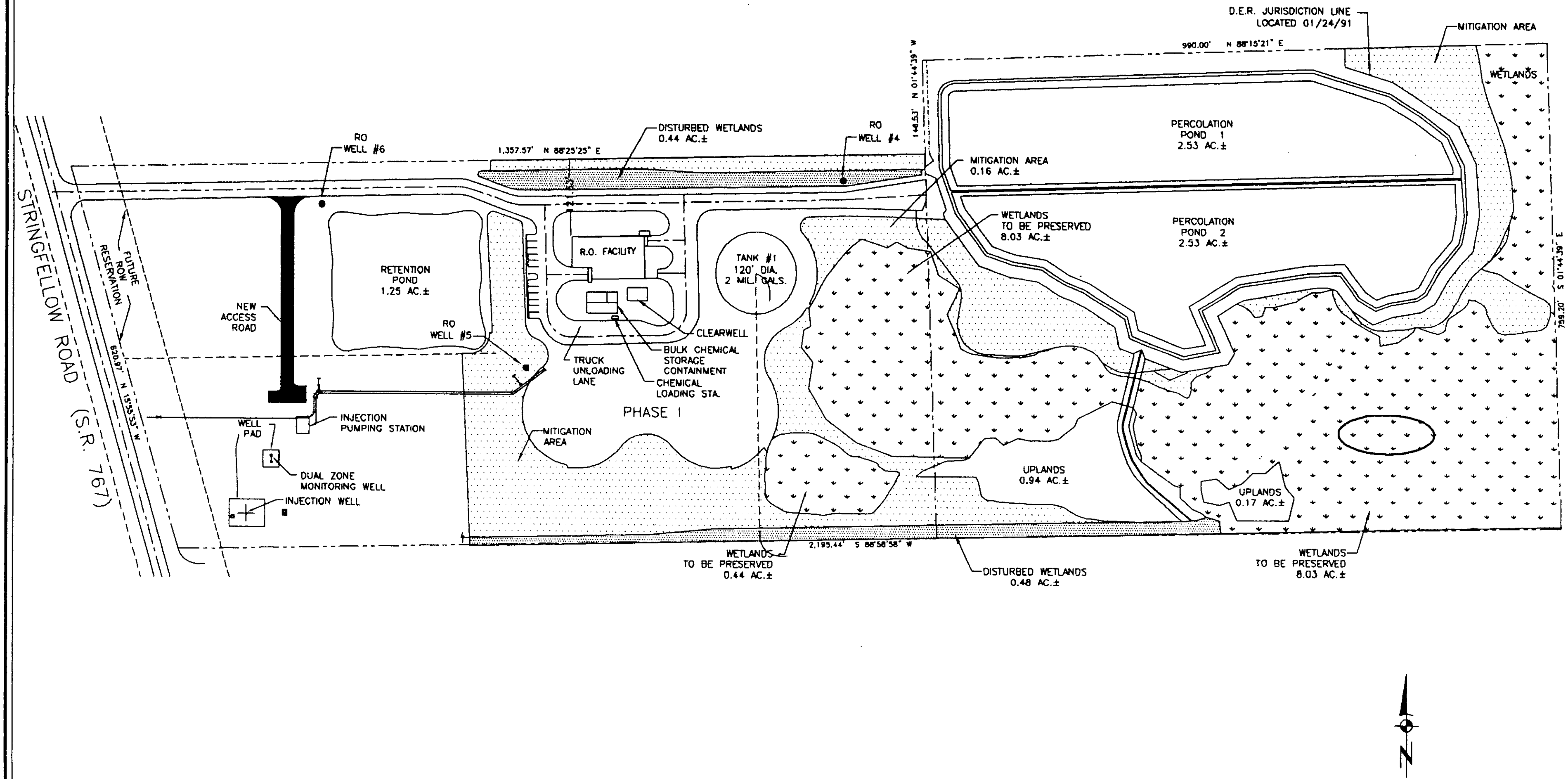


Water Resource Solutions	PROJECT NAME: GPIWA IW	DWG. NUMBER: A-014409P32-2
	PROJECT NUMBER: 01-04409.HO	DATE: 01/26/05

FIGURE 2-2. DETAILED GPIWA WTP SITE MAP.

Well construction operations, for the subsurface portion of the GPIWA injection well system, commenced on March 23, 2004 and were completed on August 3, 2004. Daily reports for the IW and the DZMW are included in Appendix C of this report. The wells were installed by Youngquist Brothers, Inc. drilling company, Fort Myers, Florida. Well site geology, construction oversight, and regulatory compliance were provided by Water Resource Solutions, Inc (WRS).

In conformance with the limiting conditions of the FDEP construction permit, weekly construction progress reports were submitted to the FDEP and members of the Technical Advisory Committee (TAC), composed of the SFWMD and the United States Geological Survey. FDEP personnel were notified of significant testing events during construction of both the IW and the DZMW, and were present for casing pressure testing events. Copies of all geophysical logs, lithologic logs, casing pressure test results, casing mill certificates, core and packer test data, water quality data, and other pertinent information, were supplied to the FDEP and the TAC along with the weekly progress reports.

III. INJECTION WELL (LM-7973) INSTALLATION

A. Pad Monitoring Wells

Prior to commencement of drilling operations for the IW, a gravel subbase for the steel drilling pads, was installed at the site. Three shallow groundwater monitoring wells (LM-7999, LM-7975, and LM-7976) were installed outside of the gravel subbase, one proximal to each corner. An existing water-table aquifer monitoring well was used as the fourth (northwest) shallow pad monitoring well. The existing well is the background monitoring well for the on-site concentrate disposal percolation ponds. Construction details for the four pad monitoring wells are summarized on Table 3-1, a schematic illustration of a typical pad monitoring well is provided as Figure 3-1, and a site map showing the location of the pad monitoring wells is provided as Figure 3-2.

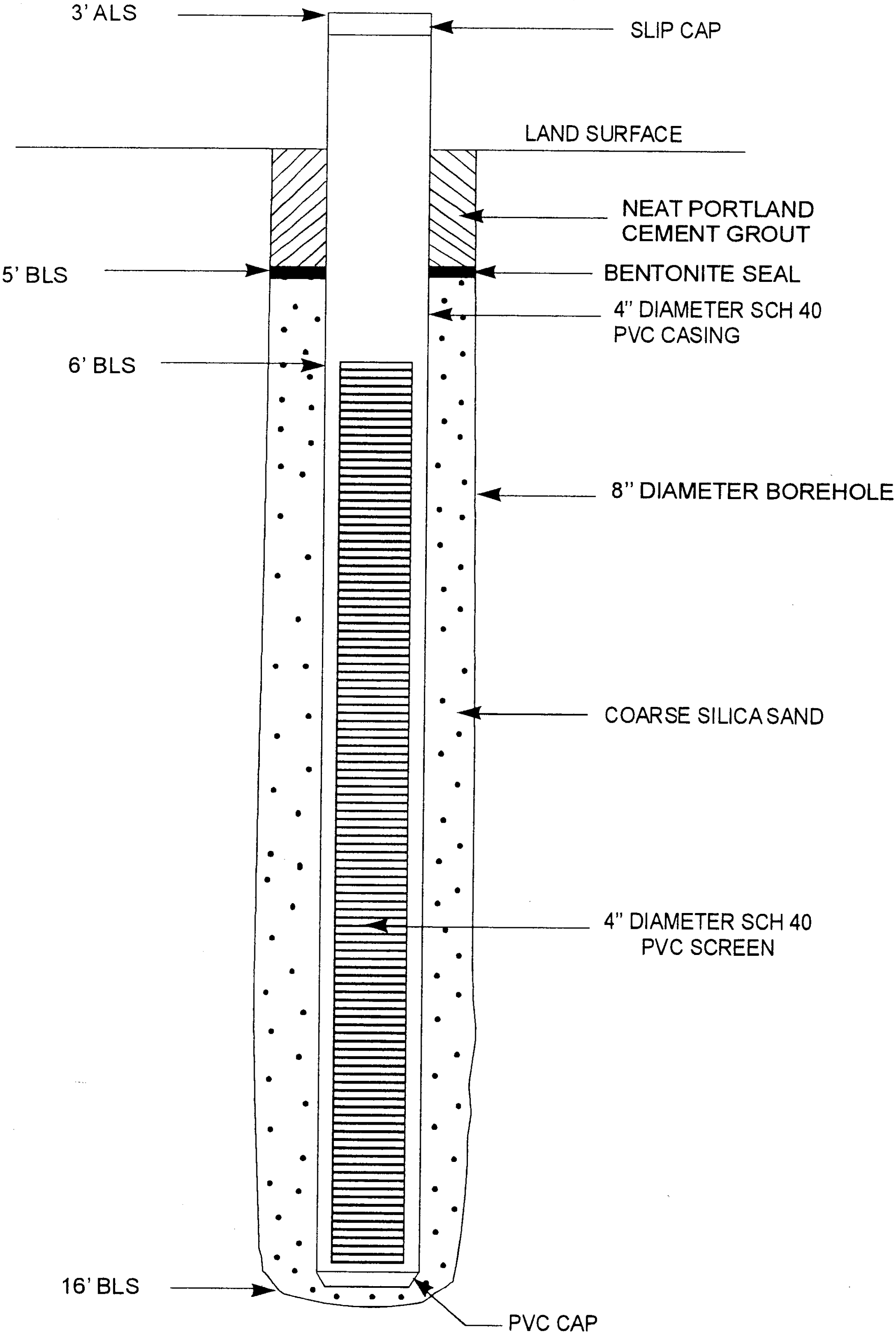
Subsequent to installation, the measuring points of each of the pad monitoring wells was surveyed relative to National Geodetic Vertical Datum (NGVD) by a registered land surveyor. Lithologic descriptions for the four pad monitoring wells are included in Appendix D of this report. The purpose of the pad monitoring wells was to provide a means of assessing any potential impacts to the shallow surficial aquifer at the site resulting from uncontrolled leaks or spills of saltwater emanating from deep saline aquifers during the drilling operations or from equipment fueling.

The pad monitoring wells were monitored each week during the drilling operations for water levels, temperature, conductivity, dissolved chloride concentrations, and pH. Copies of the weekly monitoring reports for the four pad monitoring wells are included in Appendix E of this report. No significant changes in water quality in the surficial aquifer were recorded during the installation of the IW and the DZMW.

TABLE 3-1. SUMMARY OF PAD MONITORING WELL CONSTRUCTION DETAILS

WELL #	TOTAL DEPTH BELOW LAND SURFACE (ft)	CASING DEPTH (ft)	SCREENED INTERVAL (ft)	CASING DIAMETER (in)	TOP OF CASING MEASURING POINT ELEVATION (NGVD)	CASING MATERIAL
LM-3685 (MW-1)*	15.0	4.0	4.0 - 14.0	2	9.65	Schedule 40 PVC
LM-7999 (MW-2)	16.9	6.9	6.9 - 16.9	4	9.78	Schedule 40 PVC
LM-7975 (MW-3)	16.3	6.3	6.3 - 16.3	4	11.04	Schedule 40 PVC
LM-7976 (MW-4)	17.0	7.0	7.0 - 17.0	4	10.61	Schedule 40 PVC

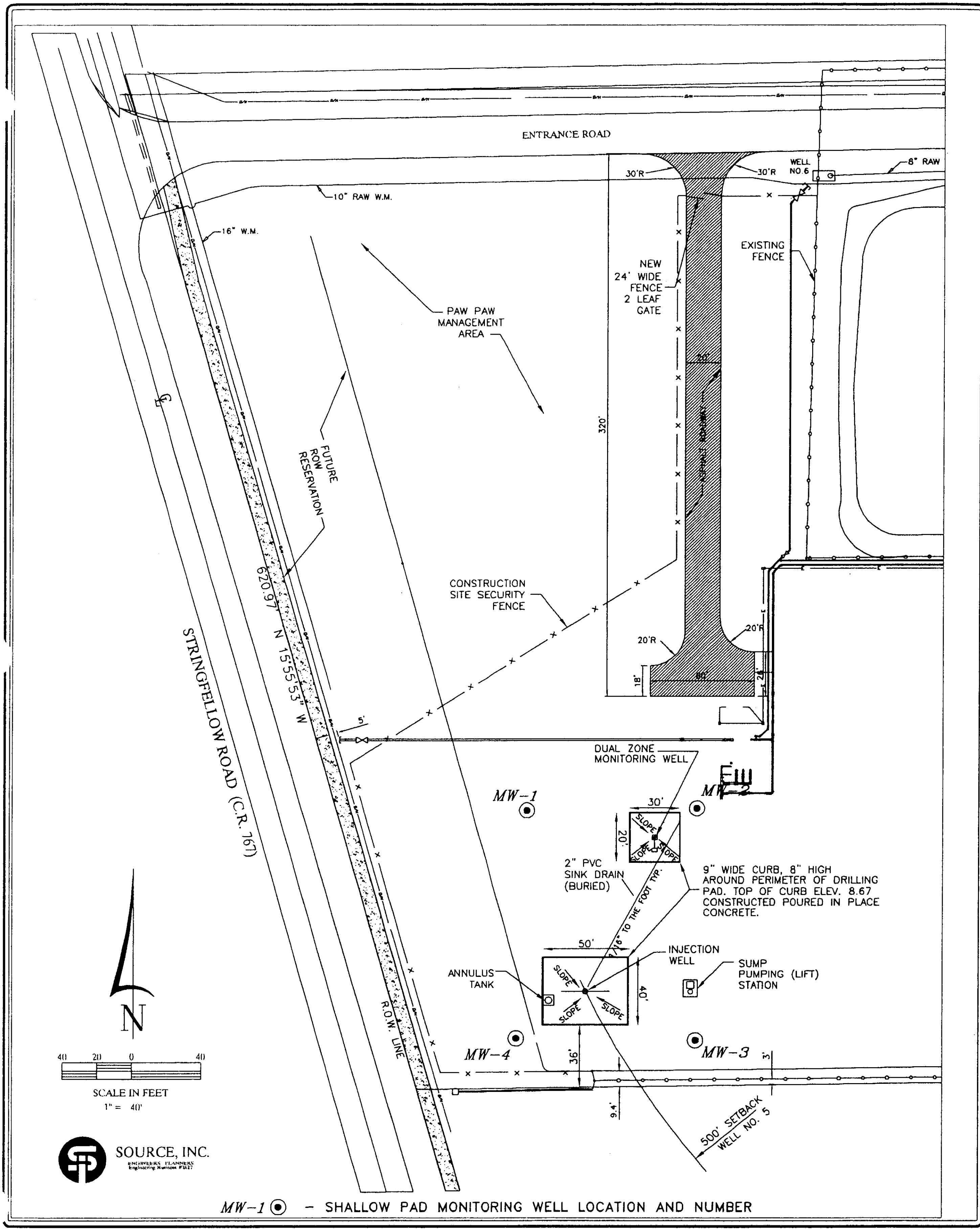
* Existing Well



NOTE: STEEL PROTECTIVE CASING TO BE INSTALLED AT THE END OF THE JOB

Water Resource Solutions	PROJECT NAME: GPIWA - INJECTION WELL	
	PROJECT NUMBER: 01-04409.HO	DATE: 03/04/04

FIGURE 3-1. SCHEMATIC DIAGRAM OF PAD MONITORING WELLS



Water Resource Solutions	PROJECT NAME: GPIWA–IW	DWG. NUMBER: A-014409H4_c-1
	PROJECT NUMBER: 01-04409.HO	DATE: 01/26/04

FIGURE 3-2. WELL SITE LAYOUT MAP.

B. Injection Well (LM-7973)

A brief summary of the construction sequence for the IW is provided as Table 3-2. A schematic illustration of the IW is presented as Figure 3-3. A summary of the construction details for the IW is provided as Table 3-3. The lithologic log for the IW is included in appendix D of this report.

A closed drilling fluid system, utilizing the mud rotary method to the upper casing setting depth of 600 feet and the reverse air rotary method below that depth, was used for drilling of both the IW and the DZMW.

The IW was permitted and constructed with a tubing and packer design. The tubing installed is of 13.375-inch outside diameter reinforced fiberglass plastic (RFP) manufacture. The packer installed is an YBI permanent packer. The annular fluid emplaced between the tubing and the 18-inch outside diameter steel injection casing is Halliburton Baracor 100. Copies of the mill certificates for the IW casings are included in Appendix F of this report. Copies of the casing logs for the IW are included in Appendix G. Copies of the cement records for the IW casing setting are included in Appendix H of this report. Copies of the cement logs for the IW casing setting are included in Appendix I. Copies of the tubing manufacturer's information is provided in Appendix F.

TABLE 3-2.

SUMMARY OF INJECTION WELL (LM-7973) CONSTRUCTION SEQUENCE

Date	Activities of Significance
2/22/04	Began site preparation
03/05/04	Completed installation and development of four shallow pad monitoring wells.
03/12/04	Began moving in Youngquist Bros. Rig #311 and installing gravel subbase.
03/15/04	Moved rig and equipment onto gravel subbase.
03/23/04	Spudded injection well at 2:08 PM. Drilled 12.25-inch diameter pilot hole to 58 feet. Completed reaming 52.5-inch diameter hole to 59 feet. Landed 48-inch diameter (0.375-inch wall thickness) steel casing at 55 feet. Pressure grouted surface casing with 89 barrels neat cement.
03/25/04	Drilled 12.25-inch diameter pilot-hole to 605 feet. Ran Cal/GR, Sonic, and DIL logs.
03/29/04	Completed reaming 46-inch diameter hole to 605 feet. Ran GR/Caliper log. Landed 36-inch diameter steel casing at 600 feet. Pressure grouted with 335 barrels 12% and 181 barrels neat cement.
04/01/04	Switched to reverse air rotary system.
04/02/04	Completed drilling 12.25-inch diameter pilot-hole to 1118 feet. Ran Cal/GR log. Ran packer test #1 (single packer) of interval 1060-1118 feet.
04/04/04	Completed drilling 12.25-inch diameter pilot hole to 1260 feet. Ran GR/Caliper/Temperature, DIL, BHC Sonic, and Flowmeter logs.
04/05/04	Ran packer test #2 (single packer) of interval 1229-1260 feet. Completed backplugging of pilot hole to 950 feet with 80 barrels of 12% bentonite cement.
04/12/04	Completed reaming 34 1/2-inch diameter hole to 1245 feet.
04/18/04	Ran GR-Caliper log.
04/19/04	Landed 28-inch diameter steel casing at 1240 feet.
04/19/04	Pressure grouted first stage with 135 barrels neat cement.

TABLE 3-2. (CONTINUED)

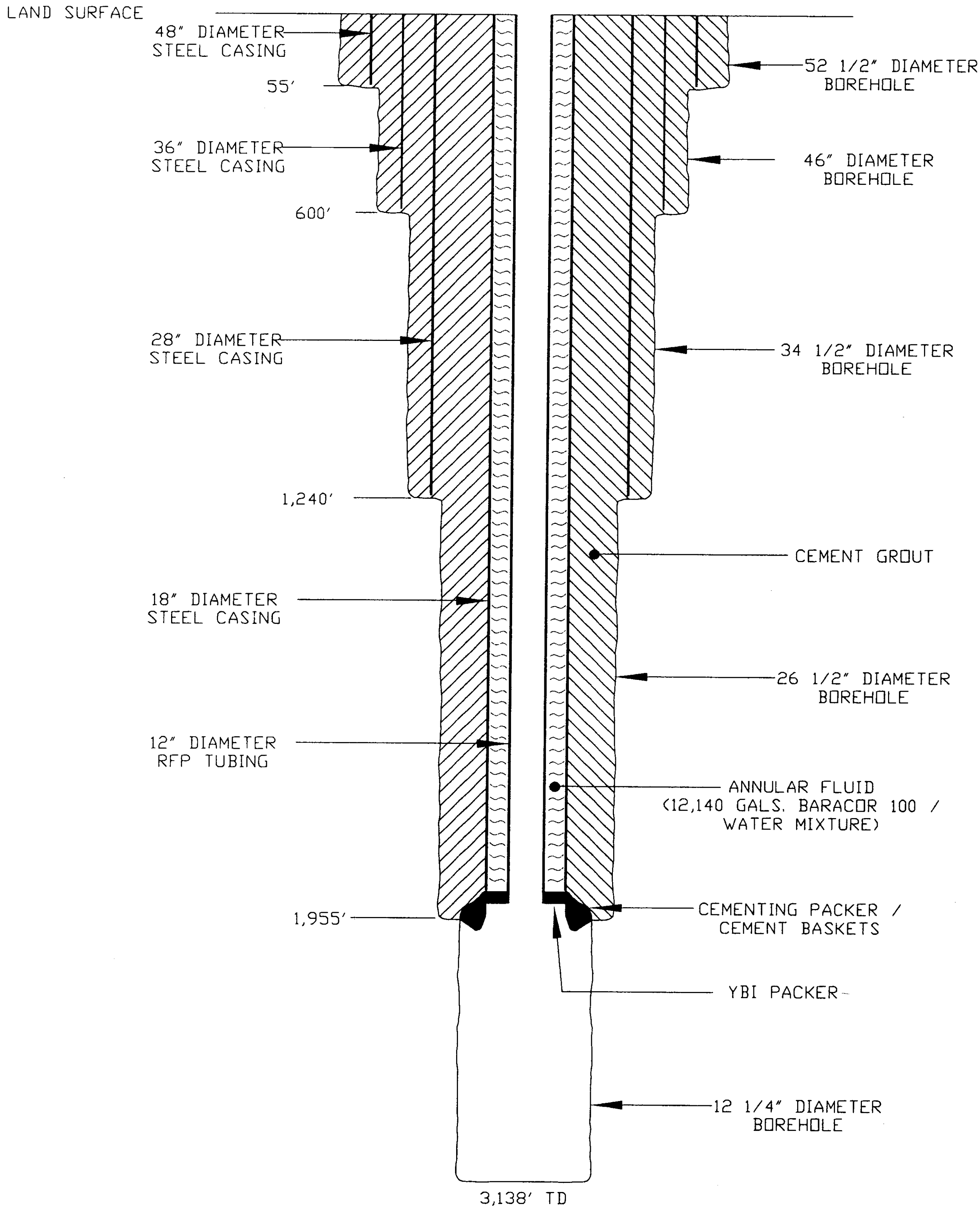
SUMMARY OF INJECTION WELL (LM-7973) CONSTRUCTION SEQUENCE

Date	Activities of Significance
04/21/04	Completed cementing 28-inch casing annulus.
04/23/04	Completed drilling 12.25-inch diameter pilot hole to 1790 feet.
04/24/04	Cut Core #1 (1790-1808 feet).
04/25/04	Cut Core #2 (1820-1840 feet).
04/28/04	Cut Core #3 (1946-1966 feet).
04/29/04	Cut Core #4 (1980-2000 feet).
04/30/04	Cut Core #5 (2014-2030 feet)
05/03/04	Drilled 12.25-inch diameter pilot hole to 3015 feet. Ran GR/Caliper/Temperature, Dual Induction, BHC sonic, Static Flowmeter logs.
05/04/04	Ran Dynamic Flow log, Ran Video Survey from 1240 to 3008 feet.
05/06/04	Ran packer test #3 (straddle) of interval 1720-1738 feet.
05/08/04	Ran packer test #4 (single packer) of interval 1956-3015 feet.
05/13/04	Ran packer test #5 (straddle) of interval 1503-1521 feet.
05/14/04	Completed setting a cement basket assembly at 1953 feet.
05/17/04	Completed backplugging 12.25-inch diameter pilot hole to 1228 feet with 392 barrels 12% bentonite cement and 23.5 barrels neat cement.
05/28/04	Completed reaming 26.5-inch diameter hole to 1952 feet.
06/06/04	Completed reaming 18.25-inch diameter hole to 3015 feet, drilled 123 feet new footage (to 3138 feet). Completed cleaning out reamed hole to 3138 feet. Ran GR/Caliper log from total depth to 1240 feet.
06/07/04	Landed 18-inch diameter steel casing with YBI smooth bore packer seat.

TABLE 3-2. (CONTINUED)

SUMMARY OF INJECTION WELL (LM-7973) CONSTRUCTION SEQUENCE

Date	Activities of Significance
06/14/04	Completed cementing annulus to 278 feet. Ran Video Survey. Ran Sector Bond log.
06/15/04	Ran pressure test on 18-inch diameter injection casing.
06/18/04	Installed 13.375-inch outside diameter fiberglass tubing. Installed annular fluid.
06/19/04	Ran Video Survey of tubing and open hole section (could not get pass 3081 feet due to cavernous zone and ledges).
06/21/04	Purged well and sampled for Primary and Secondary Drinking Water analyses. Conducted annular pressure test. Witnessed by FDEP.
06/23/04	Began rigging down and moving equipment to the DZMW site.
11/09/04	Conducted Radioactive Tracer Survey test.
01/06/05	Conducted injection test.



Water Resource Solutions	PROJECT NAME: GPIWA-IW	DWG. NUMBER: A-014409H4_a1
	PROJECT NUMBER: 01-04409.HO	DATE: 01/26/05

FIGURE 3-3. SCHEMATIC DIAGRAM SHOWING INJECTION WELL (LM-7973) CONSTRUCTION DETAILS.

TABLE 3-3.

SUMMARY OF INJECTION WELL CONSTRUCTION DETAILS

CASING TYPE	CASING DIAMETER (OD-in.)	CASING MATERIAL	SETTING DEPTH (ft.)
Conductor	48	Steel	55
Upper	36	Steel	600
Intermediate	28	Steel	1240
Injection	18	Steel	1955
Tubing	12	FRP	1951

Other Construction Details:

Total Depth of Well: 3138'
Annular Fluid Between RFP Tubing and 18" Injection Casing:
    12140 Gallons Baracor 100/Water Mix
Tubing Packer: YBI Retrievable Type

IV. DUAL ZONE MONITORING WELL (LM-7974) INSTALLATION

The DZMW was installed at the site using the same Youngquist Brothers, Inc. (YBI) drilling rig. Construction operations began after the drilling of the IW was concluded. Construction of the DZMW commenced on June 28, 2004 and was completed on August 3, 2004.

A brief summary of the construction sequence for the DZMW is provided as Table 4-1. A schematic illustration of the DZMW is provided as Figure 4-1. A summary of the construction details is provided as Table 4-2. The lithologic log for the DZMW is included in Appendix D of this report. Copies of the mill certificates for the DZMW casings are included in Appendix F of this report. Copies of the casing logs are included in Appendix G. Copies of the cement records for the DZMW casing settings are included in Appendix H of this report. Copies of the cement logs are included in Appendix G.

TABLE 4-1.

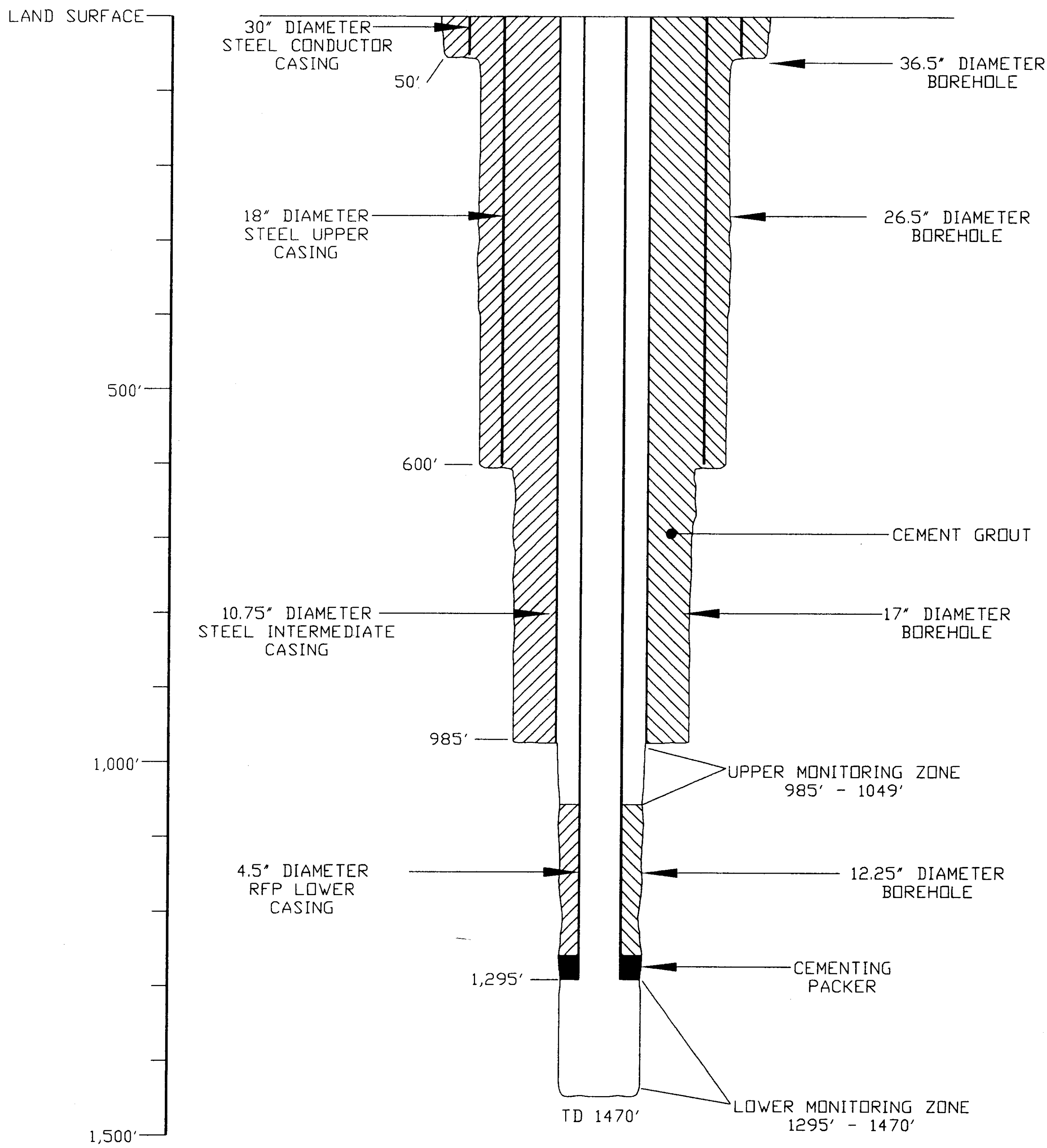
SUMMARY OF DUAL ZONE MONITORING WELL (LM-7974) CONSTRUCTION SEQUENCE

Date	Activities of Significance
06/22/04	Began moving in Youngquist Bros. Rig #311 and equipment.
06/28/04	Spudded well at 11:10 AM. Completed drilling 36.5-inch diameter hole to 55 feet. Landed 30-inch diameter steel casing at 500 feet. Pressure grouted with 48 barrels neat cement.
07/02/04	Completed drilling 26 1/2-inch diameter hole to 605 feet. Ran GR-Caliper log.
07/03/04	Landed 18-inch diameter steel casing at 600 feet. Pressure grouted with 112 barrels 12% and 185 barrels neat cement.
07/06/04	Completed switching to reverse air rotary system.
07/07/04	Completed drilling 12.25-inch diameter hole to 1119 feet. Ran Dual Induction, GR/Caliper, Sonic, Flow logs.
07/08/04	Ran packer test #1 (single packer) of interval 1068-1119'.
07/09/04	Pan packer test #2 (straddle) of interval 985-1058'.
07/13/04	Landed 10.75-inch diameter steel casing at 985 feet. Pressure grouted first stage with 102.5 barrels 12% and 97.5 barrels neat cement. Tremied second cement stage – 55 barrels 12%. Tagged cement at 235 feet.
07/15/04	Completed drilling 9.875" diameter hole to 1395 feet.
07/16/04	Completed drilling 5.5" diameter hole to 1470'. Conducted pressure test on 10.75-inch diameter steel casing.
7/17/04	Ran Temperature, Gamma Ray/Caliper, Dual Induction, Sonic, and Flow logs.
7/18/04	Ran packer test #3 (single packer) of interval 1371-1470 feet. Ran packer test #4 (single packer) of interval 1297-1470'.
7/19/04	Ran packer test #5 (single packer) of interval 1247-1470 feet. Ran packer test #6 (single packer) of interval 1297-1470 feet.

TABLE 4-1. (CONTINUED)

SUMMARY OF DUAL ZONE MONITORING WELL (LM-7974) CONSTRUCTION SEQUENCE

Date	Activities of Significance
7/20/04	Ran cement Bond Log.
7/27/04	Landed 4 ½-inch outside diameter FRP casing with cementing packer at 1295 feet.
07/28/04	Went in annulus with tremie. Pumped first stage cement - 1 barrel cement. Tagged after 5 hours at 1283 feet. Pumped second stage cement – 2 barrels neat. Tagged after 4.5 hours at 1264 feet. Pumped third stage cement – 14 barrels neat.
7/29/04	Tagged after 4.5 hours at 1175 feet. Pumped fourth stage cement – 6 barrels neat. Tagged after 8.5 hours at 1085 feet. Pumped fifth stage cement – barrels neat. Tagged after 8.5 hours at 1058 feet.
07/30/04	Completed cementing annulus of 4 1/2-inch diameter casing 1049 feet.
08/02/04	Set test packer at 1268 feet. Conducted pressure test on 4 ½-inch diameter RFP casing. Tagged top of cement at 231 feet in annulus of 10.75-inch diameter casing. Completed cementing to land surface with 43 barrels neat cement.
08/03/04	Rigged down and moved out Youngquist Bros. Rig #311.



Water Resource Solutions	PROJECT NAME: GPIWA-IW	DWG. NUMBER: A-014409H4_a1
	PROJECT NUMBER: 01-04409.HO	DATE: 01/26/05

FIGURE 4-1. SCHEMATIC DIAGRAM SHOWING DUAL ZONE MONITORING WELL (LM-7974) CONSTRUCTION DETAILS.

TABLE 4-2.

SUMMARY OF DUAL ZONE MONITORING WELL CONSTRUCTION DETAILS

CASING TYPE	CASING DIAMETER (OD-in.)	MATERIAL	SETTING DEPTH (ft.)
Conductor	30	Steel	50
Upper	18	Steel	600
Upper Monitoring Zone Casing	10.75	Steel	985
Lower Monitoring Zone Casing	4.5	FRP	1295

Other Construction Details:

Total Depth of Well: 1470 feet
Upper Monitoring Zone: 985-1049 feet
Lower Monitoring Zone: 1295-1470 feet

V. DATA COLLECTION AND ANALYSES

A. Strip Log

In addition to the lithologic log, a detailed strip log was maintained throughout the drilling operations of the IW. The strip log provides a detailed presentation of drilling rate, lithology, formation top depths, core intervals and results, packer test intervals and results, reverse air water quality, and casing setting depths for this well. A copy of the strip log is included in Appendix K of this report.

B. Geophysical Logging Program

A suite of open-hole geophysical logs, including dual induction laterolog (DIL) gamma ray (GR), and caliper, was run at each casing setting depth in both the IW and DZMW. In addition to these logs, prior to setting casing for each casing setting depth below the upper casing (and also at total depth), a borehole-compensated (BHC) Sonic and Flowmeter (static and dynamic) logs were run. DIL logs provide information relative to formation resistivity (the inverse of conductivity). GR logs are useful in stratigraphic correlations with off-setting wells. BHC Sonic logs provide information relative to porosity and also give some indications regarding the presence of fracture permeability. Caliper logs provide information regarding hole diameter and shape throughout the logged interval. Flowmeter logs provide information regarding the rate of inflow of formation water into the borehole while a well is pumped, and thus, these logs provide important information about the yield and permeability of discrete zones in the wellbore.

Cased hole logs run in the IW and DZMW included temperature and cement bond logs (CBL). Temperature logs are useful in determining the status of cement curing behind casing and the depth of the top of each cement stage. Cement bond logs are useful in determining bonding of the cement to the casing and the borehole wall, and compressive strength of the cement.

A summary of the geophysical logs run in the IW is provided on Table 5-1. A summary of the geophysical logs run in the DZMW is provided on Table 5-2. A set of geophysical logs for each well is contained in Appendix L of this report.

TABLE 5-1.

SUMMARY OF GEOPHYSICAL LOGS RUN IN THE INJECTION WELL (LM-7973)

DATE	LOG TYPE	FOOTAGE
March 25, 2004	Caliper/GR	605 to Surface
March 25, 2004	Dual Induction	605 to Surface
March 29, 2004	Caliper/GR	605 to 50
March 30, 2004	Temperature	605 to 50
April 2, 2004	Caliper/GR	1118 to 605
April 4, 2004	Temperature	1260 to 605
April 4, 2004	Caliper/GR	1260 to 605
April 4, 2004	Dual Induction	1260 to 605
April 4, 2004	BHC Sonic	1260 to 605
April 4, 2004	Flowmeter (Static and Dynamic)	1260 to 605
April 18, 2004	Caliper/GR	1245 to 605
April 21, 2004	Temperature	1245 to Surface
May 3, 2004	Temperature	3015 to 1245
May 3, 2004	Caliper/GR	3015 to 1245
May 3, 2004	Dual Induction	3015 to 1245
May 3, 2004	BHC Sonic	3015 to 1245
May 3, 2004	Flowmeter (Static and Dynamic)	3015 to 1245
June 06, 2004	Caliper/GR	3138 to 1245
June 13, 2004	Temperature	1955 to Surface
June 14, 2004	Sector Bond Log	1955 to Surface
November 09, 2004	Temperature	3138 to Surface
November 09, 2004	Radioactive Tracer Survey	NA

TABLE 5-2.

SUMMARY OF GEOPHYSICAL LOGS RUN IN THE DUAL ZONE MONITORING WELL (LM-7974)

DATE	LOG TYPE	FOOTAGE
July 2, 2004	Caliper/GR	605 to 50
July 7, 2004	Caliper/GR	1119 to 605
July 7, 2004	Dual Induction	1119 to 605
July 7, 2004	BHC Sonic	1119 to 605
July 7, 2004	Flowmeter (Static and Dynamic)	1119 to 605
July 12, 2004	Caliper/GR	987 to 605
July 13, 2004	Temperature	987 to Surface
July 17, 2004	Temperature	1470 to 987
July 17, 2004	Caliper/GR	1470 to 987
July 17, 2004	Dual Induction	1470 to 987
July 17, 2004	BHC Sonic	1470 to 987
July 17, 2004	Flowmeter (Static and Dynamic)	1470 to 987
July 20, 2004	Cement Bond Log	987 to Surface
July 29, 2004	Temperature	1295 to 1049

C. Packer Testing

Packer tests were conducted in order to delineate the base of the underground source of drinking water (USDW), evaluate the confinement above the injection zone, evaluate the injection zone, and determine the upper and lower monitoring zones. Five packer tests in the IW and six packer tests in the DZMW were performed. Eight single packer tests (i.e. of the bottom-hole section) and three dual (i.e. straddle) packer tests were performed.

Depending upon the hydrostatic pressure of the particular interval tested, water samples were procured from the isolated test interval either by allowing the well to flow or by pumping. The water samples obtained from the test zones were analyzed on-site for conductivity, and dissolved chloride concentrations.

An estimate of total dissolved solids (TDS) was made from the conductivity values. In addition, samples of groundwater obtained from the test intervals were transported to an analytical laboratory for analyses of dissolved chloride, sulfate, and TDS concentrations. The samples were cooled in route to the laboratory and a complete chain-of-custody was maintained throughout the sampling, transport, and analytical operations. A summary of the intervals tested and the data obtained is presented on Table 5-3. The complete packer test hydraulic data and graphical analyses are provided in Appendix M. More complete water quality analyses for the packer test intervals are contained in Appendix E of this report.

Based upon the results of the packer testing program, and also utilizing data from analyses of the open-hole geophysical logs, the base of the USDW was determined to occur at an approximate depth of 1217 feet at the site. An upper monitoring zone from 985 to 1049 feet was selected. A lower monitoring zone from 1295 to 1470 feet was selected as the first zone with any appreciable, albeit marginal, permeability, above the injection zone.

TABLE 5-3.

SUMMARY OF PACKER TEST DATA

INJECTION WELL

Packer Test #	Type	Interval Tested (ft BPL)	Total Dissolved Solids (mg/l)	Conductivity (umhos/cm)	Dissolved Chlorides (mg/l)	Estimated Transmss. (gpd/ft)
1	Single	1060 – 1118	3,400	6,800	2,000	77
2	Single	1229 – 1260	32,000	45,000	18,000	ND
3	Straddle	1720 – 1738	36,000[A]	50,600[A]	16,100[A]	5
4	Single	1956 – 3015	24,000[A]	24,000[A]	33,700[A]	82,300
5	Straddle	1503 – 1521	28,740	39,600	15,022	4

[A] Field Determined Values

ND Not Determined

DUAL ZONE MONITORING WELL

Packer Test #	Type	Interval Tested (ft BPL)	Total Dissolved Solids (mg/l)	Conductivity (umhos/cm)	Dissolved Chlorides (mg/l)	Estimated Transmss. (gpd/ft)
1	Single	1068 – 1119	4,056	6,900	1,950	61
2	Straddle	985 – 1058	3,912	6,550	1,719	2,700
3	Single*	1371 – 1470	No sample	No sample	No sample	24
4	Single*	1297 – 1470	24,800[A]	34,700[A]	15,840[A]	55
5	Single	1247 – 1470	31,700	47,500	17,814	74
6	Single	1297 – 1470	31,316	46,300	17,459	65

* Test Aborted Due to Low Yield

D. Coring Program

A coring program was conducted from the purpose of quantifying confinement between the base of the USDW and the proposed injection zone. A total of five four-inch diameter cores were taken in the IW pilot hole. A summary of the cored intervals, generalized lithologic descriptions, and vertical permeability ranges is provided on Table 5-4.

Representative portions of each core were sent to an geotechnical laboratory for analyses. The laboratory analyses included general lithologic descriptions and determination of porosity and horizontal and vertical permeabilities. Complete core analyses are included in Appendix N of this report. All unused portions of each core were transported to the Florida Geological Survey (FGS) core laboratory in Tallahassee.

The coring program substantiated that significant confinement exists at the site between the base of the USDW and the selected injection zone.

TABLE 5-4.

SUMMARY OF CORED INTERVALS IN THE INJECTION WELL (LM-7973)

CORE #1	INTERVAL CORED (ft.)	RECOVERY (ft.)	PLUGS SENT FOR LABORATORY ANALYSES	AVERAGE VERTICAL PERMEABILITY RANGE (cm/sec)	LITHOLOGY
1	1790 – 1808	10	1805	1.5×10^{-6}	Dolomite
2	1820 – 1840	5	1829	4.6×10^{-8}	Dolomite
3	1946 - 1966	3.3	1959	3.8×10^{-7}	Limestone, Dolomite
4	1980 – 2000	5.5	1988	1.4×10^{-7}	Dolomite, Limestone
5	2014 – 2030	6.3	2028	2.4×10^{-9}	Dolomite

E. Water Quality Analyses

Water samples were procured during the IW and DZMW construction by three methods: (1) from the reverse air drilling fluid return stream, (2) from packer testing, and (3) from pumping the open-hole section below the final casings.

During reverse air drilling, fresh water (i.e. water with dissolved chlorides less than 250 mg/l) was often added to the pits to replace fluid lost during the drilling operations. This resulted in a constant dilution of the return water stream and generally rendered the reverse air water quality analyses nonrepresentative, particularly when significant lengths of open-hole section were present. In shorter open-hole sections (generally after setting a string of casing) and in intervals where permeabilities and yields were high, more representative formation samples could be obtained from the reverse air return stream.

Reverse air water quality analyses were performed on-site and included determination of conductivity and dissolved chloride concentrations. Estimates of total dissolved solids (TDS) concentrations were obtained by applying a multiplication factor (i.e. 0.74) to the conductivity values. Reverse air water quality samples were obtained at 30 foot intervals during the drilling of the IW. The reverse air water quality analyses are contained in Appendix E of this report.

Water quality analyses from the packer test intervals were significantly more accurate than the reverse air water quality analyses. The packer testing procedure, intervals tested, and analytical results were described in a previous section of this report. The water quality analytical results from the packer test intervals are contained in Appendix E of this report.

Representative water samples were obtained from the injection zone in the IW and from the lower monitoring zone in the DZMW by pumping; and from the upper monitoring zone in the DZMW by flowing the well. Water samples from each of these three zones were transported to an analytical laboratory for Primary and Secondary Drinking Water analyses. A condensed summary of the inorganic analyses for each of the three zones is presented on Table 5-5. The complete water quality analytical results are included in Appendix E of this report.

F. Video Surveys

Video surveys were run in the injection well on three occasions:

(1) in the pilot hole to a depth of 3000 feet
(2) to a depth of 1955 feet after setting the 18-inch OD injection casing
(3) to a depth of 3080 feet after setting the 13.375-inch OD RFP injection tubing

Two zones are present below the injection casing setting depth, that exhibit slightly to extensive fracturing and cavernous permeability. The high permeability zones identified on the video surveys generally agree very well with those identified by combined BHC Sonic and Caliper log analyses.

TABLE 5-5.

SUMMARY OF SOME PRIMARY AND SECONDARY DRINKING AND OTHER WATER QUALITY ANALYSES FOR THE UPPER MONITORING ZONE, LOWER MONITORING ZONE, AND INJECTION ZONE

PARAMETER	UPPER MONITORING ZONE	LOWER MONITORING ZONE	INJECTION ZONE	UNITS	MCL	MDL
Chloride	4210	18,301	17,500	mg/l	250	.4
Fluoride	1.5	1.95	15.1	mg/l	4.0	.1
Sulfate	622	2236	3920	mg/l	250	1.0
Total Dissolved Solids	7680	31,545	35,000	mg/l	500	5.0
Total Suspended Solids	1.00	BDL	190*	mg/l		.3
Bicarbonate	123.6	132.2	110	mg/l		.01
Color	5.0 Q	BDL	5.0 Q	CU	15	1.0
Turbidity	2.13	2.52	1.54	NTU		.1
Odor	2.0 Q	2.0 Q	1.0 Q	TON	3	1.0
Biological Oxygen Demand	2.19	2.60	BDL	mg/l		2.0
Chemical Oxygen Demand	21.3	368	160	mg/l		10.0
Specific Gravity	1.00	1.00	1.024	NU		.1
Total Coliform	Absent	Absent	Absent	/100ml		
Nitrite	BDL	BDL	BDL	mg/l	1	.001
Nitrate	BDL	BDL	BDL	mg/l	10	.001

TABLE 5-5. (CONTINUED)

SUMMARY OF SOME PRIMARY AND SECONDARY DRINKING AND OTHER WATER QUALITY ANALYSES FOR THE UPPER MONITORING ZONE, LOWER MONITORING ZONE, AND INJECTION ZONE

PARAMETER	UPPER MONITORING ZONE	LOWER MONITORING ZONE	INJECTION ZONE	UNITS	MCL	MDL
Ammonia	0.371	0.375	0.075	mg/l		.02
Total Kjeldahl Nitrogen	0.425	BDL	0.76	mg/l	10	.02
Total Organic Carbon	BDL	BDL	BDL	mg/l		.50
Total Phosphorous	0.011	0.0007	9.1	mg/l		.002
Cyanide	BDL	BDL	BDL	mg/l	200	.005
Copper	BDL	0.072	BDL	mg/l	1000	.05
Lead	0.0256	BDL	BDL	mg/l	15	1.0
Zinc	BDL	0.126	BDL	mg/l	5	.05
Arsenic	BDL	BDL	BDL	mg/l	0.01	.02
Barium	0.0585	0.0637	0.0750	mg/l	2	.0001
Cadmium	BDL	0.122	BDL	ug/l	.005	.005
Selenium	BDL	BDL	BDL	mg/l	0.05	.001
Iron	0.12	0.66	0.3550	mg/l	0.3	.001
Sodium	2538	9860	8480	mg/l	160	.139
Aluminum	BDL	BDL	0.530	mg/l	0.2	.001

TABLE 5-5. (CONTINUED)

SUMMARY OF SOME PRIMARY AND SECONDARY DRINKING AND OTHER WATER QUALITY ANALYSES FOR THE UPPER MONITORING ZONE, LOWER MONITORING ZONE, AND INJECTION ZONE

PARAMETER	UPPER MONITORING ZONE	LOWER MONITORING ZONE	INJECTION ZONE	UNITS	MCL	MDL
Foaming Agents	BDL	BDL	0.368	mg/l	0.5	.05
Gross Alpha	42 ± 2	51 ± 2	103 ± 3	pCi/l	15	3.5
Radium 226	8.5 ± 0.7	12.5 ± 0.9	67 ± 1	pCi/l	5**	.3
Radium 228	3.3 ± 1.7	9.2 ± 2.2	0.5 ± 0.7	pCi/l	5**	.7
Hardness	1100	6900	5776	mg/l		.4
PH	8.11	7.33	7.35	SU	6.5 - 8.5	.1

BDL = Below Detection Unit

NA = Not Analyzed

*Analyzed out of holding time

**Combined Radium 226 & Radium 228

MCL = Maximum Contaminant Level

MDL = Minimum Detection Limit

NTU = Nephelometric Turbidity Units

mg/l = milligrams per liter

µg/l = micrograms per liter

pc/l = picocurries per liter

SU = Standard Units

Q = Qualitative Analysis

G. Deviation Surveys

Deviation surveys were performed at approximate 90 foot intervals in all pilot and reamed holes for both the IW and the DZMW. The deviation surveys were performed by YBI using Totco Sure-Shot instruments. A tabulation of the deviation surveys for the IW is provided in Appendix O of this report. A summary of the deviation surveys for the DZMW is also provided in Appendix O. No deviations greater than 0.6 degrees were recorded in any portion of either well.

VI. SITE GEOLOGY AND HYDROLOGY

A. Stratigraphy

The anticipated subsurface geology of the GPIWA site was described in the Area of Review portion of the FDEP construction permit application supporting documentation (WRS, 2003). The actual stratigraphy, as encountered in the IW and DZMW, is described below. A generalized hydrostratigraphic column for the GPIWA area is provided on Figure 6-1. Only those variances from the anticipated hydrostratigraphy which are considered significant are described in detail. The anticipated stratigraphic formation tops, as delineated in the well prognosis prepared prior to drilling, are compared with the actual stratigraphic tops on Table 6-1. A southwest-northeast cross-section through the GPIWA Injection Well is provided as Figure 6-2. A map showing the location of the cross-section is provided as Figure 6-3.

1. Undifferentiated Holocene-Pleistocene Deposits

The undifferentiated Holocene-Pleistocene (0 to 2.8 millions year ago) age deposits at the site consist of unconsolidated sand and poorly consolidated shells. The undifferentiated deposits extend from land surface to approximately 50 feet bpl in the injection well as determined by a change in lithology from shells to a cohesive pale olive clay.

2. Peace River Formation (of Hawthorn Group)

The Peace River formation of Middle Miocene age (7 to 15 million years ago) unconformably underlies the Undifferentiated Holocene-Pleistocene deposits at the site. It can be subdivided into two members. These are, in order of increasing depth, the Cape Coral Clay member and the Lehigh Acres Sandstone member. The Lehigh Acres

WATER RESOURCE SOLUTIONS

PROJECT NAME: GPIWA - INJECTION WELL

PROJECT NUMBER: 01-04409.HO

SITE LOCATION: SE NE 33-44S-22E

Greater Pine Island Water Association, Inc.

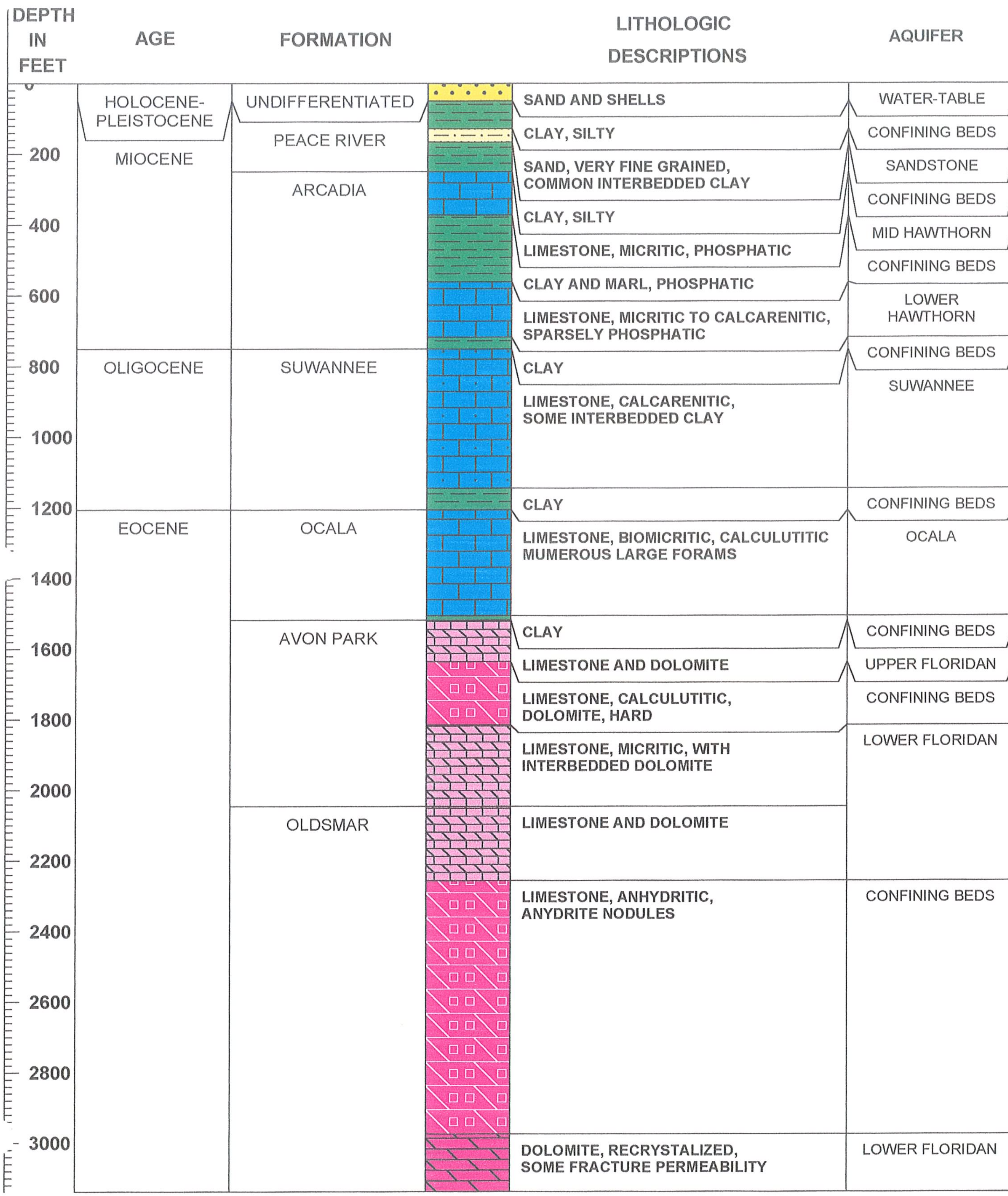
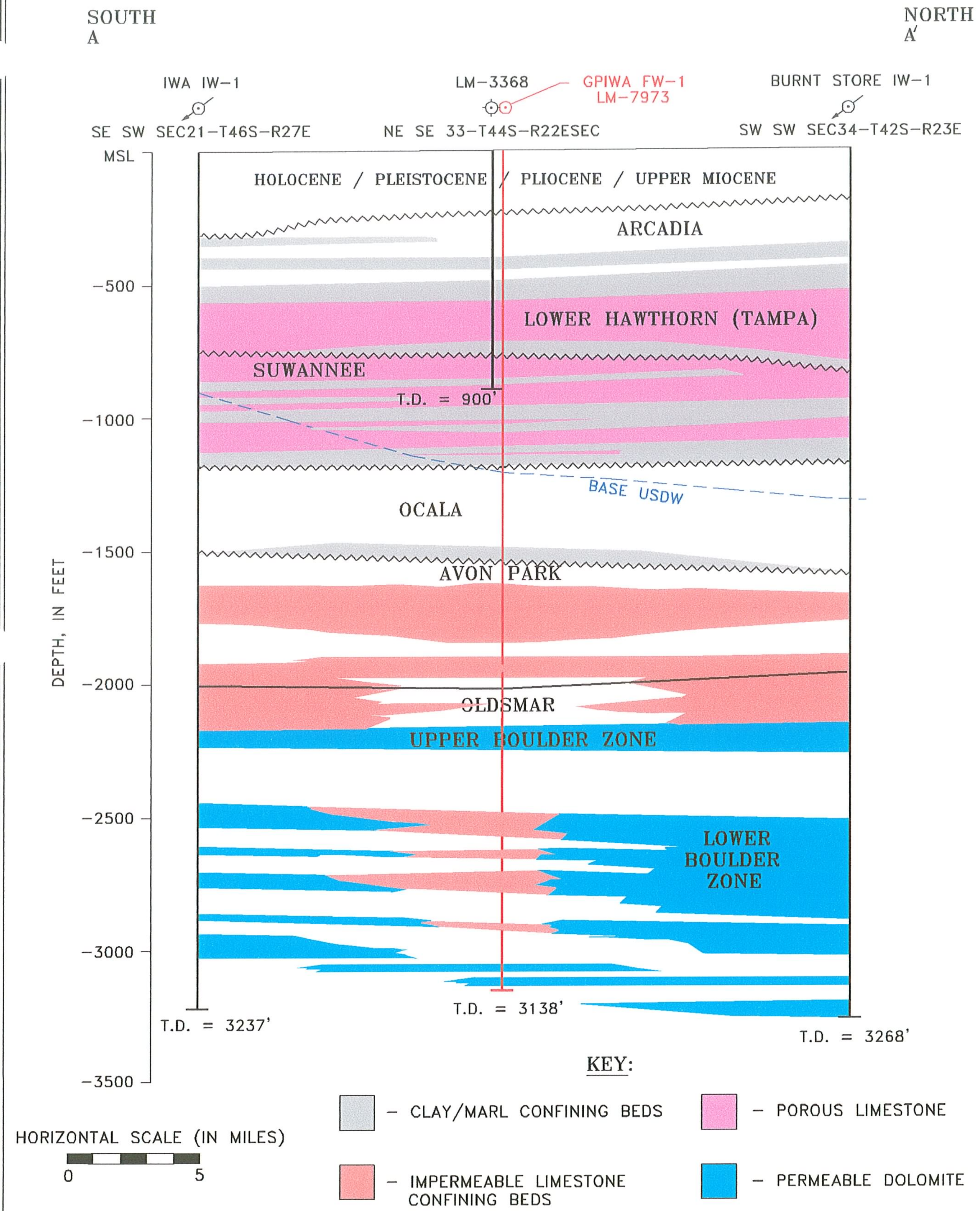


FIGURE 6-1. GENERALIZED HYDROSTRATIGRAPHIC COLUMN FOR THE GPIWA IW SITE

TABLE 6-1.

SUMMARY OF ANTICIPATED VERSUS ACTUAL FORMATION TOPS
IN THE INJECTION WELL (LM-7973)

FORMATION	ANTICIPATED DEPTH (ft.)	ACTUAL DEPTH (ft.)
Undifferentiated Holocene-Pleistocene	Surface	Surface
Cape Coral Clay Member of Peace River Fm. (Late Miocene)	40	50
Lehigh Acres Sandstone (Mbr) Of Peace River Fm.	135	123
Ft. Myers Clay Member of Peace River Fm.	145	166
Mid Hawthorn Limestone of Arcadia Fm.	235	249
Lower Hawthorn Mbr. of Acardia Fm.	570	560
Suwannee Limestone (Oligocene)	750	751
Ocala Formation (Late Eocene)	1190	1205
Avon Park (Middle Eocene)	1500	1518
Oldsmar (Early Eocene)	2000	2046



Water Resource Solutions	PROJECT NAME: GPIWA – IW PROJECT NUMBER: 01-04409.HO	DWG. NUMBER: A-014409IW11-2 DATE: 01/26/05

FIGURE 6-2. SOUTHWEST-NORTHEAST CROSS-SECTION THROUGH THE GPIWA INJECTION WELL.

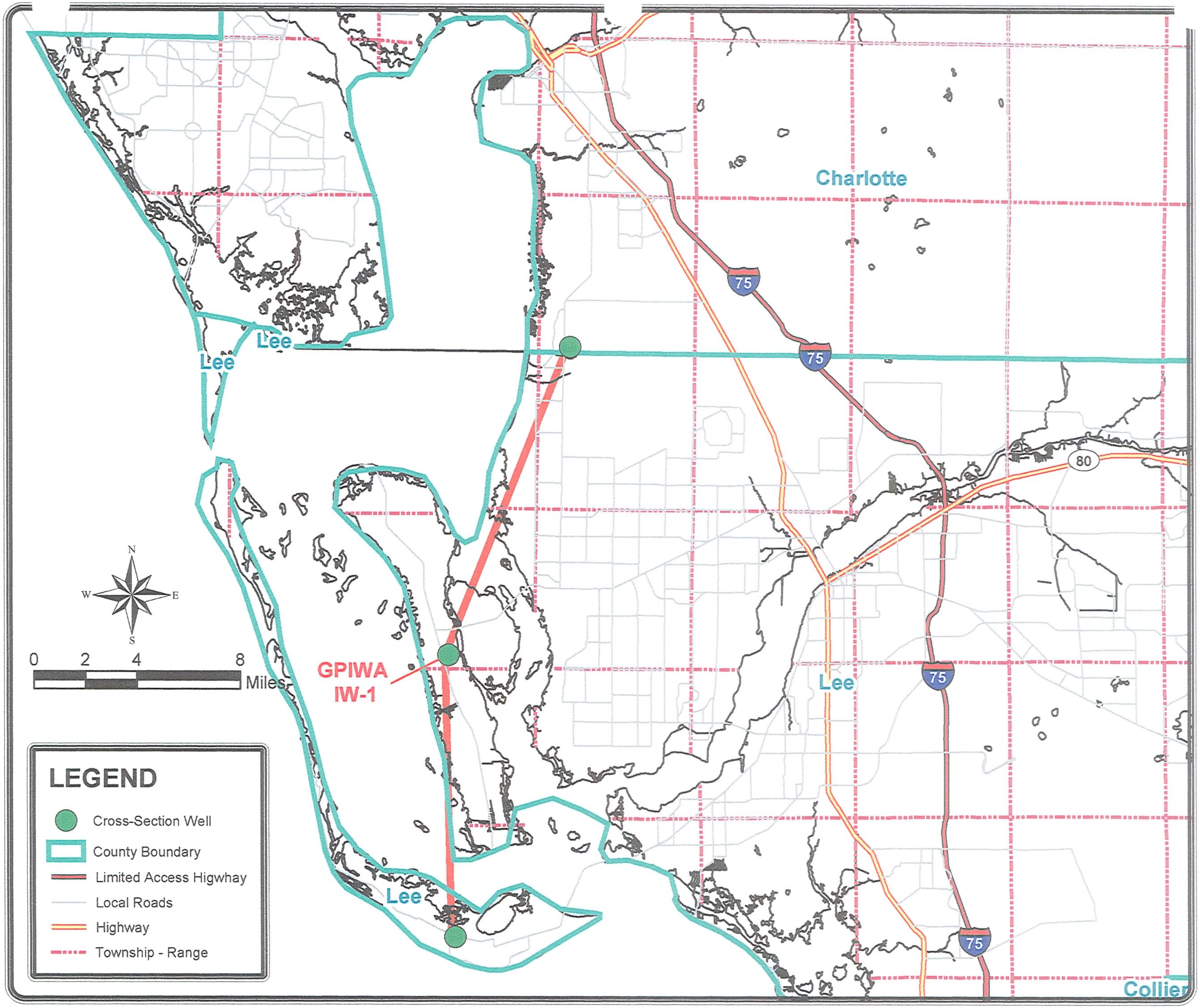


FIGURE 6-3. MAP SHOWING LOCATION OF CROSS-SECTION A-A'

Sandstone is very thin at the site and consists of about 43 feet of unconsolidated very fine grained sand, found between the approximate depths of 123 and 166 feet. The Peace River formation extends from approximately 50 to 249 feet BPL in the injection well.

3. Arcadia Formation (of Hawthorn Group)

The Arcadia formation of the Hawthorn Group (Early Miocene age - 17 to 25 mya) is, in contrast to overlying stratigraphic units, a predominantly carbonate unit. It was encountered at a depth of 249 feet in the IW. It unconformably underlies the Peace River formation at the site. It consists of interbedded phosphatic limestones, clays, and lime mud units. The best porosity exhibited in any of the limestone units occurs in the basal unit, which is also the thickest. This unit, informally named the Lower Hawthorn (or Tampa) member, which is about 191 feet thick at the site, contains some intervals which are characterized by good to excellent moldic porosity. The base of the Arcadia formation is picked at a depth of approximately 751 feet based on a sharp decrease in natural gamma activity, the disapperance of phosphate below 750 feet, and a change in lithology from a gray clay to a calcarenitic limestone. The overall thickness of the Arcadia formation at the site is about 502 feet.

4. Suwannee Formation

The Suwannee formation (Oligocene age – 27 to 37 mya) consists of moderately indurated, fossiliferous, calcarenitic to micritic limestones at the site. It was encountered at a depth of 751 feet. The Suwannee formation unconformably underlies the Hawthorn Group. Poor to good moldic and interparticle porosity characterizes the limestones of the Suwannee formation. Some interbedded lime mud intervals of up to 15 feet in thickness are also present in the Suwannee interval. The overall thickness of the Suwannee formation at the site is about 455 feet.

5. Ocala Formation

The Ocala formation (Late Eocene age – 38 to 40 mya) was encountered at a depth of 1205 feet BPL in the IW. This stratigraphic unit unconformably underlies the Suwannee formation. It consists of biomicritic to calculutitic limestone with poor to fair moldic porosity. The top of the Ocala formation is marked by the first appearance of the Ocala index fossil, Lepidocyclina ocalana, other large foraminifera, particularly Operculinides sp. is present. Thin interbedded lime mud units are also present at the site in the Ocala formation. The Ocala formation is about 313 feet thick at the site.

6. Avon Park Formation

The Avon Park formation (Middle Eocene age – 43 to 48 mya) unconformably underlies the Ocala Group at the site. It was encountered at a depth of 1518 feet in the IW. It consists mainly of micritic to calculitic limestones with some thin dolomite layers. The overall porosity of this unit is low. The fossil assemblages include Dictyoconus cookie and Coskinolina sp. The thickness of the Avon Park formation in the GPIWA IW is about 530 feet. One highly permeable zone was encountered in the Avon Park formation between the depths of 1835 and 1855 feet BPL.

7. Oldsmar Formation

The Oldsmar formation (Early Eocene age – 48 to 53 mya) unconformably underlies the Avon Park formation at the site. It was encountered at a depth of 2046 feet in the IW. It consists of relatively low porosity micritic limestones with thin interbedded dolomites in the upper approximate 200 feet. The dolomites contain some fracture permeability. Below the depth of about 2250 feet, a very thick section of very low permeability anhydritic limestones is present. The anhydrite is present as nodules and thin beds from about 2250 to 2975 feet. A coal bed about six feet thick is present from 2450 to 2456 feet BPL. Below

2975 feet, a zone of low permeability interbedded dolomitic limestones and calcareous dolomites is present to a depth of about 3030 feet. Below that depth to total depth recrystallized dolomites with some good fracture permeability are present. The overall thickness of the Oldsmar formation at the site likely exceeds 1200 feet. A total of approximately 1150 feet of this formation was penetrated in the IW.

The first thin zone of fracture and cavernous permeability, commonly referred to as a "boulder zone" occurred at a depth of 2080 feet in the IW. This first "boulder" zone is about 8 feet thick.

Because of the lower than anticipated permeability of the Oldsmar formation at the site, and the extensive confining zones above it, all of the Oldsmar formation from the first fractured zone down to 3138 feet was selected as the injection zone for the GPIWA IW.

B. <u>Hydrology</u>

As indicated on Figure 6-1, those zones which serve as water supply sources in the GPIWA WTP area include the undifferentiated Holocene-Pleistocene deposits (water-table aquifer) and the numerous limestone zones of the Arcadia formation (Mid- and Lower Hawthorn aquifers). Of these, the aquifers of the Arcadia formation, which contain slightly brackish to brackish groundwater, are the most important sources of supply.

All of the aquifers denoted above are separated from the injection zone by intervening confining zones of significant thickness.

C. Groundwater Quality

Based upon the water quality analyses performed on groundwater samples obtained from packer testing, as well as from geophysical log interpretation data, the base of the USDW was found at an approximate depth of 1217 feet in the IW. Table 5-3 presents a summary of TDS, conductivity, and dissolved chloride concentrations versus depth for the packer test intervals, the monitoring intervals in the DZMW, and the injection zone in the IW. Table 5-5 presents a summary of the inorganic portion of the Primary and Secondary Drinking Water analyses conducted on groundwater samples obtained from the monitoring zones in the DZMW and the injection zone in the IW. The complete Primary and Secondary Drinking Water analyses are contained in Appendix E.

Water samples were collected at 30 foot intervals from the reverse air discharge stream throughout the drilling of the IW. These water samples were analyzed for conductivity and dissolved chloride concentrations. An estimate of TDS was made for each sample from the conductivity data (using a multiplication factor 0.74). However, as previously described, because fresh water was added to the "mud" pits at various rates throughout most of the drilling operations, the water samples obtained from the reverse air discharge stream tend to be nonrepresentative of the native water in the formations penetrated. A complete set of water quality analyses for samples obtained from the reverse air discharge stream is also contained in Appendix E.

D. Injection Zone(s)

As described in previous sections of this report, the injection zone selected for the GPIWA injection well is the whole interval from 1955 to 3138. The 18-inch diameter injection casing was set at a depth of 1955 feet in the IW. Because the open-hole section of the IW extends to the total depth (3138 feet) of the well, several thinner highly permeable zones, also serve as injection disposal conduits. The native water quality in the injection zone(s) has a TDS concentration of about 31,000 mg/l. The injection zone is overlain by low permeability confining units of considerable thickness. A quantification of the transmissivity of the injection zone is provided in a subsequent section of this report.

E. Monitoring Zones

The two monitoring zones in the DZMW are:

(1) 985 to 1049 feet

(2) 1295 to 1470 feet.

The upper monitoring zone is in the lower part of the Suwannee formation. The uncemented annulus between the 10.75-inch outside diameter (OD) intermediate casing and the 4 1/2-inch OD lower casing allows groundwater emanating from the upper monitoring to be sampled at the surface. Hydrostatic pressure in the relatively fresh upper monitoring zone is sufficient to allow the well to flow at approximately 40 gallons per minute (gpm).

The lower monitoring zone is in the Ocala formation. The open-hole section of the DZMW below the 4 1/2-inch OD lower casing allows for groundwater entering the well to be sampled from inside the 4 1/2-inch diameter casing. This zone can be pumped at a rate of approximately 3.5 gpm.

VII. WELL TESTING PROGRAM

A. Casing Pressure Tests

Pressure tests were conducted in the injection well on the following occasions:

(1) On the 18-inch OD steel injection casing on June 15, 2004

(2) On the 12-inch OD RFP tubing / 18-inch OD injection casing annulus on June 21, 2004.

An FDEP representative witnessed the annular pressure test (the FDEP declined to witness the first casing pressure test). No significant pressure decreases were noted during the one-hour tests. The pressure test data for the IW is contained in Appendix P.

Pressure tests were conducted in the DZMW on the following occasions:

(1) On the 10.75-inch OD steel casing for the upper monitoring zone on July 16, 2004.

(2) On the 4 1/2-inch OD RFP casing for the lower monitoring zone on August 2, 2004.

No significant pressure decreases were noted during either one-hour test. The pressure test data for the DZMW is included in Appendix P. The FDEP declined to witness either of the pressure tests in the DZMW.

B. Injection Test

A 12-hour injection test was conducted in the IW on January 6, 2005. Prior to conducting the test, approximately 60 hours of background bottom hole pressure (BHP) and bottom hole temperature (BHT) data was collected by Youngquist Brothers, Inc. in the IW using a wireline tool. The background water level data is shown on Figure 7-1. Background water level data was also recorded for 60 hours in both zones of the DZMW. Pressure transducers and an automated data logger was used to collect the water level data in the DZMW. The barometric pressure at the site was also recorded throughout the background, injection, and recovery period.

The injection rate for the injection test was 2020 gpm. A maximum BHP increase of 10.05 psi (approximately 23.22 feet) was recorded during the injection test. No changes in pressure were noted in either monitoring zone during the injection test (the lower monitoring zone is approximately 485 feet above the top of the injection zone and the upper monitoring zone is approximately 905 feet above the top of the injection zone).

Recovery data was recorded in the IW for a period of approximately 36 hours after the injection test had been completed. Approximately 36 hours of water level data was also recorded in the two monitoring zones of the DZMW after the injection test in the IW had been completed. All water level data for the injection test is included in Appendix Q of this report.

Semi-logarithmic plots of BHP versus time during the injection test and during the recovery period are presented as Figures 7-2 and 7-3 respectively. An average transmissivity for the injection zone of approximately 247,680 gpd/ft was calculated.

FIGURE 7-1. BACKGROUND BOTTOM HOLE PRESSURE IN THE INJECTION WELL PRIOR TO CONDUCTING THE INJECTION TEST

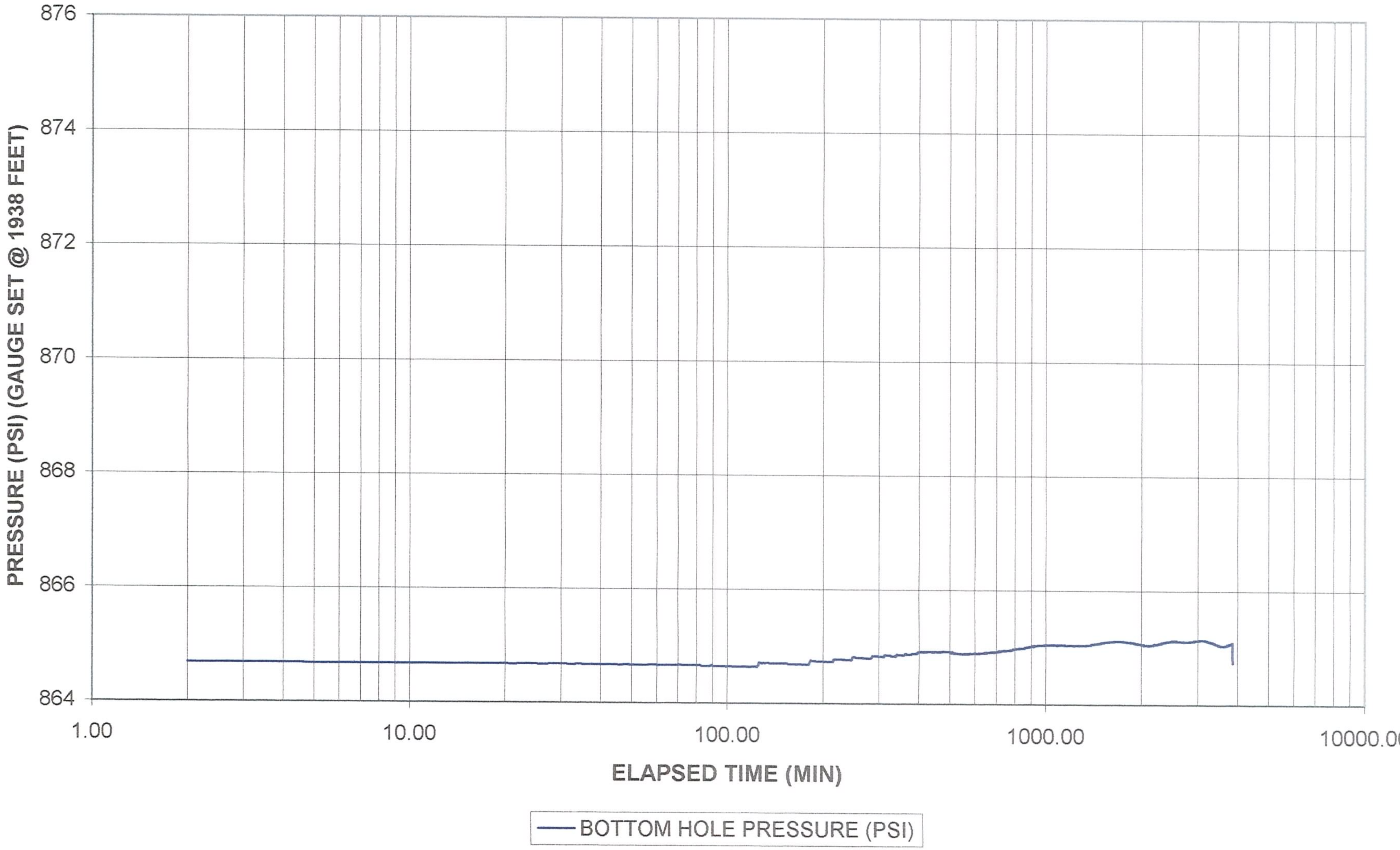


FIGURE 7-2. SEMI-LOG OF DRAWDOWN VERSUS TIME IN THE INJECTION WELL (LM-7973) DURING THE INJECTION TEST

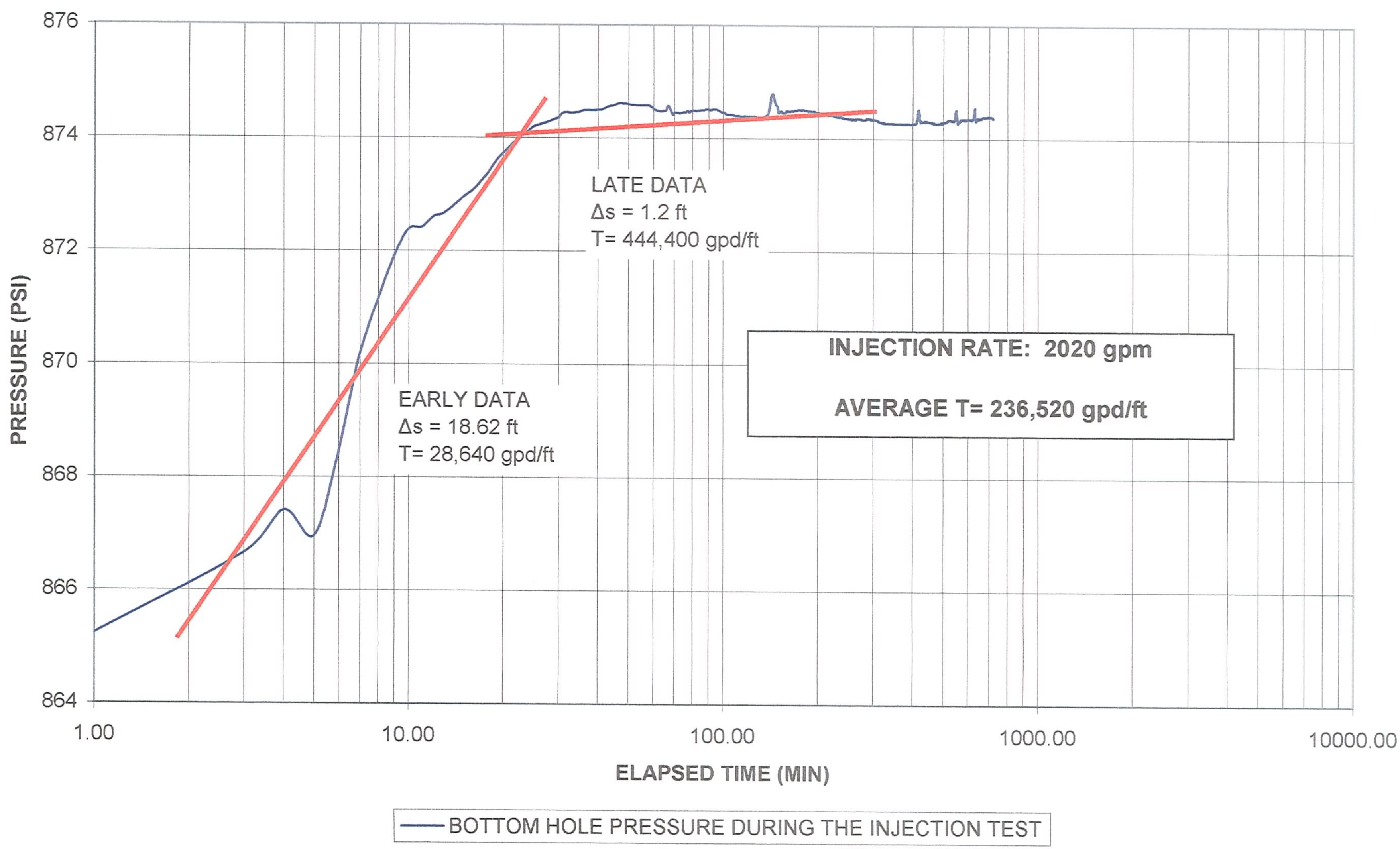
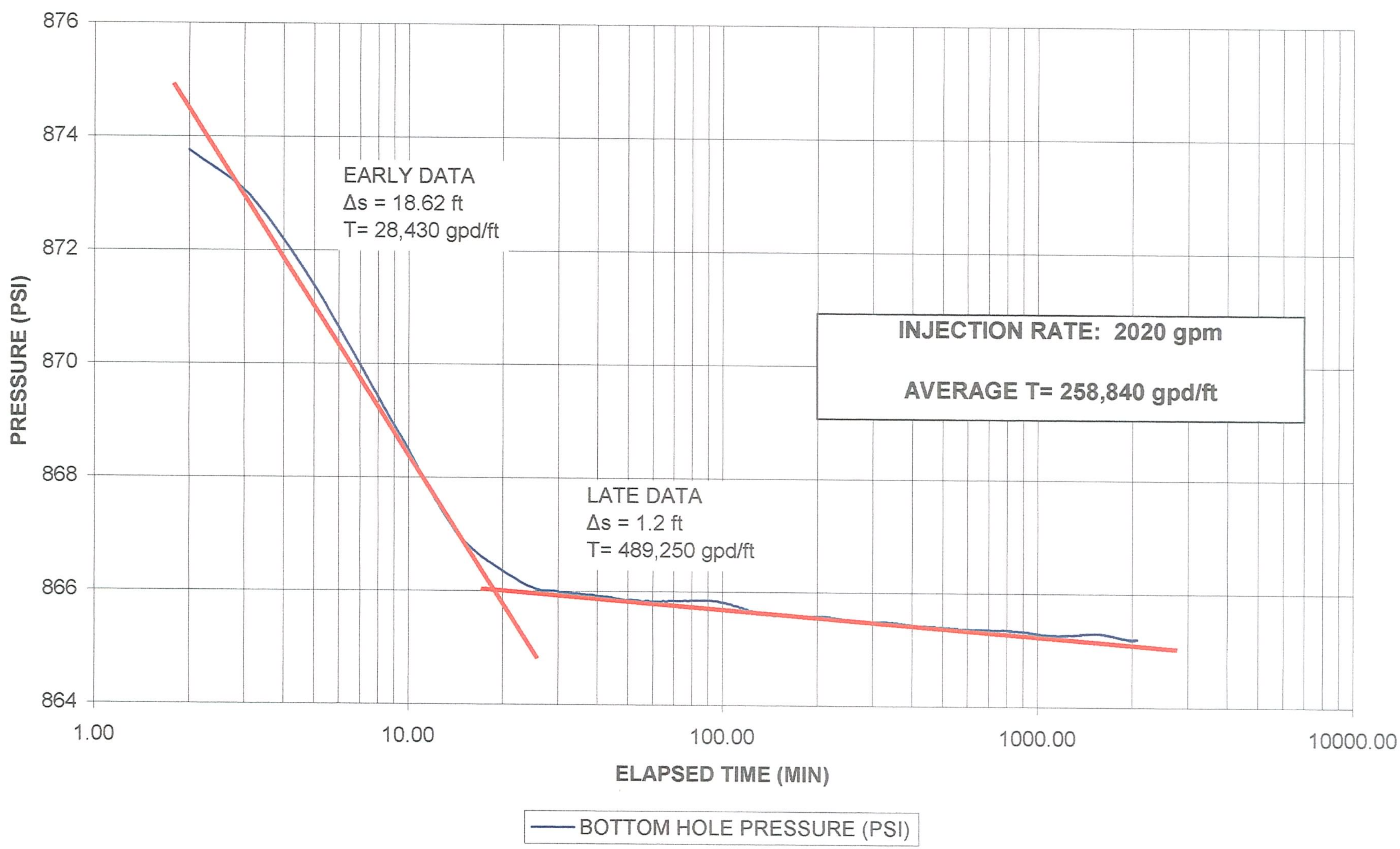
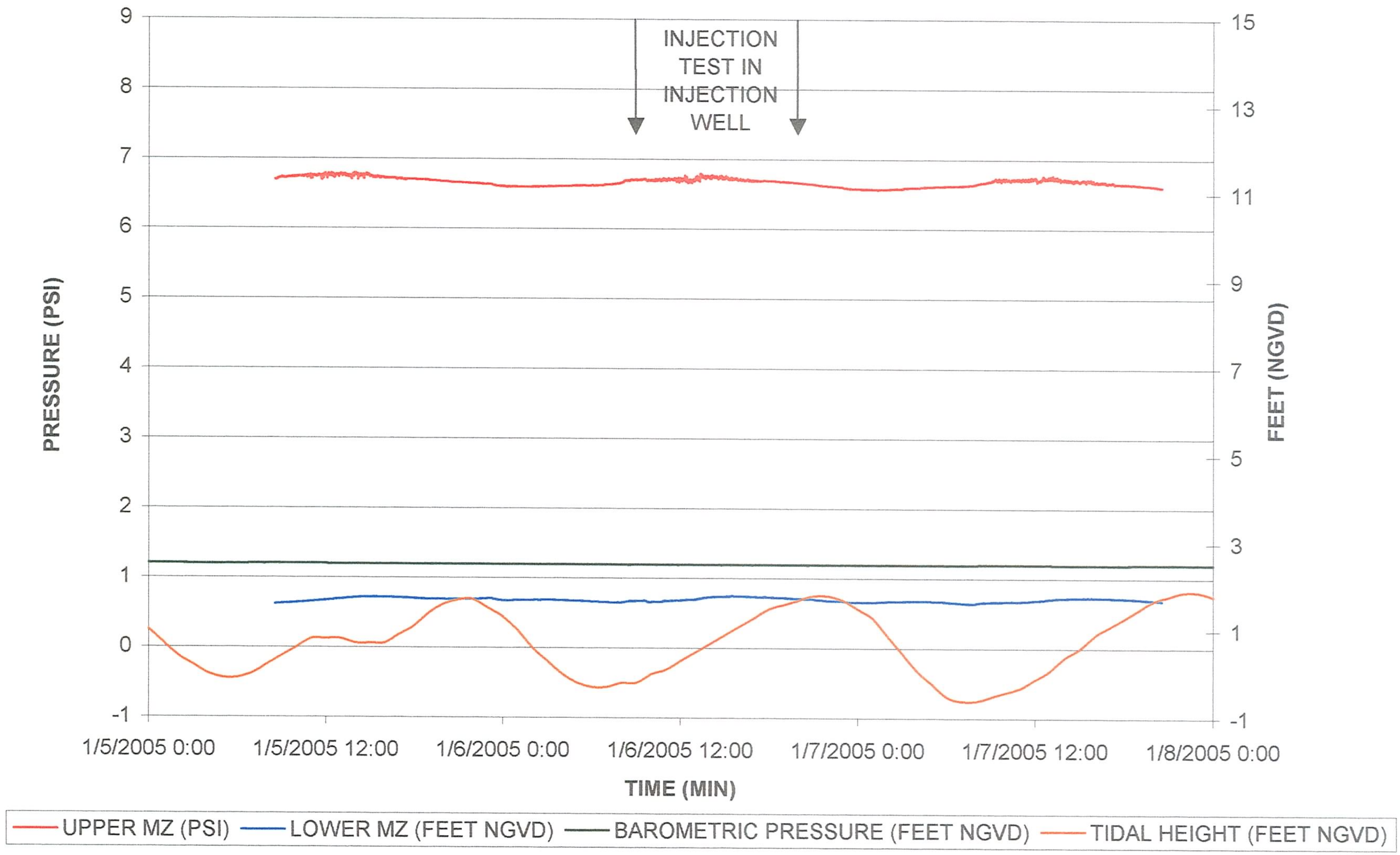


FIGURE 7-3. SEMI-LOG OF RECOVERY VERSUS TIME IN THE INJECTION WELL (LM-7973) FOLLOWING THE INJECTION TEST



Plots of background, test, and recovery data for both monitoring zones are provided on Figure 7-4. Barometric pressure recorded throughout the test period and projected tidal water levels in nearby Matlacha Pass, are also plotted on Figure 7-4.

FIGURE 7-4. PLOT OF PRESSURES RECORDED FOR UPPER AND LOWER ZONES IN DUAL ZONE MONITOR WELL BEFORE, DURING, AND AFTER INJECTION TEST



C. Radioactive Tracer Survey

A radioactive tracer survey was conducted in the IW on November 9, 2004. The test was conducted by Youngquist Brothers, Inc. in accordance with the specifications (WRS, 2003). No upward movement of the tracer slugs was noted during the various portions of the test. A copy of the geophysical log for the tracer survey is contained in Appendix I of this report.

VIII. INJECTION WELL OPERATION

A. Conceptual Design

The GPIWA IW (LM-7973) was designed for and is intended to dispose of reverse osmosis concentrate from the GPIWA WTP and reuse quality wastewater from the LCU Pine Island WWTP. Concentrate volumes, as shown on Table 8-1, from this sources are anticipated to increase from the current (2005) approximate 0.550 MGD to approximately 3.74 MGD in the year 2025 (WRS, 2004).

The design injection rate is 10 feet per second. This equates to a maximum injection rate for a 24 hour IW operating period of approximately 4.0 MGD.

Concentrate from the WTP is to be transported via an eight-inch diameter C900 PVC pipeline. Trans-membrane pressure is to be used to deliver the concentrate to the IW, bypassing the injection pumping station during times when no other fluid stream is to be delivered to the injection well.

Treated wastewater from the LCU Pine Island WTP, start-up blow-off water from the GPIWA RO supply wells, stormwater from the two concrete well pads, purge water from the DZMW, and wash-down water from the GPIWA RO WTP, all will be directed to the injection pumping station for repumping into the injection well.

The SCADA for the remote operation of the GPIWA IW is contained in the GPIWA WTP control room. The motorized valve on the injection pumping station that controls flow from the LCU Pine Island WWTP can only be operated from the GPIWA RO WTP control room or manually at the injection pumping station. It can not be operated remotely from the LCU Pine Island WWTP. Therefore, WWTP operators must call the GPIWA RO WTP to request authorization to send treated wastewater to the injection pumping station. Eventually

TABL. ,-1 PROJECTED RO CONCENTRATE AN. .IUNICIPAL WASTEWATER VOLUMES

Year	Potable ERC's	RO WTP ADF (MGD)	Concentrate ADF (MGD)	RO WTP MDF (MGD)	Concentrate MDF (MGD)	Wastewater ADF (MGD)	Wastewater MDF (MGD)	Combined Wastestream ADF (MGD)	Combinded Wastestream MDF (MGD)
2005	6549	1.585	0.281	2.441	0.432	0.126	0.316	0.407	0.748
2006	6680	1.617	0.286	2.490	0.441	0.140	0.358	0.426	0.798
2007	6814	1.649	0.292	2.539	0.449	0.155	0.404	0.447	0.854
2008	6950	1.682	0.298	2.590	0.458	0.172	0.457	0.470	0.915
2009	7089	1.716	0.304	2.642	0.468	0.191	0.516	0.495	0.984
2010	7231	1.750	0.310	2.695	0.477	0.212	0.583	0.522	1.060
2011	7376	1.785	0.316	2.749	0.487	0.235	0.659	0.551	1.145
2012	7523	1.821	0.322	2.804	0.496	0.261	0.743	0.583	1.240
2013	7674	1.857	0.329	2.860	0.506	0.289	0.853	0.618	1.359
2014	7827	1.894	0.335	2.917	0.516	0.321	0.946	0.656	1.463
2015	7984	1.932	0.342	2.975	0.527	0.356	1.067	0.698	1.594
2016	8143	1.971	0.349	3.035	0.537	0.395	1.203	0.743	1.740
2017	8306	2.010	0.356	3.096	0.548	0.438	1.356	0.793	1.904
2018	8472	2.050	0.363	3.157	0.559	0.485	1.504	0.848	2.063
2019	8642	2.091	0.370	3.221	0.570	0.538	1.668	0.908	2.238
2020	8815	2.133	0.378	3.285	0.581	0.597	1.850	0.974	2.431
2021	8991	2.176	0.385	3.351	0.593	0.662	2.052	1.047	2.645
2022	9171	2.219	0.393	3.418	0.605	0.734	2.275	1.127	2.880
2023	9354	2.264	0.401	3.486	0.617	0.814	2.523	1.215	3.140
2024	9541	2.309	0.409	3.556	0.629	0.903	2.798	1.311	3.428
2025	9732	2.355	0.417	3.627	0.642	1.000	3.100	1.417	3.742

ADF = Average Daily Flow = 242 gpd/Potable ERC
MDF = Maximum Daily Flow
ERC = Equivalent Residential Connection (2% per year growth rae for potable, growth rate varies for wastewater)
gpd = gallons per day
RO = reverse osmosis
WTP = water treatment plant
MGD = million gallons per day

monitor-only function radio telemetry units (RTU's) will be installed at the injection pumping station and LCU Pine Island WWTP to allow the WWTP operators to monitor the status of water levels in the injection pumping station and whiter the motorized valve is opened or closed.

The cement pads built for IW and DZMW construction and emergency spill containment purposes are to remain in place. The IW and DZMW sumps gravity drain to a lift station which convey stormwater, purge water from the DZMW, and any minor inadvertent spills to the IW pumping station.

The engineering design for the surface facilities for the GPIWA IW was prepared by Source, Inc. As-builts, also prepared by Source, Inc., are provided under separate cover. A four volume Operations & Maintenance manual set for the GPIWA IW system has also been prepared. Volume I prepared by WRS and Source, provides as-builts and operating protocols for the surface equipment. Regulatory compliance instructions are also contained in this volume. Volumes II through IV, prepared by Youngquist Brothers, provides equipment manuals.

B. Monitoring Program

The monitoring program for the IW system is as stipulated in the FDEP permit application supporting documentation (WRS, 2003) and as approved by the FDEP in the construction permit (Appendix A). The monitoring program for the IW and the DZMW is summarized on Table 8-2. The pressure data, which is to be recorded continuously, will be measured by the installed instrumentation. This data will be relayed by fiber optics to the WTP and digitally recorded. Chemical analyses of the injectate will be performed daily by WTP personnel.

The weekly analyses to be conducted on water samples obtained from the two zones of the DZMW will also be performed by WTP personnel. A minimum of three casing volumes, herein calculated as approximately 10,890 gallons for the upper monitoring zone and approximately 4,428 gallons for the lower monitoring, should be purged before the water samples are obtained. Since the upper monitoring zone flows at the surface, it was not necessary to install a sampling pump in the annulus between the 9 $^{3}/_{4}$-inch ID steel and 4 $^{1}/_{2}$-inch OD FRP casings in the DZMW. However, a submersible sampling pump set at a depth of 100 feet, is needed to pump water from the lower monitoring zone. All purged water should be conveyed into the IW for disposal.

All monitoring data obtained for the IW and the DZMW should be tabulated and submitted to the FDEP Fort Myers office on a monthly basis

After the operational testing period has been completed, an UIC Class I operation permit should be applied for and obtained from the FDEP. The minimum allowable operational testing period is one year. Issuance of that permit will likely result in a modified monitoring program with quarterly and annual analyses.

TABLF

GREATER PINE ISLAND WATEF SOCIATION INJECTION WELL SYSTEM
MONI G PROGRAM

Parameter	Measured	Tabulated
INJECTION WELL		
Injection Pressure (psi)	Continuously	Daily
Maximum Injection Pressure (psi)	Continuously	Daily
Minimum Injection Pressure (psi)	Continuously	Daily
Average Injection Pressure (psi)	Continuously	Daily
Flow Rate (gpm)	Continuously	Daily
Maximum Flow Rate (gpm)	Continuously	Daily
Minimum Flow Rate (gpm)	Continuously	Daily
Total Volume Injected (gals.)	Continuously	Daily
Annular Pressure (psi)	Continuously	Daily
Temperature (°C) of Injectate	Monthly	Monthly
Specific Conductance (umhos/cm)	Monthly	Monthly
Total Dissolved Solids (mg/l)	Monthly	Monthly
Dissolved Chlorides (mg/l)	Monthly	Monthly
pH (SU)	Monthly	Monthly
Bicarbonate (mg/l)	Monthly	Monthly
Calcium (mg/l)	Monthly	Monthly
Carbonate (mg/l)	Monthly	Monthly
Iron (mg/l)	Monthly	Monthly
Magnesium (mg/l)	Monthly	Monthly
Potassium (mg/l)	Monthly	Monthly
Sodium (mg/l)	Monthly	Monthly
Sulfate (mg/l)	Monthly	Monthly
Total Kjeldahl Nitrogen (mg/l)	Monthly	Monthly
Gross Alpha (pCi/l)	Monthly	Monthly
Radium 226/228 (pCi/l)	Monthly	Monthly

EACH ZONE OF THE DUAL ZONE MONITORING WELL		
Water Level (ft)/Pressure (psi)	Continuously	Daily
Maximum Water Level Pressure (psi)	Continuously	Daily
Minimum Water Level Pressure (psi)	Continuously	Daily
pH (SU)	Weekly	Weekly
Temperature (°C)	Weekly	Weekly
Specific Conductance (uhmos/cm)	Weekly	Weekly
Total Dissolved Solids (mg/l)	Weekly	Weekly
Dissolved Chloride (mg/l)	Weekly	Weekly
Dissolved Sulfate (mg/l)	Weekly	Weekly
Total Kjeldahl Nitrogen (mg/l)	Weekly	Weekly
Bicarbonate (mg/l)	Monthly	Monthly
Calcium (mg/l)	Monthly	Monthly
Carbonate (mg/l)	Monthly	Monthly
Iron (mg/l)	Monthly	Monthly
Magnesium (mg/l)	Monthly	Monthly
Potassium (mg/l)	Monthly	Monthly
Sodium (mg/l)	Monthly	Monthly
Gross Alpha (pCi/l)	Monthly	Monthly
Radium 226/228 (pCi/l)	Monthly	Monthly

IX. REFERENCES

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