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Lake Okeechobee Aquifer Storage & Recovery (ASR) Pilot Project

VOLUME 1 OF 2

Hydrogeologic Investigation of the Floridan Aquifer System Kissimmee River Site Okeechobee County, Florida

Prepared by

CH2MHILL

In cooperation with the

South Florida Water Management District West Palm Beach, Florida

December 2004

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EXKR-1

Lake Okeechobee Aquifer Storage & Recovery (ASR) Pilot Project

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Introduction

Background

The Comprehensive Everglades Restoration Plan (CERP)–jointly being conducted by the U.S. Army Corps of Engineers (USACE) and South Florida Water Management District (SFWMD)–is focused on storing available water currently lost to tide. Aquifer Storage and Recovery (ASR) technology has been identified as a major storage option, particularly in the vicinity of Lake Okeechobee, where available water has been identified. The Lake Okeechobee ASR Pilot Project was designed to address some of the technical and regulatory uncertainties of storing treated surface water via ASR systems. Hydrogeologic testing of large-diameter exploratory wells was identified as one of the first tasks in evaluating ASR potential proximal to Lake Okeechobee.

The purpose of this project is to provide site-specific hydrogeologic information to address storage zone selection, well capacity, confinement, and hydraulic character of the Floridan Aquifer System (FAS) at the Kissimmee River Site. Data collected from the testing and monitoring of the constructed exploratory well will be instrumental in the appropriate design of the pumping and treatment facilities necessary to operate it in the future as part of a functional ASR system.

Scope

On December 8, 2003, the Florida Department of Environment Protection (FDEP) issued Permit Number 200917-001-UC to the SFWMD. This permit allowed for the construction of one Class V, Group 9, 24-inch outside diameter exploratory well at the Kissimmee River Site. A copy of the permit is provided in **Appendix A**.

This report describes the drilling, construction, and testing of a 24-inch diameter exploratory well identified as EXKR-1 at the Kissimmee River site. It summarizes and presents data obtained during drilling and testing operations and analyses conducted.

Project Description

The Kissimmee River site is approximately 42 miles southwest of Fort Pierce and approximately 2 miles north of the northern boundary of Lake Okeechobee in unincorporated Okeechobee County near the town of Okeechobee, Florida. The exploratory well at Kissimmee River (EXKR-1) was constructed on SFWMD-owned land adjacent to the Kissimmee River in the northwest quarter of Section 19 of Township 38 South, Range 35 East (see **Figure 1**). The geographic coordinates of the exploratory well are latitude 27°09'17" N and longitude 80° 52' 31" W (North American Datum of 1983 – NAD, 83). Land surface (well pad elevation) was determined to be +18.85 feet (by a closed-loop survey), relative to the National Geodetic Vertical Datum of 1929 (NGVD, 29).

SFWMD issued a notice to proceed to Diversified Drilling Corp (DDC) on May 2, 2003 to drill and construct the first of two 24-inch diameter exploratory wells at separate locations proximal to Lake Okeechobee. On May 15, 2003, construction began on the first exploratory well identified as EXPM-1 (Port Mayaca). Drilling, testing, and construction activities related to EXKR-1 started December 2, 2003, continued for approximately 6 months, and was completed on May 19, 2004.

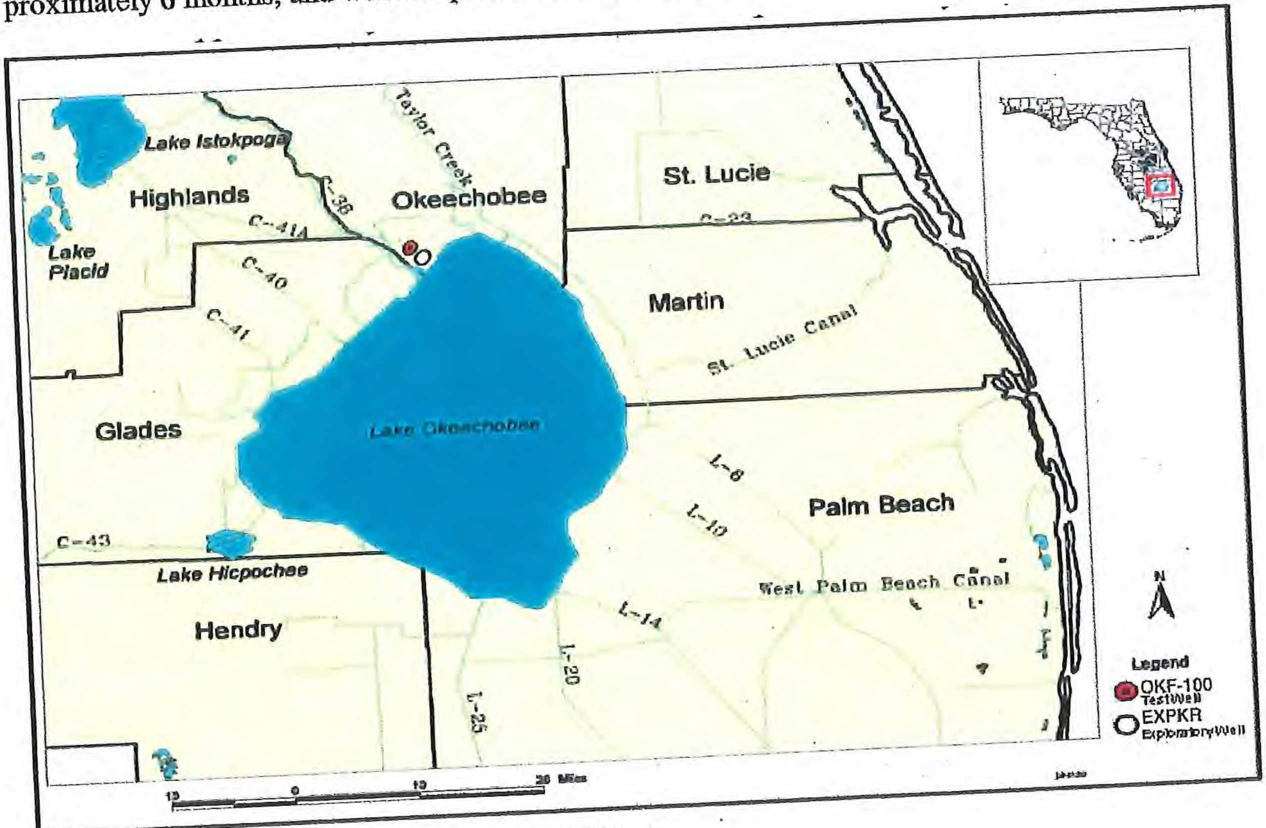


Figure 1. Project Location Map – EXKR-1

Exploratory Drilling and Well Construction

DDC began site preparation during December 2003. After minor clearing and rough grading of the site, the ground surface beneath the compacted lime-rock drilling pad was lined with a buried impermeable high-density polyethylene (HDPE) liner (e.g., 30-mil geomembrane). A 2-foot-thick temporary drilling pad was then constructed using crushed limestone. An earthen berm, 2 feet in height above pad level, surrounded the perimeter of the rig and settling tanks. This earthen berm was constructed to contain drilling fluids and/or formation waters produced during well drilling, testing, and well construction activities (see **Figure 2**).

DDC installed four pad monitor wells at the corners of the temporary drilling pad prior to the start of drilling operations. Onsite field representatives provided by CH2M HILL, under separate contract to SFWMD, monitored the water quality of these wells on a weekly basis to ensure no releases of brackish water occurred at surface during construction.

Formation samples (well cuttings) and borehole geophysical log data were used to determine the actual casing setting depths. The pilot-hole was reamed to specified

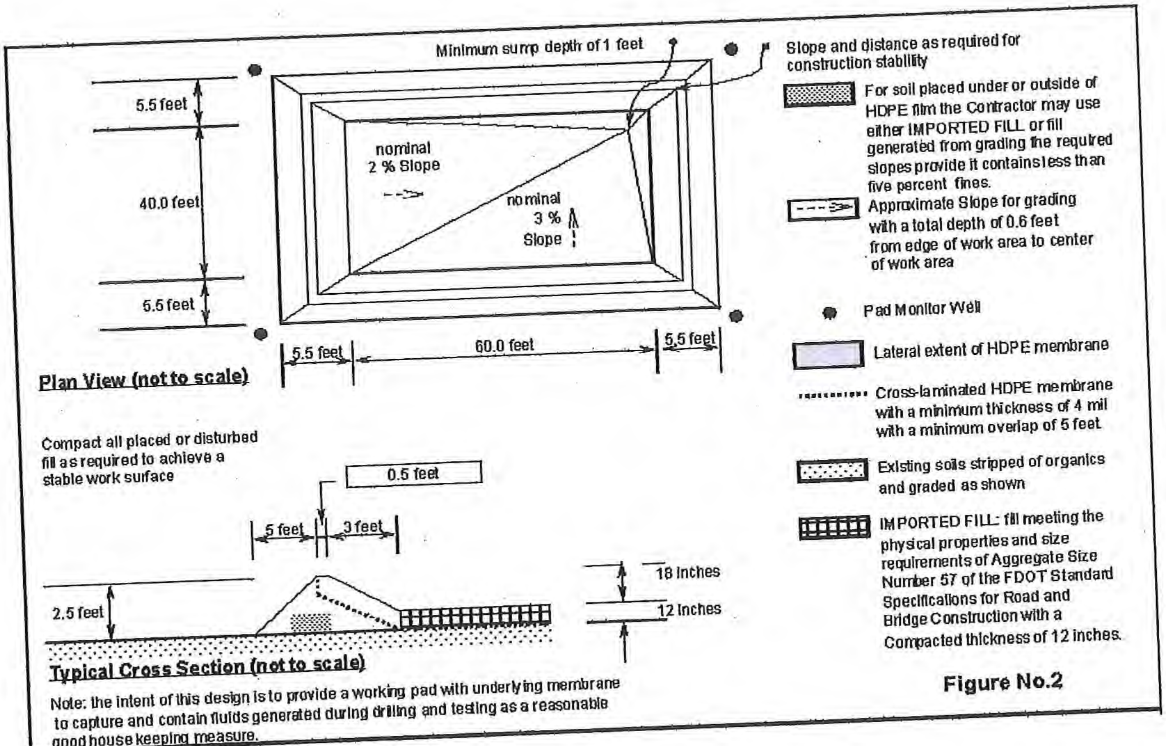


Figure 2. Well Pad Schematic

diameters, and the casing was installed. Three concentric steel casings (42-, 34-, and 24-inch-diameter) were used in the construction of EXKR-1. **Figure 3** summarizes the construction details of EXKR-1

DDC initiated drilling activities for EXKR-1 on December 2, 2003. Drilling operations began by advancing a 48-inch-diameter borehole to a depth of 36 feet below land surface (bls) via the mud rotary-auger method. That same day, DDC installed the nominal 42-inch-diameter, steel pit casing (ASTM A53, Grade B, and 0.375-inch wall thickness) in the nominal 48-inch-diameter borehole 35 feet bls. The annulus was pressure-grouted to land surface using approximately 130 cubic feet (ft^3) of ASTM Type II, Portland cement (15.6 lbs./gal.). A factory mill certificate for the 42-inch diameter steel pit casing is provided in **Appendix B.**

After installing the 42-inch diameter pit casing, DDC drilled-out the cement plug at the base of the pit casing to full gauge, then reconfigured their drilling assembly and began drilling a nominal 8-inch diameter pilot-hole via the mud rotary method. On December 15, 2003, DDC advanced the pilot-hole through the Pleistocene-Pliocene aged sediments and into the Miocene-aged Hawthorn Group to a depth of 225 feet bls. On December 16, 2003, MV Geophysical Surveys, Inc., of Ft. Myers, Florida, geophysically logged the pilot-hole from land surface to 236 feet bls without incident. The logs demonstrated a slight error in the depth recorded by the driller. The logging suite consisted of the following logs: 4-arm caliper, natural gamma ray, spontaneous potential (SP), borehole compensated sonic (BHC), and dual induction/laterolog(3) combination. Field copies from geophysical log run No. 1 are presented in **Appendix C.**

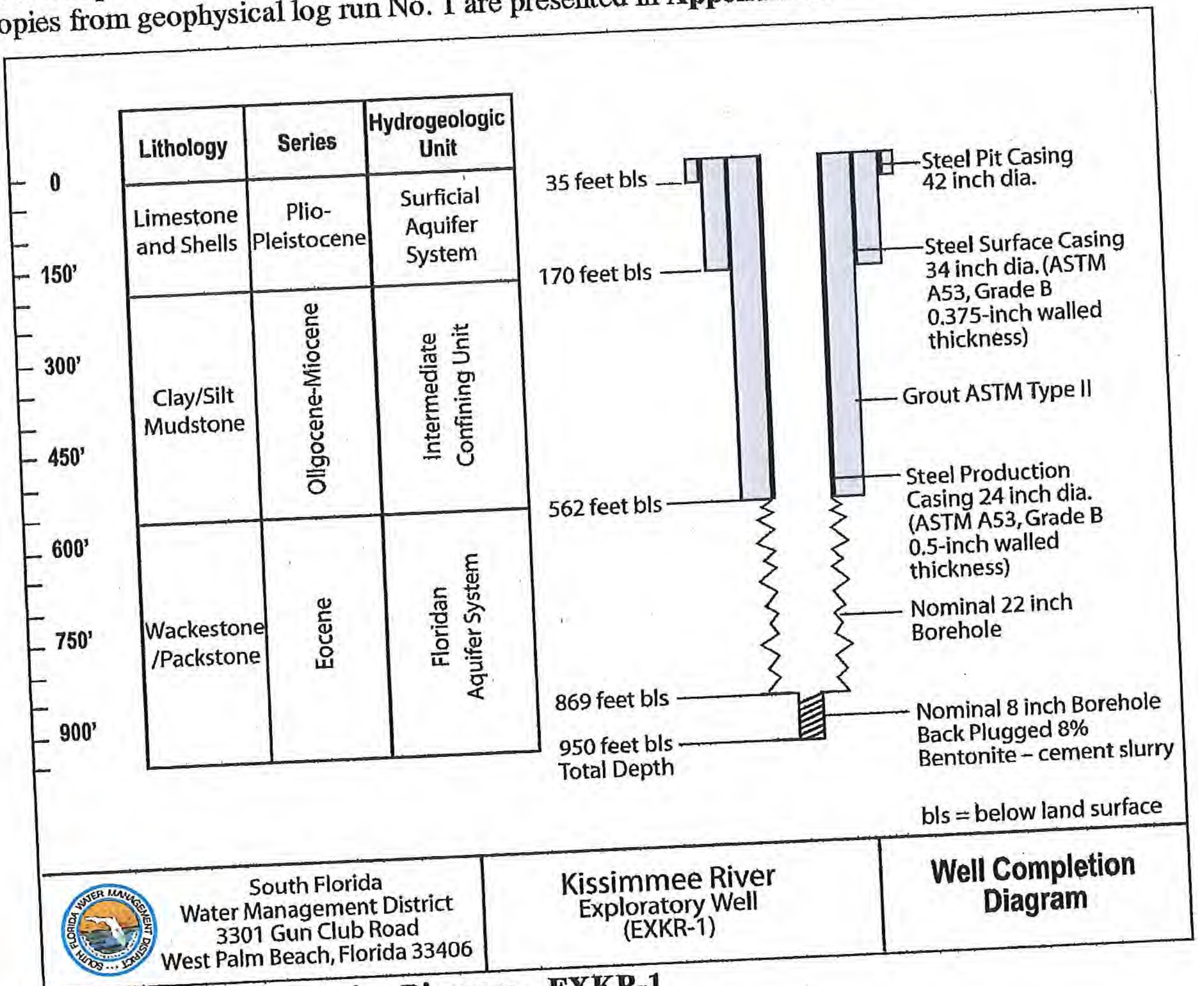


Figure 3. Well Completion Diagram – EXKR-1

Using well cuttings and geophysical log data, the base of the Surficial Aquifer System (SAS) was identified at approximately 146 feet bls, where a greenish-gray phosphatic, silty clay unit was encountered. In addition, the natural gamma log noted an increase in natural gamma ray emissions, which corresponded to the lower permeable silty, phosphatic clays found at similar depth. On December 17, 2003, DCC reamed the nominal 8-inch diameter pilot-hole to 173 feet bls using a nominal 42-inch-diameter staged bit reamer. The nominal 42-inch borehole was geophysically logged (caliper-natural gamma ray) to verify depths and to calculate cement volumes for subsequent cement grouting operations. The caliper log showed no unusual borehole conditions that would prohibit proper installation of the 34-inch diameter surface casing (see **Appendix C**). DDC began installation of the 34-inch diameter steel casing (ASTM A53, Grade B, and 0.375-inch wall thickness) in the nominal 42-inch diameter borehole on December 18, 2003. At a depth of approximately 140 feet bls, swelling or a blockage in the borehole prohibited further casing installation. The casing was cut and removed from the borehole, and the borehole was re-reamed to a nominal diameter of 42 inches. The 34-inch steel casing was successfully installed to a depth of 170 feet bls on December 19, 2003, and pressure-grouted using 679 ft^3 (121 barrels based on 5.6146 ft^3 per barrel) of ASTM Type II cement. On December 23, 2003, the cement was tagged at a depth of 10 feet bls. An additional 85 ft^3 of ASTM Type II cement was installed via the tremie method to bring cement levels in the annulus to surface on May 11, 2004.

The purpose of the surface casing is to isolate the SAS from brackish water produced during subsequent drilling and to provide drill rig stability during continued drilling operations. A factory mill certificate for the 34-inch-diameter surface casing is provided in **Appendix B**.

With the surface casing installed, DDC advanced a nominal 8-inch-diameter pilot-hole via the closed circulation mud-rotary method. On January 16, 2004, DDC completed pilot-hole drilling operations through the unconsolidated to semi-consolidated sediments of the Miocene-aged Hawthorn Group into the upper Eocene-aged carbonates of the upper Floridan aquifer to a depth of 950 feet bls. Two attempts were made to collect 4-inch-diameter conventional cores while drilling the pilot hole from the following depth intervals: 300 to 320 feet bls (Hawthorn Group), and 880 to 884 feet bls (Eocene). Core recovery from the 300 to 320-foot bls interval was 45 percent; no recovery was made from the 880 to 884-foot bls interval (see **Hydrogeologic Testing** section for further details).

On January 16, 2004, Schlumberger Water Services proceeded with geophysical logging operations on the nominal 8-inch diameter pilot-hole from 170 to 950 feet bls and completed the logging on January 18, 2004. The geophysical logging suite included the following logs: spectral gamma ray, array induction imager, composite density/neutron PEF, electron capture spectroscopy, diapole sonic imager, long spaced sonic, and formation micro-imager. A composite of the geophysical log traces is presented in **Figure 4.** Field copies from geophysical run No. 3 are provided in **Appendix C.**

Review of the geophysical logs (**Appendix C**) and lithologic data (provided in **Appendix D**) from the subject borehole indicates that the top of the FAS occurs at a depth of approximately 540 feet bls. However, the final 24-inch-diameter steel production casing was set at a depth of 562 feet bls to:

1. Seal off overlying clays of the Hawthorn Group and carbonate mud stringers and fine quartz and phosphatic sands within the lower portion of the Arcadia Formation-Hawthorn Group.
2. Facilitate reverse-air-drilling operations through the underlying permeable horizons of the FAS to the anticipated depth of 950 feet bls.
3. Locate the casing in a competent, well-indurated rock unit to reduce undermining (erosion) at its base as a result of natural and induced high-velocity upward flow.
4. Evaluate flow characteristics of the FAS within the anticipated open-hole interval of 562 to 950 feet bls.

5. Avoid phosphate-bearing silt/sand from approximately 510 to 560 feet bls – as evidenced by the drill cuttings and peaks on the natural gamma ray log trace that may pose impacts to FAS water quality and further drilling operations.

Therefore, on January 23, 2004, the nominal 8-inch diameter pilot-hole was temporarily back-filled with ⅜-inch-diameter crushed limestone gravel to approximately 585 feet bls and a 10-foot cement cap to 575 feet bls. These measures prohibited the low permeability clay-rich sediments of the Hawthorn Group from entering the previously drilled pilot hole during reaming operations, reducing the potential for formation damage to the permeable Eocene-aged carbonates. DDC began to ream the nominal 8-inch-diameter pilot-hole using a nominal 33-inch-diameter staged bit reamer. On February 5, 2004, DDC circulated and geophysically logged (caliper and natural gamma) the nominal 33-inch-diameter borehole to its total depth of 565 feet bls without incident. The caliper log trace showed no unusual borehole conditions that would prohibit proper installation of the 24-inch outside diameter casing to 562 feet bls (see **Appendix C**). The 24-inch outside diameter casing was installed (ASTM A53, Grade B, and 0.500-inch wall thickness) to a depth of 562 feet bls. The factory mill certificate for the 24-inch-diameter steel casing is provided in **Appendix B.** Once the casing was installed to a depth of 562 feet bls, it was rotated and reciprocated to discern if it was free within the borehole for subsequent cement grouting. DDC then circulated approximately 500 gallons of water through the cement pipe at the base of the casing up the annular space to displace heavy drilling mud that was previously required for borehole stabilization. This post-conditioning water flush reduces the potential mixing of grout and drilling mud (of similar densities) during grouting operations, reducing the risk of mud channels (annular voids) within the cement sheath.

After the post-conditioning water flush, pressure-grouting operations began by installing tremie pipe (2.875-inch-diameter) to 554 feet bls. A volume of 1,180 ft^3 (1,000 sacks @ 94 lbs/sack) of ASTM C-150 Type II neat cement was then pumped during pressure grouting operations. A temperature/gamma survey was conducted 9 hours after cementing operations ceased. This survey was used to identify the top of the cement within the annulus as a result of pressure grouting. A significant shift in the temperature gradient log and corresponding deflection in the temperature differential log occurred at 249 feet bls (see Appendix C for temperature-gamma log), which suggests that the top of the first stage was located at that depth. Steel tubing was then used to physically locate (hard tag) the cement level within the annulus. The physical tag indicated the cement level at 255 feet bls, which was in close agreement to that suggested by the temperature log. An additional 637 ft^3 (based on 540 sacks of neat cement at 1.18 ft^3 per sack) of ASTM Type II neat cement was pumped by the tremie method on February 6 and 9, 2004, filling the annular space that resulted in cement returns at land surface. Actual cement volumes pumped during casing installation exceeded theoretical volumes by approximately 21 percent (theoretical 1,572 ft^3 vs. actual pumped 1,908 ft^3) based on a nominal 33-inch diameter borehole and 24-inch-diameter steel casing. Because the casing setting depth was selected to isolate an interval with elevated gamma response, the casing was set into the top of a somewhat more permeable interval, thus resulting in the 21 percent cement loss.

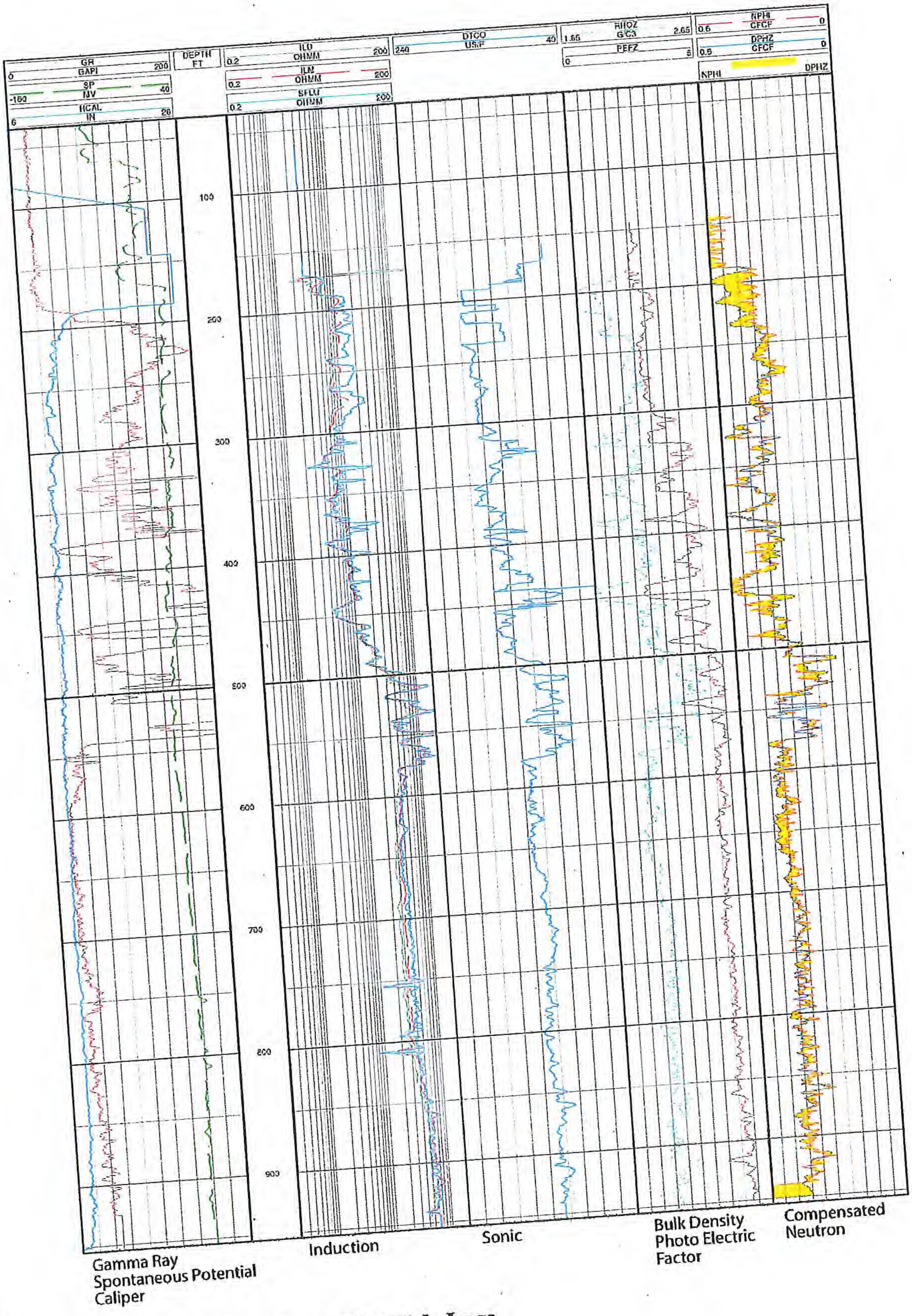


Figure 4. Schlumberger Pilot Hole Logs

Once grouting operations were completed, a temporary well header was installed on the 24-inch-diameter steel casing in preparation of mechanical integrity (pressure) testing operations. Next, the well was filled with water and pressurized to approximately 100 pounds per square inch (psi) using a high-pressure water pump. A preliminary pressure test was conducted on February 10, 2004, to verify integrity of the wellhead. An increase of 1 psi was observed during the 1-hour preliminary pressure test.

After successful completion of the preliminary test, CH2M HILL notified FDEP of the official pressure test date for the 24-inch-diameter steel casing. The formal pressure test was conducted and successfully completed on February 11, 2004, witnessed by FDEP and SFWMD representatives. During the course of the 60-minute pressure test (see **Table 1**), total pressure within the 24-inch-diameter casing decreased 1.75 psi, representing a 1.75 percent decline—well within test tolerance limit of ±5 percent, per Florida Administrative Code (FAC) 62-528.

Table 1. Pressure Test on 24-inch Steel Casing
EXKR-1 UIC Permit # 200917-001-UC

Date	Time (Hour)	Elapsed Time (min)	Pressure Reading (psi)	Delta Pressure (psi)	Remarks	Recorded By
02/11/04	10:05	0	100.00	0.00	Start of Pressure Test	ER
02/11/04	10:10	5	100.00	0.00		ER
02/11/04	10:15	10	100.00	0.00		ER
02/11/04	10:20	15	100.00	0.00		ER
02/11/04	10:25	20	99.50	0.50		ER
02/11/04	10:30	25	99.50	0.00		ER
02/11/04	10:35	30	99.00	0.50		ER
02/11/04	10:40	35	99.00	0.00		ER
02/11/04	10:45	40	99.00	0.00		ER
02/11/04	10:50	45	98.75	0.25		ER
02/11/04	10:55	50	98.50	0.25		ER
02/11/04	11:00	55	98.50	0.00		ER
02/11/04	11:05	60	98.25	0.25	End of Pressure Test	ER

Witnessed by: Ed Rectenwald (SFWMD)
Total Pressure Change: 1.75 psi

After the casing pressure test, DDC reconfigured the drilling equipment and site to accommodate open-circulation, reverse-air drilling operations. In addition, SFWMD personnel installed water quality probes into the Kissimmee River equipped with sondes used to measure and record temperature, pH, specific conductance, dissolved oxygen, and turbidity levels. These probes were deployed approximately 0.75 miles upstream from the point of discharge (POD), approximately 0.33 miles downstream from the POD, and 0.5 miles downstream from the POD. During reverse-air drilling operations, formation water was diverted through two 7,500-gallon settling tanks and filtration system and then discharged into the Kissimmee River via a 12-inch-diameter polyvinyl chloride (PVC) pipe. A site field representative collected water quality data (three times daily) from the water quality sondes in the Kissimmee River during formation water discharges in compliance with FDEP-issued National Pollutant Discharge Elimination System (NPDES) permit monitoring requirements.

On February 17, 2004, DDC drilled out the cement-plug (a result of pressure grouting) at the base of the final casing string with a nominal 22-inch-diameter bit. DDC installed a nominal 10-inch-diameter bit and began to drill out the temporary backfill material (⅜-inch-diameter crushed limestone) from the original pilot-hole via reverse-air rotary technique to 952 feet bls.

On February 20, 2004, MV Geophysical Services provided the following suite of geophysical logs: 4-arm caliper, natural gamma ray, dual induction/laterolog(3) combination, borehole compensated sonic (BHC), static and dynamic fluid resistivity/temperature (FRT), flow meter, and borehole video.

Based on the results of the geophysical logs, it was decided to isolate the interval between 562 and 622 feet bls with an inflatable packer to obtain a water quality sample near the top of the FAS. The well was allowed to flow, and water quality samples were collected on February 26, 2004. Results of analyses and testing are discussed in more detail in the **Hydrogeologic Testing** section.

Following the packer test, the temporary backfill placed in the pilot was removed to the original depth of the pilot hole (950 feet bls). The borehole was then back plugged with 56 sacks of neat cement using the tremie method on March 2, 2004. The cement level was subsequently tagged at a depth of 900 feet bls, and an additional 25 sacks of neat cement were added that resulted in a tag of 869 feet bls on March 4, 2004. With the pilot hole back plugged the contractor proceeded with reaming the pilot hole using a nominal 22-inch-diameter bit. Reaming was completed on March 5, 2004, to a depth of 875 feet bls.

On March 9, 2004, MV Geophysical Services provided the following suite of geophysical logs: static and dynamic FRT, flow, 4-arm caliper, natural gamma ray, and cement bond. Water samples were collected via a depth-specific "thief" sampling device from 875, 800, 760, 720, 640, and 565 feet bls.

On March 12, 2004, a high-volume, specific capacity test was conducted on the nominal 22-inch-diameter borehole from 562 to 875 feet bls. The objective was to determine the production capacity characteristics of the open borehole. Based on a lower than expected specific capacity, it was determined that the borehole should be acidized.

On March 17, 2004, Schlumberger Water Services proceeded with geophysical logging operations on the nominal 10-inch-diameter pilot hole from 170 to 875 feet bls. The geophysical logging suite included the following logs: spectral gamma ray, array induction imager, composite density/neutron PEF, electron capture spectroscopy, and long spaced sonic. A composite of the geophysical log traces (see **Figure 4**) and field copies from geophysical run No. 3 are provided in **Appendix C**.

EXKR-1 was acidized by HydroChem Industrial Services with approximately 3,750 gallons of 36 percent hydrochloric acid solution on March 22, 2004, to increase the production capacity of the well. Well acidization took place from a depth of 567 feet bls. and were completed within 2 hours with no apparent pressure increase recorded at the wellhead. After approximately 24 hours, the well was allowed to back flow at a rate of approximately 1,100 gallons per minute (gpm) for 12 hours. All produced waters were neutralized with soda ash whereby the pH was adjusted to six standard units and then passed through an onsite filtration system before being discharged to the Kissimmee River in accordance with NPDES permit requirements.

On March 25, 2004, MV Geophysical Services conducted static and dynamic FRT, static and dynamic flow, 4-arm caliper, and natural gamma geophysical logging on EXKR-1. After the dynamic logging, a post-acidization specific capacity test of the well was conducted. Because of lower than expected specific capacity values, a second acidization of the borehole took place on April 5, 2004, at a depth of 750 feet bls. The second acidization was followed by another specific capacity test on April 12, 2004. On May 4, 2004, an aquifer performance test (APT) was performed to determine the aquifer characteristics of the proposed ASR horizon. Further discussion of all specific capacity tests and the APT can be found in the **Hydrogeologic Testing** section of this report.

After the APT, DDC installed the permanent well head, constructed a 6-foot by 6-foot concrete pad and installed 4-foot-high steel corner posts (**Figure 5**) completing well construction activities at this site. Well construction and testing activities related to EXKR-1 are summarized in **Appendix E.**

Figure 5. Completed Wellhead – EXKR-1

After construction was completed, EXKR-1 was surveyed relative to permanent reference points by a Florida-registered land surveyor, and located on a site plan map by latitude and longitude, and recorded in the public record (**Appendix F**).

Hydrogeologic Framework

Two major aquifer systems underlie this site: the Surficial Aquifer System, and the Floridan Aquifer System separated by an Intermediate Confining Unit (Hawthorn Group). The FAS is the focus of this exploratory well program and is composed of multiple, discrete flow zones separated by low permeability "semi-confining" units that occur throughout this Eocene-aged sequence. **Figure 6** shows a generalized hydrogeologic section underlying the Kissimmee River Site.

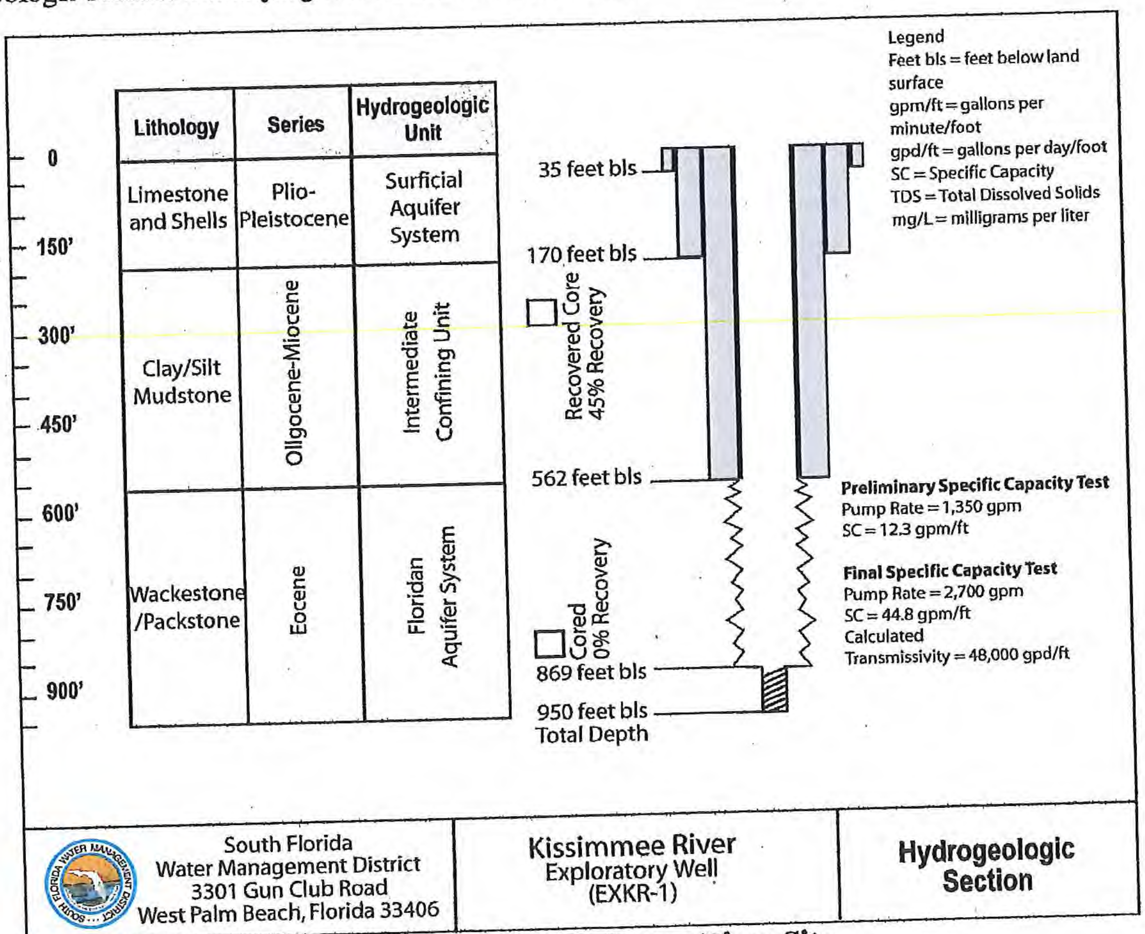


Figure 6. Hydrogeologic Section for the Kissimmee River Site

Surficial Aquifer System

The SAS extends from land surface (top of the water table) to a depth of approximately 146 feet bls. It consists of Pliocene-Pleistocene-aged sediments. The undifferentiated Holocene sediments occur from land surface to a depth of 30 feet bls, and consist of unconsolidated orange to light gray, very fine to coarse-grained quartz sands and shell fragments. The sediments from 30 to 114 feet bls are composed primarily of light gray silty sand and shell fragments (e.g., gastropod and echinoderm). Below 114 feet bls, a gradual increase of the natural gamma emission is observed to 153 feet bls (maximum of 100 American Petroleum Institute [API] units) indicates the increase of clay content observed in the cutting samples and trace amounts of phosphate.

Natural gamma response below 153 feet bls decreases to between 20 to 30 API units to a depth of 176 feet bls where the response once again gradually increases to more than 100 API units to the bottom of the pilot hole at 236 feet bls. Though this entire interval (153 to 236 feet bls), a dark green clay is prevalent in the well cuttings.

Intermediate Confining Unit

Below the SAS lies the Intermediate Confining Unit that extends from 150 to approximately 540 feet bls at this location. The Peace River and Arcadia Formations of the Miocene-Pliocene-aged Hawthorn Group (Scott, 1988) act as confining units separating the FAS from the SAS. Lithologic information obtained from drill cuttings from EXKR-1 indicates that the Hawthorn Group sediments consist predominately of soft, non-indurated detrital clays, silts, and poorly to moderately indurated mudstones/wackstone/packestone with minor amounts of sand and shell material (see lithologic descriptions in **Appendix D**).

The signature of the natural gamma ray log from 155 to approximately 330 feet bls indicates a clayey silt unit (interpreted to be the Peace River Formation) with values ranging from 20 to more than 200 API units.

A change in lithology from a clay-silt unit to predominantly high porosity, moderately indurated carbonate units occurs below 330 feet bls. This interval was identified as the Arcadia Formation. The natural gamma log below 330 to 540 feet bls produces thin, intermittent, gamma radiation peaks, associated primarily with intervals of significant phosphatic sand/silt content with thin, intermittent moderately indurated limestone units identified by positive spikes in the resistivity and sonic log traces.

This unit, from 330 to 540 feet bls consists of a yellowish-gray, packstone with significant carbonate mud content, which limits this interval's vertical and horizontal permeability. These low permeability units form the lower boundary of the Intermediate Confining Unit.

Floridan Aquifer System

The FAS consists of a series of Tertiary limestone and dolostone units. The system includes sediments of the lower Arcadia Formation, Suwannee and Ocala Limestones, Avon Park Formation, and the Oldsmar Formation. The Paleocene-age Cedar Keys Formation with evaporitic gypsum and anhydrite forms the lower boundary of the FAS (Miller, 1986).

Upper Floridan Aquifer

The top of the FAS, as defined by the Southeastern Geological Society AdHoc Committee on Florida Hydrostratigraphic Unit Definition (1986), coincides with the base of a vertically continuous, low permeability, Miocene-aged clay sequence. The upper Floridan aquifer (UFA) consists of thin, moderately permeable, water-bearing horizons interspersed with thick, low permeability units of early Oligocene to middle-Eocene age sediments, including the basal Arcadia Formation and Ocala Limestones, and the Avon Park Formation. At this site, the top of the FAS occurs at a depth of 540 feet bls, which coincides with the basal Hawthorn Unit as demonstrated by the significant change (from in excess of 200 to approximately 40 API counts) in natural gamma response.

The Arcadia Formation from 335 to 485 feet bls is composed primarily of interbedded clay and moderately indurated packstone and grainstone units containing approximately 5-10% shell fragments and 3-5% phosphatic sands and silts. The dual induction, sonic, density and caliper logs all indicate an interbedded unit that is generally, low to moderate in porosity, competent, and well indurated from 485 to 575 feet bls. The resistivity values increase from 4 to greater than 40 ohm-meter (ohm-m) and the caliper log shows a relatively gauged borehole (i.e., similar to the diameter of the drill bit). The selection of the casing setting depth at 562 feet bls. was based on an observed deflection (less competent part of the formation) in the response of the above mentioned logs, between 550 and 560 feet bls, and a reverse inflection on the logs (indicating a more competent part of the formation) that takes place below 560 feet bls.

The sharp formation contact between the Miocene-aged Arcadia Formation (Hawthorn Group) and the underlying Oligocene-aged Ocala Limestone at a depth of 540 feet bls is identified by a change in lithology from a dark gray, well-indurated wackestone to a yellowish-gray packstone, which predominates to 950 feet bls. The discontinuity at 540 feet bls is evidenced by a significant attenuation of the natural gamma activity, and a decrease in the formation resistivity and sonic transit time.

A slight change in lithology from a yellowish-gray, wackestone to light orange-gray, friable, moderately indurated wackestone-packstone identifies the upper boundary of the Ocala Limestone at a depth of 540 feet bls. This formation boundary coincides with a slight attenuation of natural gamma activity, and uniform response in sonic travel times, the resistivity log trace, and uniform borehole diameter (see geophysical log traces from run no. 4 in **Appendix C**).

Based on lithologic and geophysical log data, the Ocala Limestone occurs from 540 feet to 850 feet bls and consists of low to moderate permeability, orangeish-gray moderately indurated wackestones, and packstones, inter-bedded with light-gray micrite. This unit was evident on the geophysical logs by a positive shift in the resistivity and a decrease in sonic transit times (than above) (**Appendix C**). The top of the Avon Park Formation, identified at a depth of 850 feet bls, is marked by an increase in electrical resistivity, a decrease in sonic transit times, a slightly elevated gamma response (see **Appendix D**, lithologic log for presence of clay) and by a gauged borehole (similar in diameter to the drill bit).

Generally, two predominant permeable zones exist within the UFA. The most transmissive part usually occurs near the top, coincident with an unconformity at the top of the Oligocene or Eocene-aged formations (540 feet bls). Well cuttings and production-type geophysical logs suggest that a moderate productive horizon exists within the UFA at this site from 560 to 775 feet bls, resulting in modest productive capacities. A slight deflection in the fluid resistivity differential log trace at 745 feet bls suggests the presence of a minor flow zone. Based on this data, depths for acidization were selected. A specific capacity test (following the first acidization procedure), conducted on the interval from 560 feet to 850 feet bls, straddled the Suwannee-Ocala formation contact and yielded 29 gallons per minute per foot (gpm/ft) of drawdown when pumped at a rate of 3,500 gpm.

In addition, the production type geophysical log traces (e.g., temperature, fluid resistivity and flow meter logs) from a depth of 850 to 950 feet bls indicate little to no significant water production across this interval. This is demonstrated by the lack of response on the log traces for both the temperature and flow meter logs, which support the presence of low permeability sediments and the confining nature of this interval.

Hydrogeologic Testing

Specific information was collected during the drilling program to determine the lithologic, hydraulic and water quality characteristics of the FAS at the Kissimmee River site. These data were used in the final design of EXKR-1.

Formation Sampling

Geologic formation samples (well cuttings) were collected, washed, and described (using the Dunham, 1962 classification scheme) onsite during the drilling of the pilot hole. Formation samples were collected at 5-foot intervals. The field lithologic descriptions for EXKR-1 are provided in **Appendix D**. Representative formation samples were sent to the Florida Geological Survey (FGS) for evaluation and long-term storage.

Geophysical Logging

Geophysical logs were conducted in the pilot hole after each stage of drilling and before casing installation. These logs were conducted to provide a continuous record of the physical properties of the subsurface formations and their contained fluids. These logs were later used to assist in the interpretation of lithology; to provide estimates of permeability, porosity, bulk density, and resistivity of the aquifer; and to determine the salinity of the groundwater. In addition, the extent and degree of confinement of specific intervals can be discerned from the individual logs. The geophysical logs also provided data to determine the desired casing setting depths on the exploratory well. A cement bond log (CBL) was conducted to assess the quality of the cement sheath surrounding the 24-inch-diameter steel casing of EXKR-1.

The geophysical logging contractor downloaded all geophysical log data directly from their onsite logging processor in log ASCII standard (LAS) version 1.2 or 2.0 format. The neutron and density porosity values calculated as part of geophysical log runs No.1 and 8 were derived using a limestone matrix with a density of 2.71 grams per cubic centimeter (gm/cm^3).

The geophysical log traces from log runs No. 1 through 11 are presented in **Appendix C**. The original geophysical logs and video surveys are archived and available for review at SFWMD headquarters located in West Palm Beach, Florida. **Table 2** summarizes conventional geophysical logging operations conducted by MV Geophysical Services, Inc., at this site.
Specialty logging operations conducted by Schlumberger Water Services are summarized in **Table 3**.

Table 2. Conventional Geophysical Logs Summary

Summary of Geophysical Logging Program -- EXKR-1

Run #	Date	Logging Company	Logged Interval (ft.) bls	Caliper	Natural Gamma	SP	DIL	Sonic	Flow-Meter	Temp	Fluid Res.	Cement Bond Log	Video
1	12/16/03	MVG	0-175	x	x	x	X						
2	12/19/03	MVG	0-175	x	x								
4	02/05/04	MVG	0-562	x	x								
5	02/06/04	MVG	0-543		x					x			
6	02/20/04	MVG	562-950	x	x	x	X	x	x	x	x		x
7	03/09/04	MVG	562-875	x	x				x	x	x	x	x
9	03/25/04	MVG	562-875	x	x				x	x	x		
10	04/07/04	MVG	562-875	x	x				x	x	x		
11	04/23/04	MVG	562-875						x	x	x		

MVG=MV Geophysical Services Inc.
DIL - Dual Induction Log

Table 3. Specialty Geophysical Logs Summary

Summary of Specialty Geophysical Logging Program – EXKR -1

Run #	Date	Logging Company	Logged Interval (ft.) bls	Spectal Gamma Ray	Array Induction Imager	Comp. Density/ Neutron/P EF	Electron Capture Spectro	Dipole Sonic Imager	Long Spaced Sonic	Formation Micro Imager
3	01/16/2004	SWS	172-950	x	x	x	x	x	x	x
8	03/17/2004	SWS	573-875		x	x	x		x	

SWS=Schlumberger Water Services

Petrophysical Data and Analyses

During drilling of EXKR-1, DDC obtained one conventional core using a 4-inch-diameter, 20-foot-long, diamond-tipped core barrel. One 9-foot core was recovered from between 300 and 320 feet bls with a core recovery of 45 percent. An additional coring attempt between 880 to 884 feet bls was unsuccessful. **Table 4** is a summary of the full-diameter coring program conducted at this site.

Table 4. Summary of Full Diameter Coring Operations - EXKR-1				
Core No.	Core Interval (feet bls)	Core Footage (feet)	Core Recovered (feet)	Percent Recovery
1	300-320	20	9.0	45.0
2	880-884	4	0.0	0.0
Totals:		24	9.0	37.5

The recovered core was sent, by SFWMD, to Core Laboratories (CL) in Midland, Texas, to determine the following parameters: horizontal and vertical permeability, porosity, grain density, elastic, mechanical and acoustic properties, and lithologic character. Upon arrival, CL recorded a spectral gamma log on each core for downhole correlation with the geophysical logs. Full diameter and plug samples, when core conditions necessitated, were selected for core analyses. Fluid removal was achieved by convection oven drying.

CL determined full diameter porosity by direct pore volume measurement using the Boyle's Law Helium Expansion Method. Once the samples were cleaned and dried, CL determined bulk volume by Archimedes Principle with grain density calculated from the dry weight, bulk volume, and pore volume measurements using **Equation No.1** (American Petroleum Institute, 1998).

Grain Density = Dry Weight / (Bulk Volume – Pore Volume) **(Equation No. 1)**

Porosity as a percent was calculated using bulk volume and grain volume measurements using **Equation No. 2**.

Porosity = ((Bulk Volume – Grain Volume)/ Bulk Volume) x 100 **(Equation No. 2)**

After cleaning the sample, CL measured bulk volume on the individual samples by Archimedes Principle with porosity calculated using **Equation No. 2**. Steady-state air permeability was measured on the full-diameter core samples in two horizontal directions and vertically while confined in a Hassler rubber sleeve at a net confining stress of 400 psi. **Table 5** presents the compressive test results.

Table 5. Summary of Core Compressive Test Results - EXKR-1					
Core Depth (feet)	Confining Pressure (psi)	Bulk Density (gm/cm^3)	Compressive Strength (psi)	Young's Modulus (10)	Poisson's Ratio
304.8	400	1.92	45.0	0.01	0.34

Pumping/Interval-Packer Tests

Several interval tests were conducted in the FAS from 562 to 875 feet bls at this site. The purpose of these tests was to gain water quality and production capacity data on incrementally larger intervals within the UFA. Testing included:

- Test 1: February 26, 2004 - packer test of 562 to 622-foot interval for water quality sampling
- Test 2: March 9, 2004 - pumping test at 500 gpm, logging, and water quality sampling
- Test 3: March 12, 2004 - pre-acidization specific capacity
- Test 4: March 25, 2004 – post-acidization specific capacity (Acid injection at 610 feet bls)
- Test 5: April 12, 2004 – post-acidization specific capacity testing (Acid injection at 750 feet bls)
- Test 6: May 4, 2004 - Aquifer performance test

The procedures listed below were used to conduct individual interval tests in well EXKR-1 at the Kissimmee River site:

1. Select interval for testing based on geophysical logs and lithologic data.
2. Drill nominal 10- and 22-inch-diameter borehole to specified depths.
3. Install centrifugal and submersible pumps to depths that will allow a pumping capacity of 500 to 5,000 gpm.
4. Install two 100-psig-pressure transducers inside the 24-inch-diameter casing connected to a Hermit® 3000 Data Logger to measure and record water-level changes during testing operations.
5. Purge a minimum of three casing/borehole volumes prior to sampling events.
6. Perform step-drawdown test (three to four 1-hour steps) to determine specific capacity. Specific capacity was calculated using **Equation No. 3**:

$$SC = \frac{Q}{s} \qquad \textbf{(Equation No. 3)}$$

   where: SC = specific capacity (gpm/ft), Q = discharge (gpm), S = drawdown (ft)

7. Collect formation water samples for laboratory water quality analyses following SFWMD QA/QC sampling protocol.
8. Record background water level data a minimum of one day before aquifer performance test
9. Record recovery data until water levels return to static conditions.

Test 1, a single seat packer test was conducted on February 26, 2004, over an interval between 562-622 feet bls for water quality sampling as requested by FDEP. The test was conducted after setting the 24-inch casing and setting a 9.25-inch packer in the pilot hole at 622 feet bls. After setting the packer, the well was allowed to flow (artesian head) for approximately 16 hours prior to collecting a water sample for laboratory analysis. Results of the analyses are presented in **Table 6.** Drawdown data was not collected during Test 1.

Table 6. Test No. 1 and 3 - Water Quality Summary - EXKR - 1												
Identifier	Depth Interval (ft. bls)	Na^+ mg/L	K^+ mg/L	Ca^{2+} mg/L	Mg^{2+} mg/L	Cl^- mg/L	Alka as $CaCO_3$ mg/L	SO_4^{2-} mg/L	TDS mg/L	Specific Conduct. µmhos/cm	Temp °C	pH s.u.
EXKR-1 PT-1, Test 1	562-622	91	0.7	41	29.8	250	92	180	910	1,250	--	8.13
EXKR-1 SC-1, Test 3	562-875	144	6.8	49.9	39.3	234	88	196	825	1,326	25.4	7.85

mg/L = milligrams per liter
µmhos/cm = micromhos per centimeter
°C = degree Celsius
s.u = standard unit
Ft. bls = feet below land surface

PT = Packer Test - Test No. 1
SC = Specific Capacity - Test No. 3
NA = Not Analyzed

Test 2, a pumping test, was conducted while the well was pumped at 500 gpm on March 9, 2004, to perform dynamic geophysical logs over the open hole interval from the base of the casing at 562 feet bls to the bottom of the reamed open hole at 875 feet bls. Additionally, water samples were collected at discrete depths (565, 640, 720, 760, 800, and 875 feet bls) using a downhole depth sampler. The sample depths were selected based on an evaluation of the geophysical logs (e.g. flow meter, temperature, and fluid resistivity) conducted while pumping. The results of laboratory analyses (as presented in **Table 7**) seem to indicate an improvement (lower chloride and TDS concentrations) in water quality with depth. This is further demonstrated by comparing the water quality results of **Test No. 1** presented in **Table 6** to that observed in **Table 7**. Drawdown data was not collected during Test 2.

Table 7 - Test No. 2 - Depth Sample Water Quality - EXKR-1												
Identifier	Depth Interval (ft. bls)	Na^+ mg/L	K^+ mg/L	Ca^{2+} mg/L	Mg^{2+} mg/L	Cl^- mg/L	Alka as $CaCO_3$ mg/L	SO_4^{2-} mg/L	TDS mg/L	Specific Conduct. µmhos /cm	Temp °C	PH s.u.
204030081-1	565	94	7.6	41	30.3	260	89	245	830	1300	NA	7.8
204030081-2	640	NA	NA	NA	NA	NA	NA	NA	750	NA	NA	NA
204030081-3	720	NA	NA	NA	NA	NA	NA	NA	480	NA	NA	NA
204030081-4	760	85.9	8.4	43	34.3	170	90	215	720	1030	NA	8.16
204030081-5	800	NA	NA	NA	NA	NA	NA	NA	545	NA	NA	NA
204030081-6	875	57.1	6.1	42	28.4	105	85	175	535	860	NA	8.58

mg/L = milligrams per liter
µmhos/cm = micromhos per centimeter
°C = degree Celsius
s.u = standard unit
Ft. bls = feet below land surface

PT = Packer Test
NA = Not Analyzed

Test 3, a high-volume, specific capacity test, was conducted on the nominal 22-inch-diameter borehole from 562 to 875 feet bls. The objective was to determine the production capacity characteristics of the open borehole. The results of the step-drawdown test are displayed in **Figure 7** and tabulated in **Table 8**. Analyses of water

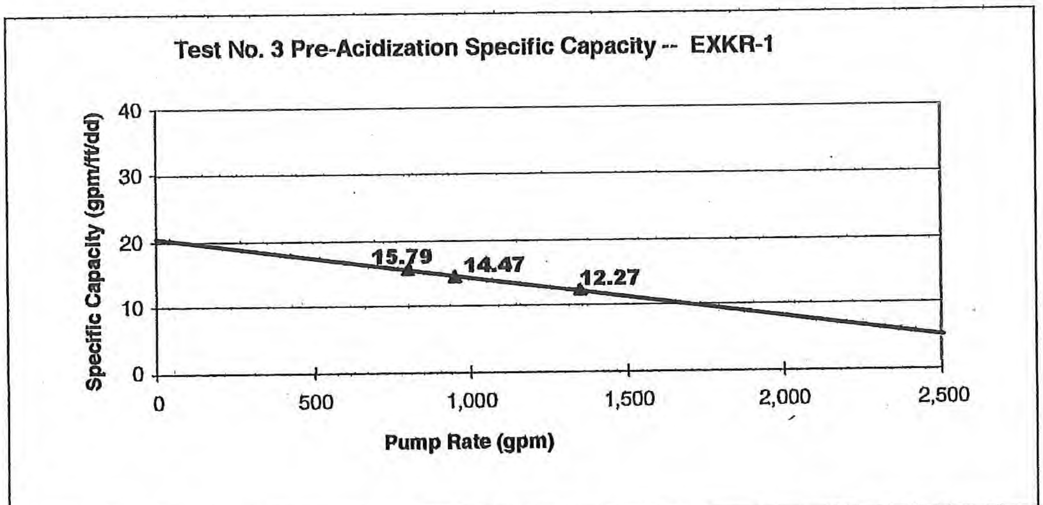


Figure 7. Test No. 3 - Pre-Acidization Specific Capacity Results - EXKR-1 (562-875')

samples collected during Test 3 (presented in **Table 6.**) reflect similar parameter concentrations to results observed in **Test 1** and the depth samples collected in **Test 2**. Although the sample for **Test 3** represents a composite for the open hole interval from 562 to 875 feet bls., the results remain consistent with only minor deviations.

Table 8: Test No. 3 - Pre-Acidization Specific Capacity Results - EXKR-1 (562-875')

Pump Rate (gpm)	Drawdown (feet)	Sp. Capacity (gpm/ft)	s/Q (feet/gpm)	Predicted Q/s
800	50.66	15.79	0.0633	15.70
950	65.65	14.47	0.0691	14.58
1350	110.00	12.27	0.0815	12.25
2000				9.73
3000				7.39
3500				6.59

Based on a combination of factors that included, lower than expected production capacity determined from the specific capacity test, and geophysical and lithologic data that indicated water production between the base of the casing and 610 feet bls, it was determined that the borehole should be acidized.

Acidization involved installing two tremie lines, one for water and one for acid. The water line was installed to just above the base of the casing and the acid line to 5 feet below the casing. The intent of the water line was to inject water immediately above the acid injection point while injecting the acid. In doing so, the water would aid in carrying the acid into flow pathways located along the borehole.

On March 22, 2004, with both tremie lines secured and sealed in at the wellhead, the contractor acidized the open-hole section using 3,750 gallons of 18-Baume hydrochloric acid. Following the injection of acid, an additional 3,750 gallons of water was injected to help push the acid away from the casing and out into the formation. After allowing sufficient time (24 hours) for the acid to react with the limestone units, the acidified water was removed and neutralized. The borehole was then developed via air and over-pumping methods.

Test 4, a second specific capacity test was conducted on March 25, 2004, to determine the effects of well acidization related to well productivity. The results of the post-acidization step-drawdown test are displayed in **Figure 8** and tabulated in **Table 9.**

The net effect of acidizing the open-hole section was a more than a three-fold increase in well productivity. The post-acidization specific capacity increased from a predicted value of approximately 7 gpm/foot of drawdown to a measured value of 29 gpm/ foot of draw-down at the design injection/withdrawal rate of 5 million gallons per day (mgd). Because the post acidization specific capacity remained below the target of 40 to 50 gpm/ft/dd, it was determined that a second acidization would be conducted.

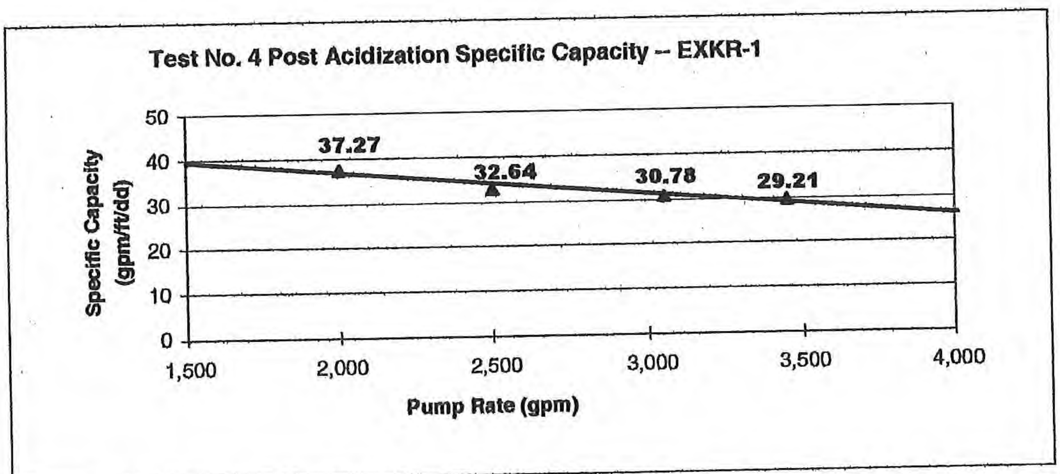


Figure 8. Test No. 4 - Post-Acidization Specific Capacity Results - EXKR-1 (562-875')

Table 9. Test No. 4 - Post-Acidization Specific Capacity Results - EXKR-1 (562-875')				
Pump Rate (gpm)	Drawdown (feet)	Sp. Capacity (gpm/ft)	s/Q (feet/gpm)	Predicted Q/s
2000	53.66	37.27	0.0268	36.55
2500	76.60	32.64	0.0306	33.53
3050	99.10	30.78	0.0325	30.74
3450	118.10	29.21	0.0342	28.99
4000				26.88
5000				23.74

On April 5, 2004, a second acidization procedure was conducted using a similar process as the first. The injection point (750 feet bls) for the 3,750 gallons of hydrochloric acid was selected based on interpretation of geophysical logs that indicated the potential for the development of additional capacity from the lower section of the borehole.

Test 5, a third specific capacity test was conducted on April 12, 2004, to measure the effects of the second well acidization related to well productivity. The results of the post-acidization step-drawdown test as shown in **Figure 9** and tabulated in **Table 10** indicates additional improvement from the first acidization. The specific capacity calculated from the 2700 gpm rate indicates a value of 50.09 gpm/ft as compared to a valve of 32.64 gpm/ft at 2500 gpm during Test 4 (see Table 9). Although not calculated at the same rate, this represents an approximate 50 percent increase in capacity.

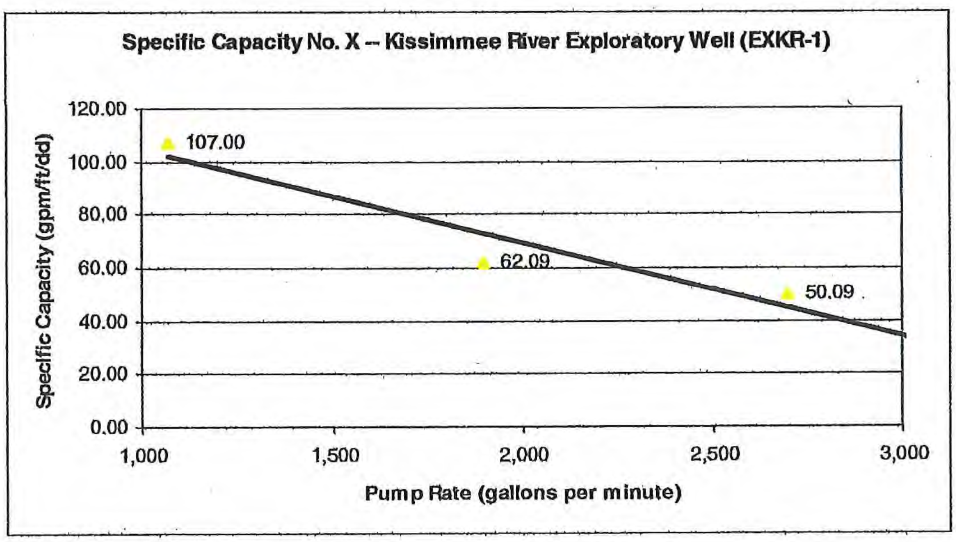


Figure 9 Test No. 5 – 2nd Post-Acidization Specific Capacity Results - EXKR-1 (562-875')

Table 10. Test No. 5 – 2nd Post-Acidization Specific Capacity Results - EXKR-1 (562-875')				
Pump Rate (gpm)	**Drawdown (feet)**	**Sp. Capacity (gpm/ft)**	**s/Q (feet/gpm)**	**Predicted Q/s**
1070	10.0	107.00	0.00935	101.82
1900	30.6	62.09	0.01611	72.77
2700	53.9	50.09	0.01996	44.77
3000				34.27
3500				16.77

Inorganic Water Quality

Before groundwater sampling, the intervals were purged until three borehole volumes were evacuated, or until field parameters of samples collected from the discharge port had stabilized. A limit of ±5 percent variation in consecutive field parameter readings was used to determine chemical stability. Field parameters including temperature, specific conductance, and pH were determined on each sample using a Hydrolab® multi-parameter probe. Chloride concentrations were also determined using a field titration method (Hach® Kit). The water flow from the discharge point was adjusted to minimize aeration and disturbance of the samples. Unfiltered and filtered samples were collected directly from the discharge point by the site field representative into a clean plastic bucket. Equipment blanks were obtained prior to sampling to qualify sampling procedures. Replicate samples were also collected from consecutive bailers in accordance with the SFWMD Comprehensive Quality Assurance Plan.

Once samples were collected, the bottles were preserved and immediately placed on ice in a closed container. The composite samples were submitted to the SFWMD Water Quality Laboratory and analyzed for major cation and anions using EPA and/or Standard Method procedures (SFWMD, Comprehensive Quality Assurance Plan, 2000).

Aquifer Performance Test (Test No. 6)

SFWMD staff conducted an APT to determine the aquifer characteristics of the proposed ASR horizon, located in the UFA from 562 to 875 feet bls. This interval is within the Suwannee and Ocala Limestones and upper part of Avon Park Formation. The principal factors of aquifer performance, such as transmissivity, can be calculated from the drawdown and/or recovery data obtained from a single well test.

The drawdown phase consisted of pumping EXKR-1 at a constant rate of 3,500 gpm for 24 hours while recording water level changes. The drawdown phase was followed by a 24-hour recovery period during which water levels were allowed to return to background condition. The 24-hour aquifer performance test yielded a sustained specific capacity of 32 gpm/ft of drawdown.

The wellhead appurtenances consisted of a shut-off valve, discharge pressure gauge, and wellhead pressure transducer. A 12-inch-diameter circular orifice weir with a 9-inch-diameter orifice plate was used to measure discharge rates that were, verified by an inline flowmeter. SFWMD personnel installed a pressure transducer on the orifice weir to record discharge rates during the APT at 2-minute intervals. Additional pressure transducers were installed in EXKR-1 and connected to a Hermit® 3000 (Insitu, Inc.) data logger via electronic cables. The transducers and data logger were used to measure and record water-level changes at pre-determined intervals during testing operations.

On May 4, 2004, the drawdown phase of the APT started by pumping EXKR-1 at a rate 3,500 gpm. SFWMD maintained the installed electronic devices that continuously measured and recorded water levels and flow rates during the drawdown phase. **Figure 10** is a semi-log plot of the drawdown data for EXKR-1 and discharge rates (manometer readings) during the pumping phase of the APT. Maximum stabilized drawdown in EXKR-1 was 112.3 feet.

Before EXKR-1 was shut-in, SFWMD reconfigured the various data loggers to record the recovery data. The contractor then manually closed the discharge port and water levels slowly recovered to static conditions. The recovery phase of the APT continued for 24 hours, ending on May 6, 2004. **Figure 11** is a semi-log plot of the recovery data for the proposed ASR horizon. Electronic copies of the original drawdown, recovery, and orifice weir (flow rate) data for the APT are archived and available for review at the SFWMD's headquarters in West Palm Beach, Florida.

SFWMD applied the Cooper-Jacob Equation (Cooper and Jacob, 1946), **(Equation 4):**

$$T = \frac{2.3Q}{4\pi\Delta s}$$ **(Equation No. 4)**

where:

T = transmissivity

Q = discharge rate

Δs = drawdown over one log cycle

to the drawdown data collected during the constant-rate portion of the recovery test. The analytical solution produced a transmissivity on the order of 325,000 gpd/ft.

The recovery data were analyzed using Theis' (1935) residual drawdown analytical solution **(Equation 5):**

$$\Delta s' = \frac{2.3Q}{4\pi T}$$ **(Equation No. 5)**

where:

Δs' = residual drawdown difference per log cycle

Q = discharge rate

T = transmissivity = 36,765 ft²/d

$\frac{gpd/ft}{7.48} = \frac{ft^2}{d}$

The analysis of the recovery data produced a transimissivity value on the order of 275,000 gpd/ft. A storage coffiecent cannot be obtained from a single well test.

Following the 24-hour recovery phase, background water-level data was collected for 3 days (11/07/03 to 11/10/03) from EXKR-1 to discern tidal and barometric effects. A time-series plot of background water-level data from EXKR-1 and barometric pressure are included in **Figure 12.**

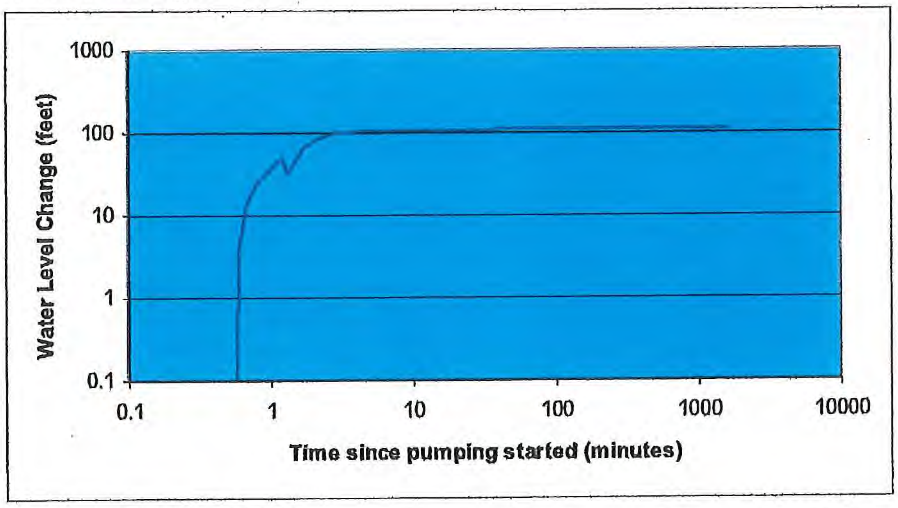


Figure 10. Aquifer Performance Test Semi-log Plot of Drawdown Data – EXKR-1

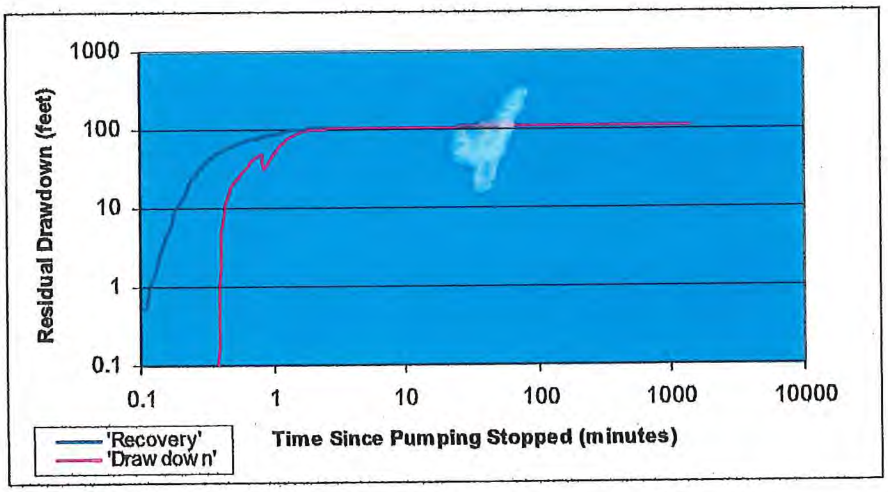


Figure 11. Aquifer Performance Test Semi-log Plot of Recovery Data - EXKR-1

Primary/Secondary Drinking Water Quality Data

Upon completion of well construction of EXKR-1, background water quality samples were collected and analyzed to determine basic water quality characteristics (e.g., temperature, pH, and specific conductance) as well as primary and secondary drinking water standards (Chapter 62-550, FAC) and minimum criteria parameters (Chapter 62-520, FAC).

EXKR-1 was purged until three borehole volumes were evacuated, or until field parameters of samples collected from the discharge pipe had stabilized. A limit of ±5 percent variation in consecutive field parameter readings was used to determine chemical stability. The flow of water from the discharge point was adjusted to minimize the aeration and disturbance of the samples. Unfiltered and filtered samples were col-

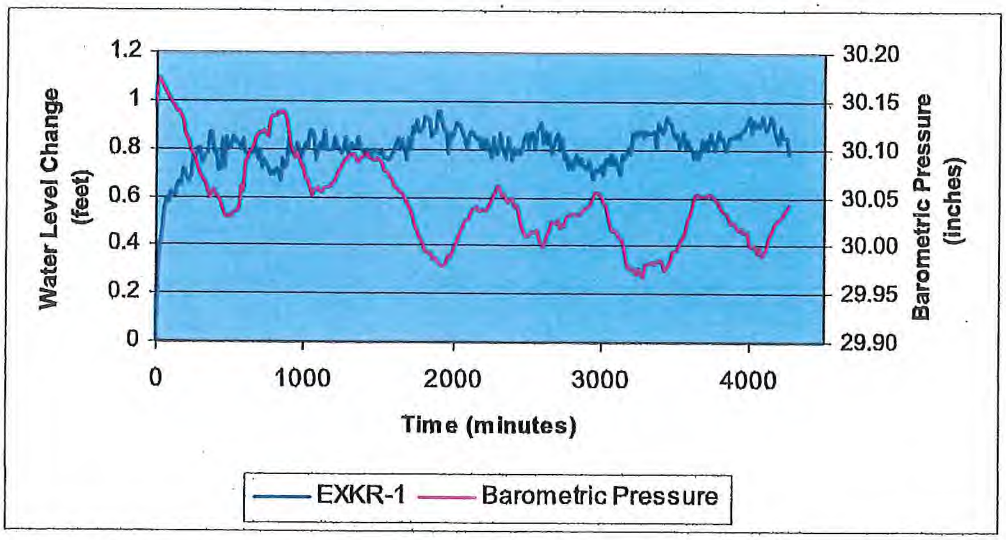


Figure 12. Background Water Level and Barometric Pressure Data

lected directly from the discharge point by USACE representatives into a clean plastic bucket. Equipment blanks were obtained prior to sampling, to qualify sampling procedures. A Teflon bailer was then placed on a bailer stand where the sample bottles were filled slowly to minimize aeration. Replicate samples were collected from consecutive bailers (SFWMD, Comprehensive Quality Assurance Plan, 2000).

Once the samples were collected, the bottles were preserved (if necessary) and immediately placed on ice in a closed container and transported to the SFWMD's water quality laboratory. The samples were then shipped to a laboratory operated by ELAB, Inc. (Ormond Beach, Florida). The samples were analyzed for primary and secondary drinking water standards and minimum criteria parameters using EPA and/or Standard Method procedures. A summary of the results, presented in Table 11, indicate concentrations similar to those previously presented in Tables 6 and 7 and had no unusual conditions. Similarly, no unusual conditions are noted in the complete analytical report presented in **Appendix G.**

Table 11. Test No. 6 - (APT) Water Quality Summary EXKR - 1

Identifier	Depth Interval (ft. bls)	Na^+ mg/L	K^+ mg/L	Ca^{2+} mg/L	Mg^{2+} mg/L	Cl^- mg/L	Alka as $CaCO_3$ mg/L	SO_4^{2-} mg/L	TDS mg/L	Specific Conduct. µmhos/cm	Temp °C	pH s.u.
EXKR-1 APT	562-875	140	8.3	53	38	250	91	200	820	1,368	25.29	7.78

mg/L = milligrams per liter
µmhos/cm = micromhos per centimeter
° C = degree Celsius
s.u = standard unit
Ft. bls = feet below land surface

APT = Aquifer Performance Test conducted for 24 hours
NA = Not Analyzed

Summary

A 24-inch outer diameter Class V, Group 9 exploratory well (EXKR-1) was successfully constructed and tested in accordance with FDEP Permit Number UC 153872-01 at the Port Mayaca site.

Lithologic information and geophysical logs obtained from EXKR-1 indicate that soft, non-indurated detrital clays, silts, and poorly indurated mudstones of the Hawthorn Group predominate from 155 to 560 feet bls. These low permeable sediments act as a confining unit separating the Floridan Aquifer System from the Surficial Aquifer System.

The top of the FAS was identified at a depth of approximately 540 feet bls, as defined by the Southeastern Geological Society AdHoc Committee on Florida Hydrostratigraphic Unit Definition (1986).

Lithologic and geophysical logs, packer test results, and specific capacity results indicate moderate to good production capacity of the upper FAS from 560 to 775 feet bls with a specific capacity value of 29 gpm/ft/dd at the design injection/withdrawal rate of 5 mgd.

A productive horizon in the upper FAS from 562 to 850 feet bls yielded transmissivity values ranging from 275,000 gallons/day/foot to 300,000 gallons/day/foot based on a confined aquifer model.

Composite water quality sampling of EXKR-1 indicate that chloride and total dissolved solids (TDS) values in the upper FAS exceed potable drinking water standards with chloride and TDS concentrations of 260 and 830 milligrams per liter (mg/L), respectively.

The fluid-type logs (e.g., flow and temperature logs) indicate good production from flow zones between 562 and 775 feet bls. Below 775 feet bls, the productive capacity is limited (as indicated by the fluid-type logs) suggesting lower permeable-semi-confining units near the base of the proposed storage horizon.

Conclusions and Recommendations

1. An acceptable ASR horizon exists within the upper Floridan Aquifer System (560 to 775 feet bls) based on lithologic and geophysical log data plus hydraulic test results.
2. If the Kissimmee River site is further developed into an ASR system as part of the Lake Okeechobee ASR Pilot Project, the test/monitor well (OKF-100) will need to be modified to accommodate monitor zone(s) consistent with the ASR wells.
3. Once the test/monitor well (OKF-100) is converted to a dual-zone monitor well, a long term APT should be conducted to determine field-scale hydraulic parameters such as transmissivity and storage of the anticipated storage zone and leakance through the underlying confining unit.

References

American Petroleum Institute, 1998.

Driscoll, F.G., 1989. Groundwater and Wells 2nd Edition. Johnson Filtration Systems Inc., St Paul, Minnesota. 1089 p.

Cooper, H.H. and C.E. Jacob, 1946. A generalized graphical method for evaluating formation constants and summarizing well field history. Transactions of the American Geophysical Union, v. 27, pp. 526-534.

Dunham, R.J., 1962. Classification of carbonate rocks according to depositional texture. In *Classification of Carbonate Rocks* (Ed. by W.E. Ham) Memoir. AAPG Vol. 1, 108–121.

Miller, J.A., 1986. Hydrogeologic framework of the Floridan Aquifer System in Florida and in parts of Georgia, Alabama, and South Carolina, *USGS Professional Paper 1403-B*.

Randazzo/Jones, 1997. The Geology of Florida, University Press of Florida.

Reese, R.S., 2003. Hydrogeology, water quality, and the distribution and source of salinity in the Floridan aquifer system, Martin and St. Lucie Counties, Florida. United States Geological Survey Water-Resources Investigation Report 03-4242, 96 p.

Scott, T.M. 1988. The Lithostratigraphy of the Hawthorn Group (Miocene) of Florida. Florida Geological Survey Bulletin 59.

Southeastern Geological Society, AdHoc Committee on Florida Hydrostratigraphic Unit Definition. 1986. Florida Geological Survey Special Publication no. 28. Tallahassee, Florida.

SFWMD, Comprehensive Quality Assurance Plan, 2000

SFWMD, 2004. Draft Report - Hydrogeologic Investigation of the Floridan Aquifer System Kissimmee Site Okeechobee County, Florida.

Theis, C.V., 1935. The relation between the lowering of the piezometric surface and the rate and duration of discharge of a well using groundwater storage. Transactions of the American Geophysical Union, v. 16, pp. 519-524.

Appendix A

Water Well Construction Permit

Department of Environmental Protection

Jeb Bush
Governor

Southeast District
400 N. Congress Avenue — Suite 200
West Palm Beach, Florida 33401

David B. Struhs
Secretary

ELECTRONIC CORRESPONDENCE December 30, 2003

NOTICE OF PERMIT

Henry Dean
Executive Director
South Florida Water Management District
3301 Gun Club Road
West Palm Beach, FL 33406-4680

OKEECHOBEE COUNTY
UIC - Kissimmee River Exploratory Well
FILE: 200917-001-UC
Exploratory Well EXKR-1

Dear Mr. Dean:

Enclosed is Permit Number 200917-001-UC, to construct and test one Class V, Group 9 exploratory well, EXKR-1, to be located near the Town of Okeechobee, near the confluence of the Kissimmee River and Lake Okeechobee, Okeechobee, County, Florida. This permit is issued pursuant to Section(s) 403.087, Florida Statutes and Florida Administrative Codes 62-4, 62-520, 62-522, 62-528 and 62-550.

Any party to this Order (permit) has the right to seek judicial review of the permit pursuant to Section 120.68, Florida Statutes, by the filing of a Notice of Appeal pursuant to Rule 9.110, Florida Rules of Appellate Procedure, with the Clerk of the Department in the Office of General Counsel, 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 Heidi Vandor, P.G., or Joseph R. May, P.G., of this office at (561) 681-6695 or (561) 681-6691, respectively.

Executed in West Palm Beach, Florida.

STATE OF FLORIDA
DEPARTMENT OF ENVIRONMENTAL PROTECTION

John F. Moulton III — Date
Assistant Director of District Management
Southeast District

JFM/JLC/LAH/JRM/HV
Copies furnished to:

Jack Maloy, SFWMD/WPB
Peter Kwiatkowski, SFWMD/WPB
Michael Bennett, SFWMD/WPB
Paul Linton, SFWMD/WPB
Steve Anderson, SFWMD/WPB
Glenn Landers/USACE/JAX
Richard Deuerling, FDEP/TLH
George Heuler, FDEP/TLH
Jose Calas, FDEP/WPB
Joseph May, FDEP/WPB
Jonathan Arthur, FGS/TLH
Will Evans, FGS/TLH
Nancy Marsh, USEPA/ATL
Bob Renken, USGS/MIA
Ron Reese, USGS/MIA
Bart Bibler, FDOH/TLH
Heidi Vandor, FDEP/WPB

CERTIFICATE OF SERVICE

This is to certify that this NOTICE OF PERMIT and all copies were mailed before the close of business on 12/30/03 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.

Clerk — Date: 12/30/03

Department of
Environmental Protection

Jeb Bush
Governor

Southeast District
400 N. Congress Avenue — Suite 200
West Palm Beach, Florida 33401

David B. Struhs
Secretary

PERMITTEE:
Henry Dean
Executive Director
South Florida Water Management District
3301 Gun Club Road
West Palm Beach, FL 33406-4680

PERMIT/CERTIFICATION NUMBER: 200917-001-UC
DATE OF ISSUANCE: December 30, 2003
EXPIRATION DATE: December 29, 2008
COUNTY: Okeechobee
POSITION: 27° 08' 45" N / 80° 52' 15" W
PROJECT: Kissimmee River
Class V, Group 9 Exploratory Well
EXKR-1, Associated with the Lake
Okeechobee ASR Pilot Project

PROJECT: Exploratory well permit to construct and test a Class V, Group 9 exploratory well, EXKR-1, near the Town of Okeechobee, near the confluence of the Kissimmee River and Lake Okeechobee, Okeechobee County, Florida.

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

TO CONSTRUCT AND TEST: One Class V, Group 9 exploratory well, EXKR-1. EXKR-1 shall be completed into the upper Floridan aquifer. EXKR-1 shall be constructed with 24-inch outside diameter (OD) carbon steel casing extending to a depth of approximately 562 feet below land surface (bls). During construction, hydrogeologic testing to a depth of approximately 1235 feet bls will be performed. The final casing and total well depths will be determined during construction and field testing. A request for approval of a preliminary uncased storage zone interval may be considered under this exploratory well permit or be addressed when a subsequent construction and testing permit is issued. If approval is granted under this exploratory well permit, then the injection of fluids into EXKR-1 may be authorized, for a limited injection test using potable water. The objective of such a test would be to measure well hydraulics and facilitate the design of the recharge and recovery pumps for a prospective ASR system, pursuant to Specific Conditions (SCs) **2.t.** and **2.u.**

Under the exploratory well permit, the purpose of the exploratory well construction and testing program is to obtain sufficient data to make an initial determination concerning the feasibility of aquifer storage and recovery (ASR) at the site location. The Kissimmee River exploratory well is part of the Lake Okeechobee ASR Pilot Project component of the Comprehensive Everglades Restoration Plan (CERP).

IN ACCORDANCE WITH: Application to Construct a Class V exploratory well received June 18, 2002; Request for Information (RFI) dated November 20, 2002; response to RFI received March 6, 2003; supplemental information to RFI response received April 8, 2003, a teleconference between FDEP and SFWMD staff on May 21, 2003; comments from the Underground Injection Control - Technical Advisory Committee (UIC-TAC); publication of the Notice of Draft Permit 200917-001-UC in the Okeechobee News newspaper on August 26, 2003; and in consideration of receipt of public comment received as a result of a public meeting held on September 30, 2003.

LOCATED: near the Town of Okeechobee, near the confluence of the Kissimmee River and Lake Okeechobee, Okeechobee County, Florida.

SUBJECT TO: General Conditions 1-24 and Specific Conditions 1-8

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.

SPECIFIC CONDITIONS

1. General Requirements

   a. This exploratory well permit is to construct and test a Class V, Group 9 exploratory well, referred to herein as EXKR-1. This exploratory well system will include the existing SFWMD Test Well OKF-100 for monitoring during the performance of an aquifer performance test (APT). This permit allows only for the construction and testing of EXKR-1 as an exploratory well in accordance with Chapter 62-528, F.A.C. A request for approval of a preliminary uncased storage zone interval may be considered under this permit or be addressed when a subsequent construction and testing permit is issued. If approval is granted under this permit, then the injection of fluids into EXKR-1 may be authorized, for a limited injection test using potable water (see Specific Condition (SC) **4.h.**). The objective of such a test would be to measure well hydraulics and facilitate the design of the recharge and recovery pumps for a prospective ASR system, [SCs **2.u.** and **2.v.**] Any modification of this exploratory well system to accept/inject waters, other than a limited injection test, must be accomplished through the regulatory process and will require an application for a new permit from the Department.

   b. The permittee shall be subject to all requirements and regulations of Okeechobee County and the South Florida Water Management District regarding the construction and testing of this exploratory well.

   c. Four permanent surficial aquifer monitor wells, identified as Pad Monitor Wells (PMWs), shall be located near the corners of the pad to be constructed for EXKR-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; prior to events as described under Item **4)** below; and at all times when specifically requested by the Department.
      4) The PMWs shall be sampled 48 hours prior to any maintenance, testing (including mechanical integrity testing) or repairs to the system which represent an increased potential for accidental discharge to the surficial aquifer.

   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 for sampling that may be required under a construction and testing permit.

   d. 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.

2. Construction and Testing Requirements

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

b. The measurement points for drilling and logging operations shall be surveyed and referenced to NAVD 88 prior to the onset of drilling activities for the exploratory well.

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. Any formation waters discharged to surface waters during the aquifer performance test shall require an Industrial Wastewater permit from the Department.

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

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 exploratory well shall be contained and properly disposed.

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

   1) Spud date
   2) EXKR-1 final casing seat
   3) Plugging back open hole in EXKR-1 (if proposed under this permit)
   4) EXKR-1 preliminary uncased storage zone interval (if proposed under this permit)

h. Department notification is required prior to the following stages of construction and testing:

   1) Selection of interval-test intervals based upon testing at OKF-100 and EXKR-1
   2) Selection of core intervals based upon testing at Test Well OKF-100 and EXKR-1

i. The formation evaluation program shall consist of the construction and testing program (SC **2.l.** below), the formation core sampling program (SC **2.j.** below), and the packer testing program (SC **2.k.** below). They shall be implemented in accordance with this permit and as proposed in the submittal dated June 18, 2002 "Class V Underground Injection Control Permit Application to Construct an Exploratory Well near the confluence of the Kissimmee River and Lake Okeechobee, Lake Okeechobee ASR Pilot Project, Comprehensive Everglades Restoration Plan" and the responses to Requests for Information received March 6, 2003 and April 8, 2003. All depths specified are approximate. Exact depths will be determined based on field conditions and are subject to the conditions of this permit.

j. The formation core sampling program shall be implemented according to SC **2.i.** above, and shall include a minimum of four cores.

k. The packer testing program shall be implemented according to SC **2.i.** above, and shall at a minimum include one interval test to a depth of 50 feet below the proposed depth of the final casing (approximately 562 feet bls) to determine water quality in the uppermost portion of the FAS. Subsequent packer test(s) (straddle or single, as appropriate) shall be conducted at 50 foot intervals, if possible.

l. The construction and testing program includes the geophysical logging program. The geophysical logging program shall be implemented according to SC **2.i.** above, and shall at a minimum include:

1) Pilot-hole from approximately 40 feet to 175 feet bls (base of surficial aquifer):

- Caliper
- Natural gamma
- Dual induction
- Spontaneous potential
- Borehole compensated sonic

2) Pilot-hole from approximately 175 feet to 630 feet bls:

- Caliper
- Natural gamma
- Dual induction
- Spontaneous potential
- Borehole compensated sonic

3) Smaller diameter (e.g., 8-inch) pilot-hole or nominal 23-inch diameter borehole, from the base of the final casing, 562 feet bls to a maximum depth of approximately 1235 feet bls. See SC **2.l.5)** below, regarding a comparative analysis to determine the hole size for geophysical logging:

- Caliper
- Natural gamma
- Dual induction or equivalent (see SC **2.l.7)a)** below)
- Spontaneous potential
- Borehole compensated sonic with VDL display, or equivalent (see SC **2.l.7)a)** below)
- Fluid resistivity
- Downhole video survey with rotating lens
- Temperature
- Flowmeter (run under pumping and static conditions)

4) Completed well:

- Downhole video survey with rotating lens
- Cement Bond Log

5) Caliper and natural gamma logs shall be run on all reamed holes

6) Temperature and natural gamma logs shall be run after each stage of cementing on all casings to identify the top of the annular cement.

7) Based on a comparative analysis submitted to the Department for review the geophysical logs cited in SC **2.l.3)** above will be run in either a smaller diameter (e.g., 8-inch) pilot-hole or a nominal 23-inch diameter borehole. The comparative analysis will utilize geophysical log testing conducted at other SFWMD exploratory wells located at the Port Mayaca and Berry Groves sites, and at the Moore Haven site, if available. At these sites, the comparative testing will be conducted from below the base of the final casings to the total depth of the wells. Specifics pertaining to the comparative analysis are:

a) The analysis shall include all geophysical logs conducted within the Floridan Aquifer System (FAS) that are required under the exploratory well construction and testing permits issued for the Port Mayaca and Berry Groves sites and Moore Haven, if available. Specialized geophysical logging equipment shall be used to obtain the dual induction and sonic log data. All of the geophysical logs for the comparative analysis shall be run:

- In both the smaller diameter (e.g., 8-inch) pilot hole (referred to as the "**standard approach**") and in the nominal 23-inch diameter borehole (referred to as the "**alternative approach**").
- Over the entire depth interval of each well (for both the smaller diameter (e.g., 8-inch) pilot hole and the nominal 23-inch diameter borehole) from the base of the final casing to total depth.

b) The results of the standard approach and the alternative approach (implemented at the Port Mayaca and Berry Groves sites) shall be compared. Results and interpretations shall be submitted to the Department, all members of the UIC-TAC and to the USEPA Region IV office in Atlanta, for review.

8) Department authorization must be obtained to implement the alternative approach, prior to the initiation of drilling below the base of the final casing at EXKR-1.

a) Should the Department conclude that the alternative approach yields substantially similar information as the standard approach, the Department will provide authorization for implementation of the alternative approach. This authorization would apply to the logging from the base of the final casing to a maximum depth of approximately 1235 feet bls.

b) Should the Department conclude that the alternative approach does not yield substantially similar information as the standard approach, this permit shall automatically revert to the standard approach. The standard approach would include drilling of a nominal 8-inch diameter pilot hole followed by conducting the geophysical logs outlined above, followed by reaming of the 23-inch-diameter borehole and continuation of the project.

m. Upon completion of well construction, background water quality sampling shall be performed to determine water quality characteristics (chlorides, conductivity, total dissolved solids, temperature and pH). If a preliminary uncased storage zone interval has been approved under this exploratory well permit, then the background water quality sampling shall also include the water quality parameters listed on Table B-3 of the exploratory well permit application document received June 18, 2002. [See SC **4.h.6)**]

n. Hydrogeologic testing of the upper Floridan aquifer (from approximately 630 to 1235 feet bls) shall include:

1) Interval tests to be performed to determine the characteristics of the anticipated flow zones.

a) The uppermost interval to be tested shall extend to a depth not to exceed 50 feet below the base of the final casing. A sample collected from this interval shall be analyzed for field parameters, including temperature, specific conductance, chloride and pH; and for TDS, which shall be analyzed in the laboratory.

b) In each succeeding interval to be tested, samples shall be collected using a thief sampler for the parameters listed in Item **a)** above. In a newly drilled portion of an interval, thief samples shall be collected directly above and below each zone where there appears to be a more abrupt salinity shift than the average salinity shift, as determined from the dual induction log, flowmeter log and other pertinent data. This sampling will take into account the potential for mixing of waters from different depths and the existence of vertical flows along the borehole. If, in a certain portion of an interval, a more abrupt salinity shift is not discerned, then a thief sample shall be collected every 80 feet or less.

c) A flow test shall be performed to determine hydraulic and water quality characteristics of each interval that is tested. Samples collected during the flow test shall be analyzed for chlorides, temperature adjusted specific conductance, TDS, major cations and anions, SiO_2, trace metals (including arsenic), and stable isotopes (including ^{18}O and deuterium). The flow test shall be of sufficient duration to achieve stabilization of water levels and water quality. Sufficient pre- and post-test monitoring shall be performed to observe stabilization of water levels.

2) Preliminary aquifer performance testing (APT) to include monitoring during:

a) 3-day background phase

b) 24-hour constant rate discharge phase

c) 12-hour recovery phase

o. Towards the evaluation of the potential for upconing of poorer quality water, water quality samples shall be collected at the beginning, middle and end of the constant rate discharge phase of the APT. These samples shall be analyzed for chlorides (mg/L), pH, specific conductance (μmho/cm or μS/cm), temperature, and total dissolved solids (mg/L), at a minimum.

p. The Department shall be notified at least 72 hours prior to all testing for mechanical integrity.

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

r. A pressure test for the final casing shall be performed. The final casing must be tested for 60 minutes with a fluid-filled casing at 1.5 times the maximum expected operating pressure with a test tolerance of + or - 5%. A Certificate of Calibration of the pressure gauge must be provided to the Department staff witnessing the test, prior to commencement of the test, and with the final test reports.

s. UIC-TAC meetings are scheduled on the 2nd and 4th Tuesday of each month subject to a five working day prior notice and timely receipt of critical data by all UIC-TAC members and the United States Environmental Protection Agency (USEPA) Region IV office in Atlanta. Emergency meetings may be arranged when justified to avoid undue construction delays.

t. Department approval at a scheduled UIC-TAC meeting shall be based on the permittee's presentation that shows compliance with Department rules and this permit.

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

v. The only source of injectate shall be water meeting all Primary and Secondary drinking water quality standards and minimum criteria parameters unless otherwise exempted. All parameters that are not exempted under a water quality criteria exemption, variance or waiver, as appropriate, shall meet the appropriate standard at all times.

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 exploratory well. 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 exploratory well 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 pilot-hole drilling, testing, geophysical logging, casing installation and cementing operations.

4. Reporting Requirements

a. All reports and surveys required by this permit shall be submitted concurrently to all members of the UIC-TAC as well as to the USEPA Region IV office in Atlanta. The UIC-TAC shall consist of representatives of the following agencies:

- Department of Environmental Protection, West Palm Beach and Tallahassee
- Florida Geological Survey, Tallahassee
- United States Geological Survey (USGS), Miami
- Department of Health (DOH), Tallahassee

b. Prior to site preparation for EXKR-1, the following items shall be submitted to the Department, all members of the UIC-TAC and to the USEPA Region IV office in Atlanta:

1) A drilling and construction schedule.
2) Contract documents
3) Site drawing(s) produced at a scale that shows well locations (including EXKR-1 and SFWMD Test Well OKF-100 and all surface features of the exploratory well system).

c. Weekly progress reports — certified by a Florida Licensed Professional Geologist or qualified Florida Licensed Professional Engineer, pursuant to SCs **3.b.** and **7.a.** — shall be submitted throughout the construction period, and shall include at a minimum the following information:

1) A cover letter summary of the daily engineer report, driller's log and a projection for activities in the next reporting period.
2) Daily engineers report and driller's log with detailed descriptions of all drilling progress, cementing, testing, logging, and casing installation activities.
3) Lithologic and geophysical logs, hydrogeologic/specific capacity and APT results, and water quality test results.
4) Well development records.
5) Interpretations included with all test results, logs and well development activities submitted under Items **2), 3)** and **4)** above.
6) Detailed description of any unusual construction-related events that occur during the reporting period.
7) Weekly water quality analysis and water levels for the four PMWs.

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 within 24 hours from the time that the permittee becomes aware of the circumstances. A written submission shall also be provided within five days of the time that 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. Per Rules 62-528.410(4)(c) and 62-528.605(2), F.A.C., the Department must approve the selection of the final casing seat. To obtain approval, the permittee shall submit a request to the Department, to all members of the UIC-TAC, and to the USEPA Region IV office in Atlanta. To the extent possible, the casing seat request shall be accompanied by technical justification, including but not limited to, the following items:

1) Lithologic and geophysical logs with interpretations, as the interpretations relate to the casing seat.
2) Water quality data.
3) Identification of confining unit(s), including hydrogeologic data and interpretations.
4) Identification of monitoring zone.
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).

f. A submittal requesting a preliminary uncased storage zone interval for EXKR-1, if proposed under this permit, shall include, but not necessarily be limited to, the following:

1) Lithologic and geophysical logs with interpretations, as the interpretations relate to the requested storage zone.
2) Water quality of proposed storage zone.
3) Identification of confining unit(s), including hydrogeologic data and interpretations.
4) Transmissivity or specific capacity of proposed storage zone.

g. A submittal for a request for approval to plug back the open hole to modify the storage zone, if proposed under this permit, shall include:

1) Withdrawal test data for the storage zone, with interpretations and evaluation.
2) Water quality reports.
3) Geophysical log interpretations including flow analysis, as the interpretations relate to the request.
4) Identification of storage zone boundaries and characteristics and confinement evaluation.
5) Evaluation of potential for upconing of poorer quality water.

h. A request to perform a limited injection test (of short duration, to measure well hydraulics and facilitate the design of the recharge and recovery pumps of a prospective ASR system, pursuant to SC **2.v.**) shall include:

1) Planned injection procedures, including but not limited to duration of testing, and planned injection and recovery flow rates(Rule 62-528.603(5)(a), F.A.C.).
2) Cement bond logs and interpretation.
3) Final downhole video survey with interpretation.
4) Demonstration of mechanical integrity.

5) Background water quality results from the storage zone of EXKR-1, for the water quality parameters listed on Table B-3 of the exploratory well permit application received June 18, 2002. [See SC **2.m.**]
6) Water quality results for the proposed potable water to be used for the limited injection test, sampled within six months of submission of the limited injection test request, for dissolved oxygen and total trihalomethanes.

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

j. Upon completion of analysis of cores and sample cuttings, the permittee shall contact the UIC Section of the Department of Environmental Protection in Tallahassee to arrange their transfer to the Florida Geological Survey (FGS).

k. The FGS is currently involved in a study that is investigating the effects of ASR on the storage aquifers. For this reason, it is requested that at least one 5-gallon sample of ambient ground water be collected from each interval/packer test conducted within the potential storage zone. Dr. Jon Arthur at the FGS will arrange for the samples to be collected. He can be contacted at the Florida Geological Survey at 903 West Tennessee Street, Tallahassee FL 32304-7700, phone number (850) 488-9380.

l. A 5-gallon sample of formation fluid shall be collected from the completed well after development but before injection begins. Samples should be labeled as to well number, depth, and type of sample. The samples shall be shipped to Florida State University, Department of Geological Sciences, 108 Carraway Building, Tallahassee, FL 32306-4100.

m. Upon completion of construction and testing of the exploratory well, a final report shall be submitted to the Department, the UIC-TAC and to the USEPA Region IV office in Atlanta. The report shall include, but not be limited to, all information and data collected under Rules 62-528.605, 62-528.615, and 62-528.635, F.A.C., with appropriate interpretations. To the extent possible, the report shall include:

1) Transmissivity test data for intervals tested in the upper Floridan aquifer, with evaluation.
2) Evaluation of the maximum ASR capacity within safe pressure limits (if an ASR well open interval/storage zone is proposed and tested).
3) Detailed results and analysis of aquifer performance testing.
4) Evaluation of confinement and potential for upconing of poorer quality water.
5) Record (as-built) drawings of the exploratory well (EXKR-1) and surface equipment, certified by the engineer of record.
6) Well location (EXKR-1) surveyed relative to permanent reference points by a Florida registered land surveyor, and located on a site plan by latitude and longitude.
7) Factory mill certificates for all casing pipe (EXKR-1).
8) Summary of all water quality, water level and well testing data collected, with interpretations, conclusions, and recommendations.

5. Surface Equipment

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

b. Spillage onto the exploratory well pad during construction activities, and any waters spilled during mechanical integrity testing, other maintenance, testing or repairs to the system shall be contained by an impermeable wall around the edge of the pad and disposed of via approved and permitted methods.

c. The four surficial aquifer monitor wells installed at the corners of the well pad shall be secured and maintained.

6. Plugging and Abandonment

   a. The permittee shall unconditionally obligate themselves to plug and abandon EXKR-1 (with the appropriate Department permit), should the well become a threat to the waters of the State, if the well is no longer used or usable for its intended purpose or other purpose as approved by the Department, per Rule 62-528.645(1), F.A.C.

   b. In the event the exploratory well must be plugged and abandoned, the permittee shall obtain an FDEP permit, as required by Rule 62-528.645, F.A.C.

7. Signatories

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

   b. In accordance with Rule 62-528.340(4), F.A.C., all reports and submittals shall contain the following certification signed by a person authorized under Rules 62-528.340(1) or (2), F.A.C. or be included under such certification as may have been previously provided (i.e., responses to a Request for Information (RFI) which are simple clarifications are thereby certified):

   "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."

8. Permit Extension(s) and Renewal(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.

   b. If construction or testing of EXKR-1 is to continue beyond the expiration date of this permit the permittee shall apply for, and obtain, a new exploratory well or construction permit.

   c. Testing of EXKR-1 shall cease upon expiration of this permit, unless a new permit is issued by the Department, or a timely renewal application (Rules 62-4.090, F.A.C. and 62-528.307(2)(a), F.A.C.) for an exploratory well permit has been submitted to the Department.

Issued this _____ day of__________________, 2003

STATE OF FLORIDA
DEPARTMENT OF ENVIRONMENTAL PROTECTION

____
John F. Moulton III
Assistant Director of District Management

Southeast District

JFM/JLC/LAH/JRM/HV

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
ELEVATION OF TOC* (NGVD)				
DEPTH TO WATER (TOC*)				
WATER LEVEL (NGVD)				
CHLORIDE (mg/l)				
CONDUCTIVITY(µmhos/cm)				
TOTAL DISOLV. SOLIDS (mg/l)				
TEMPERATURE (° F.)				

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

ANALYZED BY____________________ SAMPLED BY ____________________

PHONE # ____________________ TITLE ____________________

SITE PLAN OF SAMW LOCATIONS

DIVERSIFIED DRILLING CORPORATION

P.O. Box 290699 • Tampa Florida 33687-0699
Phone 813-988-1132 • Fax 813-985-6636

Exploration Wells for the ASR Pilot Projects

South Florida Water Management District
Kissimmee River Site

Submittal Number: 4
42" x 0.375" Steel Casing

DEVIATIONS: **NONE** ✓ **; AS LISTED** ______

REFERENCE SPECIFICATION NUMBER ______

REFERENCE DRAWING NUMBER ______

CONTRACTOR HAS REVIEWED AND SUBMITTED FOR REVIEW

SIGNATURE [signature] **DATE** 12-9-03
DIVERSIFIED DRILLING CORPORATION

BERG STEEL PIPE CORP.
P. O. BOX 2029
PANAMA CITY, FL 32402
904/769-2273

MILL TEST REPORT

SOLD TO: THOMAS PIPE
P.O. BOX 53187

BATON ROUGE, LA
70805

CUSTOMER ORDER NO: 3292
MILL ORDER NO: 807130

BILL OF LADING NO: 059901 059904 059907
059908 059909 059910

SHIPMENT DATE: 10/25/96

ITEM NO.	QUANTITY	O.D.	WALL	GRADE SPECIFICATION	HYDROSTATIC TEST PRESSURE (PSI)	HYDROSTATIC TEST DWELL (SEC)
2	24	42.000"	.375"	API 5L X-52	840	10

—— BASE MATERIAL ——

ITEM NO.	HEAT NO.	YIELD P.S.I.	TENSILE P.S.I.	ELONG %	Y/T	C	MN	P	S	CB	V	TI	AL	SI	CR	MO	CU	NI	B	CE
2	401T7191	65860	81792	34.0		.12	.74	.015	.009	.002	.003	.001	.037	.19	.032	.005	.017	.035		.251
→ 2	401T7911	63983	78644	34.0		.09	1.25	.021	.009	.035	.036	.001	.035	.19	.040	.004	.014	.035	.0002	.316
2	412T3441	62393	79213	35.0		.09	1.25	.018	.010	.031	.033	.001	.040	.23	.041	.009	.013	.038	.0002	.318
→ 2	803U74000	70000	78417	33.5		.08	1.16	.016	.007	.032	.004	.002	.037	.20	.028	.006	.014	.035	.0002	.282
2	803U74020	70190	79670	32.0		.08	1.19	.018	.006	.031	.005	.002	.033	.21	.050	.007	.013	.030	.0002	.289

—— LOT TEST (WELD) ——

ITEM NO.	HEAT NO.	TENSILE P.S.I.	ELONG %	DIRCT	BEND TEST	BEND TYPE
2	412T3441	84876		TRANS	OK	ROOT & FACE
2	401T7911	83969		TRANS	OK	ROOT & FACE

WE CERTIFY THAT THIS REPORT IS CORRECT AS CONTAINED IN THE COMPANY RECORDS:

CERTIFICATION NUMBER: 059901 DATE: 10/29/96

THESE MILL TEST REPORTS APPLY TO
YOUR P.O. # 24301
BARTOW STEEL REF. # 2009097

DIVERSIFIED DRILLING CORPORATION

P.O. Box 290699 • Tampa Florida 33687-0699
Phone 813-988-1132 • Fax 813-985-6636

Exploration Wells for the ASR Pilot Projects

South Florida Water Management District
Kissimmee River Site

Submittal Number: 5
34" x 0.375" Steel Casing

DEVIATIONS: **NONE** ✓ ; **AS LISTED** ______

REFERENCE SPECIFICATION NUMBER ______

REFERENCE DRAWING NUMBER ______

CONTRACTOR HAS REVIEWED AND SUBMITTED FOR REVIEW

SIGNATURE [signature] **DATE** 12/16/03
DIVERSIFIED DRILLING CORPORATION

RG STEEL PIPE CORP.
O. BOX 59209
PANAMA CITY, FL 32412-0209
850/769-2273

MILL TEST REPORT

ISO 9001 ANSI-RAB ACCREDITED

SOLD TO: BARTOW STEEL, INC.
an Edgen Company
3595 HWY 60 WEST
ATTN: GREG BAKER
BARTOW

CUSTOMER ORDER NO: BLK 2015
MILL ORDER NO: B09310

BILL OF LADING NO: 096074

SHIPMENT DATE: 8/28/2003

NOTES:
ALL PIPE MANUFACTURED IN THE USA
PROCESS OF MANUFACTURE - DSAW
MELTED AND MANUFACTURED IN THE USA

ITEM NO.	QUANTITY	O.D.	WALL	GRADE SPECIFICATION		HYDROSTATIC TEST PRESSURE (PSI)	DWELL (SEC)
1	10	34.000"	.375"	B/X-42 PSL2	*	830	10

SPECIFICATION API 5L 42ND EDITION 7/1/2000
TENSILE SPECIMEN STRIP TYPE PER API5L FIGURE 4E
UT INSPECTION OF WELD SEAM TO 1/16" DRILLED HOLE SENSITIVITY
X-RAY OF 8" OF WELD SEAM AT EACH END USING 2% ISO WIRE PENTRAMETERS

THESE MILL TEST REPORTS APPLY TO
YOUR P.O. # 24348
BARTOW STEEL REF. # 2005740

---- BASE MATERIAL----

ITEM NO.	HEAT NO.	YIELD P.S.I.	TENSILE P.S.I.	ELONG %	Y/T	C	MN	P	S	CB	V	TI	AL	SI	CR	MO	CU	NI	B	CE	PcM
1	E3F047	49742	67870	38.9	.73	.03	1.01	.010	.006	.018	.004	.019	.024	.23	.084	.035	.227	.137	.0001	.247	.109
	TEST PIPE: 323245-6	MFG: IPS																			
1	W3F044	50723	67114	43.2	.76	.04	1.01	.010	.007	.020	.004	.018	.028	.23	.073	.035	.242	.134	.0002	.255	.120
	TEST PIPE: 323239-6	MFG: IPS																			

---- LOT TEST (WELD) ----

ITEM NO.	HEAT NO.	TENSILE P.S.I.	ELONG %	DIRCT	BEND TEST	BEND TYPE		
1	E3E095	75693		TRANS	OK	ROOT & FACE	TEST PIPE: 323226-0	MFG: IPS
1	E3F047			TRANS	OK	ROOT & FACE	TEST PIPE: 323245-6	MFG: IPS

WE CERTIFY THAT THIS REPORT IS CORRECT AS CONTAINED IN THE COMPANY RECORDS. PIPE WERE MANUFACTURED, TESTED, AND INSPECTED IN COMPLIANCE WITH THE LATEST EDITION OF THE APPLICABLE SPECIFICATION.

CERTIFICATION NUMBER: 096074 Mike Biggs DATE: 8/29/2003

ATTN: PAUL 813-985-6636

ERG STEEL PIPE CORP.
.O. BOX 59209
PANAMA CITY, FL 32412-0209
850/769-2273

MILL TEST REPORT

CUSTOMER NAME: BARTOW STEEL, INC.

BVQi ISO 9001 ANSI-RAB QMS ACCREDITED

				CHARPY V NOTCH				DWTT					
ITEM NO.	HEAT NO.	SIZE	DIRCT	TEST TEMP	ENERGY (FT/LB) 1 - 2 - 3 / A	AVG.% SHEAR	LOC	SIZE	DIRCT	TEMP	ENERGY (FT/LB) 1 - 2	AVG.% SHEAR	LOC
1	E3F047	2/3	TRANS	+32F	180-185-178/181	100	BODY						
	TEST PIPE: 323245-6		MFG:	IPS									
1	W3F044	2/3	TRANS	+32F	118-129-103/117	93	BODY						
	TEST PIPE: 323239-6		MFG:	IPS									

WE CERTIFY THAT THIS REPORT IS CORRECT AS CONTAINED IN THE COMPANY RECORDS. PIPE WERE MANUFACTURED, TESTED, AND INSPECTED IN COMPLIANCE WITH THE LATEST EDITION OF THE APPLICABLE SPECIFICATION.

CERTIFICATION NUMBER: 096074 *Mike Biggs* DATE: 8/29/2003

THESE MILL TEST REPORTS APPLY TO
YOUR P.O. # 24348
BARTOW STEEL REF. # 2005740

DAVID A. THURNER
INDUSTRIAL SALES
BARTOW STEEL, INC.
800-282-7819
FAX 863-869-8520

DIVERSIFIED DRILLING CORPORATION

P.O. Box 290699 • Tampa Florida 33687-0699
Phone 813-988-1132 • Fax 813-985-6636

Exploration Wells for the ASR Pilot Projects

South Florida Water Management District
Kissimmee River Site

Submittal Number: 6
24" x 0.5" Steel Casing

DEVIATIONS: **NONE** ✓ **; AS LISTED** ________

REFERENCE SPECIFICATION NUMBER ________________

REFERENCE DRAWING NUMBER ____________________

CONTRACTOR HAS REVIEWED AND SUBMITTED FOR REVIEW

SIGNATURE [signature] **DATE** 12/16/03
DIVERSIFIED DRILLING CORPORATION

Sales Order #s: 149053
Invoice #s:
CPO #s: 24399

Notes:

HEAT NUMBER	O.D./WALL	SPEC/GRADE
B2M5067	24.000/0.500	API5L/B/X42
A2M0107	24.000/0.500	API5L/B/X42
B2M5066	24.000/0.500	API5L/B/X42
125044	24.000/0.500	API5L/B/X42

AMERICAN STEEL PIPE
A division of American Cast Iron Pipe Co.,
P.O. Box 2727, Birmingham, AL 35202-2727

QUALIFICATION REPORT OF SHIPMENT

DATE: 12/APR/2002

CUSTOMER ADDRESS: LABARGE PIPE & STEEL COMPANY
901 NORTH 10TH STREET
ST. LOUIS MO 63101

Customer Order Number 214170

MFG Order Number S104876

SPECIAL NOTES

Pipe were NDT tested using an ultrasonic test method calibrated on ID & OD N-10 NOTCHES
HYDROSTATIC TEST DURATION 10 SECONDS. MAX ALLOWABLE PCM .25.
MINIMUM WELD SEAM ANNEAL TEMPERATURE 1600 DEGREES F FOR ALL PIPE.
ALL TESTS ARE FROM THE BODY OF THE PIPE IN THE TRANSVERSE DIRECTION UNLESS OTHERWISE NOTED. STANDARD TENSILE GAGE LENGTH 1-1/2" X 2".
CHARPY ACCEPTANCE CRITERIA MIN. ENERGY 14/HEAT, MIN. SHEAR AREA N/A.

LINE	PIECES	FOOTAGE	SIZE	WALL	SHIPMENT DESCRIPTION SHIP. NO 1-9	SPECIFICATIONS	GRADE
1			24.00	.500	ERW API LINE PIPE	API 5L, PSL2	BX42
						ASTM A53	B
						ASME SA53	B
						ASTM A500	B & C

HEAT	C	MN	P	S	CB	SI	TI	CU	NI	MO	CR	V	AL	B	N	C.E.	Coil Pipe
A2M0106 LINE 1																	
H=	0.070	1.060	0.014	0.002	0.074	0.190	0.002	0.120	0.050	0.015	0.030	0.003	0.025	0.000	0.010	0.139	0008
P=	0.064	1.071	0.015	0.002	0.069	0.176	0.001	0.133	0.055	0.016	0.037	0.004	0.024	0.000	0.000	0.134	07/11

M=Weld Ten. 73.0 ksi Ten. 69.5 ksi Yield 57.5 ksi %EL 45.5 RB 84 Hydro: 1580 Psi

Attachments

PAGE 1
Continued

Date: 12/APR/2002

CUSTOMER NAME: LABARGE PIPE & STEEL COMPANY

Customer Order Number 214170

MFG Order Number S104876

B2M5066 LINE 1
H= 0.070 1.050 0.012 0.003 0.075 0.210 0.003 0.100 0.040 0.015 0.040 0.003 0.026 0.000 0.009 0.138 0010
P= 0.064 1.116 0.014 0.004 0.080 0.209 0.001 0.119 0.051 0.017 0.046 0.006 0.030 0.000 0.000 0.138 07/11
M=Weld Ten. 71.5 ksi Ten. 70.5 ksi Yield 58.0 ksi %EL 46.5 RB 84 Hydro: 1580 Psi

A2M0107 LINE 1
H= 0.070 1.050 0.014 0.004 0.078 0.210 0.003 0.080 0.040 0.012 0.040 0.003 0.028 0.000 0.008 0.137 0012
P= 0.067 1.054 0.015 0.003 0.072 0.199 0.002 0.097 0.038 0.013 0.050 0.000 0.023 0.000 0.000 0.135 07/11
M=Weld Ten. 71.5 ksi Ten. 70.5 ksi Yield 57.0 ksi %EL 44.0 RB 84 Hydro: 1580 Psi

Attachments

PAGE 2
Continued

Date: 12/APR/2002

Customer Order Number 214170

MFG Order Number S104876

CUSTOMER NAME: LABARGE PIPE & STEEL COMPANY

Charpy "V" Notch Tests

HEAT NO.	SIZE	TEMP	Energy (FT./LBS.)			AVG.	Fracture Appearance (% Shear Area)			AVG.	Line
A2M0106-	.666	32	174.0	172.0	130.0	158.7	100	100	100	100.0	1
B2M5066-	.666	32	170.0	144.0	118.0	144.0	100	100	100	100.0	1
A2M0107-	.666	32	140.0	75.0	148.0	121.0	100	73	100	91.0	1
ALL HEAT AVERAGE =						141.2				97.0	

Legend Analyses:

A-Z - Additional Testing
H - Heat Analysis
P - Product Analysis
M- Mechanical Properties

R - Retest
L - Longitudinal
T - Transitional
W - Weld Line

Hydrostatic Test: OK
Flattening Test: OK
Yield Strength by Ring

Manufactured and Melted in the USA.

We hereby certify that the above figures are correct as contained in the records of this company, and that the pipe were manufactured, tested and inspected in compliance with the Latest edition of the applicable specification, in Birmingham, Alabama, U.S.A.

Noel A. Gordon

Noel A. Gordon
Manager of Quality Assurance - Steel Pipe

End Of Report

Issue No.: 4

Issue Date: 01/17/1996

QD-AW3F055

Appendix D

Lithologic Descriptions

Lithologic Log
SFWMD Kissimmee River Exploratory Well
Glades County, Florida

Depth in Feet (bls)

From	To	Lithologic Description Kissimmee River Exploratory Well
0	35	No Samples
35	60	drilling pad gravel, trace amounts of small shell, pale olive (10Y 6/2) to light gray (5Y 5/2) silty sand
60	160	100 % small pelecypod, gastropod and echinoderm shell material whole and fragments (sand content washed out)
160	180	60% small shell, 40% greenish gray (5GY 5/1) clay
180	190	50% small shell, 50% dark greenish gray (5GY 4/1) clay
190	195	75% dark greenish gray (5GY 4/1) clay, 25% small shell frags, trace phosphate
195	205	90% dark greenish gray (5GY 4/1) clay, 10% small shell frags, trace phosphate
205	215	75% dark greenish gray (5GY 4/1) clay, 25% small shell frags, trace phosphate
215	220	50% dark greenish gray (5GY 4/1) clay, 50% small shell frags, trace phosphate
220	225	75% small shell frags, 25% dark greenish gray (5GY 4/1) clay, trace phosphate
		Pilot Hole drilled to 225 ft. Geophysical logging performed on borehole (depth 236 ft.). 34 inch steel casing set at 170' below land surface
225	245	75% greenish gray (5GY 6/1) to dark greenish gray (5GY 4/1) clay, 24% fossil shell (Mollusca), 1%calcite sand subangular to well rounded,
245	255	65% dusky yellow green (5GY 5/2) clay, 34% fossil shell (Mollusca), 1%calcite sand subangular to well rounded,
255	270	75% dusky yellow (5Y 6/4) clay, 23% fossil shell (Mollusca), 1%calcite sand subangular to well rounded,
270	300	75% greenish gray (5GY 5/1) clay, 19% fossil shell (Mollusca), 4% greenish gray (5GY 6/1) calcilutite mudstone, 1%calcite sand subangular to well rounded, 1% coarse sand-sized phosphate
300	305	65% greenish gray (5GY 5/1) clay, 27% fossil shell (Mollusca), 4% greenish gray (5GY 6/1) calcilutite mudstone, 1%calcite sand subangular to well rounded, 3% coarse sand-sized phosphate
305	310	65% grayish yellow green (5GY 7/2) clay, 27% fossil shell (Mollusca), 4% light grayish olive (10 Y 4/2) calcilutite packstone, 1% calcite sand well rounded high sphericity, 3% coarse sand-sized phosphate
310	320	65% dusky yellow green (5GY 5/2) clay, 27% fossil shell (Mollusca,sharks teeth), 4% greenish gray (5GY 6/1) calcilutite mudstone, 1%calcite sand subangular to well rounded, 3% coarse sand-sized phosphate
320	325	75% grayish yellow green(5GY 7/2) clay, 21% fossil shell (Mollusca), 1%calcite sand subangular to well rounded, 3% coarse sand-sized phosphate
325	330	65% grayish olive green (5GY 3/2) clay, 27% fossil shell (Mollusca), 4% greenish gray (5GY 6/1) calcilutite mudstone, 1%calcite sand subangular to well rounded, 3% coarse sand-sized phosphate
330	340	80% light grey (N7) to white (N9) phosphatic coarse calcarenite wackestone w/<20% allochems (Mollusca), 20% grayish yellow green (5GY 7/2) clay, <1% coarse sand-sized phosphate
340	350	55% greenish yellow grey (5GY 7/2) clay, 45% light grey (N7) to white (N9) wackestone to packstone w/ >25% allochems (mollusca) and silt sized phosphate, 1% coarse sand-sized phosphate
350	355	90% light grey (N7) to white (N9) phosphatic coarse calcarenite packstone w/50% allochems (Mollusca), 7% grayish yellow green (5GY 7/2) clay, >3% coarse sand-sized phosphate
355	360	60% light grey (N7) to white (N9) phosphatic coarse calcarenite packstone w/50% allochems (Mollusca), 38% grayish yellow green (5GY 7/2), <2% coarse sand-sized phosphate
360	370	87% light grey (N7) to white (N9) to yellowish gray (5Y 7/2) phosphatic coarse calcarenite packstone w/50% allochems (Mollusca), 10% yellowish gray (5Y 7/2) to pale olive (10Y 6/2) clay, 3% coarse sand-sized phosphate

Lithologic Log
SFWMD Kissimmee River Exploratory Well
Glades County, Florida

Depth in Feet (bls)

From	To	Lithologic Description Kissimmee River Exploratory Well
370	380	92% light grey (N7) to white (N9) to yellowish gray (5Y 7/2) phosphatic coarse calcarenite packstone w/50% allochems (Mollusca), 5% yellowish gray (5Y 7/2) to pale olive (10Y 6/2) clay, 3% coarse sand-sized phosphate
380	405	67% light grey (N7) to white (N9) to light greenish gray (5GY 8/1) phosphatic coarse calcarenite packstone w/ >50% allochems (Mollusca), 30% light greenish gray (5GY 8/1) clay, 3% coarse sand-sized phosphate
405	420	67% light grey (N7) to white (N9) to light greenish gray (5GY 8/1) phosphatic coarse calcarenite packstone w/ 50% allochems (Mollusca), 25% greenish gray (5G 6/1) clay, 5% dark greenish gray (5GY 5/1) clay, 3% coarse phosphate
420	435	95% light grey (N7) to white (N9) to yellowish gray (5Y 8/1) phosphatic coarse calcarenite packstone w/50% allochems (Mollusca), 5% coarse sand-sized phosphate
435	460	97% light grey (N7) to white (N9) to yellowish gray (5Y 8/1) fine calcirudite packstone w/50% allochems (Mollusca), 3% coarse sand-sized phosphate
460	485	50% greenish grey (5GY 6/1) to dark greenish grey (5GY 4/1) clay, 45% light grey (N7) to white (N9) to greenish gray (5Y 6/1) fine calcirudite packstone w/50% allochems (Mollusca), 5% coarse sand-sized phosphate
485	500	80% greenish grey (5GY 6/1) to dark greenish grey (5GY 4/1) clay, 19% light grey (N7) to white (N9) to greenish gray (5Y 6/1) fine calcirudite packstone w/50% allochems (Mollusca), 1% coarse sand-sized phosphate
500	505	65% greenish grey (5GY 6/1) to dark greenish grey (5GY 4/1) clay, 34% light grey (N7) to white (N9) to greenish gray (5Y 6/1) fine calcirudite packstone w/50% allochems (Mollusca), 1% coarse sand-sized phosphate
505	560	90% light grey (N7) to white (N9) to yellowish gray (5Y 8/1) fine calcirudite packstone w/<50% allochems (Mollusca), 8% light grey (N7) to white (N9) clay (marl), 2% coarse sand-sized phosphate
560	570	97% light grey (N7) to white (N9) to yellowish gray (5Y 8/1) fine calcirudite packstone w/<50% allochems (Mollusca), 1% pale orange (10 YR 8/2) fine to coarse calcirudite made up primarily of foraminifera with a matrix of yellowish grey (5Y 7/1) peloidal calcarenite grainstone, 1% light olive grey (5Y 5/1) vf sandstone, 1% coarse sand-sized phosphate
570	590	80% light grey (N7) to white (N9) to yellowish gray (5Y 8/1) fine calcirudite packstone w/<50% allochems (Mollusca), 18% pale orange (10 YR 8/2) fine to coarse calcirudite w/>50% allochems (foraminifera) with a matrix of yellowish grey (5Y 7/1) peloidal calcarenite grainstone, 2% light olive grey (5Y 5/1) vf sandstone, trace phosphate
590	620	70% pale orange (10 YR 8/2) fine to coarse calcirudite w/>50% allochems (foraminifera) with a matrix of yellowish grey (5Y 7/1) peloidal calcarenite grainstone, 28% light grey (N7) to white (N9) to yellowish gray (5Y 8/1) fine calcirudite packstone w/<50% allochems (Mollusca), 2% light olive grey (5Y 5/1) vf sandstone
620	690	95% pale orange (10 YR 8/2) fine to coarse calcirudite w/>50% allochems (foraminifera) with a matrix of yellowish grey (5Y 7/1) peloidal calcarenite grainstone, 3% light grey (N7) to white (N9) to yellowish gray (5Y 8/1) fine calcirudite packstone w/<50% allochems (Mollusca), 2% light olive grey (5Y 5/1) vf sandstone, trace phosphate
690	775	98% pale orange (10 YR 8/2) fine to coarse calcirudite w/>50% allochems (foraminifera) with a matrix of yellowish grey (5Y 7/1) peloidal calcarenite grainstone, 1% light grey (N7) to white (N9) to yellowish gray (5Y 8/1) fine calcirudite packstone w/<50% allochems (Mollusca), trace light olive grey (5Y 5/1) vf sandstone, trace phosphate, minor greenish grey (5GY 6/1) clay

Lithologic Log
SFWMD Kissimmee River Exploratory Well
Glades County, Florida

Depth in Feet (bls)

From	To	Lithologic Description Kissimmee River Exploratory Well
775	795	100% pale orange (10 YR 8/2) to grayish orange (10YR 7/4) fine to coarse calcirudite w/>50% allochems (foraminifera and echinoidea with calcite crystals) with a matrix of yellowish grey (5Y 7/1) peloidal calcarenite grainstone, minor greenish grey (5GY 6/1) to white (N9) clay (marl)
795	840	100% yellowish grey (5Y 8/1) to olive grey (5Y6/1) fine to coarse calcirudite w/<50% allochems (echinoidea with calcite crystals and foraminifera) with a matrix of yellowish grey (5Y 7/1) peloidal calcarenite grainstone, minor greenish grey (5GY 6/1)) to white (N9) clay (marl)
840	880	100% yellowish grey (5Y 8/1) to olive grey (5Y6/1) fine to coarse calcirudite w/ 25% allochems (echinoidea with calcite crystals and foraminifera) with a matrix of yellowish grey (5Y 7/1) peloidal calcarenite grainstone,
880	930	50% greenish grey (5GY 6/1))clay, 48% yellowish grey (5Y 8/1) to olive grey (5Y6/1) fine to coarse calcirudite w/ 25% allochems (echinoidea with calcite crystals and foraminifera) with a matrix of yellowish grey (5Y 7/1) peloidal calcarenite grainstone, 2% phosphate
930	950	100% yellowish grey (5Y 8/1) to olive grey (5Y6/1) fine to coarse calcirudite w/<25 % allochems (echinoidea with calcite crystals and foraminifera) with a matrix of yellowish grey (5Y 7/1) peloidal calcarenite grainstone, trace phosphate, minor greenish grey (5GY 6/1))clay

Appendix E

Well Construction Summary

Table 2. Construction and Testing Activities Associated with the Kissimmee ASR Exploratory Well

May 4-6, 2004	Conducted 72 hour APT
April 12, 2004	Conducted specific capacity pump test and 24 hour APT
April 8, 2004	Started and completed air development of well
April 7, 2004	Conducted geophysical logging to 875 feet bls. Logs conducted were caliper, natural gamma, static and dynamic temperature, static and dynamic fluid resistivity, and static and dynamic flow logging
April 6, 2004	Started and completed post-acidization well development
April 5, 2004	Acidized well with 4,200 gallons of 26% hydrochloric acid. Acid installation line installed to 745 feet bls
March 31, 2004	Conducted step specific capacty step test. Step rates at 2000, 2500, 3000, and 3500 gpm
March 30, 2004	Completed installation of test pump
March 29, 2004	Started installation of test pump
March 25, 2004	Conducted geophysical logging to 875 feet bls. Logs conducted were caliper, natural gamma, static and dynamic temperature, static and dynamic fluid resistivity, and static and dynamic flow logging.
March 24, 2004	Completed post-acidizaion well development
March 23, 2004	Started post-acidization well development
March 22, 2004	Acidized well with 3,750 gallons of 36% hydrochloric acid. Acid installation line installed to 585 feet bls
March 17, 2004	Conducted geophysical logging to 875 feet bls. Logs conducted were caliper, natural gamma, static and dynamic temperature, static and dynamic fluid resistivity, and static and dynamic flow logging.
March 15, 2004	Removed test pump from well
March 12, 2004	Conducted specific capacity pump test
March 11, 2004	Completed installation of test pump
March 10, 2004	Completed geophysical logging. Started installation of test pump
March 9, 2004	Started geophysical logging. Logs conducted were caliper, natural gamma, static and dynamic temperature, static and dynamic fluid resistivity, static and dynamic flow logging, cement bond, and video survey. Pumping rate = 500 gpm
March 5, 2004	Completed reaming to 875 feet bls

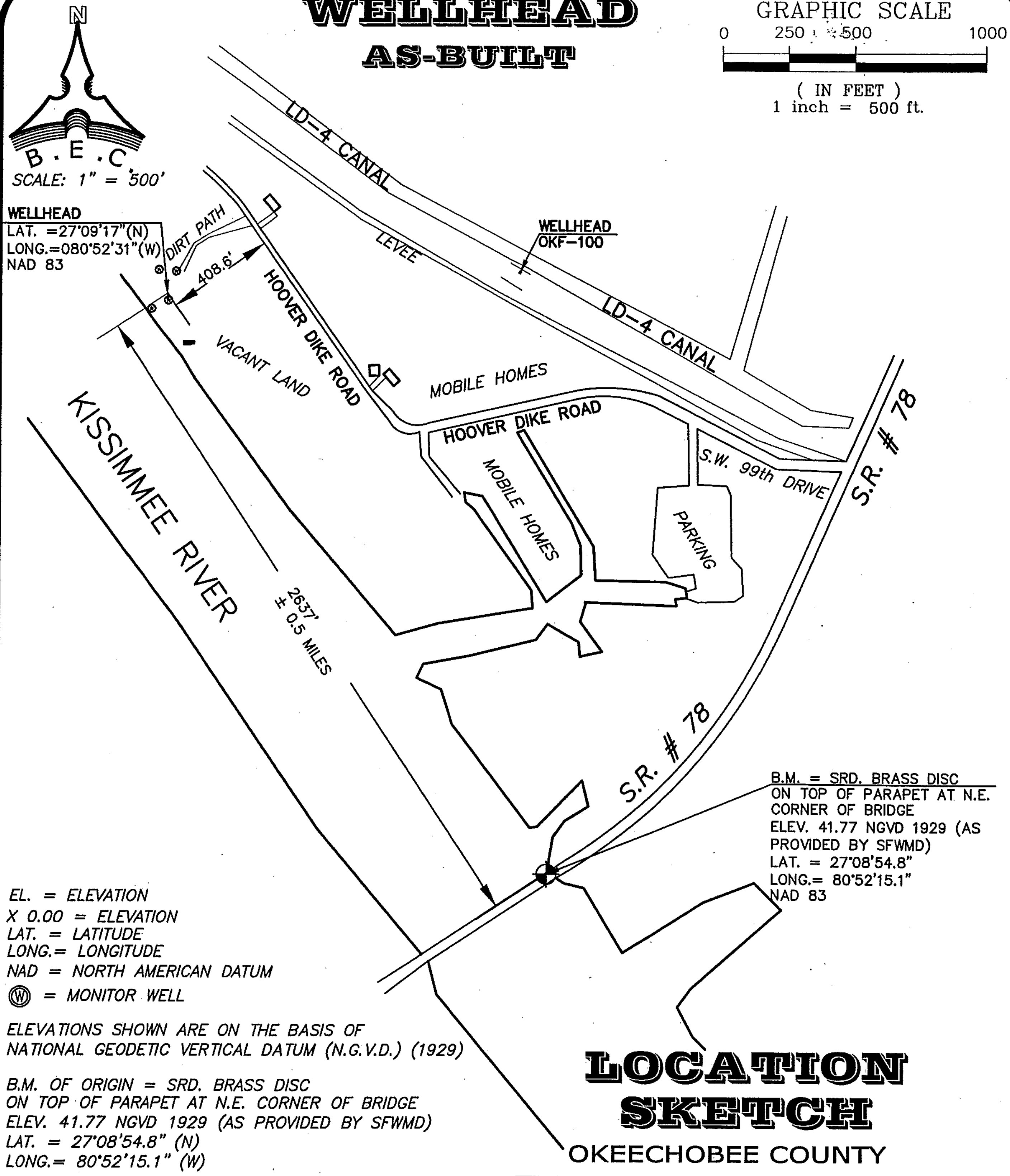
March 4, 2004	Completed backpluging to 869 feet bls. Resumed reaming 22-inch diameter borehole from 592 feet bls
March 2, 2004	Started backplugging borehole with neat cement
March 1, 2004	Completed conditioning borehole to 950 feet bls
February 26, 2004	Completed packer test #1. Started conditioning borehole using 8-inch diameter bit from 680 feet bls
February 25, 2004	Started packer test #1 on interval from 562 feet bls to 622 feet bls
February 24, 2004	Started and completed reaming 22-inch diameter borehole from 562 feet bls to 592 feet bls
February 20, 2004	Conducted geophysical logging. Logs conducted were caliper, natural gamma, sp, dual induction, borehole compensated sonic with variable density, static and dynamic temperature, static and dynamic fluid resistivity, and static and dynamic flow logging. Flow rate = ~300 gpm
February 19, 2004	Completed drilling/cleaning out gravel to a depth of 950 feet bls
February 18, 2004	Started drilling/cleaning out gravel from pilot hole using reverse-air method
February 11, 2004	Conducted casing pressure test on 24-inch diameter casing. Lost 1.75% in one hour
February 9, 2004	Completed cementing casing to land surface
February 6, 2004	Conducted temperature geophysical logging. Continued cementing 24-inch diameter casing
February 5, 2004	Conducted caliper geophysical logging. Installed 24-inch diameter casing to 562 feet bls. Started cementing casing in place
February 4, 2004	Completed reaming borehole to 565 feet bls
January 27, 2004	Started reaming 33-inch diameter borehole
January 23, 2004	Backfilled pilot hole with gravel and cement cap to 560 feet bls
January 18, 2004	Resumed and completed geophysical logging (Schulumberger) to 950 feet bls.
January 17, 2004	Reconditioned pilot hole to 950 feet bls for additional geophysical logging
January 16, 2004	Pilot hole drilling reached a depth of 950 feet bls. Conducted geophysical logging (Schulumberger). Logs conducted were caliper, natural gamma, SP, dual induction and borehole compensated sonic
January 15, 2004	Collected 4-inch core from 880 to 900 feet bls. 0% recovery. Resumed 8-

	inch pilot hole drilling
January 14, 2004	Pilot hole drilling reached a depth of 880 feet bls
January 7, 2004	Resumed 8-inch diameter pilot hole drilling from 300 feet bls
January 6, 2004	Collected 4-inch core from 300 feet to 320 feet bls. 45% recovery
January 5, 2004	Pilot hole drilling reached depth of 300 feet bls
December 30, 2003	Resumed 8-inch diameter pilot hole drilling from 170 feet bls
December 19, 2003	Conducted caliper geophysical logging. Installed 34-inch diameter casing to 170 feet bls. Cemented casing to land surface
December 18, 2003	Conducted caliper geophysical logging. Unsuccessfully attempted to install 34-inch diameter casing. Started and completed re-reaming 42-inch diameter borehole to 175 feet bls
December 17, 2003	Started and completed reaming 42-inch diameter borehole to 173 feet bls
December 16, 2003	Conducted geophysical logging of pilot hole to 225 feet bls. Logs conducted were caliper, natural gamma, sp, dual induction, and borehole compensated sonic with variable density
December 15, 2003	Started and completed 8-inch pilot hole to 225 feet bls using mud rotary method
December 2, 2003	Set 42-inch surface casing to 35 feet bls

Appendix F

Site Survey Map

WELLHEAD AS-BUILT



EL. = ELEVATION
X 0.00 = ELEVATION
LAT. = LATITUDE
LONG.= LONGITUDE
NAD = NORTH AMERICAN DATUM
Ⓦ = MONITOR WELL

ELEVATIONS SHOWN ARE ON THE BASIS OF NATIONAL GEODETIC VERTICAL DATUM (N.G.V.D.) (1929)

B.M. OF ORIGIN = SRD. BRASS DISC ON TOP OF PARAPET AT N.E. CORNER OF BRIDGE ELEV. 41.77 NGVD 1929 (AS PROVIDED BY SFWMD) LAT. = 27°08'54.8" (N) LONG.= 80°52'15.1" (W)

LOCATION SKETCH

OKEECHOBEE COUNTY

SEC. 19 TWP 38 RNG 35

DIVERSIFIED DRILLING CO.

ORDER No. 03-77257
SHEET No. 1 of 5

OKEECHOBEE

FOR: DIVERSIFIED DRILLING CORPORATION

SCALE: 1"=500'	DESIGNED BY:	DRAWN BY: W.H.	CHECKED BY: W.H.
DATE: 05-28-04	APPROVED BY: M.B.	FIELD BOOK No. 2370	PAGE No. 18

BISCAYNE ENGINEERING COMPANY, INC.
Consulting Engineers Planners Surveyors

REVISED

DRA?ING NO. 2089-SS-32

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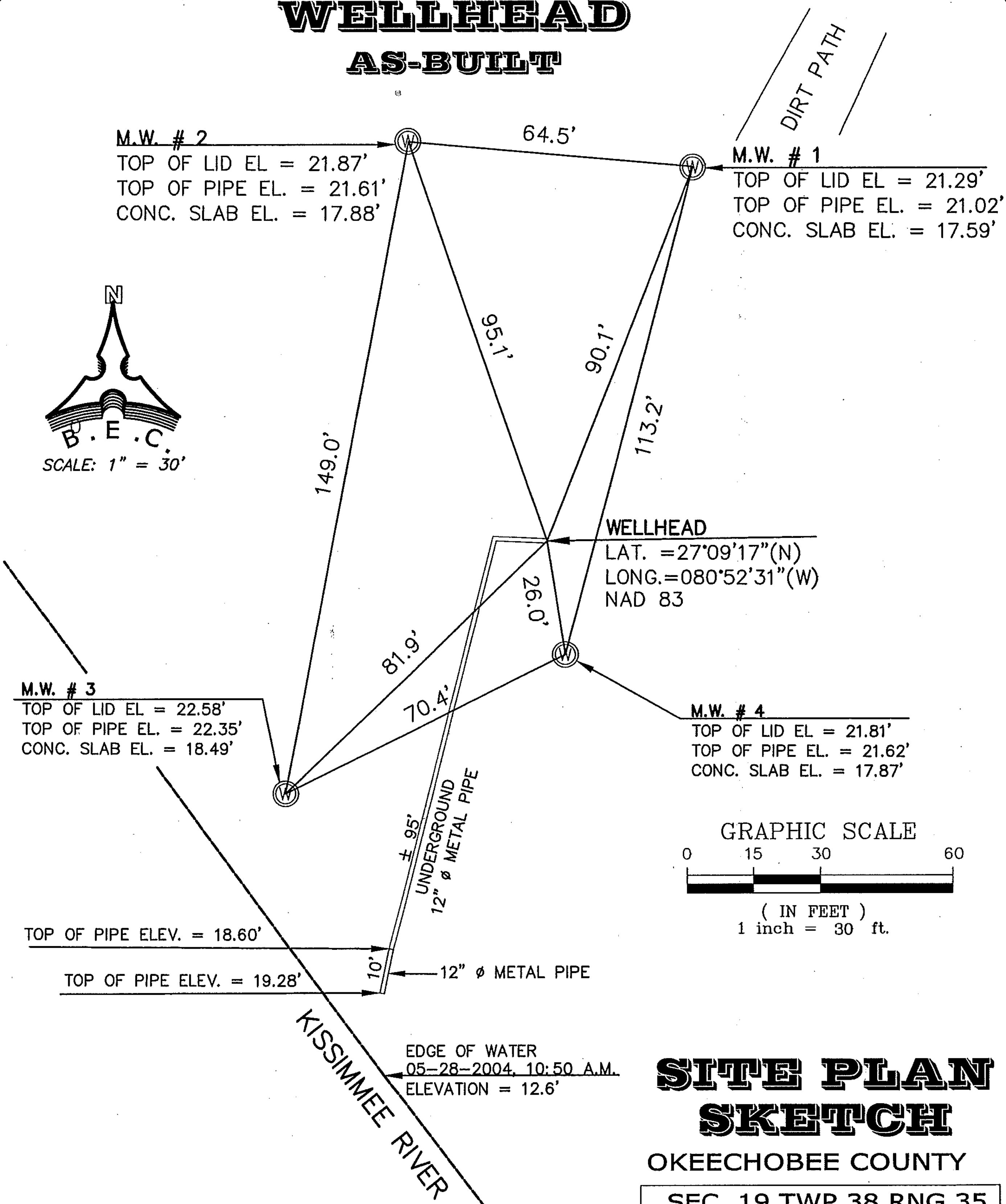
WELLHEAD

AS-BUILT



SITE PLAN SKETCH

OKEECHOBEE COUNTY

SEC. 19 TWP 38 RNG 35

DIVERSIFIED DRILLING CO.

SHEET 2 OF 6

ORDER No. 03-77257 | SHEET No. 2 of 6

OKEECHOBEE

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Consulting Engineers Planners Surveyors
MIAMI

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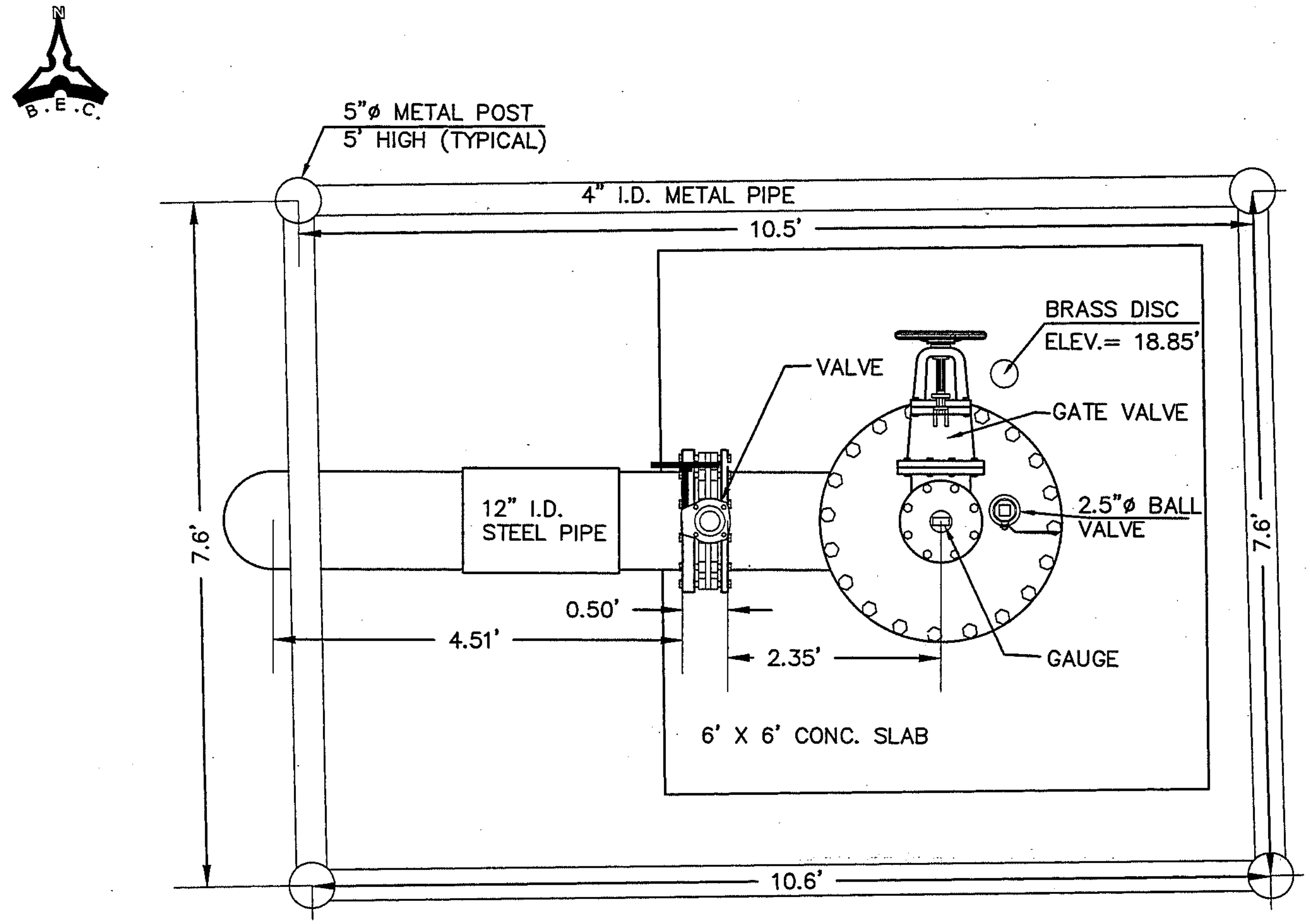
DRAWING NO. 2089-SS-32

WELLHEAD AS-BUILT



WELLHEAD
LAT. =27°09'17"(N)
LONG.=080°52'31"(W)
NAD 83

GRAPHIC SCALE

0 1 2 4

(IN FEET)
1 inch = 2 ft.

SHEET 3 OF 6

LOCATION SKETCH

OKEECHOBEE COUNTY

SEC. 19 TWP 38 RNG 35

DIVERSIFIED DRILLING CO.

BISCAYNE ENGINEERING COMPANY, INC.
Consulting Engineers Planners Surveyors

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OKEECHOBEE

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ORDER No. 03-77257

SHEET No. 3 of 6

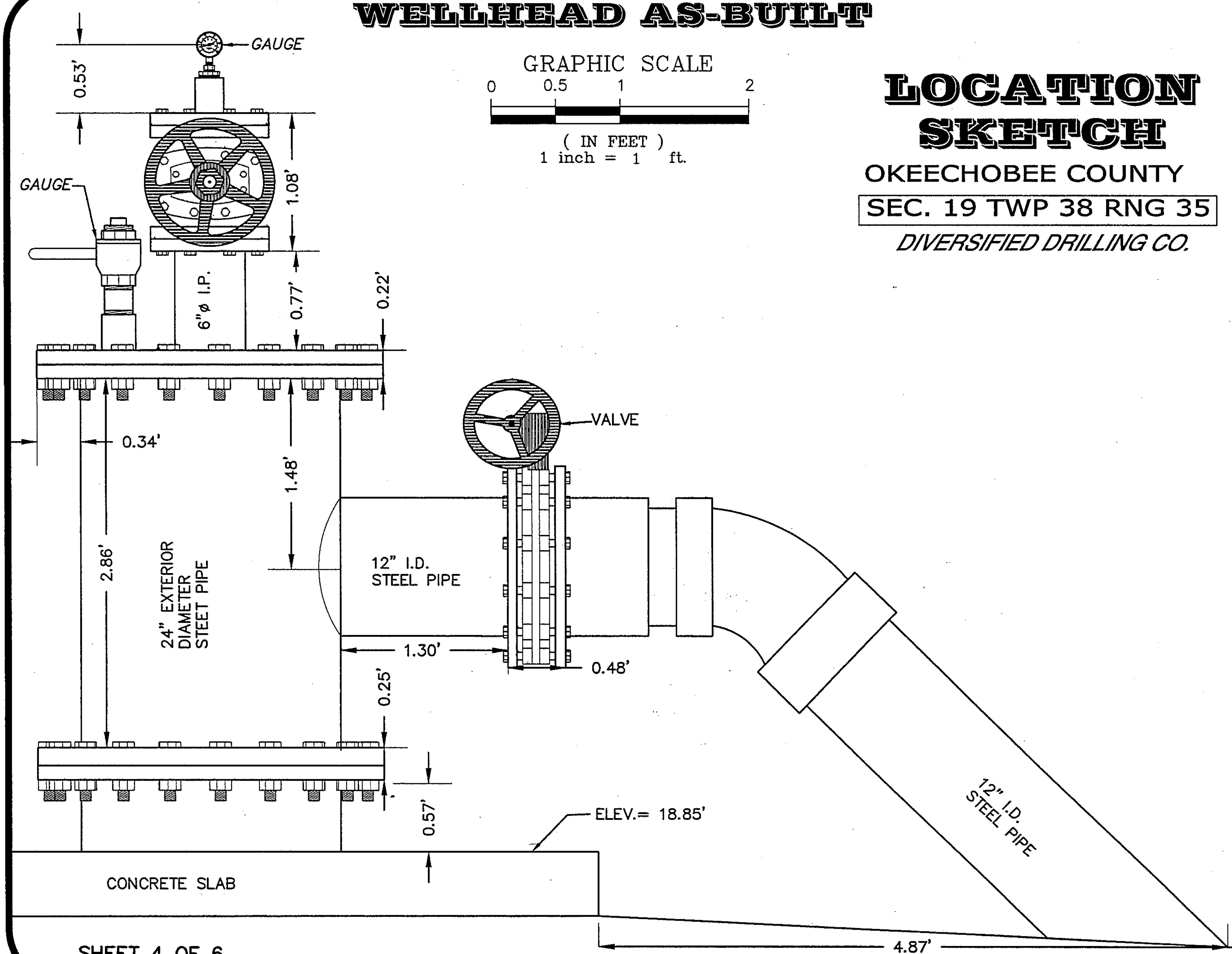
WELLHEAD AS-BUILT

LOCATION SKETCH

OKEECHOBEE COUNTY

SEC. 19 TWP 38 RNG 35

DIVERSIFIED DRILLING CO.



SHEET 4 OF 6

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Consulting Engineers Planners Surveyors

OKEECHOBEE

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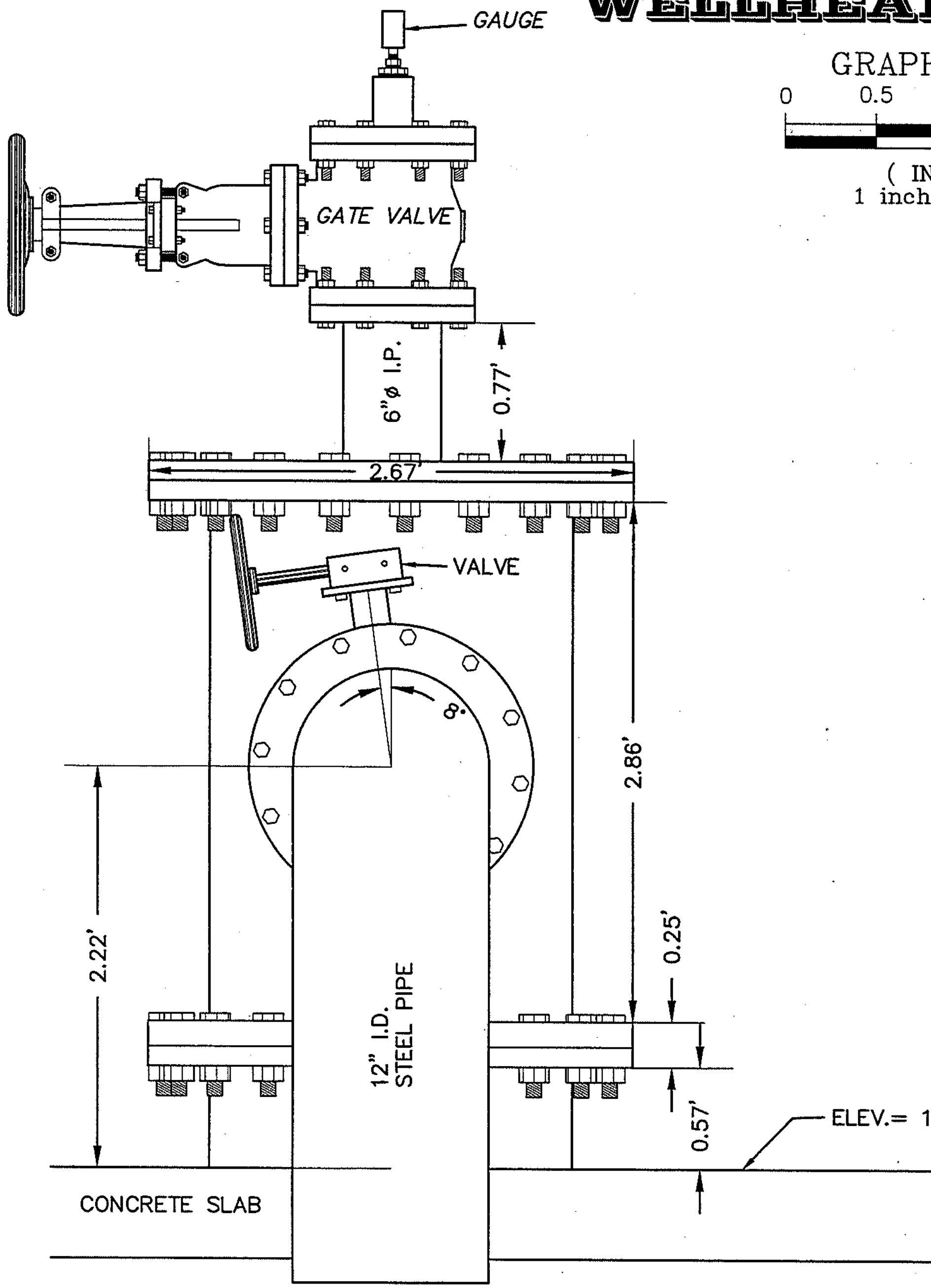
ORDER No. 03-77257

SHEET No. 4 of 6

REVISED

WELLHEAD AS-BUILT



GRAPHIC SCALE

0 0.5 1 2

(IN FEET)
1 inch = 1 ft.

LOCATION SKETCH

OKEECHOBEE COUNTY

SEC. 19 TWP 38 RNG 35

DIVERSIFIED DRILLING CO.

SHEET 5 OF 6

BISCAYNE ENGINEERING COMPANY, INC.
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FOR: DIVERSIFIED DRILLING CORPORATION		
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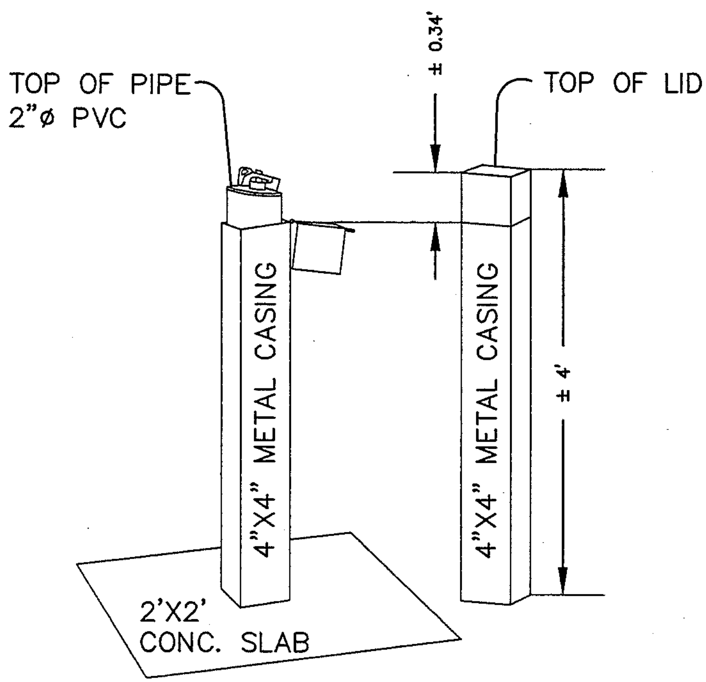
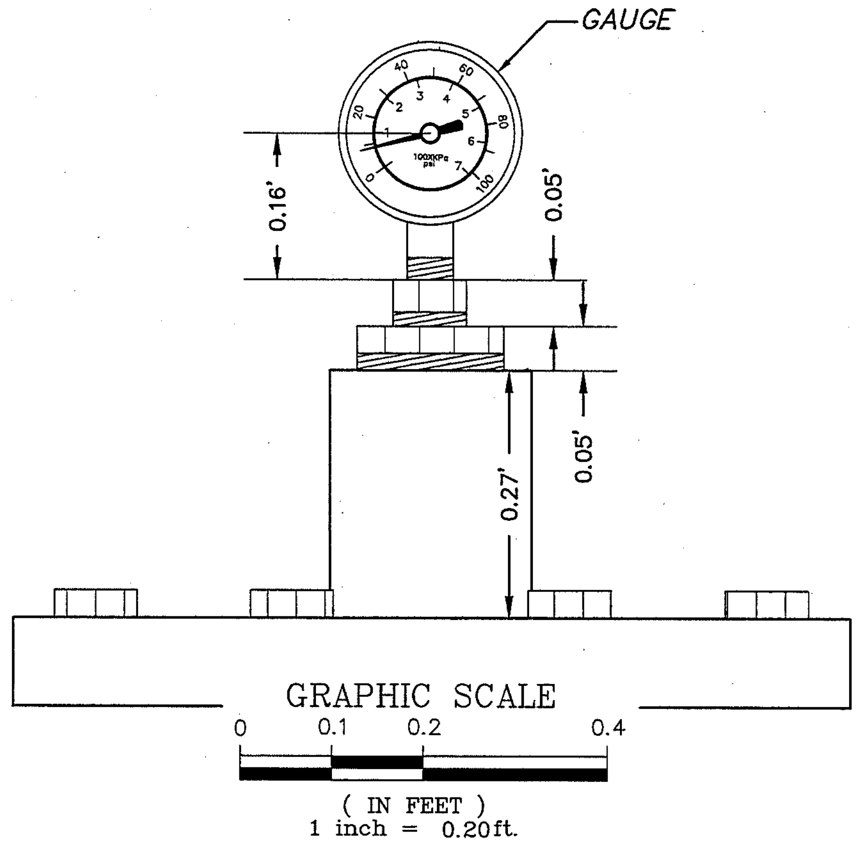
ORDER No. 03-77257
SHEET No. 5 of 6

WELLHEAD AS-BUILT



MONITORING WELL DETAIL
NOT TO SCALE



SHEET 6 OF 6

LOCATION SKETCH

OKEECHOBEE COUNTY

SEC. 19 TWP 38 RNG 35

DIVERSIFIED DRILLING CO.

BISCAYNE ENGINEERING COMPANY, INC.
Consulting Engineers Planners Surveyors

REVISED

OKEECHOBEE

FOR: DIVERSIFIED DRILLING CORPORATION

SCALE: 1"=0.2'	DESIGNED BY:	DRAWN BY: W.H.
DATE: 05-28-04	APPROVED BY: M.B.	FIELD BOOK No. 2370 PAGE No. 18
		CHECKED BY: W.H.

ORDER No. 03-77257

SHEET No. 6 of 6

Appendix G

Background Primary and Secondary Water Quality Parameters

SOUTH FLORIDA WATER MANAGEMENT DISTRICT
CROSS TAB REPORT
01-DEC-2004

Project Code	Station Id	Date YYYYMMDD	Time HR:MI	Sample Id	Sample Type	Coll Meth	UD	DIS	Depth Meters	Source	Latitude	Longitude
LOASR	OKF-100	20040505	10:20	OKF-100GW	SAMP	G	0	0	0.00	EAL	270917.348	805216.254
LOASR	OKF-100	20040505	10:20	OKF-100GW	SAMP	G	0	0	0.00	FGS	270917.348	805216.254
LOASR	OKF-100	20040505	10:20	OKF-100GW	SAMP	G	0	0	0.00	HBEL	270917.348	805216.254
LOASR	OKF-100	20040505	10:20	OKF-100GW	SAMP	G	0	0	0.00	RICH	270917.348	805216.254
LOASR	OKF-100	20040505	10:20	OKF-100GW	SAMP	G	0	0	0.00	SAV	270917.348	805216.254
LOASR	OKF-100	20040505	10:20	OKF-100GW	SAMP	G	0	0	0.00	WMD	270917.348	805216.254
LOASR	OKF-100	20040505	10:20	OKF-100GWF	SAMP	G	0	0	0.00	HBEL	270917.348	805216.254
LOASR	OKF-100	20040505	10:20	OKF-100GWF	SAMP	G	0	0	0.00	RICH	270917.348	805216.254
LOASR	OKF-100	20040505	10:20	OKF-100GWF	SAMP	G	0	0	0.00	SAV	270917.348	805216.254
LOASR	OKF-100	20040505	10:20	OKF-100GWF	SAMP	G	0	0	0.00	WMD	270917.348	805216.254

SOUTH FLORIDA WATER MANAGEMENT DISTRICT
CROSS TAB REPORT
01-DEC-2004

Project Code	Station Id	Date YYYYMMDD	Time HR:MI	Sample Id	F.Turb NTU	F.CL MG/L	TEMP Deg C	D.O. mg/L
LOASR	OKF-100	20040505	10:20	OKF-100GW				
LOASR	OKF-100	20040505	10:20	OKF-100GW				
LOASR	OKF-100	20040505	10:20	OKF-100GW				
LOASR	OKF-100	20040505	10:20	OKF-100GW				
LOASR	OKF-100	20040505	10:20	OKF-100GW				
LOASR	OKF-100	20040505	10:20	OKF-100GW	.87	512	25.29	.29
LOASR	OKF-100	20040505	10:20	OKF-100GWF				
LOASR	OKF-100	20040505	10:20	OKF-100GWF				
LOASR	OKF-100	20040505	10:20	OKF-100GWF				
LOASR	OKF-100	20040505	10:20	OKF-100GWF	.87	512		

SOUTH FLORIDA WATER MANAGEMENT DISTRICT
CROSS TAB REPORT
01-DEC-2004

Project Code	Station Id	Date YYYYMMDD	Time HR:MI	Sample Id	SP COND uS/cm	PH UNITS	COLOR PCU	LAB PH UNITS
LOASR	OKF-100	20040505	10:20	OKF-100GW				
LOASR	OKF-100	20040505	10:20	OKF-100GW				
LOASR	OKF-100	20040505	10:20	OKF-100GW				
LOASR	OKF-100	20040505	10:20	OKF-100GW				
LOASR	OKF-100	20040505	10:20	OKF-100GW			-5	8
LOASR	OKF-100	20040505	10:20	OKF-100GW	1368	7.78		
LOASR	OKF-100	20040505	10:20	OKF-100GWF				
LOASR	OKF-100	20040505	10:20	OKF-100GWF				
LOASR	OKF-100	20040505	10:20	OKF-100GWF				
LOASR	OKF-100	20040505	10:20	OKF-100GWF				

SOUTH FLORIDA WATER MANAGEMENT DISTRICT
CROSS TAB REPORT
01-DEC-2004

Project Code	Station Id	Date YYYYMMDD	Time HR:MI	Sample Id	T.SUS.SD mg/L	NO2 mg/L	OPO4 mg/L	TPO4 mg/L
LOASR	OKF-100	20040505	10:20	OKF-100GW				
LOASR	OKF-100	20040505	10:20	OKF-100GW				
LOASR	OKF-100	20040505	10:20	OKF-100GW				
LOASR	OKF-100	20040505	10:20	OKF-100GW				
LOASR	OKF-100	20040505	10:20	OKF-100GW	-5	-.05		-.01
LOASR	OKF-100	20040505	10:20	OKF-100GW				
LOASR	OKF-100	20040505	10:20	OKF-100GWF				
LOASR	OKF-100	20040505	10:20	OKF-100GWF				
LOASR	OKF-100	20040505	10:20	OKF-100GWF			-.05	
LOASR	OKF-100	20040505	10:20	OKF-100GWF				

SOUTH FLORIDA WATER MANAGEMENT DISTRICT
CROSS TAB REPORT
01-DEC-2004

Project Code	Station Id	Date YYYYMMDD	Time HR:MI	Sample Id	K mg/L	CA mg/L	MG mg/L	CL mg/L
LOASR	OKF-100	20040505	10:20	OKF-100GW				
LOASR	OKF-100	20040505	10:20	OKF-100GW				
LOASR	OKF-100	20040505	10:20	OKF-100GW	8.3	53	38	
LOASR	OKF-100	20040505	10:20	OKF-100GW				
LOASR	OKF-100	20040505	10:20	OKF-100GW				250
LOASR	OKF-100	20040505	10:20	OKF-100GW				
LOASR	OKF-100	20040505	10:20	OKF-100GWF	8.5	54	39	
LOASR	OKF-100	20040505	10:20	OKF-100GWF				
LOASR	OKF-100	20040505	10:20	OKF-100GWF				
LOASR	OKF-100	20040505	10:20	OKF-100GWF				

SOUTH FLORIDA WATER MANAGEMENT DISTRICT
CROSS TAB REPORT
01-DEC-2004

Project Code	Station Id	Date YYYYMMDD	Time HR:MI	Sample Id	SO4 mg/L	AMMONIA MG/L	TOTAL FE ug/L	F MG/L
LOASR	OKF-100	20040505	10:20	OKF-100GW				
LOASR	OKF-100	20040505	10:20	OKF-100GW				
LOASR	OKF-100	20040505	10:20	OKF-100GW			28	
LOASR	OKF-100	20040505	10:20	OKF-100GW				
LOASR	OKF-100	20040505	10:20	OKF-100GW	200	.21		.53
LOASR	OKF-100	20040505	10:20	OKF-100GW				
LOASR	OKF-100	20040505	10:20	OKF-100GWF			27	
LOASR	OKF-100	20040505	10:20	OKF-100GWF				
LOASR	OKF-100	20040505	10:20	OKF-100GWF				
LOASR	OKF-100	20040505	10:20	OKF-100GWF				

SOUTH FLORIDA WATER MANAGEMENT DISTRICT
CROSS TAB REPORT
01-DEC-2004

Project Code	Station Id	Date YYYYMMDD	Time HR:MI	Sample Id	SULFIDE mg/L	BOD-5 mg/L	OX/RED P mv	TOTAL AL ug/L
LOASR	OKF-100	20040505	10:20	OKF-100GW				
LOASR	OKF-100	20040505	10:20	OKF-100GW				
LOASR	OKF-100	20040505	10:20	OKF-100GW				-20
LOASR	OKF-100	20040505	10:20	OKF-100GW				
LOASR	OKF-100	20040505	10:20	OKF-100GW	.8	-2		
LOASR	OKF-100	20040505	10:20	OKF-100GW			-283	
LOASR	OKF-100	20040505	10:20	OKF-100GWF				-20
LOASR	OKF-100	20040505	10:20	OKF-100GWF				
LOASR	OKF-100	20040505	10:20	OKF-100GWF				
LOASR	OKF-100	20040505	10:20	OKF-100GWF			-283	

SOUTH FLORIDA WATER MANAGEMENT DISTRICT
CROSS TAB REPORT
01-DEC-2004

Project Code	Station Id	Date YYYYMMDD	Time HR:MI	Sample Id	ALKALNYA mg/L	TOTAL CR ug/L	NO3 mg/L	FLUOR-D MG/L
LOASR	OKF-100	20040505	10:20	OKF-100GW				
LOASR	OKF-100	20040505	10:20	OKF-100GW				
LOASR	OKF-100	20040505	10:20	OKF-100GW		-1.8		
LOASR	OKF-100	20040505	10:20	OKF-100GW				
LOASR	OKF-100	20040505	10:20	OKF-100GW	91		-.1	
LOASR	OKF-100	20040505	10:20	OKF-100GW				
LOASR	OKF-100	20040505	10:20	OKF-100GWF		-1.8		
LOASR	OKF-100	20040505	10:20	OKF-100GWF				
LOASR	OKF-100	20040505	10:20	OKF-100GWF				.53
LOASR	OKF-100	20040505	10:20	OKF-100GWF				

SOUTH FLORIDA WATER MANAGEMENT DISTRICT
CROSS TAB REPORT
01-DEC-2004

Project Code	Station Id	Date YYYYMMDD	Time HR:MI	Sample Id	TOTSE ug/L	FOAMAGNT MG/L	ODOR TON	TDORGC mg/L
LOASR	OKF-100	20040505	10:20	OKF-100GW				
LOASR	OKF-100	20040505	10:20	OKF-100GW				
LOASR	OKF-100	20040505	10:20	OKF-100GW	-2.1			
LOASR	OKF-100	20040505	10:20	OKF-100GW				
LOASR	OKF-100	20040505	10:20	OKF-100GW		.072	-1	
LOASR	OKF-100	20040505	10:20	OKF-100GW				
LOASR	OKF-100	20040505	10:20	OKF-100GWF	-2.1			
LOASR	OKF-100	20040505	10:20	OKF-100GWF				
LOASR	OKF-100	20040505	10:20	OKF-100GWF				-1
LOASR	OKF-100	20040505	10:20	OKF-100GWF				

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Project Code	Station Id	Date YYYYMMDD	Time HR:MI	Sample Id	BICARBON MG/L CACO3	CARBONAT MG/L CACO3	TOTAL AG ug/L	T.DS.SOL MG/L
LOASR	OKF-100	20040505	10:20	OKF-100GW				
LOASR	OKF-100	20040505	10:20	OKF-100GW				
LOASR	OKF-100	20040505	10:20	OKF-100GW			-1	
LOASR	OKF-100	20040505	10:20	OKF-100GW				
LOASR	OKF-100	20040505	10:20	OKF-100GW	90	-1		820
LOASR	OKF-100	20040505	10:20	OKF-100GW				
LOASR	OKF-100	20040505	10:20	OKF-100GWF			-1	
LOASR	OKF-100	20040505	10:20	OKF-100GWF				
LOASR	OKF-100	20040505	10:20	OKF-100GWF				
LOASR	OKF-100	20040505	10:20	OKF-100GWF				

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Project Code	Station Id	Date YYYYMMDD	Time HR:MI	Sample Id	TOTAL HG ug/L	TOTAL CD ug/L	TOTAL CU ug/L	TOTAL ZN ug/L
LOASR	OKF-100	20040505	10:20	OKF-100GW				
LOASR	OKF-100	20040505	10:20	OKF-100GW				
LOASR	OKF-100	20040505	10:20	OKF-100GW	-.06	-.7	-1.4	14
LOASR	OKF-100	20040505	10:20	OKF-100GW				
LOASR	OKF-100	20040505	10:20	OKF-100GW				
LOASR	OKF-100	20040505	10:20	OKF-100GW				
LOASR	OKF-100	20040505	10:20	OKF-100GWF	-.06	-.7	-1.4	-10
LOASR	OKF-100	20040505	10:20	OKF-100GWF				
LOASR	OKF-100	20040505	10:20	OKF-100GWF				
LOASR	OKF-100	20040505	10:20	OKF-100GWF				

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Project Code	Station Id	Date YYYYMMDD	Time HR:MI	Sample Id	TOTAL AS ug/L	TOTAL PB ug/L	TOTAL BA ug/L	TOTAL CO ug/L
LOASR	OKF-100	20040505	10:20	OKF-100GW				
LOASR	OKF-100	20040505	10:20	OKF-100GW				
LOASR	OKF-100	20040505	10:20	OKF-100GW	-2.6	-3	29	-1
LOASR	OKF-100	20040505	10:20	OKF-100GW				
LOASR	OKF-100	20040505	10:20	OKF-100GW				
LOASR	OKF-100	20040505	10:20	OKF-100GW				
LOASR	OKF-100	20040505	10:20	OKF-100GWF	-2.6	-3	29	-1
LOASR	OKF-100	20040505	10:20	OKF-100GWF				
LOASR	OKF-100	20040505	10:20	OKF-100GWF				
LOASR	OKF-100	20040505	10:20	OKF-100GWF				

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Project Code	Station Id	Date YYYYMMDD	Time HR:MI	Sample Id	TOTAL MN ug/L	TOTAL SR ug/L	TOTAL NI ug/L	TOT.ANTY ug/L
LOASR	OKF-100	20040505	10:20	OKF-100GW				
LOASR	OKF-100	20040505	10:20	OKF-100GW				
LOASR	OKF-100	20040505	10:20	OKF-100GW	-3.8	20000	-2	-2.3
LOASR	OKF-100	20040505	10:20	OKF-100GW				
LOASR	OKF-100	20040505	10:20	OKF-100GW				
LOASR	OKF-100	20040505	10:20	OKF-100GW				
LOASR	OKF-100	20040505	10:20	OKF-100GWF	-3.8	20000	-2	-2.3
LOASR	OKF-100	20040505	10:20	OKF-100GWF				
LOASR	OKF-100	20040505	10:20	OKF-100GWF				
LOASR	OKF-100	20040505	10:20	OKF-100GWF				

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Project Code	Station Id	Date YYYYMMDD	Time HR:MI	Sample Id	TOT.BERY ug/L	TOT.THAL ug/L	TOTBR mg/L	TOT.M.HG ng/L
LOASR	OKF-100	20040505	10:20	OKF-100GW				
LOASR	OKF-100	20040505	10:20	OKF-100GW				-.001
LOASR	OKF-100	20040505	10:20	OKF-100GW	-.1	-1		
LOASR	OKF-100	20040505	10:20	OKF-100GW				
LOASR	OKF-100	20040505	10:20	OKF-100GW			.75	
LOASR	OKF-100	20040505	10:20	OKF-100GW				
LOASR	OKF-100	20040505	10:20	OKF-100GWF	-.1	-1		
LOASR	OKF-100	20040505	10:20	OKF-100GWF				
LOASR	OKF-100	20040505	10:20	OKF-100GWF				
LOASR	OKF-100	20040505	10:20	OKF-100GWF				

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Project Code	Station Id	Date YYYYMMDD	Time HR:MI	Sample Id	ALPHA-T PCI/L	GALPHA-D PCI/L	URANIUM UG/L	RAD228 PCI/L
LOASR	OKF-100	20040505	10:20	OKF-100GW				
LOASR	OKF-100	20040505	10:20	OKF-100GW				
LOASR	OKF-100	20040505	10:20	OKF-100GW				
LOASR	OKF-100	20040505	10:20	OKF-100GW	-5.87		.0198	-1.26
LOASR	OKF-100	20040505	10:20	OKF-100GW				
LOASR	OKF-100	20040505	10:20	OKF-100GW				
LOASR	OKF-100	20040505	10:20	OKF-100GWF				
LOASR	OKF-100	20040505	10:20	OKF-100GWF		-5.61		
LOASR	OKF-100	20040505	10:20	OKF-100GWF				
LOASR	OKF-100	20040505	10:20	OKF-100GWF				

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Project Code	Station Id	Date YYYYMMDD	Time HR:MI	Sample Id	RAD228 D PCI/L	RAD226-D PCI/L	RADON222 PCI/L	OXYGEN18 PER MIL
LOASR	OKF-100	20040505	10:20	OKF-100GW				
LOASR	OKF-100	20040505	10:20	OKF-100GW				
LOASR	OKF-100	20040505	10:20	OKF-100GW				
LOASR	OKF-100	20040505	10:20	OKF-100GW			477	-2.4
LOASR	OKF-100	20040505	10:20	OKF-100GW				
LOASR	OKF-100	20040505	10:20	OKF-100GW				
LOASR	OKF-100	20040505	10:20	OKF-100GWF				
LOASR	OKF-100	20040505	10:20	OKF-100GWF	-1.02	2.34		
LOASR	OKF-100	20040505	10:20	OKF-100GWF				
LOASR	OKF-100	20040505	10:20	OKF-100GWF				

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Project Code	Station Id	Date YYYYMMDD	Time HR:MI	Sample Id	TRITIUM PCI/L	COLIPH-M PFU/100ML	COLIPH-S PFU/100ML	CRYPTOSP CRYPTO/100L
LOASR	OKF-100	20040505	10:20	OKF-100GW		-1	-1	-9
LOASR	OKF-100	20040505	10:20	OKF-100GW				
LOASR	OKF-100	20040505	10:20	OKF-100GW				
LOASR	OKF-100	20040505	10:20	OKF-100GW	-90.4			
LOASR	OKF-100	20040505	10:20	OKF-100GW				
LOASR	OKF-100	20040505	10:20	OKF-100GW				
LOASR	OKF-100	20040505	10:20	OKF-100GWF				
LOASR	OKF-100	20040505	10:20	OKF-100GWF				
LOASR	OKF-100	20040505	10:20	OKF-100GWF				
LOASR	OKF-100	20040505	10:20	OKF-100GWF				

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Project Code	Station Id	Date YYYYMMDD	Time HR:MI	Sample Id	GIARDIAL IARDIA/100L	CFC-12 UG/L	2,4-D ug/L	CARBOFUR ug/L
LOASR	OKF-100	20040505	10:20	OKF-100GW	-9			
LOASR	OKF-100	20040505	10:20	OKF-100GW				
LOASR	OKF-100	20040505	10:20	OKF-100GW		-.28	-.62	-.18
LOASR	OKF-100	20040505	10:20	OKF-100GW				
LOASR	OKF-100	20040505	10:20	OKF-100GW				
LOASR	OKF-100	20040505	10:20	OKF-100GW				
LOASR	OKF-100	20040505	10:20	OKF-100GWF				
LOASR	OKF-100	20040505	10:20	OKF-100GWF				
LOASR	OKF-100	20040505	10:20	OKF-100GWF				
LOASR	OKF-100	20040505	10:20	OKF-100GWF				

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Project Code	Station Id	Date YYYYMMDD	Time HR:MI	Sample Id	DIQUAT ug/L	GLYPHOSA ug/L	OXAMYL ug/L	ug/L
LOASR	OKF-100	20040505	10:20	OKF-100GW				
LOASR	OKF-100	20040505	10:20	OKF-100GW				
LOASR	OKF-100	20040505	10:20	OKF-100GW	-4.8	-26	-.41	-.21
LOASR	OKF-100	20040505	10:20	OKF-100GW				
LOASR	OKF-100	20040505	10:20	OKF-100GW				
LOASR	OKF-100	20040505	10:20	OKF-100GW				
LOASR	OKF-100	20040505	10:20	OKF-100GWF				
LOASR	OKF-100	20040505	10:20	OKF-100GWF				
LOASR	OKF-100	20040505	10:20	OKF-100GWF				
LOASR	OKF-100	20040505	10:20	OKF-100GWF				

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Project Code	Station Id	Date YYYYMMDD	Time HR:MI	Sample Id	1,1,1-TR ug/L	1,1,2,2- ug/L	1,1,2-TR ug/L	1,1-DICH ug/L
LOASR	OKF-100	20040505	10:20	OKF-100GW				
LOASR	OKF-100	20040505	10:20	OKF-100GW				
LOASR	OKF-100	20040505	10:20	OKF-100GW	-.21	-.47	-.44	-.23
LOASR	OKF-100	20040505	10:20	OKF-100GW				
LOASR	OKF-100	20040505	10:20	OKF-100GW				
LOASR	OKF-100	20040505	10:20	OKF-100GW				
LOASR	OKF-100	20040505	10:20	OKF-100GWF				
LOASR	OKF-100	20040505	10:20	OKF-100GWF				
LOASR	OKF-100	20040505	10:20	OKF-100GWF				
LOASR	OKF-100	20040505	10:20	OKF-100GWF				

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Project Code	Station Id	Date YYYYMMDD	Time HR:MI	Sample Id	1,2-DICH ug/L	1,2-DICH ug/L	1,2-DICH ug/L	BENZENE ug/L
LOASR	OKF-100	20040505	10:20	OKF-100GW				
LOASR	OKF-100	20040505	10:20	OKF-100GW				
LOASR	OKF-100	20040505	10:20	OKF-100GW	-.21	-.29	-.4	-.2
LOASR	OKF-100	20040505	10:20	OKF-100GW				
LOASR	OKF-100	20040505	10:20	OKF-100GW				
LOASR	OKF-100	20040505	10:20	OKF-100GW				
LOASR	OKF-100	20040505	10:20	OKF-100GWF				
LOASR	OKF-100	20040505	10:20	OKF-100GWF				
LOASR	OKF-100	20040505	10:20	OKF-100GWF				
LOASR	OKF-100	20040505	10:20	OKF-100GWF				

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Project Code	Station Id	Date YYYYMMDD	Time HR:MI	Sample Id	BROMODIC ug/L	BROMOFOR ug/L	CARBON T ug/L	CHLOROBE ug/L
LOASR	OKF-100	20040505	10:20	OKF-100GW				
LOASR	OKF-100	20040505	10:20	OKF-100GW				
LOASR	OKF-100	20040505	10:20	OKF-100GW	-.25	-.41	-.24	-.3
LOASR	OKF-100	20040505	10:20	OKF-100GW				
LOASR	OKF-100	20040505	10:20	OKF-100GW				
LOASR	OKF-100	20040505	10:20	OKF-100GW				
LOASR	OKF-100	20040505	10:20	OKF-100GWF				
LOASR	OKF-100	20040505	10:20	OKF-100GWF				
LOASR	OKF-100	20040505	10:20	OKF-100GWF				
LOASR	OKF-100	20040505	10:20	OKF-100GWF				

Project Code	Station Id	Date YYYYMMDD	Time HR:MI	Sample Id	CHLOROFO ug/L	CHLOROME ug/L	CIS-1,2- ug/L	DIBROMOC ug/L
LOASR	OKF-100	20040505	10:20	OKF-100GW				
LOASR	OKF-100	20040505	10:20	OKF-100GW				
LOASR	OKF-100	20040505	10:20	OKF-100GW	-.25	-.4	-.21	-.3
LOASR	OKF-100	20040505	10:20	OKF-100GW				
LOASR	OKF-100	20040505	10:20	OKF-100GW				
LOASR	OKF-100	20040505	10:20	OKF-100GW				
LOASR	OKF-100	20040505	10:20	OKF-100GWF				
LOASR	OKF-100	20040505	10:20	OKF-100GWF				
LOASR	OKF-100	20040505	10:20	OKF-100GWF				
LOASR	OKF-100	20040505	10:20	OKF-100GWF				

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Project Code	Station Id	Date YYYYMMDD	Time HR:MI	Sample Id	ETHYLBEN ug/L	METHYLEN ug/L	TETRACHL ug/L	TOLUENE ug/L
LOASR	OKF-100	20040505	10:20	OKF-100GW				
LOASR	OKF-100	20040505	10:20	OKF-100GW				
LOASR	OKF-100	20040505	10:20	OKF-100GW	-.21	-.23	-.24	-.22
LOASR	OKF-100	20040505	10:20	OKF-100GW				
LOASR	OKF-100	20040505	10:20	OKF-100GW				
LOASR	OKF-100	20040505	10:20	OKF-100GW				
LOASR	OKF-100	20040505	10:20	OKF-100GWF				
LOASR	OKF-100	20040505	10:20	OKF-100GWF				
LOASR	OKF-100	20040505	10:20	OKF-100GWF				
LOASR	OKF-100	20040505	10:20	OKF-100GWF				

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Project Code	Station Id	Date YYYYMMDD	Time HR:MI	Sample Id	TRANS-1, ug/L	TRICHLOR ug/L	TRICHLOR ug/L	VINYL CH ug/L
LOASR	OKF-100	20040505	10:20	OKF-100GW				
LOASR	OKF-100	20040505	10:20	OKF-100GW				
LOASR	OKF-100	20040505	10:20	OKF-100GW	-.35	-.36	-.22	-.32
LOASR	OKF-100	20040505	10:20	OKF-100GW				
LOASR	OKF-100	20040505	10:20	OKF-100GW				
LOASR	OKF-100	20040505	10:20	OKF-100GW				
LOASR	OKF-100	20040505	10:20	OKF-100GWF				
LOASR	OKF-100	20040505	10:20	OKF-100GWF				
LOASR	OKF-100	20040505	10:20	OKF-100GWF				
LOASR	OKF-100	20040505	10:20	OKF-100GWF				

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Project Code	Station Id	Date YYYYMMDD	Time HR:MI	Sample Id	XYLENES ug/L	1,2,4-TR ug/L	1,4-DICH ug/L	VANADIUM ug/L
LOASR	OKF-100	20040505	10:20	OKF-100GW				
LOASR	OKF-100	20040505	10:20	OKF-100GW				
LOASR	OKF-100	20040505	10:20	OKF-100GW	-.46	-.41	-.23	-.4
LOASR	OKF-100	20040505	10:20	OKF-100GW				
LOASR	OKF-100	20040505	10:20	OKF-100GW				
LOASR	OKF-100	20040505	10:20	OKF-100GW				
LOASR	OKF-100	20040505	10:20	OKF-100GWF				-.4
LOASR	OKF-100	20040505	10:20	OKF-100GWF				
LOASR	OKF-100	20040505	10:20	OKF-100GWF				
LOASR	OKF-100	20040505	10:20	OKF-100GWF				

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Project Code	Station Id	Date YYYYMMDD	Time HR:MI	Sample Id	UG/L	1,2DBRET UG/L	PICLORAM UG/L	CYAN-D MG/L
LOASR	OKF-100	20040505	10:20	OKF-100GW				
LOASR	OKF-100	20040505	10:20	OKF-100GW				
LOASR	OKF-100	20040505	10:20	OKF-100GW	-.0021	-.0049	-.62	
LOASR	OKF-100	20040505	10:20	OKF-100GW				
LOASR	OKF-100	20040505	10:20	OKF-100GW				
LOASR	OKF-100	20040505	10:20	OKF-100GW				
LOASR	OKF-100	20040505	10:20	OKF-100GWF				
LOASR	OKF-100	20040505	10:20	OKF-100GWF				
LOASR	OKF-100	20040505	10:20	OKF-100GWF				-.005
LOASR	OKF-100	20040505	10:20	OKF-100GWF				

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Project Code	Station Id	Date YYYYMMDD	Time HR:MI	Sample Id	ug/L
LOASR	OKF-100	20040505	10:20	OKF-100GW	
LOASR	OKF-100	20040505	10:20	OKF-100GW	
LOASR	OKF-100	20040505	10:20	OKF-100GW	-1.2
LOASR	OKF-100	20040505	10:20	OKF-100GW	
LOASR	OKF-100	20040505	10:20	OKF-100GW	
LOASR	OKF-100	20040505	10:20	OKF-100GW	
LOASR	OKF-100	20040505	10:20	OKF-100GWF	
LOASR	OKF-100	20040505	10:20	OKF-100GWF	
LOASR	OKF-100	20040505	10:20	OKF-100GWF	
LOASR	OKF-100	20040505	10:20	OKF-100GWF	

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Type	F.Turb NTU	F.CL MG/L	TEMP Deg C	D.O. mg/L	SP COND uS/cm	PH UNITS	COLOR PCU
Count	2	2	1	1	1	1	1
Average	.87	512	25.29	.29	1368	7.78	5
Std Dev	0	0	0	0	0	0	0
Min Val	.87	512	25.29	.29	1368	7.78	5
Max Val	.87	512	25.29	.29	1368	7.78	5

Type	LAB PH UNITS	T.SUS.SD mg/L	NO2 mg/L	OPO4 mg/L	TPO4 mg/L	K mg/L	CA mg/L
Count	1	1	1	1	1	2	2
Average	8	5	.05	.05	.01	8.4	53.5
Std Dev	0	0	0	0	0	.141	.707
Min Val	8	5	.05	.05	.01	8.3	53
Max Val	8	5	.05	.05	.01	8.5	54

Type	MG mg/L	CL mg/L	SO4 mg/L	AMMONIA MG/L	TOTAL FE ug/L	F MG/L	SULFIDE mg/L
Count	2	1	1	1	2	1	1
Average	38.5	250	200	.21	27.5	.53	.8
Std Dev	.707	0	0	0	.707	0	0
Min Val	38	250	200	.21	27	.53	.8
Max Val	39	250	200	.21	28	.53	.8

Type	BOD-5 mg/L	OX/RED P mv	TOTAL AL ug/L	ALKALNYA mg/L	TOTAL CR ug/L	NO3 mg/L	FLUOR-D MG/L
Count	1	2	2	1	2	1	1
Average	2	283	20	91	1.8	.1	.53
Std Dev	0	0	0	0	0	0	0
Min Val	2	283	20	91	1.8	.1	.53
Max Val	2	283	20	91	1.8	.1	.53

Type	TOTSE ug/L	FOAMAGNT MG/L	ODOR TON	TDORGC mg/L	BICARBON MG/L CACO3	CARBONAT MG/L CACO3	TOTAL AG ug/L
Count	2	1	1	1	1	1	2
Average	2.1	.072	1	1	90	1	1
Std Dev	0	0	0	0	0	0	0
Min Val	2.1	.072	1	1	90	1	1
Max Val	2.1	.072	1	1	90	1	1

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Type	T.DS.SOL MG/L	TOTAL HG ug/L	TOTAL CD ug/L	TOTAL CU ug/L	TOTAL ZN ug/L	TOTAL AS ug/L	TOTAL PB ug/L
Count	1	2	2	2	2	2	2
Average	820	.06	.7	1.4	12	2.6	3
Std Dev	0	0	0	0	2.828	0	0
Min Val	820	.06	.7	1.4	10	2.6	3
Max Val	820	.06	.7	1.4	14	2.6	3

Type	TOTAL BA ug/L	TOTAL CO ug/L	TOTAL MN ug/L	TOTAL SR ug/L	TOTAL NI ug/L	TOT.ANTY ug/L	TOT.BERY ug/L
Count	2	2	2	2	2	2	2
Average	29	1	3.8	20000	2	2.3	.1
Std Dev	0	0	0	0	0	0	0
Min Val	29	1	3.8	20000	2	2.3	.1
Max Val	29	1	3.8	20000	2	2.3	.1

Type	TOT.THAL ug/L	TOTBR mg/L	TOT.M.HG ng/L	ALPHA-T PCI/L	GALPHA-D PCI/L	URANIUM UG/L	RAD228 PCI/L
Count	2	1	1	1	1	1	1
Average	1	.75	.001	5.87	5.61	.02	1.26
Std Dev	0	0	0	0	0	0	0
Min Val	1	.75	.001	5.87	5.61	.0198	1.26
Max Val	1	.75	.001	5.87	5.61	.0198	1.26

Type	RAD228 D PCI/L	RAD226-D PCI/L	RADON222 PCI/L	OXYGEN18 PER MIL	TRITIUM PCI/L	COLIPH-M PFU/100ML	COLIPH-S PFU/100ML
Count	1	1	1	1	1	1	1
Average	1.02	2.34	477	2.4	90.4	1	1
Std Dev	0	0	0	0	0	0	0
Min Val	1.02	2.34	477	2.4	90.4	1	1
Max Val	1.02	2.34	477	2.4	90.4	1	1

Type	CRYPTOSP CRYPTO/100L	GIARDIAL IARDIA/100L	CFC-12 UG/L	2,4-D ug/L	CARBOFUR ug/L	DIQUAT ug/L	GLYPHOSA ug/L
Count	1	1	1	1	1	1	1
Average	9	9	.28	.62	.18	4.8	26
Std Dev	0	0	0	0	0	0	0
Min Val	9	9	.28	.62	.18	4.8	26
Max Val	9	9	.28	.62	.18	4.8	26

SOUTH FLORIDA WATER MANAGEMENT DISTRICT
CROSS TAB SUMMARY
01-DEC-2004

Type	OXAMYL ug/L	ug/L	1,1,1-TR ug/L	1,1,2,2- ug/L	1,1,2-TR ug/L	1,1-DICH ug/L	1,2-DICH ug/L
Count	1	1	1	1	1	1	1
Average	.41	.21	.21	.47	.44	.23	.21
Std Dev	0	0	0	0	0	0	0
Min Val	.41	.21	.21	.47	.44	.23	.21
Max Val	.41	.21	.21	.47	.44	.23	.21

Type	1,2-DICH ug/L	1,2-DICH ug/L	BENZENE ug/L	BROMODIC ug/L	BROMOFOR ug/L	CARBON T ug/L	CHLOROBE ug/L
Count	1	1	1	1	1	1	1
Average	.29	.4	.2	.25	.41	.24	.3
Std Dev	0	0	0	0	0	0	0
Min Val	.29	.4	.2	.25	.41	.24	.3
Max Val	.29	.4	.2	.25	.41	.24	.3

Type	CHLOROFO ug/L	CHLOROME ug/L	CIS-1,2- ug/L	DIBROMOC ug/L	ETHYLBEN ug/L	METHYLEN ug/L	TETRACHL ug/L
Count	1	1	1	1	1	1	1
Average	.25	.4	.21	.3	.21	.23	.24
Std Dev	0	0	0	0	0	0	0
Min Val	.25	.4	.21	.3	.21	.23	.24
Max Val	.25	.4	.21	.3	.21	.23	.24

Type	TOLUENE ug/L	TRANS-1, ug/L	TRICHLOR ug/L	TRICHLOR ug/L	VINYL CH ug/L	XYLENES ug/L	1,2,4-TR ug/L
Count	1	1	1	1	1	1	1
Average	.22	.35	.36	.22	.32	.46	.41
Std Dev	0	0	0	0	0	0	0
Min Val	.22	.35	.36	.22	.32	.46	.41
Max Val	.22	.35	.36	.22	.32	.46	.41

Type	1,4-DICH ug/L	VANADIUM ug/L	UG/L	1,2DBRET UG/L	PICLORAM UG/L	CYAN-D MG/L	ug/L
Count	1	2	1	1	1	1	1
Average	.23	.4	.002	.005	.62	.005	1.2
Std Dev	0	0	0	0	0	0	0
Min Val	.23	.4	.0021	.0049	.62	.005	1.2
Max Val	.23	.4	.0021	.0049	.62	.005	1.2