AECOM

August, 2013

Operation & Maintenance Manual
Town of Davie, Fl
Water Treatment and
Water Reclamation Facility

Town of Davie

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DAVIE-IW1

September 20, 2013

Mr. Joseph Haberfeld, P.G.
Florida Dept. of Env. Protection
UIC Program - Mail Sta. #3530
2600 Blair Stone Road
Tallahassee, FL 32399-2400

RE: Town of Davie Water Treatment and Reclamation Facility
O&M Manual and O&M Equipment Manual for Deep Injection Well System
FDEP UIC Well Construction Permit Number 0298127-001-UC
AECOM Project No. 60185432

Dear Joe:

Hereby submitted on behalf of The Town of Davie are the O&M Manual and O&M Equipment Manual for the Deep Injection Well System at the New Water and Wastewater Treatment Facility located at 7351 SW 30th Street, Davie FL 33314. The deep injection well system consists of two (2) deep injection wells (IW-1 and IW-2) and associated dual-zone monitor well (MW-1). The deep injection well system was constructed to serve as the primary disposal method for reverse osmosis concentrate and treated effluent generated at this facility. IW-1 and IW-2 were built to Class I (industrial) injection well construction standards in accordance with Rule 62-528, FAC, and the conditions of FDEP issued Class I Injection Well Construction Permit No. 0298127-001-UC.

Should you have any questions regarding the attached engineering report, please contact me at (561) 684-3375.

Sincerely,

Michael W. Bennett
9/20/13

Michael W. Bennett,
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SECTION 1
Introduction

This Operation and Maintenance (O&M) Manual has been prepared by AECOM Technical Services to serve as a guide for the operation and maintenance of the new deep injection well (DIW) system at the Town of Davie Water Treatment and Water Reclamation Facility (WTF/WRF) located at 7351 SW 30th Street, Davie, Florida 33314. The location of the site is presented in **Figure 1-1**. A map of the site, including the DIW system is presented in **Figure 1-2**.

Figure 1-1: Site Location Map

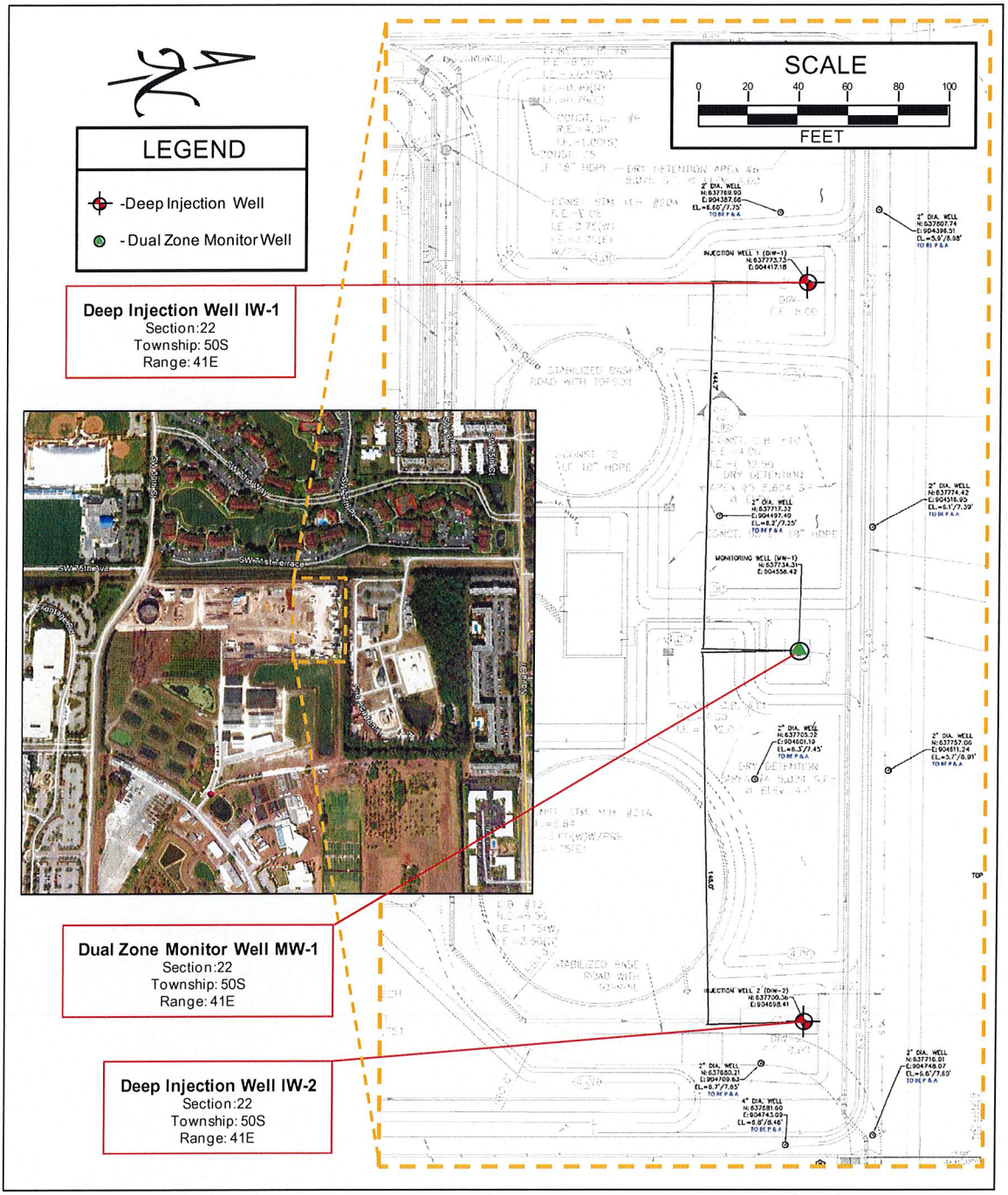

Figure 1-2: Site Plan

This manual should be used in conjunction with the *Deep Injection Well System Operation & Maintenance Equipment Manual Town of Davie, Fl,* hereafter referred to simply as the *Deep Injection Well System Equipment Manual,* that provides various manufacturers equipment information sheets. The guidelines and procedures that follow are necessary for safe and efficient operation of this Class I DIW system.

The preparation of this manual follows the guidelines set forth in Chapter 62-528 of the Florida Administrative Codes (F.A.C.). The injection well system provides the Town of

Davie an environmentally safe method for the disposal and monitoring of concentrate generated by the reverse osmosis plant and as the secondary system to handle treated effluent generated from the WRF. The disposal horizon for waste streams is located in the "Boulder Zone" a highly tranmissive, saltwater horizon located at a depth of 2,902 to 3,800 feet below land surface at this site.

1.1 Operator Responsibility

The State of Florida regulates the operation of Class I injection well systems under Chapter 62-528, F.A.C., and in accordance with specific conditions provided in Town's injection well system construction permit. The operator should be familiar with Chapter 62-528, F.A.C., and must ensure that copies of the current injection well system permit issued by the Florida Department of Environment Protection (FDEP) t and Monthly Operating Reports are onsite and accessible at all times. The operator should also have the ability to record, file, report and interpret system operating and monitoring data.

Successful operation of the Class I injection well system will depend on qualified personnel and adequate supplies to enable a prompt, thorough response to system maintenance requirements and to correct system problems as they may occur.

1.2 General System Descriptions

The Florida Department of Environmental Protection (FDEP) issued permit number 0298127-001-UC to the Town to allow the construction and operational testing of the deep injection well system. A copy of the Town's FDEP construction permit is provided in **Appendix A.**

The Town of Davie deep injection well system consists of two (2) alternative design, Class I industrial-type deep injection wells (IW-1 and IW-2) and associated dual-zone monitor well (MW-1), controls and monitoring instrumentation and associated transmission piping to the deep injection wells. This Class I injection well system will serve as the primary method for the disposal and monitoring of concentrate generated by the reverse osmosis plant and as the secondary system to handle treated effluent generated from the WRF with a maximum permitted injection rate of 11.4 million gallons per day (MGD).

SECTION 2
System Description

2.1 Deep Injection Well System Description

The Town of Davie deep injection well system consists of two (2) alternative design, Class I industrial-type deep injection wells (IW-1 and IW-2), associated dual-zone monitor well (MW-1), controls and monitoring instrumentation and associated transmission piping to the deep injection wells. The deep injection wells, IW-1 and IW-2, will be utilized as the primary method for the disposal of concentrate generated by the reverse osmosis plant and as the secondary system to handle reuse quality treated effluent generated from the WRF.

2.1.1 Injection Well - IW-1

Deep injection well IW-1 was constructed in general accordance with the design and construction standards of Chapter 62-528, F.A.C., and in accordance with the general and specific conditions of the FDEP-issued construction permit 0298127-001-UC. The well was constructed with three (ASTM A-139 Grade B) concentric steel casings (60-, 50- and 40-inch outside diameters) with a wall thickness of 0.375 inches. The final injection casing (30-inch outer diameter) is longitudinally welded (API 5L Grade B) carbon steel with a wall thickness of 0.50 inches. The final injection steel casing was installed to a depth of 2,902 feet below land surface (bpl) with an open-hole interval from 2,902 to 3,685 feet bpl. Installed within the 30-inch diameter steel injection casing is a 20-inch outer diameter (17.988–inch ID) injection liner. The 20-inch diameter injection liner is composed of aromatic amine cured epoxy resin fiberglass reinforced pipe (FRP) with an internal pressure rating of 1,500 psi (wall thickness of 1.0 inches) manufactured by Future Pipe Industries. The FRP injection liner is set on a Youngquist Brother Inc (YBI) designed mechanical packer at a depth 2,892 feet bpl and the annulus for the 20-inch diameter FRP is fully cemented to land surface. A completion diagram of IW-1 is provided as **Figure 2-1** and also in drawing **13 D-601** in **Appendix B**.

The injection well IW-1 is located on a 10 by 30 foot concrete well pad. The injection well pad provides a stable working surface during future repairs and/or testing of the injection well. Drawings of the wellhead and well pad are provided as **Drawing 13 D-101** in **Appendix B**.

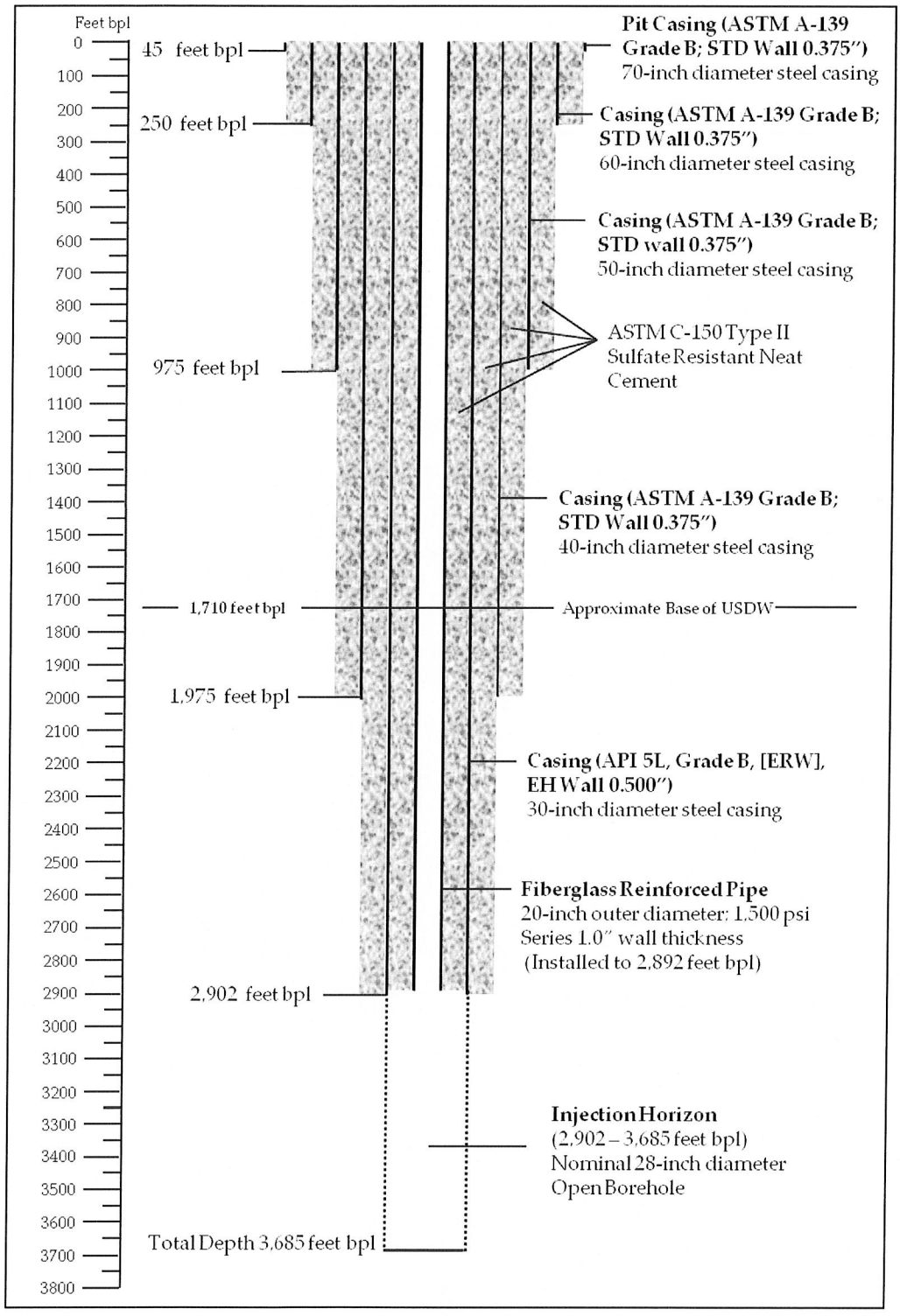

Figure 2-1: IW-1 Well Completion Diagram

2.1.2 Injection Well - IW-2

Deep injection well IW-2 was constructed in general accordance with the design and construction standards of Chapter 62-528, F.A.C., and in accordance with the general and specific conditions of the FDEP-issued construction permit 0298127-001-UC. The well was constructed with three (ASTM A-139 Grade B) concentric steel casings (60-, 50- and 40-inch outside diameters) with a wall thickness of 0.375 inches. The final injection casing (30-inch outer diameter) is longitudinally welded (API 5L Grade B) carbon steel with a wall thickness of 0.50 inches. The final injection steel casing was installed to a depth of 2,925 feet below land surface (bpl) with an open-hole interval from 2,925 to 3,800 feet bpl. Installed within the 30-inch diameter steel injection casing is a 20-inch outer diameter (17.988–inch ID) injection liner. The 20-inch diameter injection liner is composed of aromatic amine cured epoxy resin fiberglass reinforced pipe (FRP) with an internal pressure rating of 1,500 psi (wall thickness of 1.0 inches) manufactured by Future Pipe Industries. The FRP injection liner is set on a Youngquist Brother Inc (YBI) designed mechanical packer at a depth 2,917 feet bpl and the annulus for the 20-inch diameter FRP is fully cemented to land surface. A completion diagram of IW-1 is provided as **Figure 2-2** and also in drawing **13 D-601** in **Appendix B**.

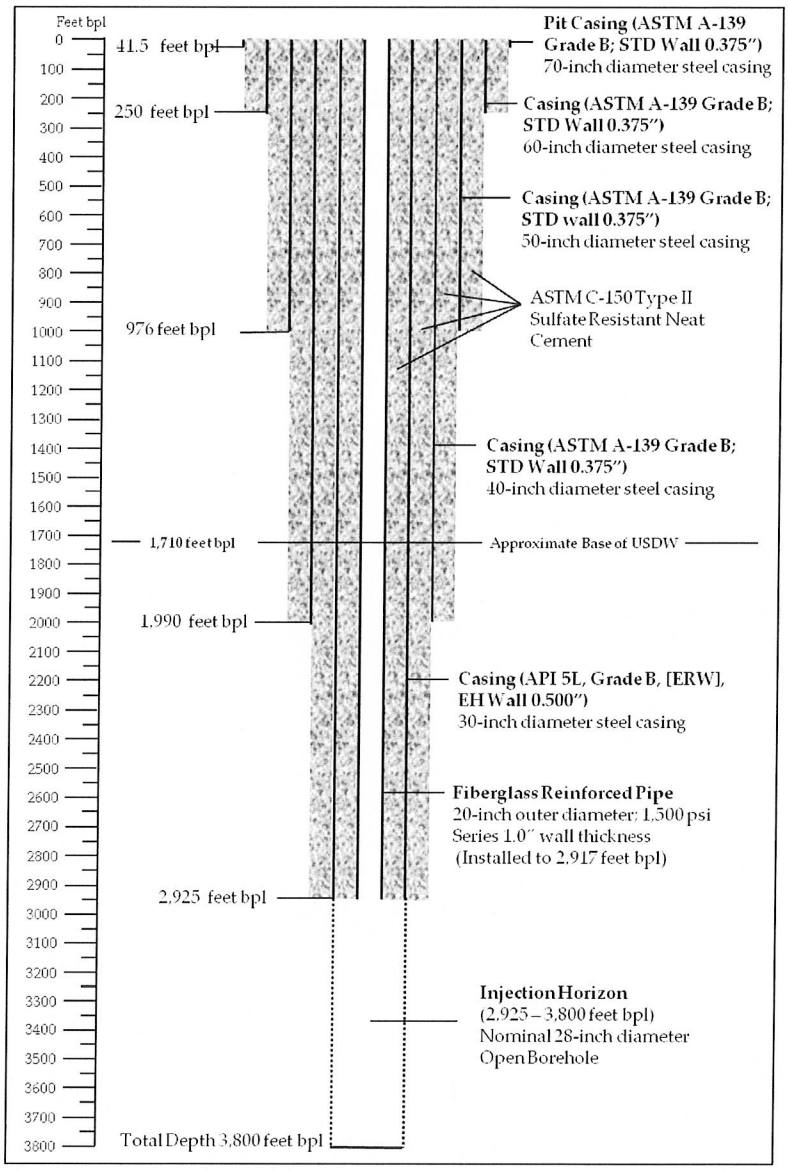

Figure 2-2: IW-2 Well Completion Diagram

The injection well IW-1 is located on a 10 by 30 foot concrete well pad. The injection well pad provides a stable working surface during future repairs and/or testing of the

injection well. Drawings of the wellhead and well pad are provided as **Drawing 13 D-102** in **Appendix B**.

2.1.3 Dual-Zone Monitor Well

The dual-zone monitor well identified as MW-1 was constructed in accordance with FDEP 62-528 and the specific conditions of the FDEP-issued construction permit number 62368-001-UC. The dual-zone monitor well and associated concrete well pad is located between IW-1 and IW-2 as illustrated on **Figure 1-2**. The dual-zone monitor well was constructed to monitor for upward migration of injected fluids from the injection horizon into the overlying source of drinking water (USDW). The USDW is defined as ground water that has total dissolved solid concentration less than 10,000 milligram per liter. A completion diagram of MW-1 is provided as **Figure 2-3** and also in drawing **13 D-601** in **Appendix B**. Diagrams of the monitor well wellhead and well pad are provided as **Drawing 13 D-103** in **Appendix B**.

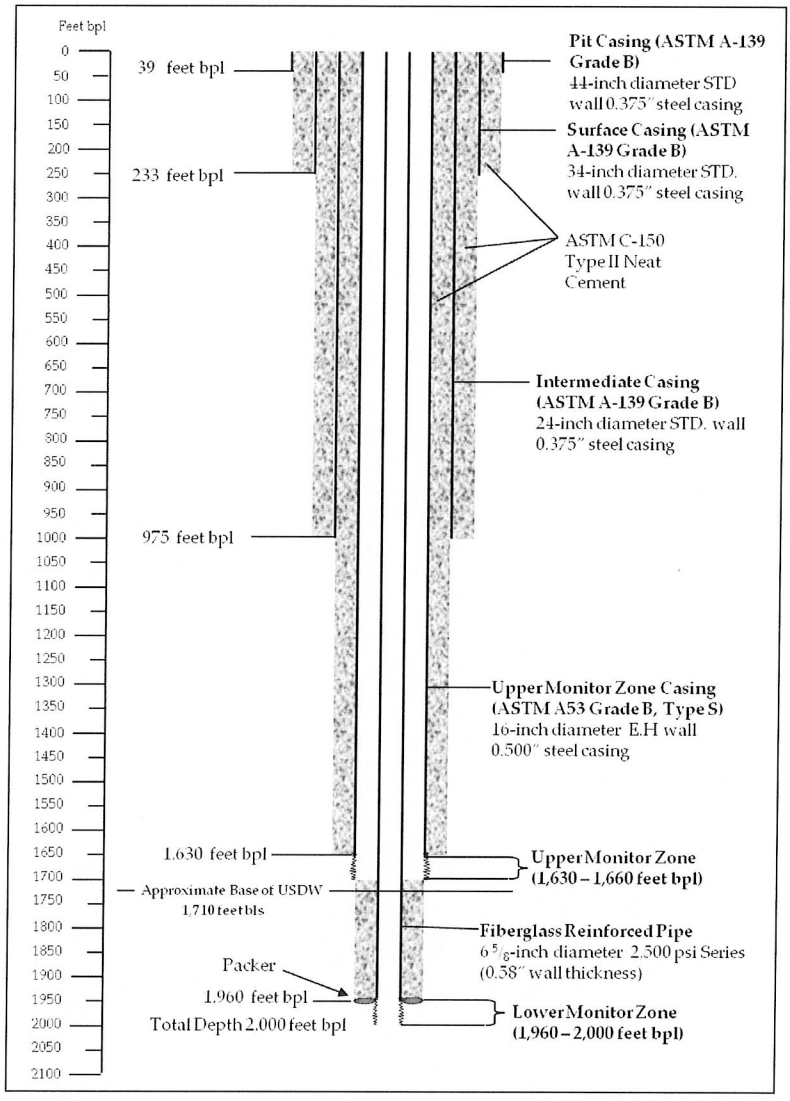

Figure 2-3: MW-1 Well Completion Diagram

The upper monitor zone identified as MW-1U monitors the interval from 1,630 to 1,660 feet below pad level (bpl). The upper monitor zone is the un-cemented portion of the annulus between the 16-inch diameter steel casing (ASTM A53 Grade B) set at 1,630 feet bpl and the 6 5/8-inch diameter FRP (2,500 psi rated) set at 1,960 feet and cemented back to 1,660 feet bpl. Background water samples indicate the native ground water in this interval is brackish with a chloride and total dissolved solids (TDS) concentration of 3,440 and 6,588 mg/L, respectively.

The hydraulic head of the upper monitor zone is approximately 30 feet above NGVD. A 1 ¼-inch nickel aluminum bronze alloy centrifugal sample pump (model KC2) manufactured by Ampco Pumps Company is used to purge the upper monitor zone casing prior to water quality sample collection. It has a 2-horsepower, 3 phase, and TEFC electric motor rated to pump 30 GPM at 80 feet TDH at 3,500 RPM. Performance data and specifications for this pump are provided in **Section 9** of the *Deep Injection Well System Equipment Manual.*

The lower monitor zone identified as MW-1L monitors the interval from 1,960 to 2,000 feet bpl. The 6 $^{5}/_{8}$ FRP was set at 1,960 feet bpl which allows monitoring of water levels and water quality at this depth interval. Native ground water in this interval is saline and similar in composition to seawater with a corresponding hydraulic head of approximately 4 feet NGVD (approximately 4 feet bpl). Chloride and TDS concentrations from background analytical results for this interval are 21,500 and 38,933 mg/L, respectively.

A 4-inch diameter stainless steel submersible turbine sample pump manufactured by Grundfos Pump Corp. (model 25SE 10-7) will be used to purge the lower monitor zone casing prior to water quality sample collection. It has a 1-horsepower, 3 phase electric motor rated to pump 22-25 GPM at 160-139 feet TDH at 3,450 RPM. Performance data and specifications for this pump are provided in **Section 10** of the *Deep Injection Well System Equipment Manual.*

If injected fluid were to migrate from the injection horizon within the Boulder Zone, the lower density fluids (concentrate generated by the reverse osmosis plant and treated effluent) would first move upward into the lower monitor zone of MW-1. In such an event, water quality changes within the affected monitor zone would occur. These water quality changes typically include a decrease in chloride and TDS concentrations. An increase in water level of the affected monitor zone would also occur if injected fluids were to migrate to intervals monitored by MW-1.

2.1.4 Surge Protection System

The deep injection well system is constructed with a 660 gallon Wesselect, Model FXA 2500, vertical bladder tank to serve as surge and water hammer protection for both IW-1 and IW-2. A diagram of the tank and the connections of the tank to the injection well system is provided in drawing **13 D-501** in **Appendix B**. Performance data and specifications for the surge protection tank are provided in **Section 1** of the *Deep Injection Well System Equipment Manual.* The tank was set with a pre-charge pressure of 15 psi.

The purpose of the surge protection system is to dissipate hydraulic surges caused by a sudden increase or decrease in the flow velocity within the DIW system. When flows to the well are stopped suddenly, water in the piping system initially remains in motion due to its momentum. This momentum causes a low pressure downstream of the pump check valves. If the liquid is flowing at a high velocity, a void may open at the face of the valve.

The reversal of the water column after momentum dissipates may produce a damaging backpressure when the void collapses. This phenomenon is commonly known as "water hammer".

2.2 Injection System Process Instrumentation and Equipment

Instrumentation and equipment associated with the injection well system include pressure transmitters, level transmitters, flow meters, pump switches, centrifugal sample pump, submersible pump, and associated piping, valves and fittings.

Table 2-1 details the equipment and instrumentation used in the DIW system. The operator is encouraged to consult the equipment manufacturers' operation and maintenance literature provided in the *Deep Injection Well System Equipment Manual* for further technical information associated with the DIW system. The drawings **13 D-101, 13 D-102 and 13 D-103** in **Appendix B** provide diagrams of the injection well system equipment and instrumentation with associated tag numbers.

Table 2-1 Deep Injection Well System Equipment and Instrumentation Details

IW-1 Component	Tag ID	MW-1 Upper Component	Tag ID
IW-1 Pressure Indicating Transmitter	PIT-1301	Centrifigul Sample Pump	DM P-2
IW-1 Flow Element	FE-1301	Centrifigul Sample Pump Hand Switch	HS-1322
IW-1 Flow Indicating Transmitter	FIT-1301	Upper Zone Pressure Transmitter	LIT-1321
IW-1 Wellhead Gate Valve 18"	GV-1	Flowmeter Indicator/Totalizer - Upper Zone	FIT - 1323
IW-1 Air Vacuum Release Valve (ARV)	ARV-1	Upper Air Vacuum Release Valve (UARV)	UARV-1
IW-1 ARV Gate Valve 6"	GV-2	Upper Sample Ball Valve	USBV-1
IW-1 Motor Operated Valve 18"	MOV-1303	1½" Upper Zone Isolation Ball Valve	UIBV-1
IW-1 Wellhead Pressure Gauge Isolation Valve	PGV-1	1½" Upper Solenoid Valve	USV-1
IW-1 Pressure Gauge	PG-1	1½" Upper Zone Ball Valve	UBV-1
		1" Upper ARV Ball Valve	UBV-2
IW-2 Component	**Tag ID**	**MW-1 Lower Component**	**Tag ID**
IW-2 Pressure Indicating Transmitter	PIT-1302	Submersible Sample Pump	DM P-1
IW-2 Flow Element	FE-1302	Submersible Sample Pump Hand Switch	HS-1312
IW-2 Flow Indicating Transmitter	FIT-1302	Lower Zone Pressure Transmitter	LIT-1311
IW-2 Wellhead Gate Valve 18"	GV-3	Flowmeter Indicator/Totalizer - Lower Zone	FIT - 1313
IW-2 Air Vacuum Release Valve (ARV)	ARV-2	Lower Air Vacuum Release Valve (LARV)	LARV-1
IW-2 ARV Gate Valve 6"	GV-4	Lower Sample Ball Valve	LSBV-1
IW-2 Motor Operated Valve 18"	MOV-1304	1½" Lower Zone Isolation Ball Valve	LIBV-1
IW-2 Wellhead Pressure Gauge Isolation Valve	PGV-2	1½" Lower Zone Check Valve	LCV-1
IW-2 Pressure Gauge	PG-2	1½" Lower Solenoid Valve	LSV-1
		1" Lower ARV Ball Valve	LBV-1

Flow Rate and Pressure Instrumentation

2.2.1 Injection Well (IW-1)

Injection pressure at IW-1 will be monitored continuously at the wellhead using a Cerabar S "Evolution" Smart gauge/absolute Pressure Transmitter Model PMP-71. Performance data and specifications for this pressure transmitter are provided in **Section 2** of the *Deep Injection Well System Equipment Manual.*

The flow rate to IW-1 is measured by an 18-inch Proline ProMag Electromagnetic Flow Measuring System Model 53W. The flowmeter is located on the 18-inch diameter stainless steel surface piping. This flow meter will be used to measure flow rates and totalizer readings on a continuous basis to provide a daily minimum, maximum and average flow rate value and a total daily injection volume for IW-1. Performance data and specifications for this flowmeter are provided in **Section 4** of the *Deep Injection Well System Equipment Manual.*

2.2.2 Injection Well (IW-2)

Injection pressure at IW-2 will be monitored continuously at the wellhead using a Cerabar S "Evolution" Smart gauge/absolute Pressure Transmitter Model PMP-71. Performance data and specifications for this pressure transmitter are provided in **Section 3** of the *Deep Injection Well System Equipment Manual.*

The flow rate to IW-2 is measured by an 18-inch Proline ProMag Electromagnetic Flow Measuring System Model 53W. The flowmeter is located on the 18-inch diameter stainless steel surface piping. This flow meter will be used to measure flow rates and totalizer readings on a continuous basis to provide a daily minimum, maximum and average flow rate value and a total daily injection volume for IW-2. Performance data and specifications for this flowmeter are provided in **Section 4** of the *Deep Injection Well System Equipment Manual.*

2.2.3 Dual-Zone Monitor Well (MW-1)

The upper and lower zones of the monitor well MW-1 are monitored by submersible KPSI Titanium Level Transducers (Model No. 320) with cable jacket material composed of Tefzel®. These are the DIW systems permanent pressure sensors at MW-1 and will be utilized to continuously monitor water level/pressure at the upper and lower zones of monitor well MW-1. The transducers operate by transmitting a 4-20 mA signal from the pressure sensor. The transducer installed at the upper zone has a range of 0 to 50 psi (0 to 115.5 feet) and the transducer installed at the lower zone has a range of 0 to 100 psi (0 to 231 feet). Performance data and specifications for the submersible pressure transducers installed at MW-1 upper and MW-1 lower are provided in **Sections 11 & 12,** respectively, of the *Deep Injection Well System Equipment Manual.*

During purge and sampling of the upper and lower zones of MW-1, the flow rates are measured by 1½" Proline ProMag Electromagnetic Flow Measuring System Model 53W. The flowmeters are located on the 1½-inch diameter stainless steel surface piping. The flow rate and totalizer readings will be recorded to verify appropriate well volumes are purged from the monitor well prior to sampling for water quality analysis. Once metered, the purged water will be conveyed to an onsite sump before pumped to IW-1 or IW-2. Performance data and specifications for the flowmeters are provided in **Section 13** of the *Deep Injection Well System Equipment Manual.*

Digital data collected from the pressure sensors and flow meters of IW-1, IW-2 and MW-1 will be transmitted through the SCADA system to the control room at the facility. These data will be available to the operators in real time and will be recorded so that the required reports can be compiled on a monthly basis for submittal to the FDEP.

SECTION 3
System Operating and Monitoring

3.1 General Information

The disposal of concentrate generated by the reverse osmosis plant and treated effluent via the deep injection well system should take place in accordance with the specific conditions of the FDEP-issued construction and information provided as part of this O&M manual.

Before operating any equipment associated with the DIW system, the operator should consult the *Deep Injection Well System Equipment Manual* and read the provided equipment manufacturer's information. This manual can be referenced to assist the operator with repair during equipment malfunction. If repairs cannot be corrected in-house, the operator, after discussion with his supervisor should contact the equipment manufacturer for assistance. The names, phone numbers, and addresses of equipment suppliers are provided in the *Deep Injection Well System Equipment Manual.*

3.2 Emergency Discharge Procedures

Deep Injection Well IW-1 will serve as the primary disposal well during normal operations of the WTF/WRF. During periods of planned and unplanned outages of IW-1, Deep Injection Well IW-2 will serve as the back-up disposal well.

When circumstances make emergency disposal procedures necessary, the steps described below must be taken. These actions are required in accordance with 62-528.415 FAC, Operating Requirements for Class I Wells, paragraph (4), Abnormal Events.

1. In the event the permittee is temporarily unable to comply with any of the conditions of a permit due to breakdown of equipment, power outages, destruction by hazard of fire, wind, or by other cause, the permittee of the facility shall cease injection activities and manually close the 18-inch stainless steel gate valve identified as GV-1 (IW-1) and GV-3 (IW-2) located at the wellhead. Notification to FDEP shall be made in person, by telephone, or by e-mail within 24 hours of the event.

2. The FDEP shall require a report within 72 hours of the notification referenced in (1), above. A final written report shall be submitted within 2 weeks and shall describe the nature and cause of the breakdown or malfunction, the steps being taken or planned to be taken to correct the problem and prevent its reoccurrence, emergency procedures in use pending correction of the problem, and the time when the facility will again be operating in accordance with permit conditions.

3.3 Monitoring Data Collection and Reporting

Injection system monitoring data are collected to provide a record of system performance and to guide the operator in locating and solving operational problems. This record represents the only direct indication of injection system performance and serves to substantiate decisions and recommendations for future work on the injection well. It also provides information FDEP requires as stipulated in the construction and operating permit.

Deep injection well injection pressures at the design capacity of 11.4 MGD range from approximately 43 to 46 psi (measured at the wellhead). Typical deep injection well injection pressures during normal operations of the operational testing phase will range from approximately 31 to 37 psi at a 4.0 mgd injection rate (measured at the wellhead). Monitoring and reporting of the DIW operating pressure is required by the FDEP-issued construction and testing permit and the long-term operation permit (when issued). A database of injection pressures should be maintained to allow comparison of current and historic injection pressures and determine if any changes in pressure is occurring over time. An increasing trend in injection wellhead pressure may be an indication that the zone into which concentrate generated by the reverse osmosis plant and treated effluent is being injected is experiencing plugging or a buildup of material on the inside of the injection tubing resulting in increased friction as the wastestream is conveyed down the 18-inch ID FRP injection tubing. The maximum injection pressure measured at the injection well cannot exceed 66% of the pressure applied during the last hydrostatic pressure test. For example, the pressure applied during the last hydrostatic pressure test on the injection tubing of IW-1 was 153 psi – the maximum injection pressure would be 101 psi. The plant superintendent should be notified, if an upward trend is observed or the maximum injection pressure is recorded. **Table 3-1** lists the monitoring reporting requirements for the injection system

Table 3-1: Monitoring & Reporting Requirements for the Injection Well System

Location and Type	To Be Submitted to FDEP	Frequency
Injection Wells IW-1 and IW-2		
Flow Rate Parameters:	Average Daily Flow Rate (GPM)	Daily
(put into MOR)	Daily Maximum Sustained (15 min) Flow Rate (GPM)	Daily
	Daily Minimum Sustained (15 min) Flow Rate (GPM)	Daily
	Monthly Average of the Daily Flow Rate (MGD)	Monthly
	Monthly Maximum (peak hour) Flow Rate (MGD)	Monthly
	Monthly Minimum Flow Rate (MGD)	Monthly
Volumetric Parameters:	Total Daily Flow Volume (MG)	Daily
(put into MOR)	Total Monthly Flow Volume (MG)	Monthly
	Monthly Average of the Daily Flow Volumes (MG)	Monthly
	Monthly Maximum of the Daily Flow Volumes (MG)	Monthly
	Monthly Minimum of the Daily Flow Volumes (MG)	Monthly
Injection Pressure Parameters:	Daily Average Injection Pressure (psig)	Daily
(put into MOR)	Daily Maximum Sustained (15 min) injection pressure (psig)	Daily
	Daily Minimum Sustained (15 min) injection pressure (psig)	Daily
	Monthly Average Injection Pressure (psig)	Monthly
	Monthly Maximum Sustained (15 min) injection pressure (psig)	Monthly
	Monthly Minimum Sustained (15 min) injection pressure (psig)	Monthly

Table 3-1 Con't: Monitoring & Reporting Requirements for the Injection Well System

Injection Wells IW-1 and IW-2		
Chemical Characteristics of Combined Wastewater Stream: (put into MOR)	Residue, Ttotal Filterable (dried at 180 °C) [Total Dissolve Solids, TDS] (mg/L)	Monthly
	Chloride (mg/L)	Monthly
	Specific Conductance (µmho/cm or µS/cm)	Monthly
	Total Suspended Solids (mg/L)	Monthly
	Nitrogen, Ammonia, Total as N (mg/L)	Monthly
	Nitrogen, Total Kjeldahl as N (TKN, mg/L)	Monthly
	Nitrogen, Nitrate, Total as N (mg/L)	Monthly
	Phosphorous, Total as P (mg/L)	Monthly
	pH (Standard Units)	Monthly
	Sulfate, Total as SO4 (mg/L)	Monthly
	Gross Alpha (pCI/L)	Monthly
	Combined Radium-226 and Radium-228 (pCi/L)	Monthly
	Field Temperature (°C)	Monthly
Injectivity Testing: (put into MOR)	Injectivity Testing Results	Monthly
Exercising of Valves: (put into MOR)	For each valve, this record shall include the valve identification number (tag), typed of valve, date and time when exercised	Monthly
Monitor Well MW-1 Upper and Lower Monitor Zones		
Physical Characteristics:	Daily Maximum Pressure or Water Level	Daily
	Daily Minimum Pressure or Water Level	Daily
	Daily Average Pressure or Water Level	Daily
	Monthly Minimum Pressure or Water Level	Monthly
	Monthly Average Pressure or Water Level	Monthly
	Monthly Maximum Pressure or Water Level	Monthly
Chemical Characteristics:[1]	Residue, Ttotal Filterable (dried at 180 °C) [Total Dissolve Solids,	Weekly/Monthly
	Chloride (mg/L)	Weekly/Monthly
	Specific Conductance (µmho/cm or µS/cm)	Weekly/Monthly
	Nitrogen, Ammonia, Total as N (mg/L)	Weekly/Monthly
	Nitrogen, Total Kjeldahl as N (TKN, mg/L)	Weekly/Monthly
	Nitrogen, Nitrate, Total as N (mg/L)	Weekly/Monthly
	Phosphorous, Total as P (mg/L)	Weekly/Monthly
	Fluoride (mg/L)	Weekly/Monthly
	pH (Standard Units)	Weekly/Monthly
	Sulfate, Total as SO4 (mg/L)	Weekly/Monthly
	Field Temperature (°C)	Weekly/Monthly
	Gross Alpha (pCI/L)	Monthly
	Combined Radium-226 and Radium-228 (pCi/L)	Monthly

[1] Upper and lower monitor zones will be sampled weekly during operational testing (approximately 6 months) and monthly thereafter.

3.3.1 Monitoring Data for Monthly Operating Report

The monitoring data for the Monthly Operating Report are to be compiled from both the injection and monitor wells. The facilities data measures and transmits both the injection rate and wellhead pressure that is continuously recorded at the injection well. The flow totalizer that records flows to the injection well is located on the 18-inch stainless steel line leading to the injection well. The monitor well data recorder for the lower zone of MW-1 records water levels above the submersible level transducer which was originally

installed to 30.0 feet below the top of flange or -19.56 feet NAVD of 1988. The upper monitor zone water level is recorded in feet above the submersible level transducer which was originally installed to 10.0 feet below the top of flange or -0.96 feet NAVD of 1988. All water levels from the upper and lower monitor zones should be reported relative to NAVD-88 on the Monthly Operating Reports. Please note that the depth setting of the transducers should be verified periodically or if significant variations in pressure readings are observed. If the setting depths are found to be different or are modified in the future, the above calculations should be updated.

To convert water level values from pressure (psi) or length (feet) above the setting depth of the transducer to an equivalent freshwater level reading relative to NAVD-88, it must first be determined if the water level value to be converted is in pressure (psi) or length (feet). If the value to be converted is pressure (psi), the value will need to be converted to feet by multiplying the pressure by 2.31 feet/psi. For example, a pressure reading of 10 psi would be equivalent to 23.1 feet (10 psi * 2.31 feet/psi = 23.1 feet).

The depth to which the pressure transducer was installed should then be added to the water level value (in feet) to be converted. The lower monitor zone transducer was originally installed to a depth of -19.56 feet NAVD-88. Therefore, if the value to be converted is 11 psi (25.41 feet), the water level relative to NAVD is 5.85 feet NAVD-88 [25.41 + (-19.56) = 5.85 feet NAVD of 1988].

The upper monitor zone transducer was originally installed to a depth of -0.96 feet NAVD-88. Therefore if the value to be converted is 19 psi (43.89 feet), the water level relative to NAVD is 42.93 feet NAVD of 1988 [43.89 + (-0.96) =42.93 feet NAVD of 1988].

Moderate fluctuations of the measured water levels within the monitor well zones are anticipated and naturally occurring. However, a consistent trend of increasing or decreasing water levels in either of the two monitor zones should be reported to the plant supervisor. The plant supervisor should then have the pressure transducer from the monitor zone in which the trend is occurring recalibrated to ensure the data is correct.

The Monthly Operating Report forms, contained in **Appendix C**, should be completed for submittal to the FDEP (to both the Southeast District in West Palm Beach and Tallahassee offices)

3.3.2 Monitor Well Water Quality Sampling and Reporting

Water quality samples are to be collected weekly during the operational testing period of the injection well system and monthly thereafter from the two monitor zones of the monitor well (MW-1) after the long term DIW operating permit has been issued. The samples are compared to the pre-injection water quality samples and previous water quality samples to detect any changes that may be caused if upward migration of the injected fluids were to occur. A duplicate sample should be collected when sampling the individual monitor zones for future reference. These samples may be disposed of at a

later date when the plant supervisor has confirmed that there are no anomalies associated with each particular sampling event.

Water samples should be collected in general accordance with FDEP Standard Operating Procedures for Field Activities (DEP-SOP-001/01 FS 2200 Groundwater Sampling). A minimum of three well casing volumes of formation water should be purged from each monitor zone prior to collecting representative samples for water quality analysis. A link to access the DEP-SOP-001/01 FS 2200 Groundwater Sampling protocol is listed below.

http://publicfiles.dep.state.fl.us/dear/labs/sas/sopdoc/2008sops/fs2200.pdf

Table 3-2 presents monitor well pre-sampling (purge) information for both the upper and lower monitor zones for MW-1.The purge rates are estimates based on the originally installed pumping equipment and should be verified from time to time.

Table 3-2 Monitor Well Sampling Information (minimum of 3 well volumes)

Monitor Zone	Purge Volume (gal.)	Purge Rate (gpm)	Purge Duration
Upper (MW-1U)	36,135	26	23 hours 10 min
Lower (MW-1L)	8,637	9	15 hours 59 min

It is important that monitor zone purging not exceed the duration indicated above to allow the water level in each zone to return to ambient conditions so meaningful water level data can be collected from each monitor zone.

Some variation in reported laboratory results is normal however, if injected fluids migrate into the monitor zones, the monthly water samples may show a freshening (lower reported values) trend from background chloride, TDS, and specific conductance values. Significant deviations from background water quality, pressure or water level values should be reported immediately to the plant supervisor. If anomalies are observed in any of these parameters, the sampling routine should be repeated as soon as possible to verify if there are actual deviations from background data. The actual sample routine is as follows:

1. Note the totalizer reading on the lower and upper zone flowmeters of the dual-zone monitor well (FIT-1313 and FIT-1323, respectively) in the daily field report log.
2. Open the 1 ½-inch lower solenoid valve (LSV-1) and/or lower zone isolation ball valve (LIBV-1).
3. Open the 1 ½-inch upper solenoid valve (USV-1) and/or upper zone isolation ball valve (UIBV-1).
4. Turn on the lower and upper zone sample pumps. Note the time that the sample pumps were turned on in the daily field report log.
5. Run the sample pumps for each monitor zone according to **Table 3-2** that indicates both the approximate specified pump rate and time that corresponds to the amount of water to be purged. If the pump rate differs from those

identified in **Table 3-2** than the appropriate change in duration needs to be recalculated.

6. After the specified amount of time, open upper zone sample ball valve (USBV-1) and collect water samples into the prepared sample containers forming a meniscus at the opening of the container and place and tighten sample cap. The person performing the water quality sampling should use appropriate sized, powder free disposable nitrile gloves during sampling.
7. Fill a clean 1 to 2 gallon plastic bucket approximately ¾ full and measure upper zone pH, temperature and specific conductance using field oriented water quality meter(s). Record the measured physical values at the wellhead in the daily field log book.
8. Close the upper sample ball valve (USBV-1).
9. Close the 1 ½-inch upper solenoid valve (USV-1) and/or upper zone isolation ball valve (UIBV-1).
10. Turn off the upper zone sample.
11. After the specified amount of time, open the lower zone sample ball valve (LSBV-1) and collect water samples into the prepared sample containers forming a meniscus at the opening of the container and place and tighten sample cap. Again, the person performing the water quality sampling should use appropriate sized, powder free disposable nitrile gloves during sampling.
12. Fill a clean 1 to 2 gallon plastic bucket approximately ¾ full and measure the lower zone pH, temperature and specific conductance at the wellhead using field oriented water quality instrumentation. Record the measured values in the daily field log book.
13. Close the lower sample ball valve (LSBV-1).
14. Close the 1 ½-inch lower solenoid valve (LSV-1) and/or lower zone isolation ball valve (LIBV-1).
15. Turn off the lower zone sample pump.
16. Place the collected water samples in an insulated cooler and cover sample containers with wet ice – the sample containers should be submerged into the wet ice. Place coolers in a safe and clean location.
17. Store samples cooler in cool air-conditioned location.
18. Fill out appropriate water sample chain of custody documentation and contact, ship and/or deliver samples to analytical laboratories immediately after sampling is complete.

Be sure that information from the water quality analyses has been recorded on the proper form (sample data forms are contained in **Appendix C**). The completed forms should be filed with the laboratory analytical reports as soon as the results are received from the laboratory.

3.3.3 Specific Injectivity Testing and Reporting

The injection well should undergo a specific injectivity test on a monthly basis during the operational testing period to detect any changes that may occur in the injection wells (IW-1 and IW-2) over time. The test is performed at a given rate of injection with

wellhead pressures recorded. The specific injectivity index, which is then derived, is used to compare the relative performance of the injection well over time.

Each injectivity test will require the participation of two staff. The total time to complete the injectivity test is about 2 hours. The test participants should adhere to the following protocol for injectivity testing at this site:

1. Cease injection into the injection well to be tested for a period of 30 minutes prior to the start of injectivity testing.

2. After ceasing injection into the injection well, close the gate valve on the 18-inch diameter injection line, identified as GV-1 (IW-1) and GV-3 (IW-2), and note the time it is fully closed. Once the gate valve has been fully closed, the well is referred to as "shut-in". Leave the injection well shut-in for 10 to 15 minutes or until the pressure at the wellhead has stabilizes.

3. Record the shut-in pressure of the injection well after 10 to 15 minute period. A sample Injectivity Form is provided in **Appendix C**. Record the pressure from the calibrated pressure gauge at the injection wellhead and the pressure reading at the control panel display. Compare these two pressure readings to ensure they are in close agreement.

4. Once shut-in pressure has been recorded, open the isolation valve, identified as GV-1 (IW-1) and GV-3 (IW-2), and begin injection into the injection well at a minimum rate of 1,000 gpm. This flow rate should be consistent with previous injectivity tests.

5. Note the time when the flow rate becomes stable.

6. After the injection rate has become stable for 10 minutes, continue to inject at the specified rate record the time, injection pressure and injection rate 20 minutes and 30 minutes after the well was shut-in. Compare the injection rate and pressure recorded at the injection well with those recorded in the control building.

7. Perform the injectivity calculation for all tests and complete the Data Forms (see Sample Data Form provided in **Appendix C**).

8. Subtract the shut-in pressure at the wellhead (use pressure from calibrated pressure gauge) from the injection pressure wellhead from the 30 minute after shut-in reading. This calculation yields the pressure difference.

9. Divide the rate (gpm) by the pressure difference (psi) to obtain the injectivity index. Use the forms provided to report the injectivity index in gpm per psi.

10. If the injection rates and pressure noted in the control building are different than the rate and pressure recorded at the wellhead, notify the plant supervisor to correct the discrepancy.

11. A database of injectivity index values for the injection well should be kept by the plant staff. These data should be plotted on an injectivity index versus date graph.

The most recent injectivity index should be compared to historic injectivity data to identify abrupt changes in well performance. If the injectivity index has significantly decreased from the last injectivity test or a trend of decreasing injectivity indices are identified, inform the plant superintendent.

Include the injectivity tests results with the monthly operating report forms submitted to the FDEP.

SECTION 4
Maintenance

Section 4 provides guidelines for the continuing management of a maintenance program for the Deep Injection Well system. A good preventive maintenance program enables successful plant operation by minimizing both expensive emergency repairs and unexpected interruption of the operation schedules. This manual should be used in conjunction with the *Deep Injection Well Equipment Manual* to develop the overall maintenance program for the DIW system.

The responsibility for general and preventive maintenance resides primarily with the operator. Therefore, it is imperative that all injection system operations personnel know and follow required maintenance procedures.

4.1 Maintenance and Lubrication Records

A good maintenance program includes an effective record keeping system that provides schedules for routine maintenance tasks as well as information on past equipment performance and repairs. Its usefulness is directly dependent on the operator's diligence in keeping it up-to-date.

The operator should review the equipment manufacturer's information contained in the *Deep Injection Well System Equipment Manual.* The suggested maintenance and preventative maintenance should be incorporated into the normal plant operations procedures.

4.2 Equipment Suppliers

The equipment manufacturers are provided in *Deep Injection Well System Equipment Manual* for each major component of the DIW system. The manufacturers or their representatives should be contacted when spare or replacement parts are needed or for information about unusual conditions that may arise.

Equipment failures under warranty are generally discussed in the manufacturer's information contained in the *Deep Well System Equipment Manual,* if not; the operator should contact the manufacturer for further information.

4.3 Mechanical Maintenance

All mechanical equipment within the disposal system requires periodic inspection, lubrication and adjustment. Regular mechanical maintenance is essential to ensure good operating condition and proper performance. Regular maintenance also provides opportunities for locating and correcting minor malfunctions to avoid major problems.

Operating personnel should familiarize themselves with the procedures provided in manufacturers' information in the *Deep Injection Well System Equipment Manual* for suggested mechanical maintenance for all pumps, valves, motors, instrumentation and other major equipment within the DIW system. Detailed records should be kept of all work performed in addition to written schedules of regular tasks necessary for monitoring the DIW system. The following are general checklists of maintenance tasks and general injection system operations to be performed at the intervals noted.

4.3.1 Daily

1. Check for unusual odors or noise that would indicate motors are running hot during sampling of the monitor zones.

2. Inspect injection and monitor well recorders for variation from normal operation. Notify the plant supervisor if deviations are noted.

4.3.2 Weekly

1. Perform lubrication as recommended in the equipment manufacturers' information contained in the *Deep Injection Well System Equipment Manual.*

2. Purge the monitor well zones of 3 to 5 casing volumes and collect water quality samples from each monitor zone and submit them to a NELAP certified laboratory to perform water quality testing.

4.3.3 Monthly

1. Exercise all valves in the injection system.

2. Perform maintenance suggested by the equipment manufacturer's information contained in the *Deep Injection Well System Equipment Manual.*

3. Inspect electric motors for wear, noise, over-heating, and loose connections. Record voltage and amperage readings of each motor. Report increasing amperage or unusual voltages to the plant supervisor.

4. Inspect flow transmitter at injection well wellhead for trapped air; bleed if necessary.

5. Complete and submit monthly operating reports to Southeast District and Tallahassee UIC Department offices.

6. Calibrate all instrumentation associated with the injection system on a semi-annual basis at a minimum.

4.4 Instrumentation Maintenance

These maintenance instructions are general. Maintenance of individual pieces of equipment should be performed specifically in accordance with the recommendations of the manufacturer(s) contained in the *Deep Injection Well System Equipment Manual.*

Modern instrumentation and control equipment require periodic maintenance to be kept in proper operating condition. Every 3 months, open the instruments and/or withdraw them from their cases; inspect the instruments, and clean with a soft brush. The instruments that have moving parts should be lightly lubricated in accordance with the instructions of the manufacturer. Do not over-lubricate. Check for interference between moving parts as required. Look for sources of unusual heat, sound, or odors. Keep electronic instruments free from dust and moisture.

Check the calibration annually on instruments, gauges, and pressure switches. If possible, they should be calibrated in-place, using the piping, wiring, and fluids of the processes, calibrating a whole sub-system at once. This method is the cheapest and most reliable because it does not require removing the instrument and it avoids errors such as bad connections and leaks after reinstallation. The disadvantages are that it will disrupt the process, and that it may be difficult to obtain sufficient accuracy and range. Consult with the plant supervisor to determine which method is appropriate.

Calibrate pressure gauges and pressure switches by connecting to a pressure header with a bleed valve and a pressure valve connected to an air tank. Use a gauge of known accuracy and recent calibration for a reference. Gauges should be checked annually.

Calibrate electronic instruments such as 4/20 mA outputs using an appropriate electrical meter. The use of a hand-held signal generator is useful in checking these units. Reading outputs with an electrical meter or generating an input and reading the instruments display will dictate the need for calibration. Consult specific instrument calibration instructions prior to attempting the correction of anomalies. Electronic and electrical equipment operates best in a clean and controlled environment. Keeping the equipment clean and free of moisture is the best procedure to avoid costly repairs.

SECTION 5
Safety

A safety program is generally defined by Town of Davie management but day-to-day participation in the program is the responsibility of all employees. **Section 5** presents an overview of the safety program recommended for operation of the deep injection well (DIW) system.

5.1 General Precautions

Written emergency instructions must be kept onsite and easily accessible to all personnel. These instructions should include: the telephone number and address of the company safety office and the nearest doctor; emergency numbers for the fire department, electric power company and police station; and first aid instructions.

Plant personnel should be trained in first aid and CPR, with recertification given annually. Drills, particularly resuscitation exercises should also be conducted periodically. Physical injuries can be minimized through the following measures: an established employee training program; adequate lighting; an orderly and scheduled housekeeping program; proper identification of all equipment; maintaining the disconnecting equipment in good repair; and wearing proper protective clothing, such as safety shoes, waist harness and hard hats, at all times.

There are major hazards that employees may encounter at a Deep Injection Well system. Known hazards include physical injuries, infections, electrical shock, burns and drowning.

Personal hygiene and protective clothing including water-proof, steel toe boot, Saran Tyvek coveralls and rubber gloves should be available for protection, when needed.

Electricity is a hazard that requires careful attention. Ordinary 110-volt electricity can be fatal. Since electricity kills by paralyzing the nervous system and stopping muscular action, it is essential that the victim be freed from the live conductor promptly by use of a dry stick or other non-conductor items. Never use bare hands to remove a live wire.

5.2 Safety Equipment

It is important that all operating personnel understand the necessity of using available safety equipment at all times. There is no excuse for injury or unnecessary damage to the plant, if proper equipment is available but not used.

All safety equipment must be checked, cleaned, and repaired at regular intervals. Recommended safety equipment includes the following:

- One complete first-aid kit
- Easily accessible fire extinguisher in each building

- Eyewash with shower
- Adequate amounts of appropriate signs to warn personnel of potential hazards

5.3 Personal Safety Practices

This section gives some general safety practices that should be followed on a daily basis in operating any equipment. The importance of the properly following established safety and equipment procedures around a water treatment plant cannot be overemphasized.

Basic personal safety measures include, but are not limited to, the following:

1. To avoid back strain, lift equipment straight up, using leg muscles instead of back muscles.
2. Ensure that first aid equipment is readily available for treating minor cuts, burns and wounds.
3. Never open high-voltage equipment switchboards unless standing on a suitable rubber mat.
4. Pick up all tools and practice good-housekeeping.
5. Keep walkways free of grease and oil and clean spills immediately.
6. Do not use electrical panels as racks for clothing or tools.
7. Do not use gasoline as a cleaning fluid.
8. Do not inhale solvent fumes.
9. Use portable lighting equipment to provide proper visibility in areas where permanent lighting facilities are not available.
10. Regularly practice putting on and using self-contained breathing equipment to ensure quick, proper use in times of emergency.
11. Upon completion of servicing belts, gears and other exposed moving machine parts, promptly replace guards that have been removed.
12. Adequately mark pipelines and faucets that contain non-potable water.

5.5 Accident Report

In the event of any injury, the following action should be taken:

- Notify plant supervisor as soon as possible, but within 24 hours. If necessary, seek medical attention.
- Complete any investigation report forms that may be required and consult plant supervisor.
- Complete any Workers Compensation forms and consult field supervisor.

Failure to follow proper reporting procedures may result in disqualification for benefits under Worker's Compensation law. It is in the employee's best interest to ensure that all incidents that result in injuries are promptly brought to a supervisor's attention and properly recorded in the permanent records.

Appendix A

FDEP Construction Permit No. 0298127-001-UC

Florida Department of Environmental Protection

Southeast District Office
400 N. Congress Avenue, Suite 200
West Palm Beach, FL 33401

Rick Scott
Governor

Jennifer Carroll
Lt. Governor

Herschel T. Vinyard, Jr.
Secretary

NOTICE OF PERMIT

January 21, 2011
Mr. Gary Shimun
Town Administrator
Town of Davie
6591 Orange Drive
Davie, Florida 33314

BROWARD COUNTY
UIC – Town of Davie Water System V and
Reclamation System IV Complex
Class I Injection Wells IW-1 & IW-2
File: 0298127-001-UC

Dear Mr. Shimun:

Enclosed is Permit Number 0298127-001-UC, to construct and operationally test two Class I injection wells, IW-1 and IW-2, with one associated dual zone monitoring well, MW-1, issued pursuant to Section(s) 403.087, Florida Statutes and Florida Administrative Codes 62-4, 62-520, 62-528, 62-550, 62-600, 62-601 and 62-660. The injection well system will be constructed at the Town of Davie Water System V and Reclamation System IV Complex, Davie, Florida.

Any party to this Order (permit) has the right to seek judicial review of the permit pursuant to Section 120.68, Florida Statutes, by the filing of a Notice of Appeal pursuant to Rule 9.110, Florida Rules of Appellate Procedure, with the Clerk of the Department in the Office of General Counsel, Mail Stop 35, 3900 Commonwealth Blvd., Tallahassee, Florida 32399-3000; and by filing a copy of the Notice of Appeal accompanied by the applicable filing fees with the appropriate District Court of Appeal. The Notice of Appeal must be filed within 30 days from the date this Notice is filed with the Clerk of the Department.

Should you have any questions, please contact Len Fishkin, P.G., or Joseph R. May, P.G., of this office at (561) 681-6711 or (561) 681-6691, respectively.

Executed in West Palm Beach, Florida.

STATE OF FLORIDA
DEPARTMENT OF ENVIRONMENTAL PROTECTION

01/21/11
Kevin Claridge — Date
Assistant District Director
Southeast District

KC/LAB/JRM/lf

Nancy Marsh, USEPA/ATL	marsh.nancy@epa.gov	Joe May, FDEP/WPB	joseph.may@dep.state.fl.us
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Bruce Taylor, Util. Dir./TOD	Bruce_Taylor@davie-fl.gov	Larry Lardieri, AECOM/PC	Larry.Lardeiri@aecom.com
Michael Bennett, AECOM/PC	Michael.Bennett@aecom.com	UIC Permitting File	

CERTIFICATE OF SERVICE

This is to certify that this NOTICE OF PERMIT and all copies were mailed before the close of business on 1/21/11 to the listed persons.
Clerk Stamp

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

Vanessa Osborne — 1/21/11
Clerk — Date

Florida Department of Environmental Protection

Southeast District Office
400 No. Congress Avenue, Suite 200
West Palm Beach, FL 33401
(561) 681-6600

PERMITTEE:
Mr. Gary Shimun
Town Administrator
Town of Davie
6591 Orange Drive
Davie, Florida 33314

PERMIT/CERTIFICATION NUMBER: 0298127-001-UC
DATE OF ISSUANCE: January 21, 2011
EXPIRATION DATE : January 20, 2016
COUNTY: Broward
POSITION: 26° 05' 10.4" N / 80° 14' 36.9" W
PROJECT: Construction and Testing Permit for a Class I Injection Well System at the Town of Davie Water System V and Reclamation System IV Complex

PROJECT: Construction and testing permit for Injection Wells IW-1 and IW-2 in addition to an associated dual zone monitoring well, MW-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, 62-528, 62-550, 62-600, 62-601 and 62-660. The above named permittee is hereby authorized to perform the work or operate the facility shown on the application and approved drawing(s), plans, and other documents attached hereto or on file with the Department and made a part hereof and specifically described as follows:

TO CONSTRUCT AND OPERATIONALLY TEST: Two Class I injection wells, IW-1 and IW-2, to be constructed using tubing and packer, with an associated deep dual zone monitoring well, MW-1. Under the permit, the purpose of the injection well system will be the disposal and monitoring of non-hazardous, secondary treated domestic effluent, reverse osmosis concentrate, and nanofiltration (membrane softening) concentrate. The reverse osmosis (RO) concentrate generated at the facility's Water Treatment Plant System V as a by-product of the RO process and the secondary-treated effluent generated at the Town's membrane bioreactor process from the facility's wastewater facility will be the primary components of injectate on most days. Additionally, nanofiltration concentrate may be routed to the deep wells and will be derived from an interconnection with the Town's Water Treatment Plant (WTP) III.

The planned maximum (peak hour) flow rate of effluent and concentrate to the injection well is 11.4 million gallons per day (MGD) or 7,910 gallons per minute (gpm). The rated capacity will be contingent on the results of testing and Department approval.

Injection Wells IW-1 and IW-2 will be constructed with a design that includes tubing and fully-cemented annulus around the tubing. A 17.97-inch inner diameter fiberglass reinforced (FRP) tubing will be installed within a nominal 20-inch outside diameter (O.D.), 1.0-inch thick FRP tubing. The FRP will be installed within a 30-inch outside diameter (O.D.) steel injection casing. The injection interval will be located in the "Boulder Zone" in the lower Oldsmar Formation between approximately 2,950 and 3,800 feet below land surface (bls). The final steel injection casing shall be seated at or below the base of the lowermost confining unit overlying the Boulder zone. The final steel injection casing shall be American Petroleum Institute (API) 5L, Grade B double submerged arc welded carbon steel pipe with a 0.50-inch wall thickness. The depths cited above are anticipated; final setting depths of IW-1 and IW-2 shall be determined based upon field conditions and only after specific approval by the Department.

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 will be monitored by two monitoring zones in Monitoring Well MW-1. The intention of the dual monitoring well system design is to have the upper monitoring zone be the compliance point with regard to matters of the USDW and to have the lower monitoring zone be the compliance point with regard to vertical movement out of the injection zone. The upper interval shall be positioned in a zone in immediate proximity to the base of the USDW. The lower interval shall be positioned in a zone below the base of the USDW, to verify the effectiveness of the confining unit and external mechanical integrity of the injection well. Accordingly, this zone shall be placed far enough below the base of the USDW to function as an early warning for fluid movement. Actual setting depths in MW-1 will be determined based on field conditions only after approval from the Department.

IN ACCORDANCE WITH: Pre-application meetings between City's consultant, AECOM, and FDEP staff, held at FDEP's Southeast District (SED) office on March 2, 2009; Pre-application Alternative Design meeting between City, AECOM (as consultant) and FDEP staff, held at FDEP's SED office on September 14, 2009; Application to Construct a Class I Injection Well System received November 6, 2009; Request for Information (RFI) dated February 16, 2010; Request for Alternate Design for the Deep Injection Well System received to the Department on February 25, 2010; response to RFI received March 8, 2010 by the Department; comments from the Underground Injection Control – Tallahassee UIC received on November 25, 2009, March 22, 2010, June 1, 2010 & August 31, 2010; electronic RFI (eRFI) dated April 16 issued to the permittee; response to eRFI received May 3, 2010 by the Department; eRFI dated June 2, 2010 issued to the permittee; Requested diagram information on June 1, 2010; Received diagram information on June 10, 2010; response to RFI received June 15, 2010 by the Department; Response to eRFI received July 16, 2010 by the Department; eRFI dated July 2, 2010 issued to the permittee; correspondence from the Department to the City dated regarding clarification on July 17, 2010 & August 17, 2010; supplementary drawing information received electronically August 18, 2010 and August 19, 2010; publication of the Notice of Draft Permit 0298127-001-UC in the Fort Lauderdale Sun Sentinel newspaper on October 10, 2010; in consideration of receipt of public comment received as a result of a public meeting held on November 15, 2010; and publication of the Notice of Intent to Issue Permit 0298127-001-UC in the Fort Lauderdale Sun Sentinel newspaper on December 15, 2010.

LOCATED AT: Town of Davie Water System V and Reclamation System IV Complex, 7351 Southwest 30th Street, Davie, Broward County, Florida 33314.

TO SERVE: The Davie Water System V and Reclamation System IV Complex Service Area.

SUBJECT TO: General Conditions 1-24 and Specific Conditions 1-11.

GENERAL CONDITIONS:

The following **General Conditions** are referenced in Florida Administrative Code Rule 62-528.307.

1. The terms, conditions, requirements, limitations and restrictions set forth in this permit are "permit conditions" and are binding and enforceable pursuant to Section 403.141, F.S.

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.

3. As provided in Subsection 403.087(7), F.S., the issuance of this permit does not convey any vested rights or exclusive privileges. Neither does it authorize any injury to public or private property or any invasion of personal rights, nor 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, 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 to human health or welfare, animal, or plant life, or property caused by the construction or operation of this permitted source, or from penalties therefrom; 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, or 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 this permit;
   b. Inspect the facility, equipment, practices, or operations regulated or required under this permit; and
   c. Sample or monitor any substances or parameters at any location reasonably necessary to assure compliance with this permit or Department rules.

   Reasonable time will depend on the nature of the concern being investigated.

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

   a. A description of and cause of noncompliance; and
   b. The period of noncompliance, including 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 the recurrence of the noncompliance. The permittee shall be responsible for any and all damages which may result and may be subject to enforcement action by the Department for penalties or for revocation of this permit.

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

11. This permit is transferable only upon Department approval in accordance with Rules 62-4.120 and 62-528.350, F.A.C. 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. 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 shall be extended automatically unless the Department determines that the records are no longer required.
    b. The permittee shall hold at the facility or other location designated by this permit records of all monitoring information (including 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 used
        6) the results of such analyses

    d. The permittee shall furnish to the Department, within the time requested in writing, any information which the Department requests to determine whether cause exists for modifying, revoking and reissuing, or terminating this permit, or to determine compliance with this permit.
    e. If the permittee becomes aware that 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.

14. All applications, reports, or information required by the Department shall be certified as being true, accurate, and complete.

15. 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 scheduled date.

16. 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.

17. 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.

18. The permittee shall take all reasonable steps to minimize or correct any adverse impact on the environment resulting from noncompliance with this permit.
19. This permit may be modified, revoked and reissued, or terminated for cause, as provided in 40 C.F.R. Sections 144.39(a), 144.40(a), and 144.41 (1998). 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.

20. The permittee shall retain all records of all monitoring information concerning the nature and composition of injected fluid until five years after completion of any plugging and abandonment procedures specified under Rule 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.

21. 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. All reports shall contain the certification required in Rule 62-528.340(4), F.A.C.

22. The permittee shall notify the Department as soon as possible of any planned physical alterations or additions to the permitted facility. In addition, prior approval is required for activities described in Rule 62-528.410(1)(h).

23. 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.

24. 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.

    All information shall be provided orally within 24 hours from 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 submission shall contain a 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.

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SPECIFIC CONDITIONS:

1. General Requirements

   a. This permit is for the Town of Davie to construct and operationally test two Class I injection wells, IW-1 and IW-2, to be constructed using cemented-in tubing packer, and an associated dual zone monitoring well, MW-1, at the Town's Water System V & Reclamation System IV Complex. This permit does not authorize the construction or operational testing of any other well or wells associated with the Town's Water System V & Reclamation System IV Complex.

   b. Four permanent surficial aquifer monitoring wells, identified as Pad Monitoring Wells (PMWs), shall be located near the corners of the pads to be constructed for IW-1, IW-2 and MW-1, and shall be identified by location number and pad location, i.e. NW, NE, SW, and SE. If located in a traffic area the well head(s) must be protected by traffic bearing enclosure(s) and cover(s). Each cover must lock and be specifically marked to identify the well and its purpose. The PMWs shall be sampled as follows:

      1) During the construction and associated testing phases, the PMWs shall be sampled weekly for chlorides (mg/L), specific conductance (µmho/cm or µS/cm), temperature and water level (relative to the North American Vertical Datum of 1988 [NAVD 88]).
      2) Initial PMW analyses shall be submitted prior to the onset of drilling activities.
      3) The PMWs shall also be sampled for total dissolved solids (mg/L) during the first four weeks of PMW sampling and at all times when specifically requested by the Department.

      The results of the PMW analyses shall be submitted to the Department within 30 days of the completion of the activity. A summary sheet from the FDEP Southeast District is attached for your use when reporting the above information. The PMWs shall be retained in service throughout the construction phase of the project. Upon completion of construction, the permittee may submit a request to the Department for cessation of sampling followed by capping, or plugging and abandonment of these wells.

   c. 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.

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

2. Construction and Testing Requirements

   a. The measurement points for drilling and logging operations shall be surveyed and referenced to the NAVD of 1988 (NAVD 88) prior to the onset of drilling activities for the injection well and associated dual zone monitoring well.

   b. Blow-out preventers shall be installed on the wells prior to penetration of the Floridan aquifer system.

   c. No drilling operations shall begin without an approved disposal site for drilling fluids, cuttings, or waste. It shall be the permittee's responsibility to obtain the necessary approval(s) for disposal prior to the start of construction. A detailed disposal plan shall be submitted to the Department prior to the commencement of drilling activities (for the injection and monitoring wells).

   d. The Department shall be notified 7 days prior to the mobilization of drilling operations to the site.

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

1) Secure all on-site salt and stockpiled additive materials to prevent surface and/or groundwater contamination.

2) Properly secure drilling equipment and rig(s) to prevent damage to well(s) and on-site treatment process equipment.

f. Waters spilled during construction or testing of the injection well system shall be contained and properly disposed.

g. UIC (SED and Tallahassee offices) review and Department approval is required prior to the following stages of construction and testing:

1) Contract documents and spud date
2) Intermediate (40-inch) casing seat in each injection well
3) Final (30-inch) casing seat in each injection well
4) Final seat for tubing and packer in each injection well
5) Intermediate (16-inch) casing seat in monitoring well
6) Final (6⅝-inch O.D.) casing seat in monitoring well
7) Monitoring zone selection (upper and lower zones)
8) Mechanical integrity testing
9) Short-term injection test
10) Operational testing

h. The geophysical logging program shall at a minimum include:

1) Prior to setting the 48-inch O.D. casing in Injection Wells IW-1 and IW-2, the following geophysical logs shall be run on the nominal 60-inch diameter borehole, to identify the base of the Hawthorn Group at approximately 250 to 1,000 feet bls, and to establish a mechanically secure casing setting depth:

- X-Y caliper
- Natural gamma ray

2) To determine the intermediate (40-inch) casing depth in Injection Wells IW-1 and IW-2, the logs indicated below shall be run on the pilot hole to a depth of approximately 1,000 to 2,100 feet bls. These logs shall be interpreted for stratigraphic correlation, identification of confining units, identification of producing intervals, and to aid in the casing seat determination:

- X-Y caliper
- Natural gamma ray
- Dual induction and Spontaneous potential
- Borehole compensated sonic with VDL display
- Downhole radial color television survey with rotating lens or borehole televiewer
- Logs to be run under pumping* and static conditions:
  - Flowmeter
  - Temperature (with differential plot)
  - Fluid resistivity

* Note: The pumping logs shall be run while pumping the borehole at a rate that adequately stresses the confining units, as shown by head loss across the beds, and allows the log interpreter to clearly identify the confining beds. The results of the flowmeter log run under dynamic conditions shall include presentations both in gallons per minute and in percent of flow analysis.

3) To determine the final (30-inch) casing depth in Injection Wells IW-1 and IW-2, the logs indicated below shall be run on the pilot hole from approximately 2,000 to 3,800 feet bls. The logs shall be interpreted for stratigraphic correlation, identification of confining units, identification of producing intervals, and to aid in the casing seat determination:

   Logs to be run under pumping and static conditions, to be completed to (but not penetrating) the anticipated top of the Boulder Zone:

   - Flowmeter
   - Temperature (with differential plot)
   - Fluid resistivity

   Logs to be completed at least twenty feet into the extremely high permeability strata marking the top of the Boulder Zone, to optimize the use of available potential confinement and to best evaluate optimum setting depth for the final casing:

   - X-Y caliper
   - Natural gamma ray
   - Dual induction and Spontaneous potential
   - Borehole compensated sonic with VDL display
   - Temperature (with differential plot)
   - Downhole radial color television survey with rotating lens or borehole televiewer

4) In the injection zone below the final casing of Injection Wells IW-1 and IW-2, the following logs shall be run:

   - X-Y caliper
   - Natural gamma ray
   - Dual induction
   - Borehole compensated sonic with VDL display
   - Downhole radial color television survey with rotating lens
   - Logs to be run under static conditions:
     - Temperature (with differential plot)
     - Fluid resistivity

5) Prior to setting the 24-inch O.D. casing in Monitoring Well MW-1, the following geophysical logs shall be run on the nominal 34-inch diameter borehole from approximately 250 to 1,000 feet bls, to establish a mechanically secure casing setting depth:

   - X-Y caliper
   - Natural gamma ray
   - Dual induction

6) Prior to setting the 16-inch O.D. intermediate casing and the 6⅝-inch O.D. final casing in Monitoring Well MW-1, the following geophysical logs shall be run on the pilot hole from approximately 1,000 to 1,700 feet bls. The logs shall be run for stratigraphic correlation, identification of the upper and lower monitoring zones (see **Specific Condition [S.C.] 2.n.**), and to aid in the casing seat determination (mechanically secure casing setting depth):

   - X-Y caliper
   - Natural gamma ray
   - Dual induction with shallow resistivity
   - Borehole compensated sonic with VDL display
   - Downhole radial color television survey with rotating lens
   - Logs to be run under pumping and static conditions:
     - Temperature
     - Fluid resistivity
     - flowmeter

   * Note: The pumping logs shall be run while pumping the borehole at a rate that adequately stresses the confining units, as shown by head loss across the beds, and allows the log interpreter to clearly identify the confining beds.

7) In the 15-inch O.D. open borehole in Monitoring Well MW-1, the following geophysical logs shall be run from approximately 1,600 to 2,000 feet bls. The logs shall be run for stratigraphic correlation, identification of the upper and lower monitoring zones (see **Specific Condition [S.C.] 2.n.**), and to aid in the casing seat determination (mechanically secure casing setting depth):

- X-Y caliper
- Natural gamma ray
- Dual induction
- Borehole compensated sonic with VDL display
- Downhole radial color television survey with rotating lens
- Logs to be run under pumping and static conditions:
  - Temperature
  - Fluid resistivity
  - flowmeter

8) X-Y caliper and natural gamma ray logs shall be run on all reamed holes prior to setting casings.

9) Temperature logs shall be run after each stage of cementing on all casings in all wells to identify the top of the cement.

10) Cement bond logs (CBL) shall be run:

a) In Injection Wells IW-1 and IW-2:

(1) Before cementing the final (30-inch) casing, using the CBL tool.
(2) After cementing the final (30-inch) casing, using the CBL tool.

b) In Monitoring Well MW-1, after cementing the 16-inch diameter casing (from 0 to approximately 1,650 feet bpl) and the final FRP casing (6⅝-inch O.D. casing), using the standard CBL tool. Should the results of the cement bond log run in MW-1 be inconclusive, the completion of a sector bond log in MW-1 may be required.

11) Television surveys shall be performed (to total depth of well) upon completion of construction of Injection Wells IW-1 and IW-2 (following the setting of the FRP injection tubing) and Monitoring Well MW-1.

i. If additives are used during grouting, for lost circulation or for any other reason — which were not approved in the permit application — information on their properties shall be submitted to FDEP prior to their use — for Department review and approval. Use of such additives may be authorized in a minor permit modification after receipt of a written request, supporting data, and the applicable fee.

j. Packer testing shall at a minimum include the following:

1) A combined total of at least eight packer tests shall be conducted during the drilling of Injection Wells IW-1, IW-2 and Monitoring Well MW-1.
2) At least one packer test conducted in each prospective monitoring zone.
3) At least five packer tests, conducted from the lowermost zone of the USDW to the top of the proposed injection horizon, will be used for the demonstration of confinement at the IW-1/IW-2/MW-1 location. For this reason the packer tests will be performed in the anticipated confining zones. At least one packer test supporting the demonstration of confinement will be obtained from each interval under consideration, based on the data collected to date, to be a confining unit. [See **S.C. 2.o.**]. To the extent feasible, the packer tests in the confining zones shall be performed over intervals that are sufficiently narrow so as not to include high hydraulic conductivity beds.
4) At least one packer test conducted to determine the USDW base, conducted in Monitoring Well MW-1.
5) Water samples shall be collected from each packer test, and analyzed for total dissolved solids (TDS), chlorides, sulfate, specific conductance, temperature, ammonia and total Kjeldahl nitrogen (TKN), at a minimum. Water samples collected from each packer test in potential confinement intervals shall also be analyzed for phosphorus, magnesium, alkalinity, bicarbonate, sodium, calcium and potassium.

6) A two-gallon water sample, obtained from intervals where sufficient water is available, shall be collected at the end of each packer test. In addition, a separate 100 ml sample with nitric acid preservative should be included for metal analysis. These samples shall be shipped to Florida Geological Survey, Hydrogeology Administrator, 903 West Tennessee Street, Tallahassee, Florida 32304.

k. A combined total of at least five cores shall be collected during the drilling of Injection Wells IW-1, IW-2 and Monitoring Well MW-1.

l. The depth of the USDW and the background water quality of the monitoring zones shall be determined during drilling and testing using the following information:

1) Water samples from packer tests with analysis and interpretation.
2) Packer test data with analysis and interpretation.
3) Geophysical logging upon reaching the total depth of the appropriate pilot hole interval including the following logs: caliper, gamma, dual induction, borehole compensated sonic, pumping flowmeter, temperature, and fluid resistivity.
4) Plots of sonic porosity and apparent formation fluid resistivity (Rwa). Interpretation will include calculation of sonic porosity and Rwa. The input parameters used to make this calculation shall be provided.

m. The confinement of the injection zone in the injection well system from overlying aquifers shall be monitored using the dual zone monitoring well and a groundwater monitoring program. The intention of this monitoring well system design is to have the upper monitoring zone to be the compliance point with regard to matters of the USDW and to have the lower monitoring zone to be the compliance point with regard to vertical movement out of the injection zone.

- The **upper interval** shall be positioned **in immediate proximity** to the base of the USDW. This zone must be established within the lowermost portion of the USDW unless it can be demonstrated that no zone is present that can produce adequate water for collection of representative ground water samples. Note: Should the TDS of this zone be slightly greater than 10,000 mg/L, then the zone placement shall be considered a strict interpretation of the rule.

- The **lower interval** shall be positioned in a zone that can produce adequate water for collection of representative ground water samples, below the base of the USDW. The purpose of the lower monitor zone is to verify the effectiveness of the confining unit and external mechanical integrity of the injection well. Accordingly, this zone shall be placed far enough below the base of the USDW to provide the earliest warning of upward migration as early in time as possible, thereby affording the most opportunity for mitigation should the confining unit not perform as expected. Accordingly, this zone shall be placed far enough below the base of the USDW to function as an early warning for fluid movement.

The data and analysis supporting the selection of the monitoring intervals shall be submitted to the Department after the collection, interpretation and analysis of all pertinent cores, geophysical logs and analysis of fluid samples. The hydrogeologic evaluation of a 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 Department shall approve the final selection of the specific upper and lower monitoring intervals.

n. To identify the upper and lower monitoring zones, the following information from the injection well and all available on-site sources of data shall be analyzed, interpreted and submitted for UIC review and approval:

1) borehole televiewer or downhole television survey
2) the permeability of the transition zone (transitional regarding TDS) in the vicinity of the USDW
3) packer test data including water quality (TDS, chlorides, sulfate, specific conductance, ammonia and TKN, at a minimum)
4) the specific capacity of the proposed upper and lower monitoring zones based on packer testing results
5) the identification of the base of the USDW

o. Confinement for the Injection Wells IW-1 and IW-2 locations shall be demonstrated using, at a minimum directly measured lithologic properties, geophysical evidence, and tests performed while pumping the formation.

p. Test results pertaining to confinement shall include and/or specifically reference the following informational and quality control items:

1) Information that documents the calibration of tools, including field checks prior to testing.
2) The conditioning/development of the borehole prior to logging, including the techniques used and the time periods in which applied, and
3) Pertaining to packer/pump testing - recording the pumping rate regularly throughout the test to account for possible variations in the pumping rate, and providing information regarding the detection of packer leaks, if any, during testing.

q. Representative samples of circulation fluid shall be collected during the drilling of the pilot hole of Injection Wells IW-1, IW-2 and during the drilling of Monitoring Well MW-1, as follows:

- At IW-1 and IW-2, the representative samples of circulation fluid shall be collected at a minimum of every 90 feet in drilling from a depth of approximately 1,000 feet bls to a depth of 1,500 feet bls. Below this depth, the representative samples shall be collected a minimum of every 30 feet to the top of the "Boulder Zone" preliminarily estimated at approximately 2,950 to 3,800 feet bls. The circulation fluid samples shall be analyzed for chlorides, TDS, specific conductance, ammonia and TKN, at a minimum.

- At MW-1, the representative samples shall be collected a minimum of every 90 feet in drilling from a depth of approximately 1,000 feet bls to a depth of 1,500 feet bls. Below this depth, the representative samples shall be collected a minimum of every 30 feet to the total depth of the pilot hole. The circulation fluid samples shall be analyzed for chlorides, TDS and specific conductance, at a minimum; these circulation fluid samples shall also be analyzed for ammonia and TKN, unless the permittee affirmatively demonstrates low concentrations of these parameters in the circulation fluid analyzed from the injection well.

r. If effluent is encountered or suspected during pilot hole drilling and testing, the Department shall be notified immediately by telephone and in writing and immediate appropriate precautionary measures shall be taken to prevent any upward fluid movement.

s. Mechanical integrity of each injection well shall be determined pursuant to Rules 62-528.300(6)(b)1. and 62-528.300(6)(c), F.A.C.

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

t. The Department shall be notified at least 72 hours prior to all testing for mechanical integrity (including all testing required before as well as following operational testing authorization).

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

3. Quality Assurance/Quality Control Requirements

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

b. In accordance with Section 492, Florida Statutes, all documents prepared for the geological/hydrogeological evaluation of the 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 or geologist) is required during all testing, geophysical logging and cementing operations.

4. Reporting Requirements

a. This project shall be monitored by the Department which consists of representatives at the following offices:

- Department of Environmental Protection, Southeast District Officer, West Palm Beach
- Department of Environmental Protection, Tallahassee

b. The permittee shall provide copies of all correspondence relative to this permit to both Department offices listed above in S.C. 4.a. Such correspondence includes but is not limited to reports, schedules, analyses and geophysical logs required by the Department under the terms of this permit.

c. The drilling and construction schedule shall be submitted to the Department during site preparation but prior to drilling operation commencement for the injection well system.

d. The Department and other applicable agencies must be notified of any unusual or abnormal 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.). Any information shall be provided orally or by electronic mail within 24 hours from the time the permittee becomes aware of the circumstances. A written submission shall also be provided within five days of the time the permittee becomes aware of the circumstances. The written submission shall contain a 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.

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

1) Any monitoring or other information which indicates that any contaminant may cause an endangerment to a USDW; or

2) Any noncompliance with a permit condition or malfunction of the injection system which may cause fluid migration into or between USDWs.

Any information shall be provided orally or by electronic mail within 24 hours from the time the permittee becomes aware of the circumstances. A written submission shall also be provided within five days of the time the permittee becomes aware of the circumstances. The written submission shall contain a 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.

f. Weekly progress reports shall be submitted throughout the construction period for IW-1, IW-2, and MW-1. These reports, which may be submitted by electronic mail, shall be submitted within 72 hours of the end of the period of record and shall include at a minimum the following information:

1) A cover letter summary of the daily engineer report, driller's log and a projection for activities in the next reporting period.
2) Daily engineers reports and driller's/work logs with detailed descriptions of all drilling progress, cementing, testing, logging, and casing installation activities.
3) Description of daily footage drilled by diameter of bit or size of hole opener or reamer being used.
4) Description of work during installation and cementing of casing, including amounts of casing and cement used. Details of cementing operations shall include the number of cementing stages, and the following information for each stage of cementing: the volume of cement pumped, the theoretical fill depth, and the actual tag depth. From both the physical tag and the geophysical logs, a percent fill shall be calculated. An explanation of any deviation between actual versus theoretical fill shall be provided.

5) Details of the additions of salt or other materials to suppress well flow, including the date, depth and amount of material used.
6) Description of testing accomplished including (but not limited to) pumping tests.
7) Lithologic logs with cuttings description, formation and depth encountered.
8) Geophysical logs, video logs, and deviation survey results.
9) Water quality analyses, including but not limited to the weekly water quality analysis and water levels for the four PMWs.
10) Details of any packer tests, pump tests and core analyses.
11) Well development records
12) Description of any construction problems that developed during the reporting period and current status.
13) Interpretations included with all test results and logs submitted.
14) A certified evaluation of all logging and test results, submitted with test data.

g. Per Rules 62-528.410(4)(c), 62-528.420(4)(c) and 62-528.605(2), F.A.C., the final selection of specific injection and monitoring intervals must be approved by the Department. In order to obtain an approval, the permittee shall submit a request to the Department. The request shall be submitted concurrently to both Department offices (S.C. 4.a.). All casing seat requests for the injection well and the Floridan aquifer monitoring well shall be accompanied by technical justification. To the extent possible, each casing seat request should address the following items:

1) Lithologic and geophysical logs with interpretations, as the interpretations relate to the casing seat.
2) Water quality data (including but not necessarily limited to TDS concentrations).
3) Identification of confining units, including hydrogeologic data and interpretations.
4) Identification of monitoring zones.
5) Casing depth evaluation (mechanically secure formation, potential for grout seal).
6) Lithologic drilling rate and weight on bit data, with interpretations (related to the casing seat).
7) Identification of the base of the USDW using water quality, Rwa plots, and geophysical log interpretations.

h. Monitoring zone requests shall contain the following:

1) Identification of the base of the USDW.
2) Identification of confining units.
3) Water quality of proposed monitoring zone (including but not necessarily limited to TDS).
4) Transmissivity or specific capacity of proposed monitoring zone.
5) Packer test drawdown curves and interpretation.

i. An interpretation of all test results and geophysical logs must be submitted with all submittals.

j. The short-term injection test request shall contain the following justifications:

1) Cement bond logs and interpretation.
2) Final downhole television survey with interpretation.
3) Radioactive tracer test results.
4) Demonstration of mechanical integrity, which shall include Items **1)** through **3)** above, and the pressure testing and temperature logging results (if the test is to be run using non-potable water).
5) Reasonable assurance that adequate confinement exists.
6) Proposed source water to be used (if non-potable water, must include analysis for primary and secondary drinking water standards (62-550, F.A.C.) and minimum criteria parameters (62-520, F.A.C.) as attached). Per Rule 62-528.405(3)(b), F.A.C., if an adequate water supply for the injection test does not exist, and the data collected during drilling provide assurance of the presence of confining bed(s), the applicant shall, after demonstrating mechanical integrity pursuant to Rules 62-528.300(6)(b)2. and (c), F.A.C., be allowed to use an alternate source for testing only with specific prior written authorization from the Department as described in Rule 62-528.100(2), F.A.C.
7) Planned injection testing procedures.

k. Upon completion of analysis of cores (when no longer needed by the well owner) and sample cuttings recovered during the construction of Injection Wells IW-1, IW-2, and Monitoring Well MW-1, the permittee shall contact the UIC Section of the Department of Environmental Protection in Tallahassee to arrange their transfer to the Florida State Geologic Survey.

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

5. Operational Testing Requirements

a. The operational 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 approval, the following items must be submitted (with the request for operational testing approval) for review and Department approval:

1) Lithologic and geophysical logs with interpretations.

2) A copy of the borehole television survey(s) or borehole televiewer log(s) of the injection well with interpretation.

3) Certification of mechanical integrity and interpreted test data.

4) Results of the short-term injection test with interpretation of the data. Each well shall first be tested for integrity of construction, and shall be followed by a short term injection test of such duration to allow for the prediction of operating pressure. The test results shall include a calculation or determination of fracture pressure of the injection formation [per Rule 62-528.410(6)(b)3., F.A.C.]. For a minimum of 12 hours, the injection test rate shall be no less than the maximum rate at which injection is to be authorized (for operational testing). Pressure/water level data from the injection zone and both monitoring zones shall be recorded continuously for at least 24 hours before the test and at least 24 hours following the test. The following data shall be recorded, analyzed, and reported for the duration of the injection test, i.e., all data should encompass the entire background, injection and recovery periods:

- injection flow rate, in MGD, with all injection periods recorded (IW-1 & IW-2)
- injection wellhead pressure, in psig (IW-1 & IW-2)
- pressure with no flow (shut-in pressure in psig; IW-1 & IW-2)
- monitoring well pressures (MW-1 upper and lower zones)
- tidal data
- barometric pressure

5) 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.

6) Information concerning the compatibility of the injected waste with fluids in the injection zone and minerals in both the injection zone and the confining zone.

7) Certification of completion of well construction.

8) Surface equipment (including piping, pressure gauges and flow meters, and all appurtenances) completion certified by the Engineer of Record.

9) Draft operation and maintenance manual, including a description of surge and water hammer control and emergency discharge management plan procedures. The emergency discharge system must be fully constructed and operational (ready to operate) prior to approval of operational testing.

10) Calibration certificates for pressure gauges and flow meters.

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

12) The demonstration of confinement for the Injection Wells IW-1 and IW-2 locations, 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 monitoring well. The report shall include the results of hydraulic testing (permeability, porosity, etc.) on the cores, and shall be reviewed and updated as appropriate after the completion of any additional injection/monitoring well pairs in the future from the confining interval. This submittal shall be prepared, signed, and sealed by a Florida Registered Professional Geologist or appropriately qualified Professional Engineer.

13) Background water quality data from the monitor and injection zones, analyzed for primary and secondary drinking water standards (62-550, F.A.C.) and minimum criteria parameters (62-520, F.A.C.) as attached.

14) Other data obtained during well construction needed by the Department to evaluate whether the well will operate in compliance with Department Rules. [Rule 62-528.450(3)(a)3.i., F.A.C.]

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

d. Pressure gauges and flow meters shall be installed on the injection well prior to initiating injection activities at the site.

e. Prior to the authorization of operational testing by the Department, the permittee shall contact the UIC Section of the Department, Southeast District, to arrange a site inspection. The inspection will determine if the conditions of the permit have been met and to verify that the injection well system is operational. During the inspection, emergency procedures and reporting requirements shall be reviewed.

6. Operational Testing Conditions

a. Upon receipt of written authorization from the Department **[S.C. 5.a.]**, the operational testing of the injection well system shall be subject to the following conditions:

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

2) The Department shall be notified in writing of the date of commencement operations.

3) The Department will monitor the progress of the operational testing phase of this project. Department meetings shall be held if necessary to aid (the Department) in determining if it may be necessary to modify the operational testing conditions. If requested by the Department, reports evaluating the system's progress shall be submitted to the Department.

4) The flow to the injection well at the wellhead shall be monitored and controlled at all times to ensure the maximum injection rate does not exceed the rate at which the well was tested. Should the tested rate be restricted because of a limited volume of source water available during the initial injection test, a second (higher-rate) injection test may be performed during operational testing to verify capacity at higher flows when sufficient source water volume is available. Department authorization is required to test at the higher rate.

5) Injection well system monitoring devices:

   a) Pursuant to Rule 62-528.425(1)(b), F.A.C., the injection well system shall be monitored by continuous indicating, recording and totalizing devices to monitor wastewater stream flow rate and volume, and continuous indicating and recording devices to monitor injection pressure, and monitoring zone pressure (or water level, as appropriate; all zones). All indicating, recording and totalizing devices shall be maintained in good operating condition.
   b) The surface equipment shall be such that manual backup capability to monitor pressure shall be provided for systems utilizing automatic and continuous recording equipment.

6) The permittee shall calibrate all pressure gauges, flowmeters, chart recorders, and other related equipment associated with the injection well system on a semiannual basis, at a minimum. The permittee shall maintain all monitoring equipment and shall ensure that the monitoring equipment is calibrated and in proper operating condition at all times. Laboratory equipment, methods, and quality control will follow United States Environmental Protection Agency (USEPA) guidelines as expressed in Standard Methods for the Examination of Water and Wastewater. The pressure gauges, flow meter, and chart records shall be calibrated using standard engineering methods.

7) The wellhead and associated appurtenances shall be equipped with lightning arrestors, surge capacitors or other similar devices.

8) The flow from the monitoring zones during well evacuation and sampling must not be discharged to surface waters or aquifers containing a USDW.

9) The injectate shall be non-hazardous in nature at all times, as defined in 40-CFR, Part 261 and as adopted in Chapter 62-730, F.A.C.

10) Only non-hazardous, secondary treated domestic effluent generated at the WWTF facility's membrane bioreactor process and non-hazardous RO concentrate generated at the facility's Water Treatment Plant System V as a by-product of the RO process will be the primary components of injectate on most days. Additionally, nanofiltration concentrate may be routed to the deep wells and will be derived from an interconnection with the Town's Water Treatment Plant (WTP) III. Purge water from the on-site monitoring wells (associated with the injection well system at the Town of Davie WWTF) may also be discharged into these wells.

Mechanical Integrity

   a) Injection is prohibited until the permittee 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) Within 48 hours of receiving written notice that the well lacks mechanical integrity, unless the Department requires immediate cessation of injection, the permittee shall cease injection into the well unless the Department allows continued injection pursuant to subparagraph (d) below.
   d) The Department shall allow the permittee to continue operation of a well that lacks mechanical integrity if the permittee has made a satisfactory demonstration that fluid movement into or between USDWs is not occurring.

11) The pressure at the wellhead shall be monitored and controlled at all times to ensure the maximum pressure at the wellhead casing does not exceed 66 percent (%) of the tested pressure on the final casing and injection tubing. [See **S.C. 2.s.**]

12) Any failure of the Class I injection well monitoring and recording equipment for a period of more than 48 hours shall be reported within 24 hours to the Department. A written report describing the incident shall also be given to the Department within five days of the start of the event. The final report shall contain a complete description of the occurrence, a discussion of its cause(s) and the steps being taken to reduce, eliminate, and prevent recurrence of the event, and all other information deemed necessary by the Department.

13) The injection system shall be monitored in accordance with Rules 62-528.425(1)(g) and 62-528.430(2), F.A.C. Samples and measurements taken for the purpose of monitoring shall be representative of the monitored activity. The following injection well performance and monitoring zone data shall be collected and reported to the Department in Monthly Operating Reports (MORs) as indicated below, for each injection well.

a) Injection well performance:

(1) Physical characteristics of the injection well:

Flow rate parameters:
- average daily flow rate to injection well as measured from flowmeter (MGD)
- daily maximum sustained (15 minutes minimum) flow rate to injection well (MGD)
- daily minimum sustained (15 minutes minimum) flow rate to injection well (MGD)
- monthly average of the daily flow rates to injection well (MGD)
- monthly maximum (peak hour) flow rate to injection well (MGD)
- monthly minimum flow rate to injection well (MGD)

Volumetric parameters:
- total daily flow volume to injection well as measured from totalizer (MG)
- total monthly flow volume to injection well (MG)
- total monthly flow volume to injection well from the water treatment and the domestic wastewater plant stream (MG)
- monthly average of the daily flow volumes to injection well (MG)
- monthly maximum of the daily flow volumes to injection well (MG)
- monthly minimum of the daily flow volumes to injection well (MG)

Wellhead pressure parameters:

- daily average injection pressure at injection well (psig)
- daily maximum sustained (15 minutes minimum) injection pressure at injection well (psig)
- daily minimum sustained (15 minutes minimum) injection pressure at injection well (psig)
- monthly average injection pressure at injection well (psig)
- monthly maximum sustained injection pressure at injection well (psig)
- monthly minimum sustained injection pressure at injection well (psig)
- monthly wellhead pressure with no flow (shut-in pressure, psig)

Exercising of valves:

A record shall be included in each MOR that documents the monthly exercising of valves. (See Specific Condition 7.b.) For each valve, this record shall include the valve identification number (tag), type of valve, date and time when exercised, and the initials of operator(s) performing the work. The record shall be maintained at the facility and shall be available for review by FDEP personnel at all times.

(2) Chemical characteristics of the combined wastewater stream sampled monthly:

- residue, total filterable (dried at 180° C) [total dissolved solids, TDS] (mg/L)
- chloride (mg/L)
- specific conductance (µmho/cm or µS/cm)
- total suspended solids (mg/L)
- nitrogen, ammonia, total as N (mg/L)
- nitrogen, total Kjeldahl as N (TKN, mg/L)
- nitrogen, nitrate, total as N (mg/L)
- phosphorous, total as P (mg/L)
- pH (standard units, s.u.)
- sulfate, total as SO_4 (mg/L)
- gross alpha (ρCi/L)
- combined radium-226 and radium-228 (ρCi/L)
- field temperature (°C)

The MORs shall indicate monthly averages for all parameters sampled daily.

b) Monitoring well performance:

(1) Physical characteristics - upper and lower monitoring zones potentiometric surface or water table height relative to NAVD 88 (feet of head) or pressure (psig) referenced to NAVD 88:

- daily maximum pressure or water level (as appropriate)
- daily minimum pressure or water level (as appropriate)
- daily average pressure or water level (as appropriate)
- monthly maximum pressure or water level (as appropriate)
- monthly minimum pressure or water level (as appropriate)
- monthly average pressure or water level (as appropriate)

Chemical characteristics of the upper and lower monitoring zones:

Weekly sampling:

- residue, total filterable (dried at 180° C) [total dissolved solids, TDS] (mg/L)
- chloride (mg/L)
- specific conductance (µmho/cm or µS/cm)
- nitrogen, ammonia, total as N (mg/L)
- nitrogen, total Kjeldahl as N (TKN, mg/L)
- nitrogen, nitrate, total as N (mg/L)
- phosphorous, total as P (mg/L)
- fluoride (mg/L)
- pH (standard units, s.u.)
- sulfate, total as SO_4 (mg/L)
- field temperature (°C)

Monthly sampling:

- gross alpha (ρCi/L)
- combined radium-226 and radium-228 (ρCi/L)

The MORs shall also indicate monthly averages for all parameters sampled weekly.

c) After the upper and lower monitoring zones have been sampled weekly for at least six months, the permittee may submit data for review and Department approval to demonstrate that reasonable assurance of groundwater stability has been established in justification of any request to reduce the sampling frequency to monthly. The request for reduction in sampling frequency shall be accompanied by technical justification and interpretations.

14) A minimum of three well volumes of fluid shall be evacuated from the monitoring systems prior to sampling for the chemical parameters listed above. A State-certified laboratory shall analyze all samples. Sufficient purging shall have occurred when either of the following have occurred:

a) pH, specific conductance and temperature when sampled, upon purging the third or subsequent well volume, each vary less than 5% from that sampled upon purging the previous well volume; or
b) upon purging the fifth well volume.

15) All samples must be collected and analyzed in accordance with the quality assurance/quality control (QA/QC) requirements of Rule 62-160, F.A.C.

16) All injection well system data submissions including MORs shall be clearly identified on each page with facility name, I.D. Number, permit number, operator's name, license number, daytime phone number, date of sampling/recording, and type of data. Monitoring zones shall be identified by well number and depth interval. The lead plant operator or higher official must sign and date each submittal. An approved summary sheet from the FDEP Southeast District UIC Section is attached.

17) The permittee shall submit monthly to the Department the results of all injection well and monitoring well data required by this permit (MORs) **no later than the last day of the month** immediately following the month of record. The results shall be sent to the Department of Environmental Protection's Southeast District Office (FDEP, UIC Section, 400 N. Congress Avenue, Suite 200, West Palm Beach, FL 33401). A copy of this report shall also be sent to the Department of Environmental Protection, Underground Injection Control Program, MS 3530, 2600 Blair Stone Road, Tallahassee, Florida 32399-2400.

18) A controlled **monthly** specific injectivity test (rate/pressure) shall be conducted on injection wells IW-1 and IW-2 in accordance with Rule 62-528.430(2)(d), F.A.C. This test shall be conducted at a rate that approaches the maximum design flow but which can be repeated on a monthly basis. The injectivity test results shall be reported to the Department in the MORs. The following data shall be recorded and reported:

Parameters pertinent to flow rate:

- injection flow rate as measured from flowmeter (MGD)
- initial totalizer reading (gallons)
- final totalizer reading (gallons)
- time (minutes) from initial to final totalizer readings

Pressure parameters:

- static injection wellhead pressure (psig)
- wellhead injection pressure fall-off — every 30 seconds until again static (psig)
- final pressure upon test cessation — approximately 10-15 minutes (psig)
- wellhead pressure with no flow (shut-in pressure in psig)
- monitoring zone pressures (psig)

Specific Injectivity shall be reported in gpm/psig.
All readings shall be taken after a minimum 5-minute period of stabilized flow.

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

19) Pursuant to Rules 62-528.425(1)(a) and 62-528.450(2)(f)3., F.A.C., a wastewater stream analysis (24 hour composite sample) of the secondary treated effluent for primary and secondary drinking water standards (Chapter 62-550, F.A.C.) and minimum criteria, see attached list, shall be submitted annually (sampled in February and **submitted on or before April 30th**, both of that year). Biological and VOCs shall be collected by grab or *in situ*. Concurrent with this submission, the permittee shall also provide a copy of the annual wastewater stream analysis (24 hour composite sample) completed for the reverse-osmosis concentrate and nanofiltration (membrane softening) concentrate, analyzed for primary and secondary drinking water standards (Chapter 62-550, F.A.C.).

7. Surface Equipment

a. The integrity of the monitoring zone sampling systems 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 ensure that samples are properly identified by monitoring 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.

b. 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, and reliability and flexibility in the event of damage to the well and effluent piping. A regular program of exercising the valves integral to the wellhead shall be instituted. At a minimum, all valves integral to the wellhead shall be exercised during the regularly scheduled monthly injectivity testing. A record shall be maintained at the facility that documents the exercising of the valves. **[See Specific Condition 6.a.14.a.)1)].**

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

d. Spillage onto the injection well pad during construction activities, and — after construction completion — any waters spilled during mechanical integrity testing, other maintenance, testing or repairs to the system shall be contained. The spilled waters shall be directed to a sump which in turn discharges to the pumping station wet well or via other approved means to the injection well system.

e. An injection well pad 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.

8. Financial Responsibility

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

b. The permittee shall update annually the cost estimate for plugging and abandonment, and submit each updated cost estimate annually to the Department. If during the duration of this permit the cost estimate exceeds that upon which financial responsibility is based ($543,910 total for injection well system) by 10 percent or more, the Town of Davie will need to obtain new *Certification of Financial Responsibility* forms and Comprehensive Annual Financial Reports and submit these documents to the Department for approval. A copy of the annual update shall be submitted to the Department's West Palm Beach and Tallahassee UIC programs each year within 60 days after the anniversary date of issuance of this permit.

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 14 days of such invalidation. The permittee shall then within 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.

9. 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 Department review and approval prior to implementation.

c. 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 24 hours of the incident. A written report describing the incident shall also be submitted to the Department within five days of the start of the incident. The written report shall contain a complete description of the emergency and/or discharge, a discussion of its cause(s), 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.

d. The emergency disposal method consists of the following:

1) The injection well system constitutes two injection wells of equal capacity including a duty well and a full-capacity reserve well at any given time.

2) The emergency disposal method presented in the permit application received October 28, 2009 (on Page 8) and approved by the Department as a part of this permit, shall be maintained in fully operational order at all times.

3) Any emergency bypass of the injection well system shall be governed by Rule 62-620.610, F.A.C.

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

10. Signatories

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

11. Permit Extension(s), Renewal(s) and Operation Permit Application(s)

a. Pursuant to Rule 62-4.080(3), a permittee may request that a permit be extended as a modification of an existing permit. A request for an extension is the responsibility of the permittee and shall be submitted to the Department before the expiration of the permit. In accordance with Rule 62-4.070(4), F.A.C., a permit cannot be extended beyond the maximum 5-year statutory limit. Should operational testing need to continue beyond the 5-year limit for this permit, the permittee must renew the construction permit in accordance with **S.C. 11.b.** below.

b. 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. However, under no circumstances shall the duration of the operational testing period exceed two years as specified in Rule 62-528.450(3)(e), F.A.C.

Issued this 11 day of January, 2011

STATE OF FLORIDA
DEPARTMENT OF ENVIRONMENTAL PROTECTION

Kevin Claridge
Assistant District Director
Southeast District

KC/LAB/SRM/lf

SOUTHEAST DISTRICT UIC SECTION
SURFICIAL AQUIFER MONITORING WELL (SAMW) REPORT

FACILITY NAME

_____

REPORT MONTH/YR. _____

OPERATOR NAME _____ LICENSE # _____

INJECTION WELL # _____ PERMIT # _____

SAMPLING DATE _____ TIME _____

	SAMW #1	SAMW #2	SAMW #3	SAMW #4
LOCATION	NE CORNER	NW CORNER	SE CORNER	SW CORNER
ELEV. OF TOC* (NAVD 88)				
DEPTH TO WATER (TOC*)				
WATER LEVEL (NAVD 88)				
CHLORIDE (mg/L)				
CONDUCTIVITY(µmhos/cm)				
TEMPERATURE (° C)				

* TOC: indicates the "top of the casing" of the Surficial Aquifer Monitoring Well

ANALYZED BY_____ SAMPLED BY _____

PHONE # _____ TITLE _____

SITE PLAN OF SAMW LOCATIONS

Attachment 1

PRIMARY & SECONDARY DRINKING WATER STANDARDS & MINIMUM CRITERIA

Updated February 1, 2007

PRIMARY DRINKING WATER STANDARDS

PARAMETER

Alachlor (Polychlorinated Biphenyl or PCB)
Aldicarb
Aldicarb sulfoxide
Aldicarb sulfone (Sulfone aldoxycarb)
Alpha, Gross
Antimony
Arsenic
Atrazine
Barium
Benzene
Benzo(a)pyrene
Beryllium
Bis(2-ethylhexyl) adipate (Di(2-ethylhexyl) adipate)
Bis(2-ethylhexyl) phthalate (Di(2-ethylhexyl) phthalate)
Bromate
Cadmium
Carbofuran
Carbon Tetrachloride (Tetrachloromethane)
Chlordane
Chlorine
Chlorine Dioxide
Chlorite
Chlorobenzene (Monochlorobenzene)
Chloroethylene (Vinyl Chloride)
Chromium
Coliforms, Total
Cyanide
2,4-D (2,4-Dichlorophenoxyacetic acid)
Dalapon (2,2-Dichloropropionic acid)
Dibromochloropropane (DBCP)
1,2-Dibromoethane (EDB, Ethylene Dibromide)
1,2-Dichlorobenzene (o-Dichlorobenzene)
1,4-Dichlorobenzene (p-Dichlorobenzene or Para Dichlorobenzene)
1,2-Dichloroethane (Ethylene dichloride)
1,1-Dichloroethylene (Vinylidene chloride)
1,2-Dichlorethylene (cis-1,2-Dichloroethylene or trans-1,2-Dichloroethylene)
cis-1,2-Dichloroethylene (1,2-Dichlorethylene)
trans-1,2-Dichloroethylene (1,2-Dichlorethylene)
Dichloromethane (Methylene chloride)
1,2-Dichloropropane
Di(2-ethylhexyl) adipate (Bis(2-ethylhexyl) adipate)
Di(2-ethylhexyl) phthalate (Bis(2-ethylhexyl) phthalate)
Dinoseb
Diquat
EDB (Ethylene dibromide, 1,2-Dibromoethane)
Endothall
Endrin
Ethylbenzene
Ethylene dichloride (1,2-Dichloroethane)
Fluoride
Glyphosate (Roundup)
Gross Alpha
Haloacetic Acids (HAA5)
Heptachlor
Heptachlor Epoxide
Hexachlorobenzene (HCB)
gamma-Hexachlorocyclohexane (Lindane)
Hexachlorocyclopentadiene
Lead

Attachment 1

PRIMARY & SECONDARY DRINKING WATER STANDARDS & MINIMUM CRITERIA

Updated February 1, 2007

PRIMARY DRINKING WATER STANDARDS, CONT'D

PARAMETER

Lindane (gamma-Hexachlorocyclohexane)
Mercury
Methoxychlor
Methylene chloride (Dichloromethane)
Monochlorobenzene (Chlorobenzene)
Nickel
Nitrate (as N)
Nitrite (as N)
Total Nitrate + Nitrite (as N)
Oxamyl
p-Dichlorobenzene or Para Dichlorobenzene (1,4-Dichlorobenzene)
Pentachlorophenol
Perchloroethylene (Tetrachloroethylene)
Picloram
Polychlorinated biphenyl (PCB or Aroclors)
Radium
Roundup (Glyphosate)
Selenium
Silver
Silvex (2,4,5-TP)
Simazine
Sodium
Strontium-90
Styrene (Vinyl benzene)
Tetrachloroethylene (Perchloroethylene)
Tetrachloromethane (Carbon Tetrachloride)
Thallium
Toluene
Toxaphene
2,4,5-TP (Silvex)
1,2,4-Trichlorobenzene
1,1,1-Trichloroethane
1,1,2-Trichloroethane
Trichloroethylene (Trichloroethene, TCE)
Trihalomethanes, Total
Vinyl Chloride (Chloroethylene)
Xylenes (total)

SECONDARY DRINKING WATER STANDARDS

PARAMETER

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

PRIMARY & SECONDARY DRINKING WATER STANDARDS & MINIMUM CRITERIA

Updated February 1, 2007

MUNICIPAL WASTEWATER MINIMUM CRITERIA GROUND WATER MONITORING PARAMETERS

INORGANICS

Ammonia
Nitrogen (organic)
Total Kjeldahl Nitrogen
Total Phosphorus (phosphate)

VOLATILE ORGANICS

Chloroethane
Chloroform
para-Dichlorobenzene (1,4 Dichlorobenzene)
1,2-Dichloroethylene (cis-1,2-Dichloroethylene or trans-1,2-Dichloroethylene)

BASE/NEUTRAL ORGANICS

Anthracene
Butylbenzylphthalate
Dimethylphthalate
Naphthalene
Phenanthrene

PESTICIDES AND PCBs

Aldrin
Dieldrin

ACID EXTRACTABLES

2-chlorophenol
Phenol
2,4,6-trichlorophenol

OTHER

Specific Conductance
Biological Oxygen Demand
Chemical Oxygen Demand
Temperature

Appendix B

DIW Drawings

"RECORD DRAWING"

6.75 – INDICATES RECORD DRAWING INFORMATION

RECORD DRAWING

THIS DRAWING HAS BEEN REVISED TO SHOW THOSE CHANGES DURING THE CONSTRUCTION PROCESS REPORTED TO AECOM USA, INC. AND IS CONSIDERED TO BE "AS-BUILT" BUT IS BASED ON THE RECORD ELEVATION INFORMATION OBTAINED AND PROVIDED BY " MILLER LEGG PER DRAWING ASB-WELL, SHEET 1 OF 1, DATED 10/03/12 ".

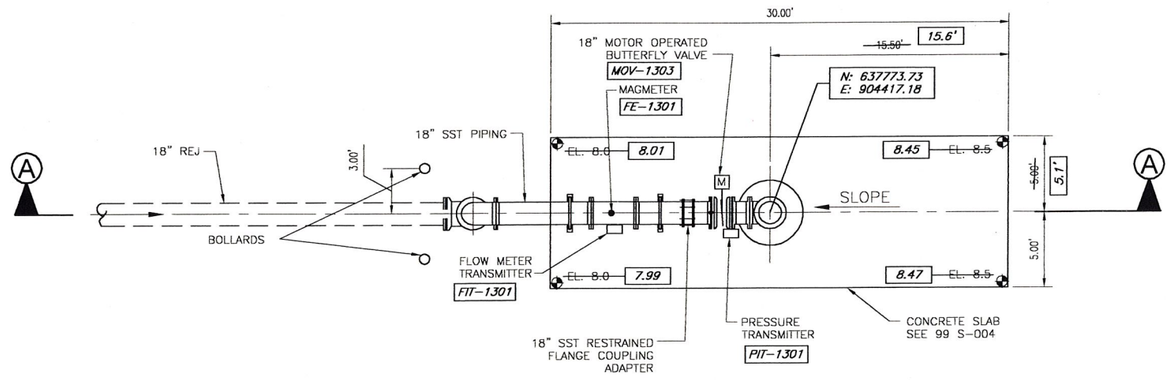
N

LEGEND:

- X 8.0 — EXISTING ELEVATION
- EL. 9.2 — PROPOSED ELEVATION

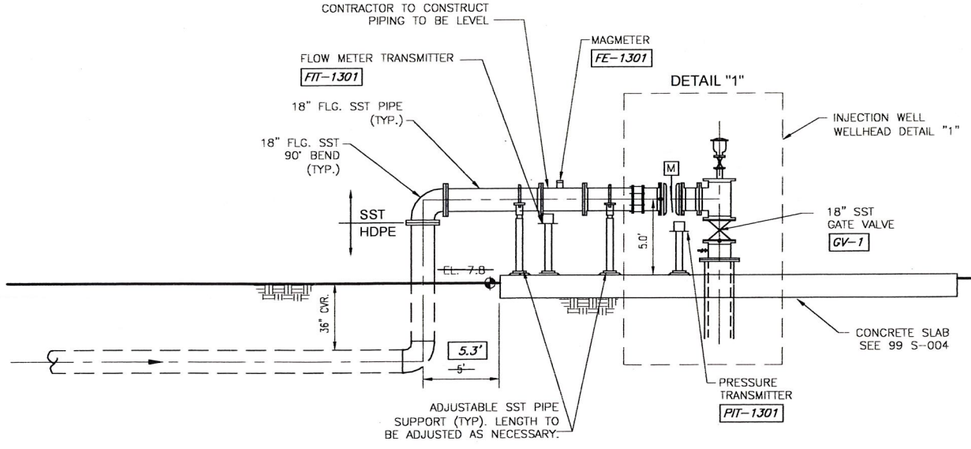
NOTES

1. CONCRETE SHALL SLOPE AWAY FROM INJECTION WELL & TOWARDS THE SOUTHEAST END OF SLAB @ MIN. 1/8" PER FOOT.
2. ALL PIPING AND FITTINGS ABOVE PAD LEVEL SHALL BE TYPE 316L STAINLESS STEEL (SST) FLANGED (FLG). UNDERGROUND DISCHARGE PIPING 4" DIA. & LARGER SHALL BE HDPE.
3. MAINTAIN 7.5' UPSTREAM AND 4.5' DOWNSTREAM OF CLEARANCE INJECTION WELL FLOW METER.
4. ALL BURIED PIPING SHALL BE RESTRAINED JOINT.
5. ALL REINFORCING BARS TO BE #5 UNLESS OTHERWISE NOTED.
6. SST 316 STEEL COMPONENTS SHALL BE SCHEDULE 40.
7. ALL WELL CASING DIAMETERS INDICATED ARE CASING OUTSIDE DIAMETERS (O.D.).
8. ALL CEMENT GROUT SHALL BE ASTM C-150 TYPE II SULFATE RESISTANT CEMENT.
9. *ELEVATIONS ARE RELATIVE TO NATIONAL GEODETIC VERTICAL DATUM OF 1929.*



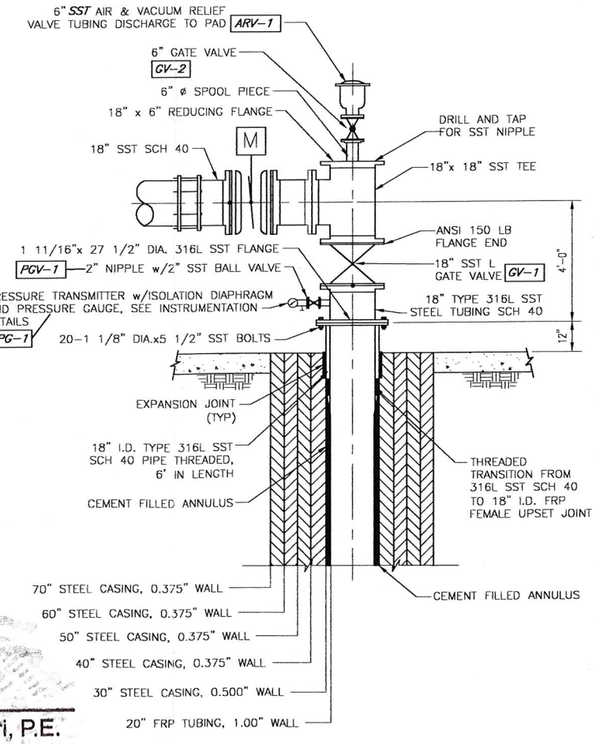
DEEP INJECTION WELL #1 PLAN

N.T.S.



SECTION "A"

N.T.S.



DEEP INJECTION WELL #1 WELLHEAD DETAIL "1"

N.T.S.

Lawrence A. Lardieri, P.E.
No. 26948
AUG 27 2013
AECOM Technical Services, Inc.
No. 8115

MARK	DATE	MADE BY	CHECKED	REVISIONS
	11/20/12	DLP		ADDED ADD'L RECORD DRAWING INFORMATION
	10/1/12	DLP		ADDED RECORD DRAWING INFORMATION

AECOM USA, INC.
3665 S.W. CORPORATE PARKWAY
PALM CITY, FL 34990
(772) 286-3583
CERTIFICATE NO. 28

TOWN OF DAVIE FLORIDA
WATER TREATMENT AND WATER RECLAMATION FACILITY

DEEP INJECTION WELL NO.1 PLAN SECTIONS & DETAILS

MECHANICAL PROCESS

PROJECT NO:	60096591
CAD DWG FILE:	_13 D-101
DESIGNED BY:	MWB
DRAWN BY:	DLP
DEPT CHECK:	LAL
PROJ CHECK:	B. DALY
DATE:	NOVEMBER 2010
SCALE:	AS NOTED

13 D-101

PATH/FILENAME: P:\60096591\DES'Y & DW CAD-11.30\10\601854321\REPORTS\CAD-V2007_13 D-101.DWG
LAST UPDATE: Wednesday, Novemb 7/12 9:00:33 AM
PLOT DATE: Wednesday, November 21, 2012 9:11:19 AM
ANSI D - 21-Nov-12

"RECORD DRAWING"

6.75 – INDICATES RECORD DRAWING INFORMATION

RECORD DRAWING

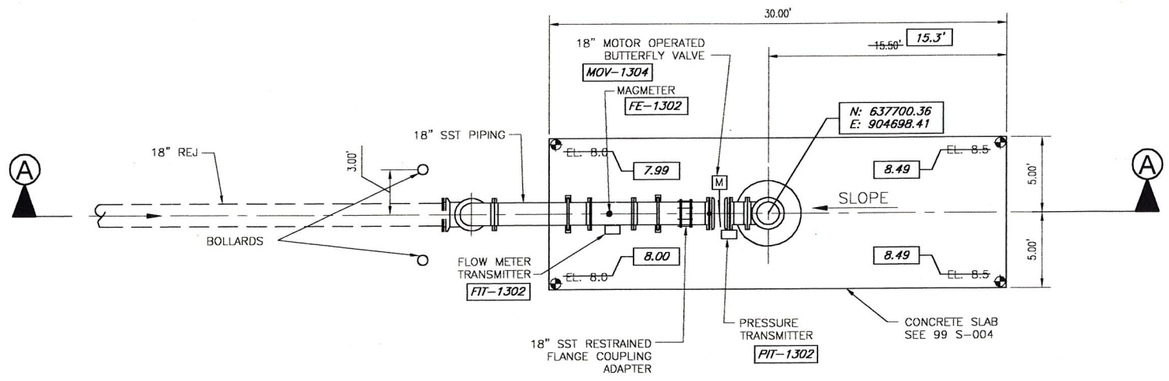
THIS DRAWING HAS BEEN REVISED TO SHOW THOSE CHANGES DURING THE CONSTRUCTION PROCESS REPORTED TO AECOM USA, INC. AND IS CONSIDERED TO BE "AS-BUILT" BUT IS BASED ON THE RECORD ELEVATION INFORMATION OBTAINED AND PROVIDED BY " MILLER LEGG PER DRAWING ASB-WELL, SHEET 1 OF 1, DATED 10/03/12 ".

LEGEND:

x 8.0	EXISTING ELEVATION
EL. 9.2	PROPOSED ELEVATION

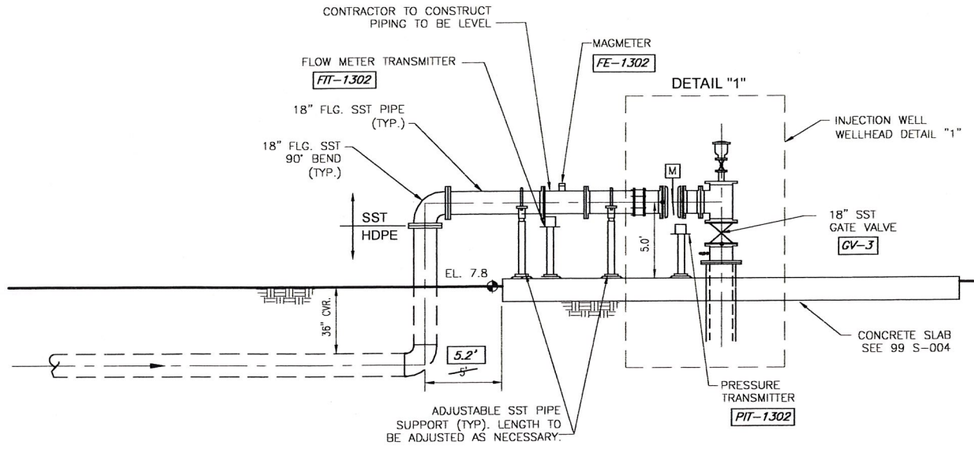
NOTES

1. CONCRETE SHALL SLOPE AWAY FROM INJECTION WELL & TOWARDS THE SOUTHEAST END OF SLAB @ MIN. 1/8" PER FOOT.
2. ALL PIPING AND FITTINGS ABOVE PAD LEVEL SHALL BE TYPE 316L STAINLESS STEEL (SST) FLANGED (FLG). UNDERGROUND DISCHARGE PIPING 4" DIA. & LARGER SHALL BE HDPE.
3. MAINTAIN 7.5' UPSTREAM AND 4.5' DOWNSTREAM OF CLEARANCE INJECTION WELL FLOW METER.
4. ALL BURIED PIPING SHALL BE RESTRAINED JOINT.
5. ALL REINFORCING BARS TO BE #5 UNLESS OTHERWISE NOTED.
6. SST 316 STEEL COMPONENTS SHALL BE SCHEDULE 40.
7. ALL WELL CASING DIAMETERS INDICATED ARE CASING OUTSIDE DIAMETERS (O.D.).
8. ALL CEMENT GROUT SHALL BE ASTM C-150 TYPE II SULFATE RESISTANT CEMENT.
9. *ELEVATIONS ARE RELATIVE TO NATIONAL GEODETIC VERTICAL DATUM OF 1929.*



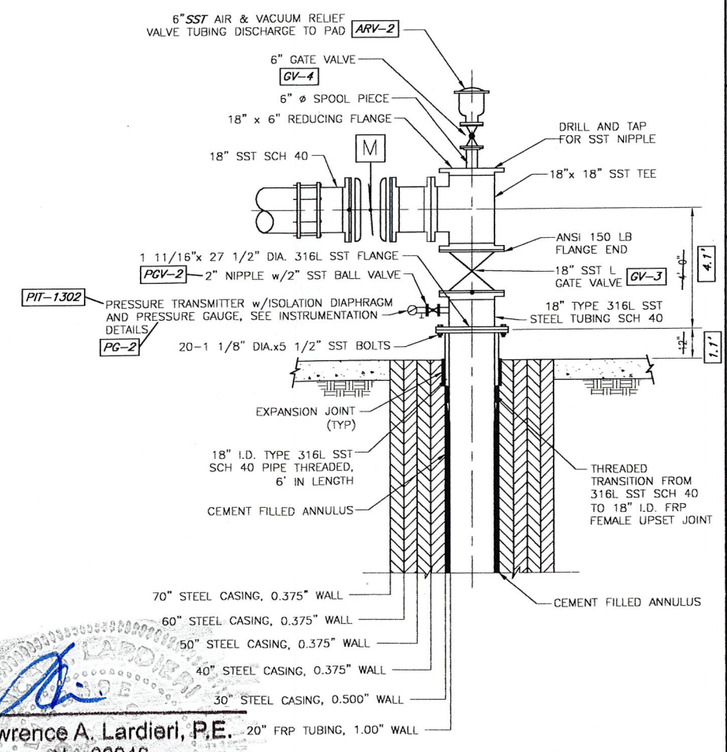
DEEP INJECTION WELL #2 PLAN

N.T.S.



SECTION "A"

N.T.S.



DEEP INJECTION WELL #2 WELLHEAD DETAIL "1"

N.T.S.

Lawrence A. Lardieri, P.E.
No. 26948
AUG 27 2013
AECOM Technical Services, Inc.
No. 8115

MARK	DATE	MADE BY	CHECKED	DESCRIPTION
	11/20/12	DLP		ADDED ADD'L RECORD DRAWING INFORMATION
	10/11/12	DLP		ADDED RECORD DRAWING INFORMATION

REVISIONS

AECOM USA, INC.
3550 S.W. CORPORATE PARKWAY
PALM CITY, FL 34990
(772) 286-3883
CERTIFICATE NO. 35

TOWN OF DAVIE FLORIDA

WATER TREATMENT AND WATER RECLAMATION FACILITY

DEEP INJECTION WELL NO. 2 - PLAN SECTIONS & DETAILS

MECHANICAL PROCESS

PROJECT NO:	60096591
CAD DWG FILE:	_13 D-102
DESIGNED BY:	MWB
DRAWN BY:	DLP
DEPT CHECK:	LAL
PROJ CHECK:	B. DALY
DATE:	NOVEMBER 2010
SCALE:	AS NOTED

13 D-102

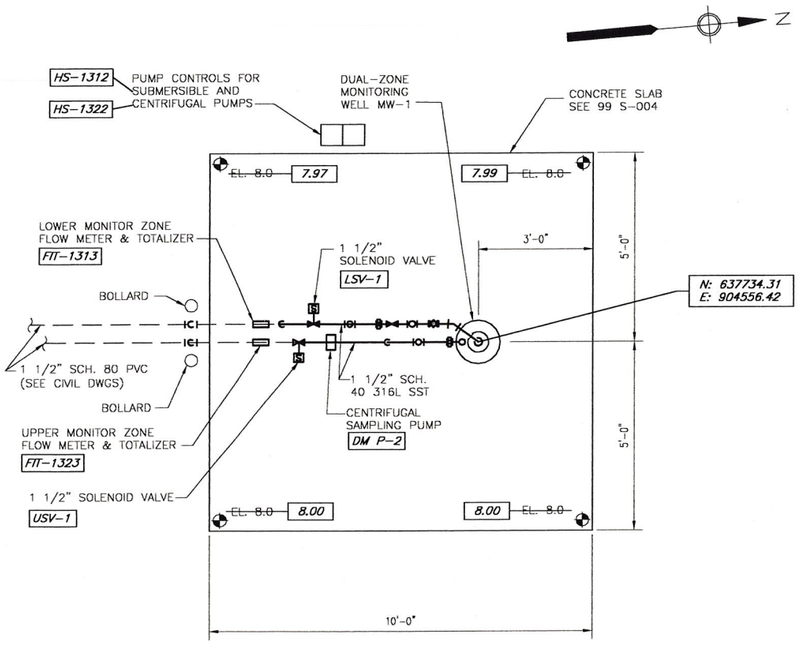
PATH/FILENAME: P:\60096591\DESIGN & DW CAD-11301\60185432\REPORTS\CAD-V2007_13 D-102.DWG
LAST UPDATE: Tuesday, November 20, 12:25:51 PM
PLOT DATE: Wednesday, November 21, 2012 9:13:28 AM
ANSI D - 20-Nov-12

NOTES:

1. ALL PIPING AND FITTINGS ABOVE PAD LEVEL TO BE 316L SST. UNDERGROUND DISCHARGE PIPING 4" DIA. & LARGER SHALL BE C-900 PVC AND BELOW 4" DIA. SHALL BE SCHEDULE 80 PVC.
2. SUBMERSIBLE PUMP SHALL BE 316 SST GRUNDFLOS REDI-FLO SERIES. APPROXIMATE SIZE 0.5 TO 1 HP, 460 V AC, THREE PHASE. FINAL SIZE TO BE DETERMINED BASED ON FIELD CONDITIONS. ASSUME PUMP SET TO APPROXIMATELY 100' BPL.
3. CENTRIFUGAL SAMPLING PUMP SHALL BE GORMAN-RUPP T-SERIES SELF PRIMING HORIZONTAL END SUCTION TYPE BRONZE CONSTRUCTION WITH 316 SST SHAFT. APPROXIMATE SIZE 0.5 TO 1.5 HP, 460 V AC, THREE PHASE. FINAL SIZE TO BE DETERMINED BASED ON FIELD CONDITIONS. PUMP SHALL BE TOTALLY ENCLOSED FAN COOLED (TEFC).
4. ALL WELL CASING DIAMETERS INDICATED ARE CASING OUTSIDE DIAMETERS (O.D.).
5. SST 316 STEEL COMPONENTS SHALL BE SCHEDULE 40.
6. ALL CEMENT GROUT SHALL BE ASTM C-150 TYPE II SULFATE RESISTANT CEMENT.
7. *UNLESS OTHERWISE NOTED, ELEVATIONS ARE RELATIVE TO NATIONAL GEODETIC VERTICAL DATUM OF 1929.*

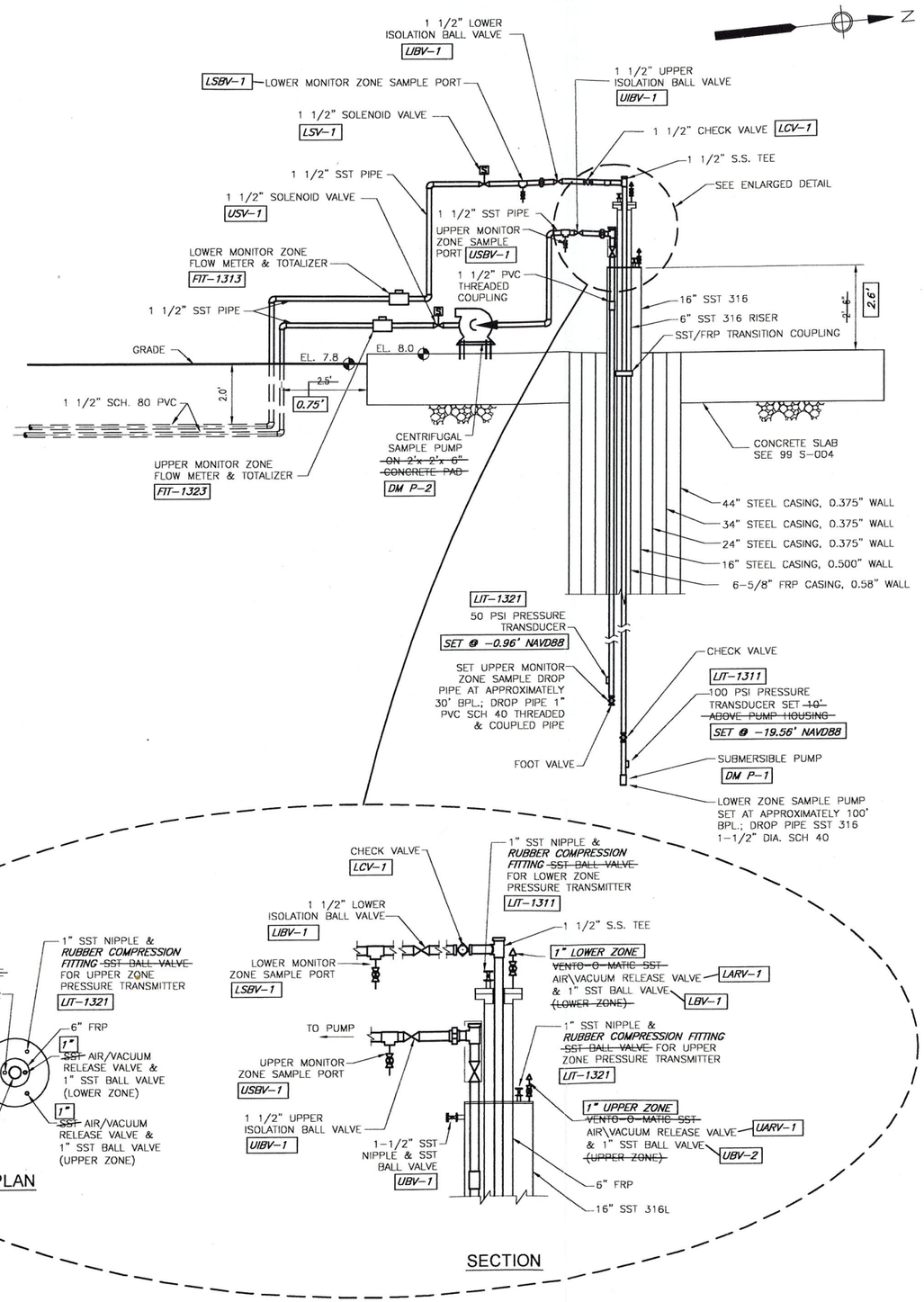
LEGEND:

- x 8.0 — EXISTING ELEVATION
- EL. 9.2 — PROPOSED ELEVATION



DUAL ZONE MONITOR WELL MW-1 PAD PLAN

N.T.S.



DUAL-ZONE MW-1 MONITOR WELLHEAD DIAGRAM

N.T.S.

"RECORD DRAWING"

6.75 – INDICATES RECORD DRAWING INFORMATION

RECORD DRAWING

THIS DRAWING HAS BEEN REVISED TO SHOW THOSE CHANGES DURING THE CONSTRUCTION PROCESS REPORTED TO AECOM USA, INC. AND IS CONSIDERED TO BE "AS-BUILT" BUT IS BASED ON THE RECORD ELEVATION INFORMATION OBTAINED AND PROVIDED BY " MILLER LEGG PER DRAWING ASB-WELL, SHEET 1 OF 1, DATED 10/03/12 ".

Lawrence A. Lardieri, P.E.
No. 26948
AUG 27 2013
AECOM Technical Services, Inc.
No. 8115

REVISIONS				
MARK	DATE	MADE BY	CHECKED	DESCRIPTION
	11/20/12	DLP		ADDED ADD'L RECORD DRAWING INFORMATION
	10/11/12	DLP		ADDED RECORD DRAWING INFORMATION

AECOM USA, INC.
3350 S.W. CORPORATE PARKWAY
PALM CITY, FL 34990
(772) 286-3583
CERTIFICATE NO. 36

TOWN OF DAVIE FLORIDA
WATER TREATMENT AND WATER RECLAMATION FACILITY

DUAL ZONE MONITORING WELL NO.1
PLAN SECTIONS & DETAILS

MECHANICAL PROCESS

PROJECT NO:	60096591
CAD DWG FILE:	...13 D-103
DESIGNED BY:	MWB
DRAWN BY:	DLP
DEPT CHECK:	LAL
PROJ CHECK:	B. DALY
DATE:	NOVEMBER 2010
SCALE:	AS NOTED

13 D-103

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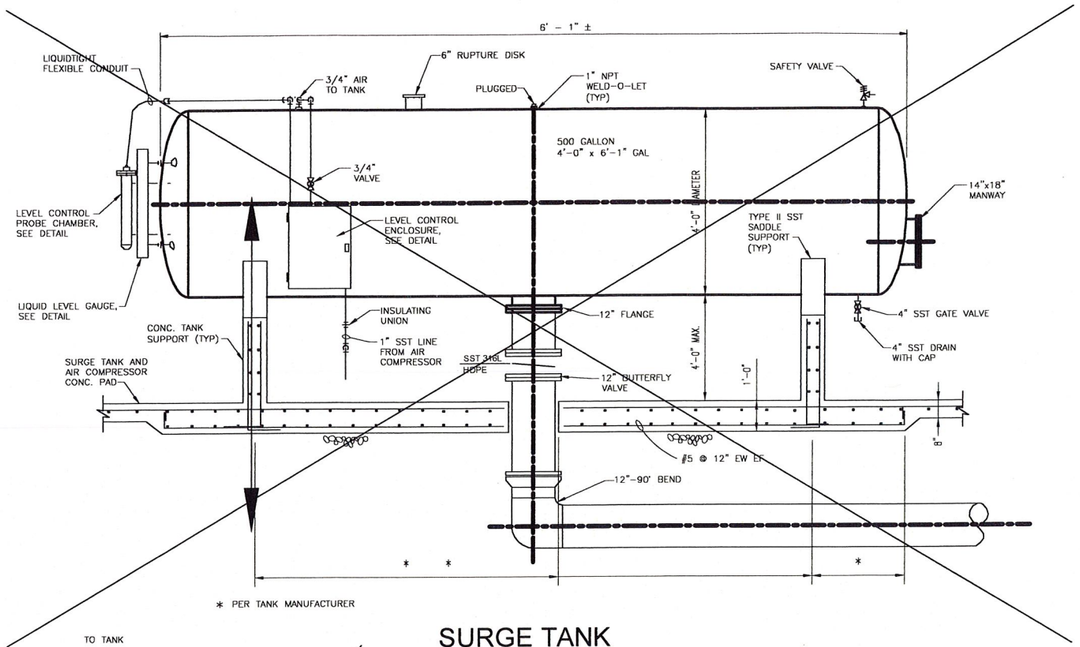
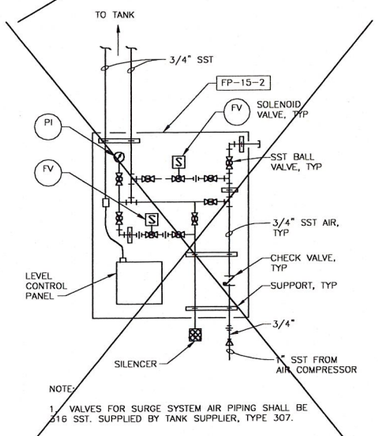
PLOT DATE: Wednesday, November 21, 2012 9:15:49 AM
ANSI D - 19-Nov-12



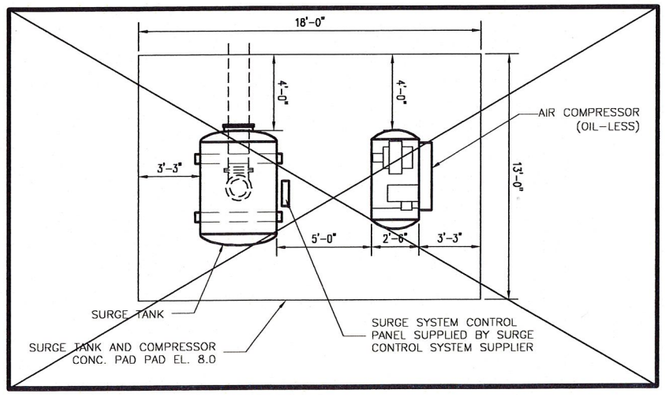
SURGE TANK

N.T.S.



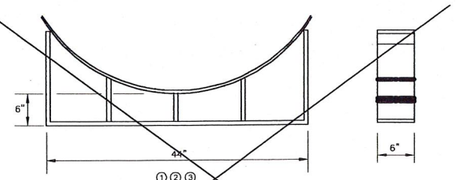
LEVEL CONTROL ENCLOSURE

N.T.S.



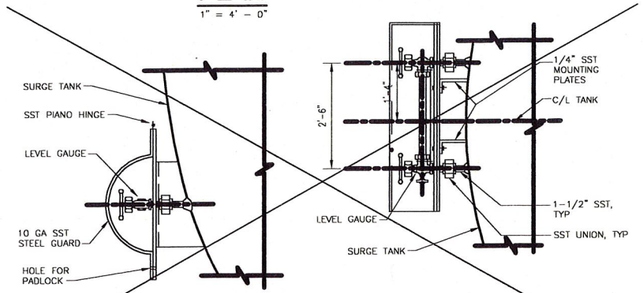
PLAN

1" = 4' - 0"



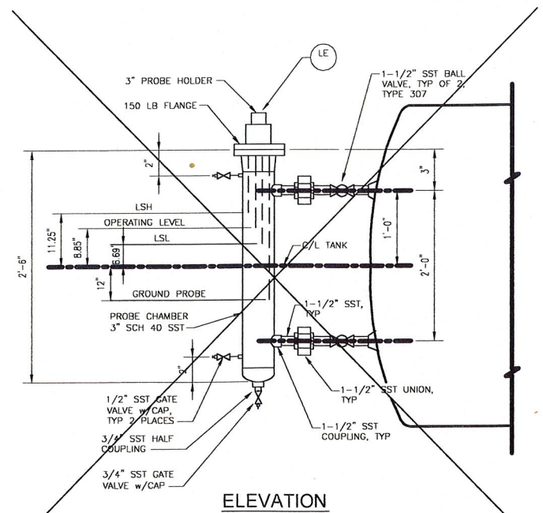
TYPE II SST SADDLE SUPPORT

N.T.S.



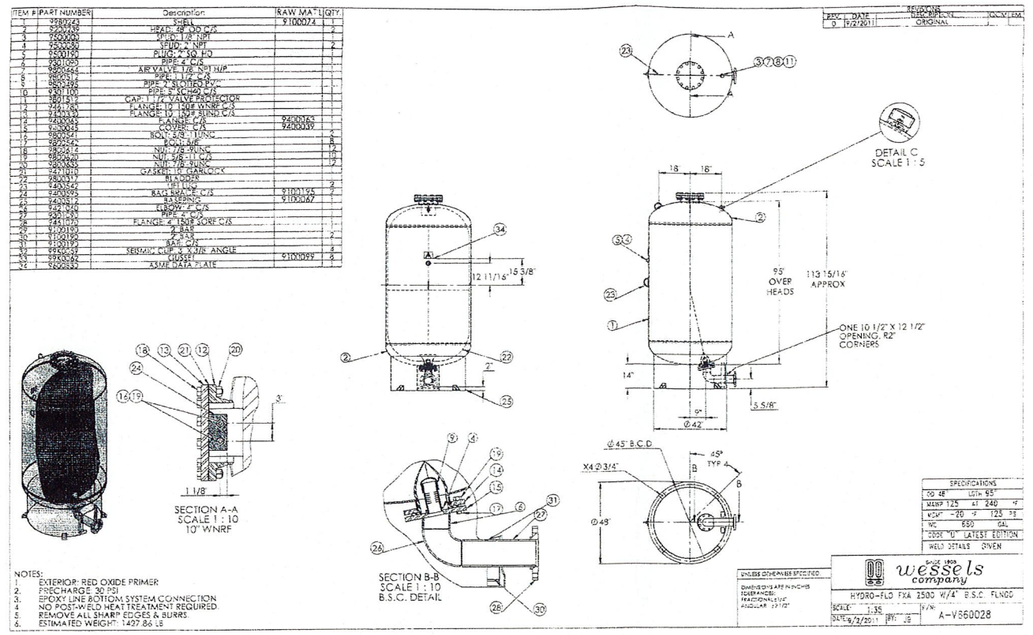
LIQUID LEVEL GAUGE AND GUARD

N.T.S.



LEVEL CONTROL PROBE CHAMBER

N.T.S.



WESSELS 660 GAL. HYDROPNEUMATIC BLADDER TANK

N.T.S.

"TO BE REVISED BASED ON BLADDER TANK"

Lawrence A. Lardieri, P.E.
No. 26948

AUG 27 2013

AECOM Technical Services, Inc.
No. 8115

MARK	DATE	MADE BY	CHECKED	DESCRIPTION
				REVISIONS
	11/20/12	DLP		ADDED RECORD DRAWING INFORMATION

AECOM USA, INC.
3350 S.W. CORPORATE PARKWAY
PALM CITY, FL 34990
(772) 286-3863
CERTIFICATE NO. 38

AECOM

TOWN OF DAVIE FLORIDA
WATER TREATMENT AND WATER RECLAMATION FACILITY

DEEP INJECTION WELLS-SURGE TANK-AIR COMPRESSOR SECTION & DETAILS

MECHANICAL PROCESS

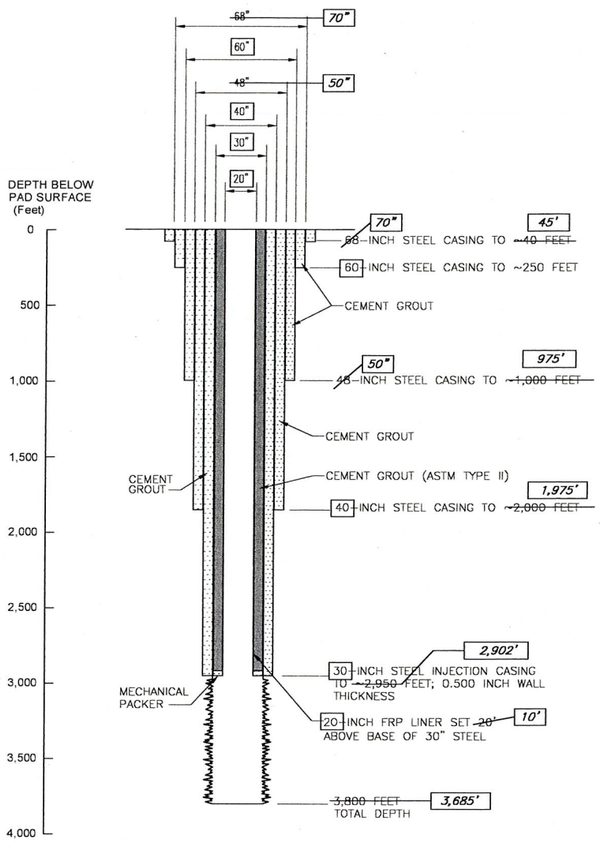
PROJECT NO:	60096591
CAD DWG FILE:	...13 D-501
DESIGNED BY:	MWB
DRAWN BY:	DLP
DEPT CHECK:	LAL
PROJ CHECK:	B. DALY
DATE:	NOVEMBER 2010
SCALE:	AS NOTED

13 D-501

PATH/FILENAME: P:\60096591\DF
LAST UPDATE: Wednesday, Nov
W & DW CAD-1130\01851432\REPORTS\CAD-V2007\...13 D-501.DWG
PLOT DATE: Wednesday, November 21, 2012 8:28:10 AM
ANSI D - 21-Nov-12

NOTE: ALL CEMENT GROUT SHALL BE ASTM C-150 TYPE II SULFATE RESISTANT CEMENT

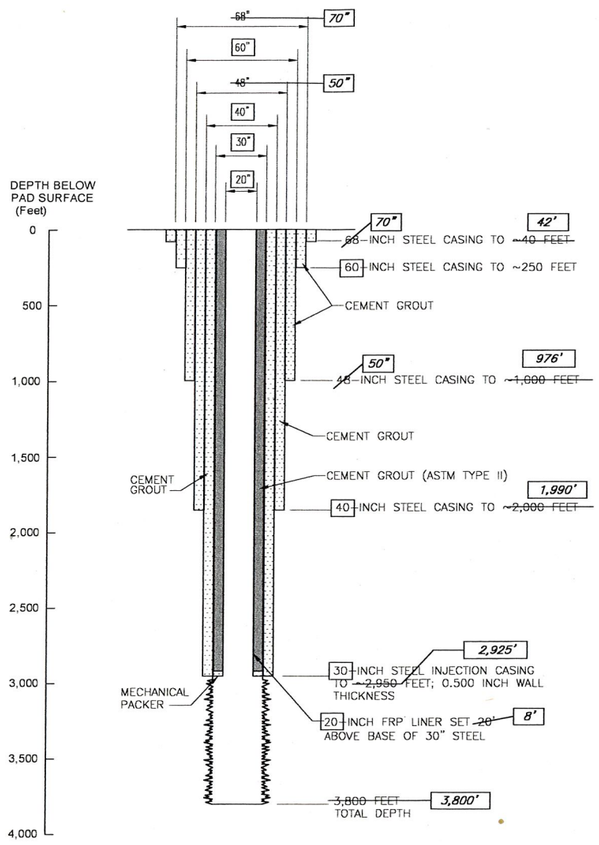
IW-1
CASING DIAMETERS



DEEP INJECTION WELL #1 (IW-1) DIAGRAM

NOT TO SCALE

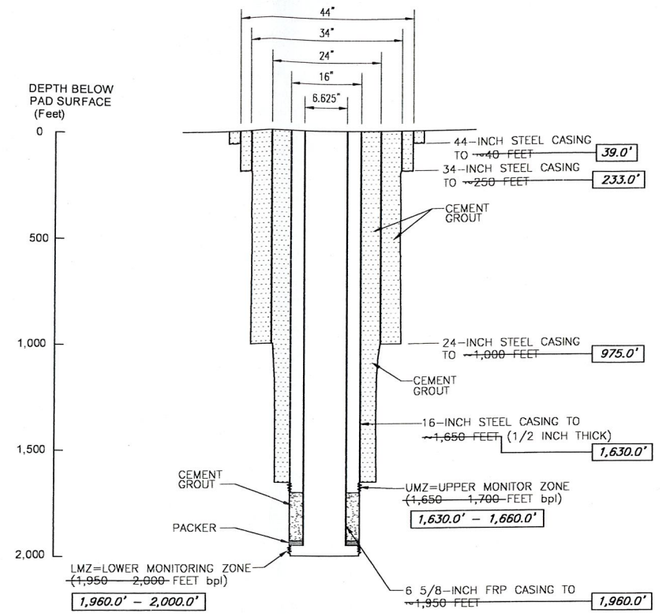
IW-2
CASING DIAMETERS



DEEP INJECTION WELL #2 (IW-2) DIAGRAM

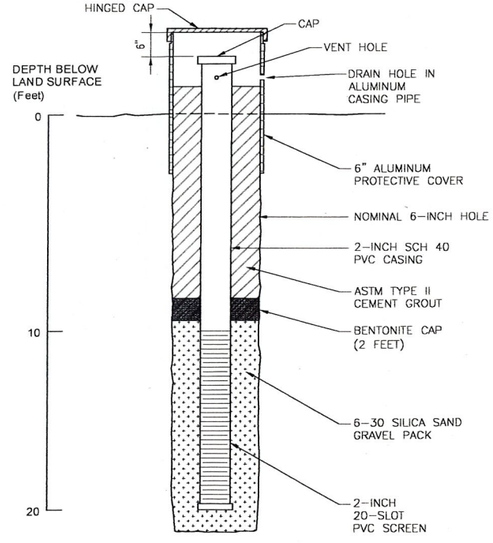
NOT TO SCALE

CASING DIAMETERS (OD)



DUAL-ZONE MONITOR WELL (DZMW-1) DIAGRAM

NOT TO SCALE



PAD MONITOR WELL DIAGRAM

NOT TO SCALE

NOTE: THE PAD MONITOR WELLS WERE PLUGGED AND ABANDONED (FILLED WITH CONCRETE) PER FDEP APPROVAL LETTER DATED AUGUST 26, 2011

"RECORD DRAWING"

1,214' - INDICATES RECORD DRAWING INFORMATION

RECORD DRAWING

THIS DRAWING HAS BEEN REVISED TO SHOW THOSE CHANGES DURING THE CONSTRUCTION PROCESS REPORTED TO AECOM USA, INC. AND IS CONSIDERED TO BE "AS-BUILT" BUT IS BASED ON THE AVAILABLE INFORMATION PROVIDED BY _____.

DATE: _____ BY: _____

Lawrence A. Lardieri, P.E.
No. 26948
AUG 27 2013
AECOM Technical Services, Inc.
No. 8115

MARK	DATE	MADE BY	CHECKED	DESCRIPTION
				REVISIONS
	10/1/12	DLP	--	ADDED RECORD DRAWING INFORMATION

AECOM USA, INC.
3550 S.W. CORPORATE PARKWAY
PALM CITY, FL 34990
(772) 286-3585
CERTIFICATE NO. 36

AECOM

TOWN OF DAVIE FLORIDA
WATER TREATMENT AND WATER RECLAMATION FACILITY

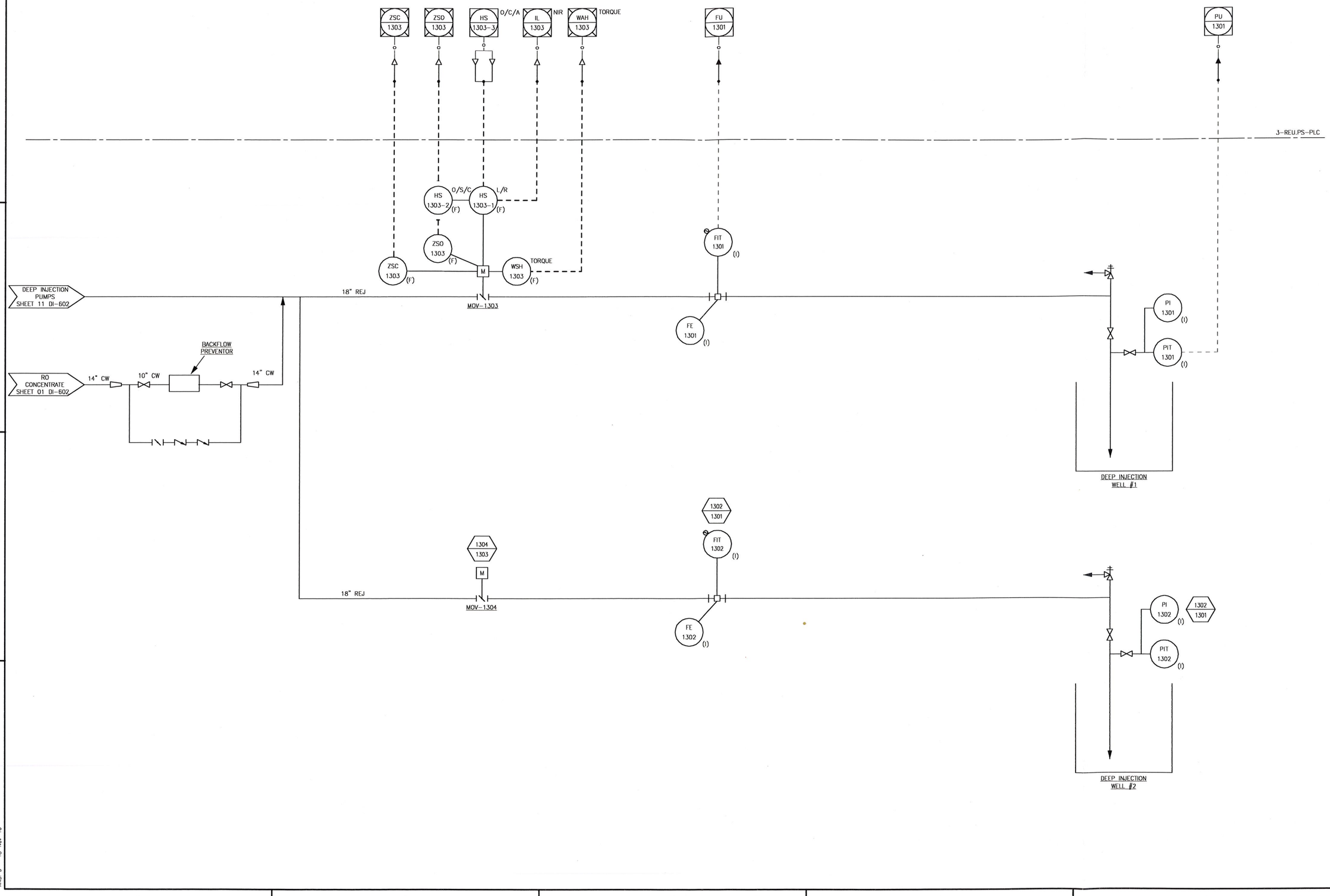
DEEP INJECTION WELLS - DIAGRAMS

MECHANICAL PROCESS

PROJECT NO:	60096591
CAD DWG FILE:	...13 D-601
DESIGNED BY:	MWB
DRAWN BY:	DLP
DEPT CHECK:	LAL
PROJ CHECK:	B. DALY
DATE:	NOVEMBER 2010
SCALE:	AS NOTED

13 D-601

PATH/FILENAME: P:\60096591\DESIGN-RW & DW CAD-11\3010\601854-32\REPORTS\CAD-12007\...13 D-601.DWG
LAST UPDATE: Thursday, October 11 9:12:48 PM
PLOT DATE: Wednesday, November 21, 2012 9:18:13 AM
ANSI D - 11-Oct-12



MARK	DATE	MADE BY	CHECKED	DESCRIPTION
				REVISIONS

AECOM USA, INC.
1450 W. SUNRISE BOULEVARD
SUNRISE, FL 33323
(954) 745-7200
CERTIFICATE NO. 38

AECOM

THIS 11X17 DRAWING IS AN EXACT COPY OF THE FULL SIZE SHEET THAT WAS SIGNED, SEALED AND SUBMITTED TO THE BUILDING DEPARTMENT OF THE TOWN OF DAVIE

JASER A. RUIZ LICENSE No. 70908 STATE OF FLORIDA PROFESSIONAL ENGINEER

TOWN OF DAVIE FLORIDA
WATER TREATMENT AND WATER RECLAMATION FACILITY

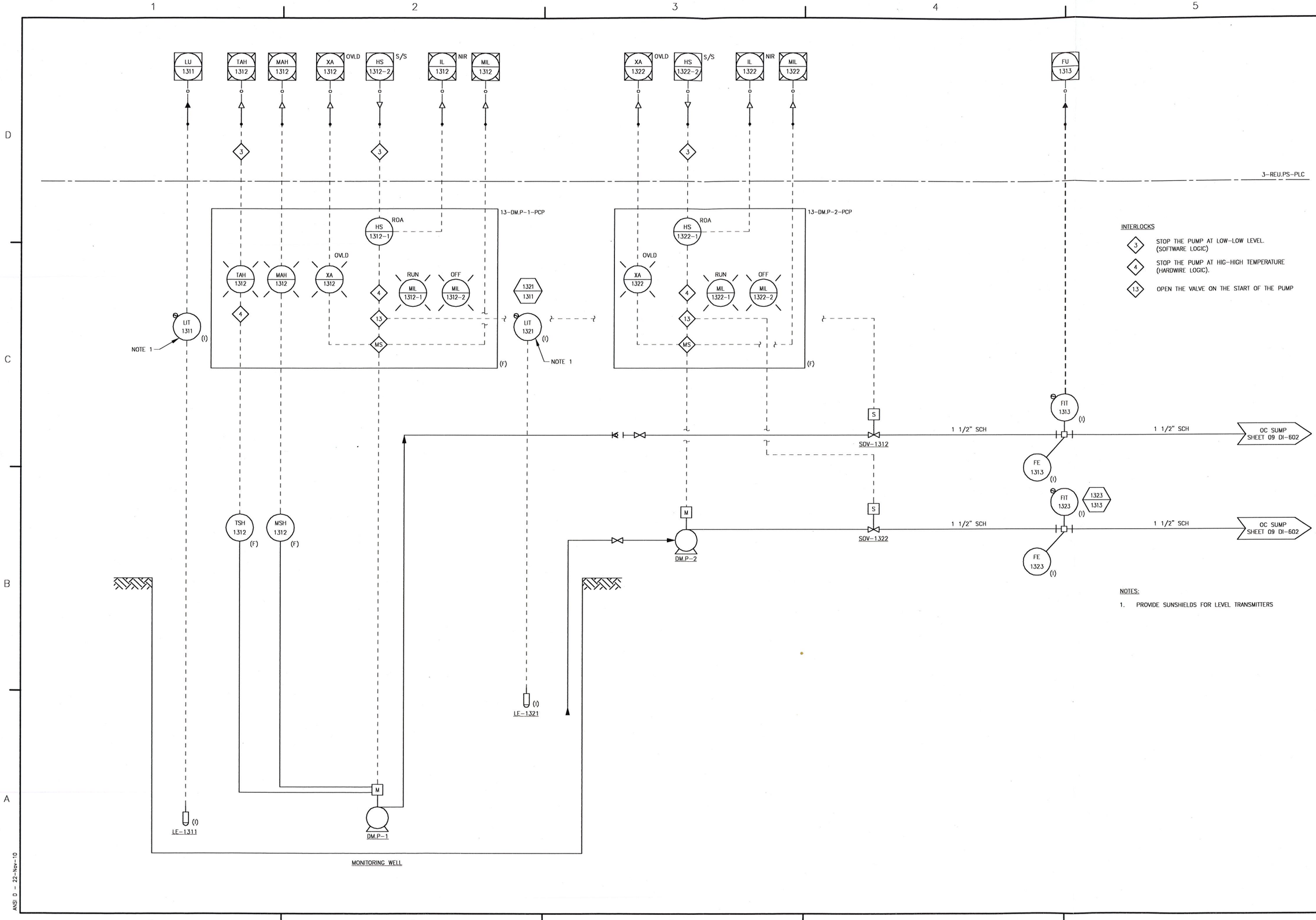
DEEP INJECTION WELLS P&ID

INSTRUMENTATION

PROJECT NO:	60096591
CAD DWG FILE:	13 DI-601
DESIGNED BY:	G. CHEN
DRAWN BY:	M. STEWART
DEPT CHECK:	E. STILLWELL
PROJ CHECK:	B. DALY
DATE:	NOVEMBER 2010
SCALE:	AS NOTED

13 DI-601

ANSI D - 18-Nov-10



MARK	DATE	MADE BY	CHECKED	DESCRIPTION
				REVISIONS

AECOM USA, INC.
1430 W. SUNRISE BOULEVARD
SUNRISE, FL 33323
(954) 745-7200
CERTIFICATE NO. 38

THIS 11X17 DRAWING IS AN EXACT COPY OF THE FULL SIZE SHEET THAT WAS SIGNED, SEALED AND SUBMITTED TO THE BUILDING DEPARTMENT OF THE TOWN OF DAVIE

ASSER A. RIZK
LICENSE
No. 70908
STATE OF FLORIDA
PROFESSIONAL ENGINEER
BENNION

TOWN OF DAVIE FLORIDA
WATER TREATMENT AND WATER RECLAMATION FACILITY

DUAL ZONE MONITORING WELL P&ID

INSTRUMENTATION

PROJECT NO:	60096591
CAD DWG FILE:	13 DI-602
DESIGNED BY:	G. CHEN
DRAWN BY:	M. STEWART
DEPT CHECK:	E. STILLWELL
PROJ CHECK:	B. DALY
DATE:	NOVEMBER 2010
SCALE:	AS NOTED

13 DI-602

ANSI D - 22-Nov-10

Appendix C

DIW Monthly Operating Report Forms

UNDERGROUND INJECTION CONTROL SECTION

MONTHLY OPERATING REPORT DATA SUMMARY

FACILITY	Town of Dave W/WWTP	REPORT MONTH/YEAR	
CHIEF OPERATOR		PERMIT NUMBER	0298127-001-UC
PHONE #		PERMIT EXPIRATION DATE	January 21, 2016
DATE		**Signed:**	

Injection Well Data

	IW-1		IW-2	
MAXIMUM MONTHLY INJECTION PRESSURE		psi		psi
MINIMUM MONTHLY INJECTION PRESSURE		psi		psi
AVERAGE MONTHLY INJECTION PRESSURE		psi		psi
SHUT-IN PRESSURE		psi		psi
MAXIMUM MONTHLY FLOW RATE		gpm		gpm
MINIMUM MONTHLY FLOW RATE		gpm		gpm
AVERAGE MONTHLY FLOW RATE		gpm		gpm
TOTAL MONTHLY VOLUME INJECTED		MG		MG

WASTESTREAM WATER QUALITY DATA (monthly)

mple Date					
Chloride		mg/L	TSS		mg/L
TDS		mg/L	pH		mg/L
Conductivity		umhos/cm	Nitrate (as N)		mg/L
TKN		mg/L	Sulfate, total as SO4		mg/L
Phosphorus, total as P		mg/L	Ammonia (as N)		mg/L

WASTESTREAM WATER QUALITY DATA (quarterly)

Sample Date			Radium 226 (when required)		pCi/L
Gross Alpha		pCi/L	Radium 228 (when required)		pCi/L

MONITOR WELL WATER LEVEL DATA - MW-1

	UPPER ZONE		LOWER ZONE	
MAXIMUM MONTHLY WATER LEVEL		psi		psi
MINIMUM MONTHLY WATER LEVEL		psi		psi
AVERAGE MONTHLY WATER LEVEL		psi		psi

* All water level recorded are 15 minute sustained readings

DUAL-ZONE MONITOR WELL WATER QUALITY DATA - Weekly During Operational Testing

MW-1U UPPER ZONE (1,630 to 1,660 feet below pad level)

	Week 1	Week 2	Week 3	Week 4	Week 5	Monthly Average
Sample Date						
Conductivity (umhos/cm)						
Temperature (deg C)						
pH (standard units)						
Chloride (mg/L)						
Sulfate (mg/L)						
Total Dissolve Solids (mg/L)						
Ammonia, total as N (mg/L)						
TKN, total Kjeldahl as N (mg/L)						
Nitrate, total as N (mg/L)						
Phosphorous, total as P (mg/l)						
Gross Alpha						

MW-1L LOWER ZONE (1,960 to 2,000 feet below pad level)

	Week 1	Week 2	Week 3	Week 4	Week 5	Monthly Average
Sample Date						
Conductivity (umhos/cm)						
Temperature (deg C)						
pH (standard units)						
Chloride (mg/L)						
Sulfate, total as SO4 (mg/L)						
Total Dissolved Solids (mg/L)						
Ammonia, total as N (mg/L)						
TKN, total Kjeldahl as N (mg/L)						
Nitrate, total as N (mg/L)						
Phosphorous, total as P (mg/l)						
Gross Alpha						

Town of Davie Deep Injection Well System
Permit No. 0298127-001-UC

Month:_____
Compiled By:_____
Approved By:_____
Date:_____

Injection Well IW-1

Day of Month	Flowrate and Volume					Wellhead Pressure		
	Totalizer Reading	Volume Injected (MG)	Minimum Flowrate (gpm)	Maximum Flowrate (gpm)	Average Flowrate (gpm)	Minimum Pressure (psi)	Maximum Pressure (psi)	Average Pressure (psi)
1								
2								
3								
4								
5								
6								
7								
8								
9								
10								
11								
12								
13								
14								
15								
16								
17								
18								
19								
20								
21								
22								
23								
24								
25								
26								
27								
28								
29								
30								
31/1								
1								

Total								
Max.								
Min.								
Average								

Town of Davie Deep Injection Well System
Permit No. 0298127-001-UC

Month:_____
Compiled By:_____
Approved By:_____
Date:_____

Injection Well IW-2

Day of Month	Flowrate and Volume					Wellhead Pressure		
	Totalizer Reading (mg)	Volume Injected (mg)	Minimum Flowrate (gpm)	Maximum Flowrate (gpm)	Average Flowrate (gpm)	Minimum Pressure (psi)	Maximum Pressure (psi)	Average Pressure (psi)
1								
2								
3								
4								
5								
6								
7								
8								
9								
10								
11								
12								
13								
14								
15								
16								
17								
18								
19								
20								
21								
22								
23								
24								
25								
26								
27								
28								
29								
30								
31/1								
1								

Total								
Max.								
Min.								
Average								

Town of Davie Deep Injection Well System
Permit No. 0298127-001-UC

Month:_____
Compiled By:_____

MW-1 Monitoring Parameters

Day of Month	MW-1U Upper Zone (1,630 to 1,660 feet bpl)			MW-1L Lower Zone (1,960 to 2,000 feet bpl)		
	Minimum Water Level (psi)	Maximum Water Level (psi)	Average Water Level (psi)	Minimum Water Level (psi)	Maximum Water Level (psi)	Average Water Level (psi)
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						
15						
16						
17						
18						
19						
20						
21						
22						
23						
24						
25						
26						
27						
28						
29						
30						
31						

Max.						
Min.						
Average						

Town of Davie - Deep Injection Well System

Injectivity Testing Form

Facility : Town of Davie W/WWTP

Compiled by: _____

Well Name: _____

Date of Test: _____

FDEP Permit No.: 0298127-001-UC

Telephone: (954)

Signed:_____ **Date:**_____

SHUT-IN PRESSURE	
MINUTES AFTER SHUT-IN	CALIBRATED PRESSURE GAUGE READING AT WELLHEAD (PSI)
10	
20	
30	

TIME	INJECTION WELL SHUT-IN PRESSURE AFTER 30 MINUTES (PSI)	PUMP NUMBER(S) ON-LINE	INJECTION RATE (gpm) AND (mgd)	INJECTION PRESSURE AFTER 10 MINUTES OF PUMPING	PRESSURE DIFFERENTIAL (5) - (2) (PSI)	INJECTIVITY INDEX (4) / (6) (PSI)
COLUMN 1	COLUMN 2	COLUMN 3	COLUMN 4	COLUMN 5	COLUMN 6	COLUMN 7
					0	#DIV/0!
					0	#VALUE!
					0	#DIV/0!

NOTES:

1. INJECTIVITY INDEX (GPM/PSI) IS:

$$\frac{\text{INJECTION RATE (GPM) (COLUMN 4)}}{\text{(INJECTION PRESSURE (PSI)) (COLUMN 5)} - \text{(SHUT-IN PRESSURE (PSI)) (COLUMN 2)}}$$

2. FOR MORE INFORMATION REGARDING EXECUTION OF THIS TEST CONSULT THE INJECTIVITY TESTING PROTOCOL.

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Town of Davie Deep Injection Well System Month:_____

Permit No. 0298127-001-UC Compiled By:_____

Exercising of Valves

Description of Valve	Valve Identification Number (tag)	Well	Type of Valve	Date Exercised	Time Exercised	Initials of Operator Performing Work
IW-1 Wellhead Gate Valve 18"	GV-1	IW-1	Gate			
IW-1 ARV Gate Valve 6"	GV-2	IW-1	Gate			
IW-1 Motor Operated Valve 18"	MOV-1303	IW-1	Butterfly			
IW-1 Wellhead Pressure Gauge Isolation Valve	PGV-1	IW-1	Ball			
IW-2 Wellhead Gate Valve 18"	GV-3	IW-2	Gate			
IW-2 ARV Gate Valve 6"	GV-4	IW-2	Gate			
IW-2 Motor Operated Valve 18"	MOV-1304	IW-2	Butterfly			
IW-2 Wellhead Pressure Gauge Isolation Valve	PGV-2	IW-2	Ball			
ɔper Sample Ball Valve	USBV-1	MW-1U	Ball			
..2" Upper Zone Isolation Ball Valve	UIBV-1	MW-1U	Ball			
1½" Upper Solenoid Valve	USV-1	MW-1U	Solenoid			
1½" Upper Zone Ball Valve	UBV-1	MW-1U	Ball			
1" Upper ARV Ball Valve	UBV-2	MW-1U	Ball			
Lower Sample Ball Valve	LSBV-1	MW-1L	Ball			
1½" Lower Zone Isolation Ball Valve	LIBV-1	MW-1L	Ball			
1½" Lower Solenoid Valve	LSV-1	MW-1L	Solenoid			
1" Lower ARV Ball Valve	LBV-1	MW-1L	Ball			