SOUTH FLORIDA WATER MANAGEMENT DISTRICT

Hydrogeologic Investigation of the Floridan Aquifer System at the S-65C Site (Well OKF-105)

Okeechobee County, Florida

Technical Publication WS-32

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Executive Summary

The South Florida Water Management District (SFWMD) oversaw the construction and testing of a Floridan aquifer exploratory well (OKF-105) in Okeechobee County, Florida. The well is located on the west side of the Kissimmee River, adjacent to structure S-65C, approximately 20 miles northwest of the City of Okeechobee. Construction and testing of OKF-105 took place in three phases over three years. The well was built in order to gather geologic, hydrogeologic, and water quality data in the Floridan aquifer system to 2,500 feet below land surface (bls). The finished well consists of three zones that monitor different intervals within the Floridan aquifer system. The upper monitor zone spans the interval from 372 to 525 feet bls in the upper Floridan aquifer. The middle monitor zone spans the interval from 1,150 to 1,468 feet bls in the Avon Park permeable zone. The lower monitor zone spans the interval from 2,130 to 2,251 feet bls in a semi-confining layer between two flow zones in the lower Floridan aquifer. The SFWMD selected this lower zone for long-term monitoring because the water quality was significantly different from the surrounding sections in the borehole.

Drilling progressed through several formations and ended in the Eocene-age Oldsmar Formation at a total depth of 2,500 feet bls. The sediments in the Floridan aquifer system are primarily carbonates (limestone and dolostone) with some sections containing evaporite minerals (anhydrite and gypsum) toward the bottom of the borehole. Lithologic descriptions, water quality data, and geophysical logs helped determine the location and thickness of the various production horizons in the Floridan aquifer system. The upper Floridan aquifer is 160 feet thick, ranging from 365 to 525 feet bls; however, this zone contained no discernable flow zones. The water in this zone comes from the primary or matrix porosity of the rocks. The Avon Park permeable zone was 85 feet thick, from 1,385 to 1,470 feet bls. This interval contained two significant flow zones that produce most of the water in this well. The water in this zone comes from fractures and solution channels in the rock. The lower Floridan aquifer consists of two flow zones separated by a semi-confining unit. This aquifer extends from approximately 1,625 feet to the bottom of the borehole at 2,500 feet bls. The first production horizon in the lower Floridan aquifer is 275 feet thick and extends from 1,625 to 1,900 feet bls. The top of the second production horizon starts around 2,265 feet bls and extends at least 135 feet to the bottom of the borehole at 2,500 feet bls. The semi-confining unit between the two production horizons is 365 feet thick.

The upper monitor zone of this well covers an interval between 372 and 525 feet bls in the upper Floridan aquifer. The water quality in this zone is brackish (total dissolved solids (TDS) concentration of 1,473 milligrams per liter

[mg/l]), and is composed of water that transitions to seawater. The middle monitor zone covers an interval between 1,150 and 1,468 feet bls. It extends from above the Avon Park permeable zone to near the base of this zone. The water quality in this zone is also brackish (TDS concentration of 1,495 mg/l). The lower monitor zone covers an interval from 2,130 to 2,251 feet bls into the semi-confining unit between the two flow zones in the lower Floridan aquifer. This zone had water that was fresher than the over- and underlying zones based on the TDS concentrations calculated from the induction log. The water in this zone is saline (TDS concentration of 18,836 mg/l).

The base of the top of the underground source of drinking water (USDW), where the total dissolved solids concentration in the groundwater is 10,000 milligrams per liter, occurs around 1,660 feet bls at this site. The top of the G-II aquifer water quality is 1,430 feet bls based on the TDS concentrations calculated from the induction log. Water quality data collected from packer tests confirmed the calculated TDS concentrations from the induction log in the lower sections of the borehole.

All three monitor zones in the well are artesian. Water levels as of January 31, 2009 were 46.08, 44.87, and 49.94 feet above the National Geodetic Vertical Datum (NGVD) of 1929 for the upper, middle, and lower monitor zones, respectively.

The SFWMD's staff and contractors installed a CR-10X data logger with pressure transducers in the three monitor zones of OKF-105. This well is now part of the SFWMD's regional Floridan aquifer monitoring well network.

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Abbreviations and Acronyms

%	percent
ϕ	porosity in decimal form
a	tortuosity factor
ABS	Advanced Borehole Services, Inc.
AEL	Advanced Environmental Laboratories, Inc.
ADE	Applied Drilling and Engineering, Inc.
APPZ	Avon Park permeable zone
APT	aquifer performance test
ASR	Aquifer Storage & Recovery
AWE	All Webbs Enterprises, Inc.
BDL	below detection limit
bls	below land surface
°C	degrees Celsius
CAS	Columbia Analytical Services
CD	compact disk
CERP	Comprehensive Everglades Restoration Program
CL	Core Laboratories
DSI	dipole shear sonic imager
DVD	digital video disk
ECS	elemental capture spectroscopy
F	formation factor
°F	degrees Fahrenheit
FAC	Florida Administrative Code
FAS	Floridan aquifer system
FDD	Florida Design Drilling, Inc.
FDEP	Florida Department of Environmental Protection
FGS	Florida Geological Survey
FMI	fullbore formation microimager
ft/day	feet per day
ft^3	cubic feet

ft^2/day	square feet per day
FRP	fiberglass reinforced plastic
gm/cc	grams per cubic centimeter
gpm	gallons per minute
gpm/ft	gallons per minute per foot
ICU	intermediate confining unit
JEL	Jupiter Environmental Laboratories, Inc.
KBPA	Kissimmee Basin Planning Area
LAS	Log ASCII standard
m	cementation factor
md	millidarcies
mg/l	milligrams per liter
MV	MV Geophysical Surveys, Inc.
NGVD	National Geodetic Vertical Datum
OBI	optical borehole image
psi	pounds per square inch
PVC	polyvinyl chloride
Q	discharge rate
QA/QC	quality assurance/quality control
R_w	resistivity in ohm-meters of the water saturating the formation
r/B	dimensionless parameter characterizing leakance
RILD	deep induction log
s	drawdown
SAS	surficial aquifer system
SC	specific capacity
Schlumberger	Schlumberger Limited
SFWMD	South Florida Water Management District
T	transmissivity
TDS	total dissolved solids
Tetra Tech	Tetra Tech EC, Inc.
µm	micron
µS/cm	microsiemens per centimeter
USDW	underground source of drinking water

USGS	Unites States Geological Survey
XRD	X-ray diffraction
YSI	Yellow Springs Instruments

1 Introduction

This report documents the construction and testing of the Floridan aquifer system (FAS) monitoring well OKF-105. The well is adjacent to the S-65C structure on the Kissimmee River, approximately 20 miles northwest of the City of Okeechobee, Florida. The purpose of this project was to evaluate different horizons within the FAS for aquifer storage and recovery (ASR) and water supply purposes. The South Florida Water Management District (SFWMD) will also use OKF-105 for long-term monitoring to understand the vertical gradients within the FAS. This site is located in the center of Section 27 of Township 35 South, Range 32 East (**Figure 1**). During the construction and testing of OKF-105, the SFWMD had the wellhead on another FAS well (OKF-42) replaced, which is located approximately 597 feet southwest of OKF-105. This well is completed into the upper portions of the Floridan aquifer and the middle confining unit.

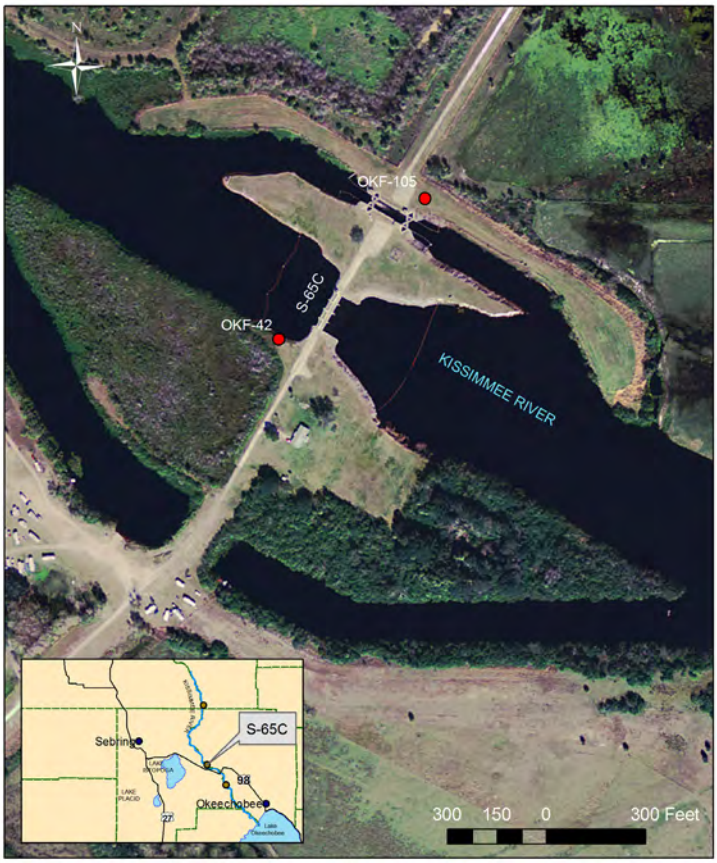


Figure 1. Project location map.

1.1 Background

OKF-105 and OKF-42 are located in the lower portion of the SFWMD's Kissimmee Basin Planning Area (KBPA). The KBPA generally reflects the drainage basin of the Kissimmee River. The region encompasses the northern portion of the SFWMD, extending from southern Orange County to the north shore of Lake Okeechobee. The KBPA includes parts of Orange, Osceola, Polk, Highlands, Okeechobee, and Glades counties. Water supply plans for the KBPA identified the FAS as a possible water supply source. Based on these plans, the SFWMD initiated a program of exploratory well construction, aquifer testing, and long-term monitoring (water quality and hydraulic heads) to provide data needed to assess the FAS underlying this area. This well will supply information to characterize the water supply potential of the FAS and will be used in the further development of a groundwater flow model that will support future planning and regulatory decisions.

The site is located in the central area of the KBPA where the SFWMD lacks hydrogeologic data, particularly with regard to deeper portions of the FAS. Data from this well will help Comprehensive Everglades Restoration Program (CERP) scientists refine their regional groundwater flow model and provide information for potential ASR projects in the region.

1.2 Purpose

This report documents the construction and testing of a tri-zone monitor well into selected portions of the FAS. This report documents the hydrogeologic data collected during the well construction and testing of OKF-105. The information includes a summary of: 1) well drilling and construction; 2) lithostratigraphy and hydrogeology; 3) geophysical logging; 4) water quality; 5) aquifer performance test data and analyses; and 6) packer test data.

1.3 Project Description

Well OKF-105 was constructed in three phases over three years. All Webb Enterprises, Inc. (AWE) of Jupiter, Florida, completed the first phase of work between January and May 2007. The scope of work included setting an 18-inch diameter steel casing to 372 feet below land surface (bls), drilling to 1,400 feet bls, and a running suite of geophysical logs. Applied Drilling Engineering, Inc. (ADE) of Tampa, Florida, completed the second phase of construction between September and November 2008. That phase included running a suite of production geophysical logs, installing a 12-inch diameter steel casing to 1,150 feet bls, and conducting a single-well aquifer performance test (APT). Florida Design Drilling, Inc. (FDD) of West Palm Beach, Florida, completed the third phase of well construction between May and September 2009. This phase of well construction included drilling to 2,500 feet bls, running geophysical logs, packer testing, and completing the well with a 5-inch diameter fiberglass reinforced plastic (FRP) casing to 2,130 feet bls.

1.4 Regional Description

The project site is located in the physiographic region known as the Okeechobee Plain, part of the Coastal Lowlands (Cooke 1939). The land surface elevation is approximately 40 feet above the 1929 National Geodetic Vertical Datum (NGVD) in this area, and it generally slopes south towards Lake Okeechobee.

Okeechobee County encompasses an area of approximately 880 square miles. It is bordered by St. Lucie County to the east, Indian River and Osceola counties to the north, Highlands and Glades counties to the west, and Lake Okeechobee to the south. The area is characterized as a subtropical environment with long, hot, wet summers, and mild, dry winters. The daily temperature averages 23 degrees Celsius (°C), with an average temperature range between 11 and 33 °C for the region. Seasonal variation of rainfall is pronounced; approximately 70 percent of the annual rainfall occurs during the 6-month wet season, from May through October. Long-term records (1966-95) indicate that average annual rainfall in Okeechobee, the major city in the county, is approximately 46 inches.

2

Exploratory Drilling and Well Construction

Construction of OKF-105 well took place over a span of three years and in three phases, as described below. During drilling and testing, the SFWMD collected cuttings every five feet or at noticeable formation changes, and collected water quality samples at depths from 1,400 to 2,500 feet bls. In addition, the drilling contractors involved in this project ran deviation surveys (Sure Shot) every 60 feet during drilling. The deviation surveys ensured that the borehole was straight and plumb, allowing clear installation of the different well casings. Below is a summary of each phase of well construction.

2.1 Phase I Well Construction

All Webb Enterprises, Inc. (AWE) began the first phase of well construction on January 29, 2007, when they mobilized their equipment to the project site. They drilled a 40-inch diameter borehole using the mud-rotary method to 40 feet bls on February 20, 2007, and installed 24-inch diameter ASTM A53 Grade B steel casing in the borehole. The casing had a wall thickness of 0.375 inches. After installing a header, AWE used 125 cubic feet (ft^3) of ASTM Type II neat cement to pressure grout the pit casing from 40 feet bls to land surface.

On February 26, 2007, AWE began mud-rotary drilling through the pit casing down to 372 feet bls using a nominal 12-inch drill bit. After reaching 372 feet bls, the driller circulated drilling mud in the borehole to remove drill cuttings and to make sure the borehole would not collapse during geophysical logging. After removing the drilling tools from the borehole, MV Geophysical Surveys, Inc. (MV) ran a 4-arm caliper and natural gamma log on March 2, 2007. The caliper log showed no unusual borehole conditions that would prohibit proper installation of the 18-inch diameter surface casing (ASTM A53, Grade B). AWE reamed the original borehole with a nominal 24-inch drill bit to 372 feet bls. AWE installed the 18-inch diameter steel casing at a depth of 372 feet bls, then cemented it back to land surface by pressure and tremie grouting in two stages using 511 ft^3 of ASTM Type II neat cement. Casing centralizers were spaced at 0, 90, 180, and 270 degrees around the well casing every 100 feet, ensuring that the well was centered in the borehole. Mill certificates for the 18-inch diameter steel casing are presented in **Appendix A**.

On March 15, 2007, the SFWMD oversaw a hydrostatic pressure test of the 18-inch diameter steel casing. AWE pressurized the well casing to 65 pounds per square inch (psi) with water. A Wika 300-psi gauge with 1-psi increments (**Figure 2**) displayed the well pressure during the test, and a SFWMD representative recorded the well pressure every five minutes for one hour. The manufacturer calibrated the pressure gauge one month before AWE used it for this test. The well casing lost 2 psi over the course of the test, a 3 percent (%) change in pressure, within the 5% criterion for a successful test. **Table 1** presents the results from the hydrostatic pressure test.

Table 1. Eighteen-inch steel casing hydrostatic pressure test results for OKF-105.

Elapsed Time (minutes)	Gauge Pressure (psi)	Pressure Change (psi)	Pressure Change (%)
0	65	0	0
5	65	0	0
10	65	0	0
15	65	0	0
20	64	1	1.5
25	64	1	1.5
30	64	1	1.5
35	64	1	1.5
40	64	1	1.5
45	63	2	3.0
50	63	2	3.0
55	63	2	3.0
60	63	2	3.0

Figure 2. Pressure gauge from pressure test on 18-inch diameter casing.

AWE resumed drilling on March 16, 2007, using mud-rotary drilling inside the 18-inch diameter casing, with a nominal 12-inch diameter drill bit to 1,400 feet bls. After reaching 1,400 feet bls, the driller circulated drilling mud in the borehole to clean out drill cuttings and to make sure the borehole would not collapse during geophysical logging. After removing the drilling tools from the borehole, Schlumberger Limited (Schlumberger) ran a suite of formation evaluation logs on April 17, 2007. **Section 5.1** discusses the geophysical logs, and copies of the logs can be found in **Appendix B**.

By May 1, 2007, AWE had developed the borehole and installed a temporary wellhead on OKF-105. This phase of well construction ended on May 7, 2007. **Figure 3** is a completion diagram for the first phase of the project, and **Figure 4** shows the wellhead at the end of this construction phase.

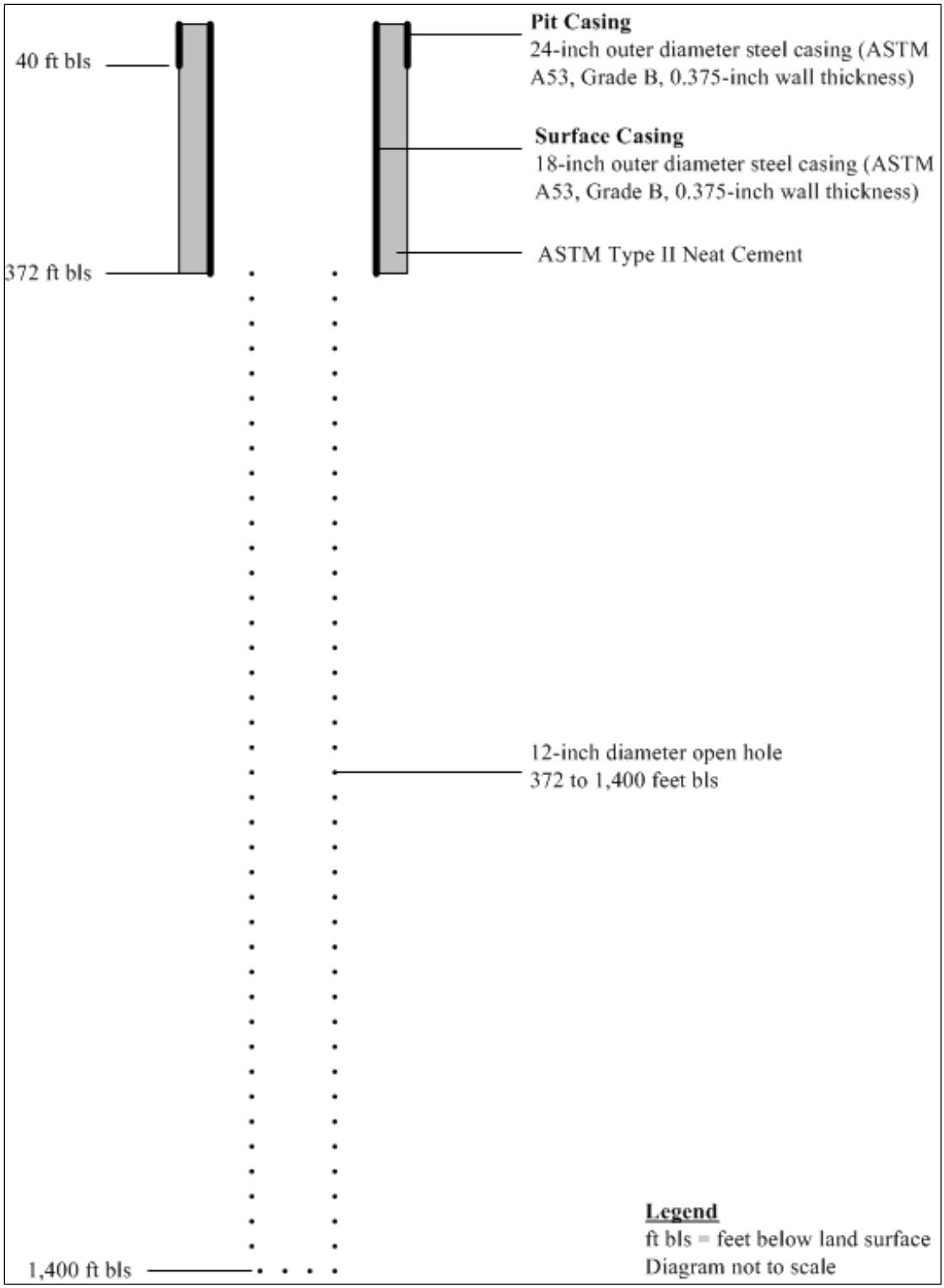


Figure 3. Phase I well completion diagram, OKF-105.

Figure 4. Phase I temporary wellhead, OKF-105.

2.2 Phase II Well Construction

On September 12, 2008, the SFWMD issued Applied Drilling Engineering, Inc. (ADE) a notice to proceed with the second phase of well construction. Since this phase required discharging water from the well to the Kissimmee River, the SFWMD obtained a Generic Discharge permit from the Florida Department of Environmental Protection (FDEP). The permit required the SFWMD to deploy two sensors into the Kissimmee River to monitor water quality during the discharge of reverse-air water: one 500 feet upstream of the discharge point, and another 500 feet downstream. The discharge permit also required water quality analysis of the groundwater in the well before the work began. ADE collected a groundwater sample from the test well and sent it to Advanced Environmental Laboratories, Inc. (AEL) for analysis. Per the Generic Discharge permit, AEL analyzed the sample for total organic carbon, pH, total recoverable mercury, total recoverable cadmium, total recoverable copper, total recoverable lead, total recoverable zinc, total recoverable chromium (hexavalent), benzene, and naphthalene. All of these constituents were within the ranges specified in the Generic Permit during this phase of work. A copy of the Generic Discharge Permit and the analytical results are included in **Appendix C**.

Between September 15 and 17, 2008, ADE reached the bottom of the well at 1,400 feet bls. They used the reverse-air drilling method to clean out the existing nominal 12-inch diameter borehole and remove sediment that may have sloughed in since the well had remained idle for 16 months after the first phase of construction ended. Advanced Borehole Services, Inc. (ABS) ran a suite of production geophysical logs in

the borehole to supplement the formation evaluation logs completed during Phase I. The SFWMD used formation samples (well cuttings), geophysical logs, and the adjacent monitor well (OKF-42) to determine an appropriate casing setting depth for this phase of well construction. At 1,140 feet bls, the resistivity log indicated that the formation material became denser relative to the overlying strata. As a result, the SFWMD requested that ADE set the 12-inch steel casing at 1,150 feet bls, 10 feet into the denser formation. **Section 5.1** of this report provides an evaluation of the geophysical logs.

On September 22, 2008, ADE began reaming the borehole by reverse-air rotary drilling using a nominal 18-inch diameter drill bit. After reaching 1,150 feet bls, the driller circulated the borehole to clean out drill cuttings and ensured it would not collapse during geophysical logging. After removing the drilling tools from the borehole, ABS ran a 4-arm caliper log to determine the borehole shape and volume. The caliper log showed no unusual borehole conditions that would prevent proper installation of the 12-inch diameter casing (ASTM A53, Grade B). ADE installed the 12-inch diameter casing to a depth of 1,150 feet bls and cemented the annular space back to 525 feet bls in three stages. ADE used pressure grouting for the first stage, and tremie grouting for the two subsequent stages. ADE used a total volume of 702 ft^3 of ASTM Type II neat cement with 8% bentonite to cement the 12-inch diameter steel casing. Casing centralizers were spaced at 0, 90, 180, and 270 degrees around the well casing every 100 feet, and ADE ensured that the well was centered in the borehole.

On October 14, 2008, the SFWMD's staff oversaw a hydrostatic pressure test of the 12-inch diameter steel casing. ADE pressurized the well casing to 52 psi with water. A Winters LF Series (model Q1548) pressure gauge with 1-psi increments displayed the pressure in the well casing, and the SFWMD representative recorded the well pressure every five minutes for one hour. The well casing lost 2 psi over the course of the test, which is a 4% change in pressure and is within the 5% criterion for a successful test. **Table 2** summarizes the pressure test data.

Table 2. Twelve-inch steel casing pressure test results for OKF-105.

Elapsed Time (minutes)	Gauge Pressure (psi)	Pressure Change (psi)	Pressure Change (%)
0	52.0	-	-
5	52.0	0	0
10	51.0	-1.0	-2
15	51.0	-1.0	-2
20	50.5	-1.5	-3
25	50.5	-1.5	-3
30	50.5	-1.5	-3
35	50.5	-1.5	-3
40	50.0	-2.0	-4
45	50.0	-2.0	-4
50	50.0	-2.0	-4
55	50.0	-2.0	-4
60	50.0	-2.0	-4

From October 14 to 17, 2008, ADE cleaned out and developed the borehole to 1,400 feet bls using a nominal 12-inch diameter bit and the reverse-air method. After removing their tools from the borehole, ADE installed a Goulds (Model 10RJMC) submersible pump with an 8-inch diameter Certa-Lok™ polyvinyl chloride (PVC) drop pipe, and a temporary wellhead on October 28 and 29, 2008. A 24-hour single-well aquifer test was conducted from October 30 to 31, 2008 to determine the transmissivity of the open-hole section. The aquifer test and subsequent analysis are discussed in **Section 5.4** of this report.

By December 12, 2008, ADE had installed the temporary wellhead on OKF-105, removed their equipment from the site, and restored the site. **Figure 5** shows the configuration of OKF-105 after the second phase of drilling. **Figure 6** is a photograph of the wellhead on OKF-105 after Phase II.

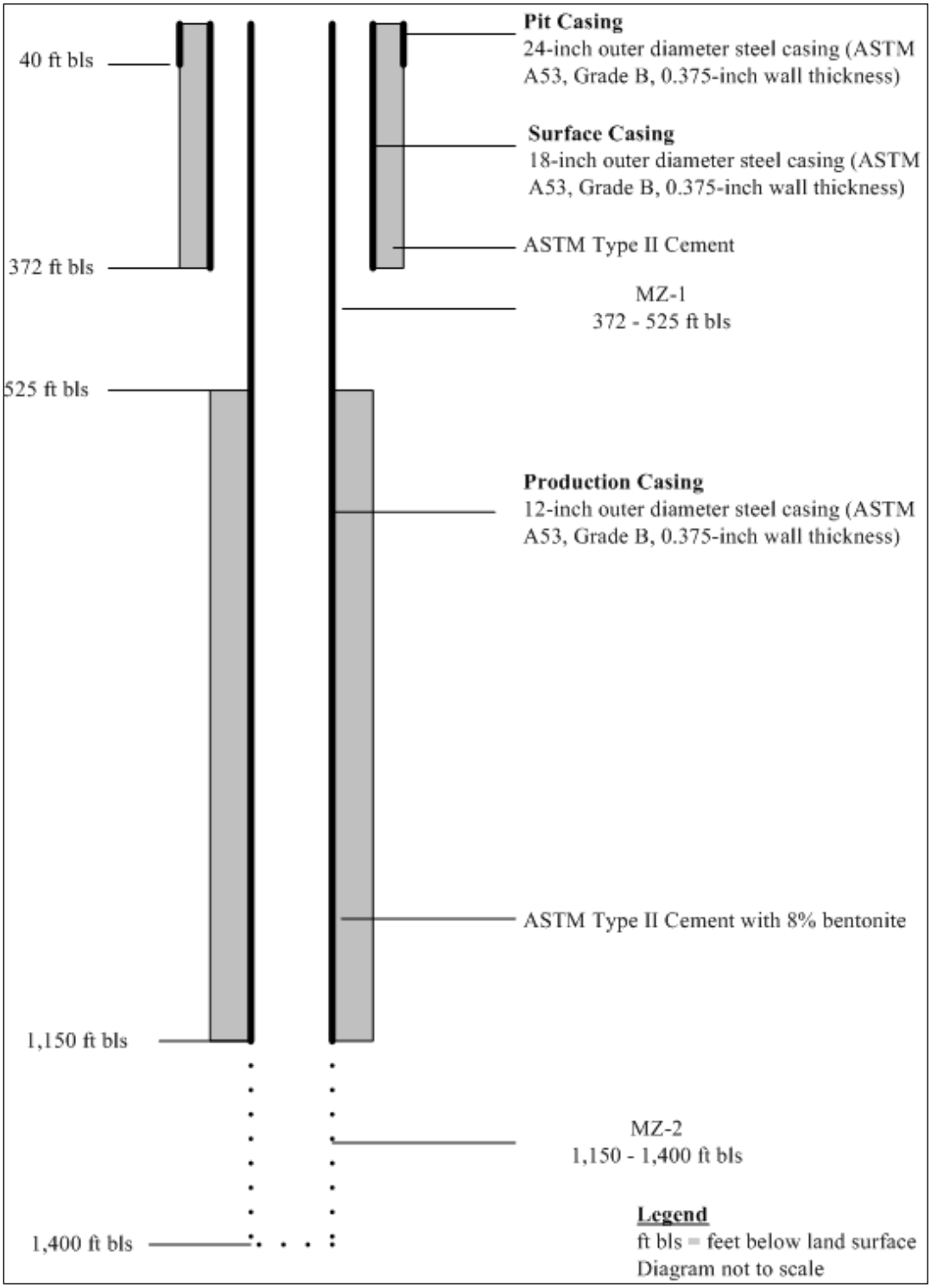


Figure 5. Phase II well completion diagram, OKF-105.

Figure 6. Phase II temporary wellhead, OKF-105.

2.3 Phase III Well Construction

On May 4, 2009, the SFWMD issued a notice to Florida Design Drilling, Inc. (FDD) to proceed with the final phase of well construction. This phase included drilling a nominal 8-inch diameter pilot hole to 2,500 feet bls, running a series of geophysical logs (including an optical borehole image log), packer testing the borehole, installing the final string of casing, and packer testing on the deepest monitored interval.

FDD began drilling a nominal 8-inch diameter pilot hole using the reverse-air rotary drilling method on May 19, 2009 and reached 2,500 feet bls on June 11, 2009. The SFWMD's staff collected water quality and water level data at the end of each drilling rod (approximately every 30 feet) during the pilot-hole drilling. These field data enabled the on-site geologists to assess water quality changes with depth as the drilling proceeded. As the water became more mineralized (denser), the depth to water measurement inside each drilling rod became deeper. A Yellow Springs Instruments (YSI) Model 6920 water quality probe screened the water samples collected at the end of each drilling rod for temperature, pH, and specific conductance. Field personnel also collected samples for analysis of chlorides, sulfates, and total dissolved solids (TDS). These samples were sent to the SFWMD's water quality laboratory for analysis.

On June 15, 2009, MV Geophysical Surveys, Inc. (MV) ran a suite of production logs in the pilot hole. These geophysical logs, along with the drill-stem water quality

samples, lithologic cuttings, and optical borehole image (OBI) log (Advanced Logic Technology OBI40 tool) helped determine where to run packer tests and set the final string of well casing. On June 17, 2009, the United States Geological Survey (USGS), under a purchase order with the SFWMD, ran an OBI log in the OKF-105 borehole. The OBI log provided a 360-degree color image of the borehole between 1,150 and 2,500 feet bls to aid in fracture detection and formation evaluation. **Section 5.1** describes the results of the geophysical logging surveys.

After the geophysical logging, FDD prepared a packer and submersible pump for three packer tests in the borehole. The selected intervals were 2,412 to 2,472 feet bls, 2,170 to 2,230 feet bls, and 1,614 to 1,674 feet bls. **Section 5.5** describes the packer testing procedures and results.

Following the packer testing, FDD reamed the borehole from 1,400 to 2,260 feet bls with a nominal 12-inch diameter bit from June 26 to July 6, 2009. The SFWMD determined, from the geophysical logs and the drill stem water quality data, that the monitor interval for the lower zone of OKF-105 should be between 2,130 and 2,251 feet bls in a zone of fresher water. From July 7 and 9, 2009, FDD backfilled the borehole to 2,251 feet bls with a ⅜-inch limestone fill and capped the last 15 feet with neat cement.

FDD installed the final string of well casing on July 17, 2009 and added ten sacks of neat cement to initially seal the casing in the borehole using the tremie method. The final string of casing was 2,130 feet of 5½-inch diameter, Fiber Glass Systems StarTM (Series 1500 ACT) fiberglass reinforced plastic (FRP). The ends of the FRP pipe had threaded joints (API threads), allowing them to be coupled with strap wrenches. Casing centralizers spaced at 0, 90, 180, and 270 degrees around the well casing every 100 feet ensured that the well was centered in the borehole. A TAM inflatable packer (model 775-LI-01), attached to the bottom of the FRP casing, was inflated to provide a seal between the well casing and the borehole wall. A tremie line ran between the well casing and the borehole wall to just above the packer. FDD used 930 ft3 of neat cement to fill the annular space from 2,130 feet bls to the bottom of the middle monitor interval at 1,468 feet bls. FDD ran a hydrostatic pressure test on the final string of casing on July 22, 2009. An Ashcroft® (model 1082) pressure gauge with 1-psi increments displayed the pressure in the well, and the SFWMD representative recorded the well pressure every five minutes for one hour. The well casing lost 0 psi from an initial pressure of 25 psi over the course of the test. **Table 3** presents the data from the hydrostatic pressure test.

Table 3. Five-inch FRP casing pressure test results, OKF-105.

Elapsed Time (minutes)	Gauge Pressure (psi)	Pressure Change (psi)	Pressure Change (%)
0	25.0	-	-
5	25.0	0	0
10	25.0	0	0
15	25.0	0	0
20	25.0	0	0
25	25.0	0	0
30	25.0	0	0
35	25.0	0	0
40	25.0	0	0
45	25.0	0	0
50	25.0	0	0
55	25.0	0	0
60	25.0	0	0

By August 27, 2009, FDD had developed the well, installed the final stainless steel wellhead, removed their equipment from the site, and restored the site to the satisfaction of the SFWMD. **Figure 7** is a photograph of the final wellhead on OKF-105. FDD hired Lidberg Land Surveying, Inc. of Jupiter, Florida to measure the elevation on the northeast corner of the well pad and install a brass survey marker. The elevation of the well pad is 39.25 feet NGVD. A copy of the survey report is included as **Appendix D**. The SFMWD issued the certificate of final acceptance on September 8, 2009, following the wellhead elevation survey. OKF-105 will be part of the SFWMD's regional Floridan aquifer monitoring well network. It will have a Campbell Scientific CR1000 datalogger connected to an In-Situ Inc. Level TROLL® 500 pressure sensor in each of the three monitor zones.

Figure 7. OKF-105 final wellhead.

Table 4 lists the open-hole intervals for each of the monitor zones in OKF-105, and **Figure 8** is a drawing of the completed well.

Table 4. OKF-105 monitor intervals.

Identifier	Monitor Interval (feet/bls)	Completion Method	Aquifer
OKF-105U	372 to 525	Open-Hole Annulus	Upper Floridan
OKF-105M	1,150 to 1,468	Open-Hole Annulus	Avon Park Permeable Zone
OKF-105L	2,130 to 2,251	Open-Hole	Lower Floridan

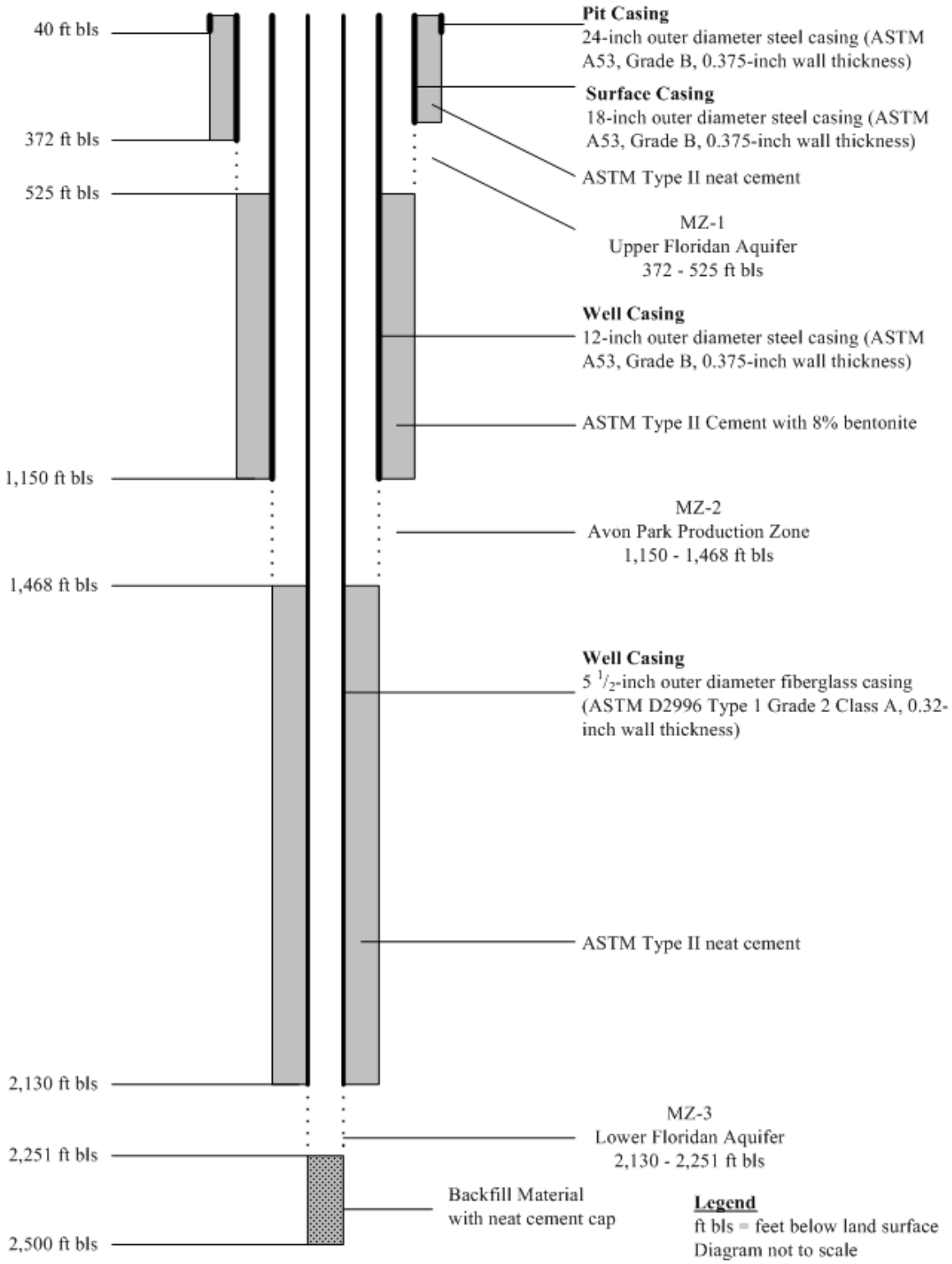


Figure 8. OKF-105 well completion diagram.

2.4 Monitor Well OKF-42 Wellhead Repair

Monitor well OKF-42 is located approximately 597 feet southeast of OKF-105, on the west side of the Kissimmee River. The SFWMD has no record of the construction date of this well, but there is an existing set of geophysical logs from 1982. The well has a 6-inch diameter Schedule 40 PVC casing installed to 370 feet bls, with an open-hole section from 370 to 1,152 feet bls. The SFWMD has had a Campbell Scientific CR-10X datalogger and a Rittmeyer® (Model MPSDIG 020) pressure transducer measuring water levels in the well since June 2004. In early 2008, the wellhead began to leak, affecting the water level readings due to the slight pressure decrease caused by the leak. During Phase II of the OKF-105 construction, the SFWMD contracted ADE to run a series of production geophysical logs in OKF-42 and replace the wellhead with 316 grade stainless steel valves and fittings. **Figure 9** is a photograph of the completed wellhead at OKF-42. ADE completed the work in conjunction with the construction and testing of OKF-105 and had ABS run the geophysical logs. **Section 5.1** discusses the geophysical logging in OKF-42.

Figure 9. Photograph of the repaired OKF-42 wellhead.

3
Stratigraphic Framework

The SFWMD collected geologic formation samples (well cuttings) from the pilot hole during drilling and described them based on their dominant lithologic and textural characteristics, and to a lesser extent, color. Formation samples from 40 to 1,400 feet bls were washed and shipped to the Florida Geological Survey (FGS) for analysis and long-term storage. The SFWMD's geologists described the remaining samples, from 1,400 to 2,500 feet bls, using the Dunham (1962) classification for carbonates. **Appendix E** contains a copy of the FGS lithologic description for the pilot-hole/monitor well OKF-105 (reference no. W-18777) and the SFWMD field description. An electronic version of the FGS lithologic description is available directly from FGS's internet site: (http://www.dep.state.fl.us/geology/gisdatamaps/litholog.htm). Geophysical logs and rock cores were also helpful in describing the geologic formations encountered during drilling.

3.1 Holocene, Pleistocene, and Pliocene Series

These sediments were not encountered at this site since lithologic sample collection began at 40 feet bls, after AWE installed the pit casing. Based on the geology of the surrounding area and the natural gamma ray log, these sediments occur from land surface to approximately 40 feet bls. At this depth, the natural gamma ray counts increase slightly on the geophysical log due to the presence of phosphate grains, indicative of the Hawthorn Group. In general, the sediments in this series tend to be alluvial deposits due to the proximity of the Kissimmee River. They probably consist of poorly sorted unfossiliferous sand, sandy clays, and clay (Scott 1992).

3.2 Miocene Series

The Hawthorn Group is composed of a heterogeneous mixture of silt, clay, calcareous clay, dolosilt, quartz sand, phosphate, limestone, and dolostone. The Hawthorn Group consists of two lithostratigraphic units at this site. The upper unit, or the Peace River Formation, is composed of predominantly siliciclastic material. The lower unit, or the Arcadia Formation, is composed principally of carbonates (Scott 1988). A major regional disconformity separates these two units (Scott 1988; Missimer 1997, 2002).

3.2.1 Peace River Formation

The top of the Peace River Formation consists of olive-gray to yellowish-gray, poorly-indurated to unconsolidated sands with a minor phosphate component (1 to 20% phosphatic sand). These sands start a depth of 40 feet bls at this site and are interspersed with a clay layer from 85 to 115 feet bls, and a thin layer of limestone (grainstone) from 160 to 165 feet bls. Generally, the sands in this formation range from very fine to coarse, sub-angular to sub-rounded grains with moderate to low permeability. There are a variety of fossils encountered in these sediments, including mollusks, barnacles, echinoids, benthic foraminifera, and shark teeth. The Peace River Formation is approximately 315 feet thick at this site and extends to a depth of 355 feet bls.

Deposition of the Peace River Formation sediments began in the Middle Miocene when siliciclastic sediments overran Florida's carbonate bank environment (Scott 1988). As sea level rose during this period, large amounts of siliciclastic material made its way to southern Florida, restricting carbonate sedimentation. Although the sediments of the Hawthorn Group show significant reworking, it appears that the depositional setting was a shallow marine to brackish water environment.

3.2.2 Arcadia Formation

Generally, a lithologic change from predominately siliciclastic to mixed siliciclastic-carbonate sediments separates the Arcadia Formation from the overlying Peace River Formation. At this site, a distinctive lithologic change occurs at 355 feet bls, where the lithology changes to a yellowish-gray to light olive-gray silt-sized, moderately indurated dolostone with phosphatic sand. The base of the Arcadia Formation occurs around 400 feet bls in OKF-105, based on the first occurrence of the benthic foraminifera *Lepidocyclina ocalana*, a key fossil in the Eocene Ocala Limestone. The Arcadia Formation correlates with an increase in formation resistivity and bulk density values, and higher natural gamma ray activity on the geophysical logs compared to the overlying Peace River Formation.

The Arcadia Formation developed in a carbonate bank environment with the deposition of siliciclastics from a southward flowing long shore current (Scott 1988). The depositional setting appears to have been a quiet water (low energy) lagoon similar to the environment currently present in Florida Bay (King 1979).

3.3 Oligocene Series

3.3.1 Suwannee Limestone

The Suwannee Limestone consists predominantly of packstone and grainstone units with a minor silt/sand component (Scott 1988). This unit was not present at this site. This unit is typically not present as a continuous sequence across eastern

peninsular Florida. The general thought is that it may have eroded away in this area (Miller 1986).

3.4 Eocene Series

3.4.1 Ocala Limestone

The late Eocene-age Ocala Limestone is identified at a depth of 400 feet bls at the site. The lithologic character of the upper portion of the Ocala Limestone consists of a poorly-indurated, yellowish-gray to a very light orange packstone. The first occurrence of the diagnostic microfossil *Lepidocyclina ocalana* (primarily a biostratigraphic designation, as noted in Applin & Applin 1944) is a key identifier of this formation. The formation changes to a yellowish-gray, poorly-indurated grainstone from 565 to 605 feet bls. The grains in this layer consist of coarse sand to gravel-size particles held together in a calcilutite matrix. From 605 to 805 feet bls, the Ocala Limestone reverts to the aforementioned packstone with intermittent sequences of a wackestone and grainstone. The bottom of the Ocala Limestone occurs at a depth of 805 feet bls.

The Ocala Limestone was deposited on a warm, shallow carbonate bank, similar to the modern day Bahamas (Miller 1986). This low-energy environment probably had low to moderate water circulation (Tucker and Wright 1990).

3.4.2 Avon Park Formation

The top of the middle Eocene-age Avon Park Formation is identified from lithologic samples at a depth of 805 feet bls in OKF-105. At this depth, the lithology is a yellowish-gray wackestone with poor induration. The first occurrence of *Dictyoconus americanus*, a diagnostic microfossil used extensively as a bio-stratigraphic indicator for the Avon Park Formation, occurs at this depth. This formation is present to a depth of 1,740 feet bls. The lithology alternates between a wackestone and packstone, from 805 to around 1,140 feet bls. At this depth, there is a noticeable increase in formation resistivity as the lithology changes from a very light orange to a grayish brown, poorly to moderately indurated dolostone. The dolostone is well-indurated below 1,195 feet bls to 1,460 feet bls, and from 1,460 to 1,610 feet bls, the formation changes from a tan to white, well-indurated mudstone to packstone with intergranular and pinpoint vuggy porosity. At 1,610 feet bls, the unit grades from a tan to dark brown crystalline dolostone with some intergranular and pinpoint vuggy porosity, where it continues to the base of the formation at 1,740 feet bls.

The sediments of the Avon Park Formation were deposited on a warm, shallow carbonate bank. These bank environments are typically shallow and dominated by tidal and wave activities, with occasional storm impacts. The presence of dolomite in the formation may indicate that seawater was present or became trapped in the

sediments, resulting in the diagenesis of limestone to dolostone. The seawater provides the source of magnesium necessary to convert limestone to dolostone.

3.4.3 Oldsmar Formation

The top of the early Eocene-age Oldsmar Formation occurs at 1,740 feet bls, where the lithology changes to a white, friable packstone with vuggy and intergranular porosity. The presence of the foraminifera *Miscellanea nassauensis* also helped identify the top of the Oldsmar Formation. The lithology grades from a tan to brown, well-indurated crystalline dolostone with pinpoint vugs at 1,840 feet bls and then alternates between white limestone (mudstone through packstone) and crystalline dolostone to the bottom of the borehole at 2,500 feet bls. Anhydrite and gypsum are present throughout this formation below 1,750 feet bls, particularly in the dolostone sequences where the OBI log shows large quantities of these evaporites in certain sections of the borehole. Between 2,200 and 2,210 feet bls, the lithology briefly changes to a white, friable, limestone (packstone), with flecks of dark green to blackish-green glauconite in the rock matrix. The increase in activity on the natural gamma log at this depth confirms the presence of the glauconite. This horizon probably corresponds to the glauconite maker horizon discussed by Reese and Richardson (2007).

The sediments of the Oldsmar Formation were deposited on a warm, shallow carbonate bank (Miller 1986) or tidal flat (Duncan *et al.* 1994) environment. The presence of evaporite minerals suggests at times that the banks were exposed to the atmosphere, allowing evaporation of the mineralized water in short-lived sabkha conditions (Miller 1986). The occurrence of glauconite in the deeper limestone confirms that the environment was low-energy and slightly reducing, with a low sedimentation rate. Odin and Fullagar (1988) found that glauconitization occurs in open marine waters at depths below 195 feet and at temperatures below 15 °C. In this environment, there are very low sedimentation rates and minimal disturbance of the settled sediments. The presence of glauconite at 2,200 feet bls probably indicates a period of high sea level when this area of the Florida platform was submerged in deeper water.

4
Hydrogeologic Framework

Two major aquifer systems underlie this site, the surficial aquifer system (SAS) and the Floridan aquifer system (FAS), with the FAS as the primary focus of this investigation. These aquifer systems are composed of multiple discrete, permeable zones and fractures separated by lower permeability units that occur throughout this Tertiary/Quaternary-age sequence. **Figure 10** shows a generalized geologic and hydrogeologic section for OKF-105.

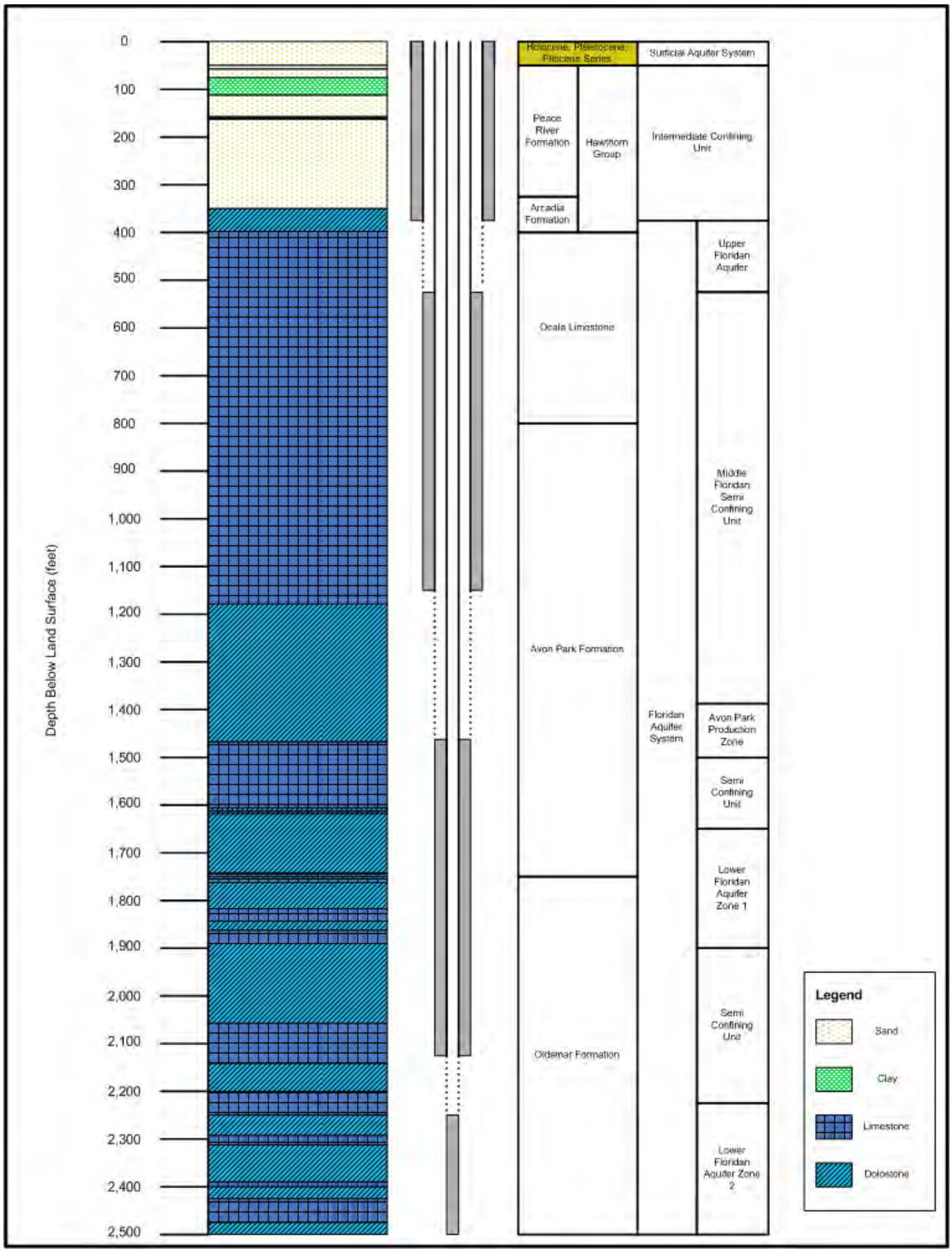


Figure 10. Geologic and hydrogeologic section underlying OKF-105.

4.1 Surficial Aquifer System

At this location, the SAS consists of the Holocene-age undifferentiated sediments. They occur from land surface to a depth of 40 feet bls. The sediments in this region are generally quartz sands (Scott 1992). The sands range from fine- to coarse-grained, poorly-indurated, and non-clayey to slightly clayey (Scott 1992). The SAS is not a major source of potable water in the KBPA.

4.2 Intermediate Confining Unit

The intermediate confining unit (ICU) occurs below the SAS and extends from 40 to 365 feet bls at this site. The sediments of this unit act as a semi-confining unit, separating the FAS from the SAS. Hawthorn Group sediments make up the ICU and consist of unconsolidated shell beds, soft non-indurated clay, silt and quartz-phosphatic sand units, and poorly to moderately-indurated mudstones/wackestones of the Peace River and Arcadia Formations. The base of the ICU occurs where the lithology changes to a grayish-brown dolostone. It is recognized by a spike in formation resistivity on the dual-induction log.

4.3 Floridan Aquifer System

The FAS consists of a series of Tertiary-age limestone and dolostone units. The system includes permeable sediments of the lower Arcadia Formation, the Ocala Limestone, the Avon Park Formation, and the Oldsmar Formation at this site. The base of the FAS occurs in the Paleocene-age Cedar Keys Formation, which consists of massive beds of gypsum and anhydrite (Miller 1986). This investigation did not encounter the Cedar Keys Formation. Recharge to the FAS occurs to the northwest of the study area in Polk County around the ridges and uplands that dominate that area. Karst features, such as sinkholes, and a thin ICU allow higher rates of recharge to the aquifer in Polk County compared to surrounding areas (Spechler and Kroening 2007). The sinkholes penetrate the ICU and provide a direct conduit from land surface to the Floridan aquifer. The water table is generally very deep in this region and lower than the potentiometric surface of the Floridan aquifer, resulting in a downward hydraulic gradient.

4.3.1 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 top of a vertically continuous permeable carbonate sequence. Generally, the upper Floridan aquifer consists of thin, water-bearing horizons with high permeability interspersed within thick units of late- to middle-Eocene age sediments with low permeability, including the basal Arcadia Formation, Ocala Limestone, and the Avon Park Formation. At this site, the top of the FAS occurs at a depth of 365 feet bls, which coincides with the lower portion of the Arcadia Formation (basal Hawthorn

unit, Reese 2004). The geophysical logs showed two large washouts, one between 425 to 445 feet bls, and another between 505 to 525 feet bls. These washouts indicate zones of softer limestone and correspond to poorly-indurated packstones of the Ocala Limestone. The primary source of permeability in this section of the FAS is most likely due to intergranular permeability of the rock formations. The upper Floridan aquifer at this site has not undergone significant dissolution, hence water in this portion of the aquifer flows through the primary porosity of the rock matrix. The hydrogeologic characteristics of the upper Floridan aquifer at this site are similar to those seen in monitor well OSF-104, approximately 20 miles north (AECOM Water 2008). During Phase I of this project, AWE drilled to 1,400 feet bls using the mud-rotary drilling method and was able to maintain circulation, confirming the lack of productive horizons in the aquifer.

The SFWMD selected the depth interval of 372 to 525 feet bls for long-term monitoring and hydraulic testing since this interval corresponded to the upper Floridan aquifer in other wells in the area. However, the lack of significant production intervals at this depth is unique compared to other upper Floridan aquifer wells in the area. Water quality samples obtained from this monitor zone (372 to 525 feet bls) yielded chloride and TDS concentrations of 1,300 and 2,400 milligrams per liter (mg/l), respectively. A detailed description of these water quality samples is found in **Section 5.3**.

4.3.2 Middle Floridan Confining Unit and Avon Park Permeable Zone

The top of the middle Floridan confining unit is difficult to interpret since the rocks in the upper portion of the borehole have similar characteristics. For this report, we will consider it to start at 525 feet bls, at the base of the upper monitor interval and the washout. The lithology of the middle Floridan confining unit consists of varying packstones and grainstones that are poorly-indurated and fossiliferous down to 1,180 feet bls, where it changes to a poorly to well-indurated dolostone. The porosity of the packstone and wackestone units tends to be both primary and moldic. As a result, the production capacity of these rocks is relatively low compared to the deeper sections with large fractures. Certain sections of the dolostone have pinpoint vugs, which tend to yield more water than the overlying limestone.

The first production zone in the Avon Park permeable zone (APPZ) is seen on the borehole temperature log at 1,385 feet bls and extends to 1,470 feet bls. The OBI log confirms the permeable nature of this zone by showing where fractures and vugs occur. The most significant production horizon in the APPZ occurs at 1,427 feet bls in the Avon Park Formation. This zone, and a lower zone at 1,463 feet bls, make up the main water sources for the APPZ and dominate the flow logs. In these zones, the formation consists of a brown, sucrosic to crystalline, well-indurated dolostone with pinpoint vugs. The OBI log shows large cavities, approximately three feet high, where significant dissolution of the formation occurred. These fractures act as a path of least resistance. Water flowing into the borehole will come from both the

fractures and the surrounding rock matrix (Kruseman and deRidder 2000). As water flows through these fractures, it will draw water from the surrounding formation.

The presence of dolostone in this section of the borehole indicates that the original rock has undergone significant diagenesis. There are several models on how dolomitization takes place; however, their discussion is beyond the scope of this report. Readers should review sources such as Tucker and Wright (1990) for a detailed description on different dolomitization models. However, research has shown that seawater is the most likely source of the magnesium ions needed to form dolostone (Tucker and Wright 1990). The seawater/groundwater mix must have a ratio of magnesium to calcium ions greater than 1 for dolomitization to occur (Duncan *et al.* 1994). The presence of evaporite minerals (gypsum and anhydrite) in some of the dolostone sections indicates that they may have formed under sabkha conditions.

Below the APPZ (below 1,475 feet bls), the lithology changes to predominantly a tan to white, well-indurated mudstone that shows a lower permeability based on the borehole compensated sonic log. This layer acts as a semi-confining layer between the APPZ and the first production zone of the lower Floridan aquifer at 1,625 feet bls.

4.3.3 Lower Floridan Aquifer

The first production horizon in the lower Floridan aquifer occurs at 1,625 feet bls. The temperature and fluid conductivity logs show this permeable zone as increased values at this depth. The borehole compensated sonic log also indicates an increase in the porosity of the formation, and the OBI log shows a vuggy porosity in the formation materials at this depth. The lithology at 1,625 feet bls is a tan to brown, well-indurated, vuggy mudstone to 1,630 feet bls before it changes to a tan to dark brown, well-indurated crystalline dolostone with vuggy porosity. The bottom of this first production zone occurs around 1,900 feet bls where the sonic log shows a decrease in the formation porosity. The OBI log confirms this by showing solid laminated layers of dolostone with layers of anhydrite and gypsum. This semi-confining layer extends from 1,900 to 2,265 feet bls, where a second production horizon is present to the bottom of the hole at 2,500 feet bls. The fluid conductivity and temperature logs both show the second production horizon in the lower Floridan aquifer. At 2,265 feet bls, there is both an increase in temperature and fluid conductivity, indicating that the formation yields water to the borehole. The OBI log shows a fracture just below this depth, and the dual induction log shows a decrease in formation resistivity, indicating a potential to yield water. The two production horizons in the lower Floridan aquifer contain several thin layers that yield water, separated by thicker layers of lower permeability material. Fractures and vugs distinguish the production horizons from the semi-confining units in this aquifer.

5
Hydrogeologic Testing

The SFWMD collected specific information during the drilling program to determine the lithologic, hydraulic, and water-quality characteristics of the FAS at this site. These data helped complete the final design of the monitor well and characterize different zones in the aquifer at this site.

5.1 Geophysical Logging

Geophysical logging of the pilot hole took place during each phase of well construction to determine intervals for casing installations and to evaluate borehole characteristics. The resulting logs provide a continuous record of the physical properties of the subsurface formations and their respective fluids. These logs assisted the SFWMD's hydrogeologists with the interpretation of lithology, with providing estimates of permeability, porosity, bulk density, and resistivity of the aquifer; and helped with determining the salinity profile of the groundwater using Archie's equation (Archie 1942). The extent of confinement of discrete intervals was also determined from the individual logs. The following subsections provide a description and analysis of the geophysical logs during the three phases of well construction.

After completing a suite of logs, each geophysical logging contractor downloaded the data directly from the onsite logging processor and saved the log files onto compact disks (CDs) in Log ASCII Standard (LAS) format, version 2.0. The various geophysical logging contractors also delivered video surveys of the borehole to the SFWMD on VHS cassette or digital video disc (DVD). **Appendix B** contains selected geophysical log traces from the various log runs in OKF-105. The original geophysical logs and video surveys from this project are archived and available for review at the SFWMD headquarters in West Palm Beach, Florida. **Table 5** is a summary of the geophysical logging program conducted in both OKF-105 and OKF-42.

Table 5. Summary of geophysical logging in OKF-105 and OKF-42.

Well	Run #	Date	Logging Company	Logged Interval (feet bls)	Caliper	Natural Gamma	Dual Induction/ Sonic	Formation Evaluation Logs (see Table 6)	Flow Meter	Temperature	Fluid Resistivity	Video
OKF-105	1	3/2/07	MV Geophysical	0 - 372	X	X	X					
	2	4/17/07	Schlumberger	0 - 1,400	X	X	X	X				
	3	9/18/08	ABS	372 - 1,400	X	X	X		X	X	X	X
	4	6/15/09	MV Geophysical	1,150 – 2,500	X	X	X		X	X	X	X
OKF-42	1	4/15/82	SFWMD	0 -1,150	X	X	X*		X	X	X	
	2	10/1/08	ABS	0 - 1,150	X	X	X		X	X	X	X

Legend:
*Neutron log run

5.1.1 Phase I: Geophysical Logging

The SFWMD ran two suites of geophysical logs during the first phase of well construction. AWE ran caliper, natural gamma, and dual induction logs in the borehole from land surface to 372 feet bls. The purpose of these logs was to confirm the top of the FAS and a suitable point to install the first string of well casing. These logs verified the lithologic log that there was competent rock to set the well casing at the top of the FAS at 372 feet bls. Geophysical logs previously run in the OKF-42 identified the top of the FAS and provided guidance for the first phase of well construction.

The main objective of the first phase of drilling was to run the formation evaluation (Schlumberger) suite of geophysical logs in the open hole section from 372 to 1,400 feet bls. **Table 6** lists these logs, their physical characteristics, and the properties measured.

The formation evaluation logs confirmed the lithology in the borehole and showed zones of varying permeability between 372 and 1,400 feet bls. The elemental capture spectroscopy (ECS) tool helped with mineral identification and estimated permeability based on the formation lithology. The ECS sonde works by bombarding the formation with neutrons and measuring the gamma rays released back to the tool. This sonde determines the lithology of the formation based on dry weight measurements of various elements present and calculates the total porosity based on the measured bulk density of the borehole materials. For example, the sonde determines carbonates by the calcium concentration measured in the formation and determines anhydrite based on calcium and sulfur measurements. The ECS showed that the interval in OKF-105 between 370 and 1,400 feet bls consisted mainly of carbonates. The ECS log also showed a sandy-clay section around 400 feet bls that corresponds to the base of the Arcadia Formation. The lithologic log confirms these sediments. The ECS log shows periodic sections of anhydrite/gypsum in this borehole section, but these minerals were not described in the well cuttings. The OBI log shows that there could be small quantities of these evaporite minerals in some of these sections. Anhydrite and gypsum are soft, and drilling could have pulverized them, thus not returning up the borehole with the drill cuttings.

The dipole shear sonic imager (DSI) log is an acoustic log that can estimate porosity and fractures using Stoneley waves. Stoneley waves are low frequency waves that are sensitive to formation permeability and tend to slow down in fractures and highly permeable materials (Haldorsen *et al.* 2006). The DSI log showed that as the resistivity of the formation increased below 1,150 feet bls, the intrinsic permeability of the formation material decreased. Fractures in the borehole, most notably at 1,230 feet bls, are an exception on the log.

The fullbore formation microimager (FMI) log provides an electrical image of the borehole and shows sedimentary features and fractures, where present. Darker

sections on the image indicate conductive areas in the formation, while lighter (white) areas are more resistive zones. The dark areas on the FMI log between 440 and 450 feet bls, as well as between 500 and 530 feet bls, represent wash out areas in the formation. The caliper log confirms that these two zones are washouts and not large fractures by showing a sizeable area with an enlarged hole diameter. One concern with the FMI log occurs around the fractured zone at 1,233 feet bls. This zone appears highly fractured on the OBI log, but the FMI log shows resistive materials, and the fracture is vaguely discernable on the log.

Table 6. Schlumberger formation evaluation logs.

Log Name	Log Type	Principal Application	Maximum Hole Size	Benefit to Groundwater Studies
4-arm Caliper	Mechanical (inches)	Determines borehole diameter and rugosity in two horizontal planes and used to correct other logs	22 inches	Used to correct flow meter logs, and aids in identifying suitable inflatable packer and casing placement zones
Gamma Ray (GR)	Natural Radioactive Nuclear reported in American Petroleum Institute Units (API)	Correlation, stratigraphic boundaries	24 inches	Correlation, used to estimate shale and clay volume
Elemental Capture Spectroscopy (ECS)	Nuclear –Natural Gamma Emissions of the 254 Mineral spectrum reported in API units	Correlation, mineral identification – Si, Fe, Ca, S, Ti, Gd, Cl, Ba, and H	20 inches	Correlation, defines clay type and aids in mineral identification and permeability estimation based on lithology
Array Induction Imager Tool (AIT-H)	Conductivity converted to Resistivity; bedding resolution to 2 feet in smooth borehole; values reported in ohm-meter (ohm-m)	Provides invasion profile and accurate water resistivity (R_w) determination	20 inches	Water Quality – determination of R_w via Archie Equation, and provides estimates of permeability from invasion profile
Dipole Shear Sonic Imager (DSI)	Compressional and shear Δt wave forms	Porosity estimation, lithology and clay identification. Stonely wave measurement for fracture evaluation	21 inches	Stonely wave measurement aids in lithology and fracture identification
Compensated Z-Density with Photoelectric absorption	Nuclear – Induced Radioactive – Pad mounted; reports bulk density in grams per cubic centimeters (gm/cc) and porosity in porosity units (p.u.)	Porosity analysis, bulk density and lithologic and fluid determination	14 inches; affected by rugose borehole	Porosity estimates and lithologic indicator; porosity may be used in Archie Equation
Compensated Neutron (CN)	Nuclear – Induced Radioactive; reports porosity in porosity units (p.u.)	Porosity analysis and lithologic determination	14 inches; good in rough or washed out borehole	Porosity estimates; porosity may be used in Archie Equation
Natural Gamma Ray Spectro-metry Tool (NGS)	Natural gamma ray emissions using five window spectroscopy	Measures K, Th, and U content of sediments	No limit	Determines clay type and depositional facies
Fullbore Formation MicroImager (FMI)	Electrical borehole image from 192 microresistivity measurements	Identifies structural and sedimentary features	21 inches	Determination of carbonate texture and secondary porosity features

Note:
K = potassium, Th = thorium, U = uranium
Appendix B contains copies of the selected Schlumberger geophysical logs.

5.1.2 Phase II: Geophysical Logging

During Phase II, ABS ran a suite of geophysical logs in both OKF-105 (September 18, 2008) and OKF-42 (October 1, 2008). **Table 5** lists the individual logs run for this event.

In OKF-105, the caliper log showed two washouts at 425 to 445 feet bls and another at 505 to 530 feet bls, corresponding to the upper Floridan aquifer in this borehole. The caliper log also shows that the borehole is tight and generally gauged to the drill bit below the washouts. Toward the bottom, once drilling entered the dolostone, the caliper log shows three fractured sections at 1,230, 1,330, and 1,385 feet bls. The resistivity log clearly shows where dolostone appears in the borehole around 1,150 feet bls, where the formation resistivity increases. The well-indurated crystalline dolostone is denser than the softer limestone that occurs above it. The fluid conductivity log shows an increase in the water conductivity near the bottom of the borehole from 950 to 1,700 microsiemens per centimeter (μS/cm). This increase is probably due to groundwater flowing into the borehole from the upper portion of the APPZ, approximately 25 feet below the bottom of this logged interval. The natural gamma log has a low and consistent response below the clays of the Hawthorn Group.

In OKF-42, the caliper log did not show any distinctive features until 1,000 feet bls, when a noticeable "kick" to the right occurs, indicating a fracture or washout in the hole. Generally, the caliper log shows that the hole does not have many fractures or washouts. The resistivity log for OKF-42 differs from OKF-105 as it is uniform through the borehole. There is no section of harder rock near the bottom of the hole as there is in OKF-105 when drilling encountered a dolostone section. The fluid conductivity log shows that the conductivity of the water in the well is also uniform and ranges between 900 and 1,000 μS/cm.

Appendix B contains the geophysical logs from OKF-105 and OKF-42 (from Phase II of this project), as well as copies of the original logs run in OKF-42 in 1982.

5.1.3 Phase III: Geophysical Logging

MV Geophysical Surveys, Inc. (MV) ran the geophysical logs for this phase of the project on June 15, 2009. **Table 5** presents a list of the geophysical logs conducted from the bottom of the second string of well casing (1,150 feet bls) to the base of the borehole at 2,500 feet bls.

The caliper log showed a few fractures and several washouts over the logged interval. The most significant fracture occurs at approximately 1,425 feet bls in the Avon Park Formation. This fracture is the main producer of water to the borehole, as shown on the borehole flow meter log. A second, smaller fracture, around 1,465 feet bls, yields significant water and coincides with a water quality change as seen on the fluid conductivity log. MV ran a flow meter log from the bottom of the hole at 2,500 feet bls up to the base of the 12-inch casing at 1,150 feet bls. This log showed

no increase in the water yield until the fracture at 1,465 feet bls. This flow zone is not as significant as the zone at 1,425 feet bls because it does not deflect as far on this log as the higher zone.

The natural gamma log shows little activity except around 1,650 feet bls and below 2,200 feet bls. At 1,650 feet bls, the dolostone cuttings contained black flecks, which could be the source of the spike on the natural gamma log. These cuttings require further examination under a petrographic microscope to determine their makeup as they could be either glauconite or phosphorite. The natural gamma log peak at, and below, 2,200 feet bls is due to glauconite present in the rock matrix. The natural gamma log peak at 2,200 feet bls corresponds to the regional glauconitic marker horizon identified by Reese and Richardson (2007). Both the fluid conductivity and temperature logs show sections of the borehole where water quality changes. The most significant change occurs around 1,630 feet bls, where the fluid conductivity increases from approximately 10,000 µS/cm to 32,000 µS/cm. The water temperature at this depth also increases from approximately 31 degrees Celsius (°C) to 34 °C. This zone is described as the uppermost production interval in the lower Floridan aquifer. The dual induction log showed variability in the borehole, with dolostone sections showing greater resistivity than the limestone sections. This log also corresponded to the lithologic cuttings collected during drilling.

The SFWMD used the dual induction geophysical log data to identify water quality changes (specifically TDS concentration) within the FAS. In previous investigations, this analysis assisted in determining the depth of the base of the underground source of drinking water (USDW) where TDS concentrations are less than 10,000 mg/l. To develop a salinity profile of the FAS, the SFWMD used the method devised by Archie in 1942, referred to as the "Archie Equation." Readers are referred to the original paper by Archie (1942) for an explanation and use of the equation. **Figure 11** shows the calculated formation water TDS log compared to measured TDS concentrations of water samples collected from the drill stem during drilling. The log-derived TDS values are used to show the 3,000 and 10,000 mg/l TDS concentration levels, a potential zone for ASR based on the TDS concentrations under Chapter 62-528 of the Florida Administrative Code (FAC). The top of the G-II aquifer starts at 1,430 feet bls. The base of the USDW, where the TDS concentration exceeds 10,000 mg/l, occurs around 1,660 feet bls. Although there are some minor sections where the log-calculated TDS spikes above 10,000 mg/l, these calculated numbers are not consistently above this value until below 1,660 feet bls. The TDS values collected from the drill stem while advancing the borehole do not show as much variation, probably due to mixing of water in the borehole. **Figure 11** also includes the TDS concentrations from the packer test intervals. These data points generally match the geophysical log derived TDS data and further confirm that mixing may have occurred with the drill stem data.

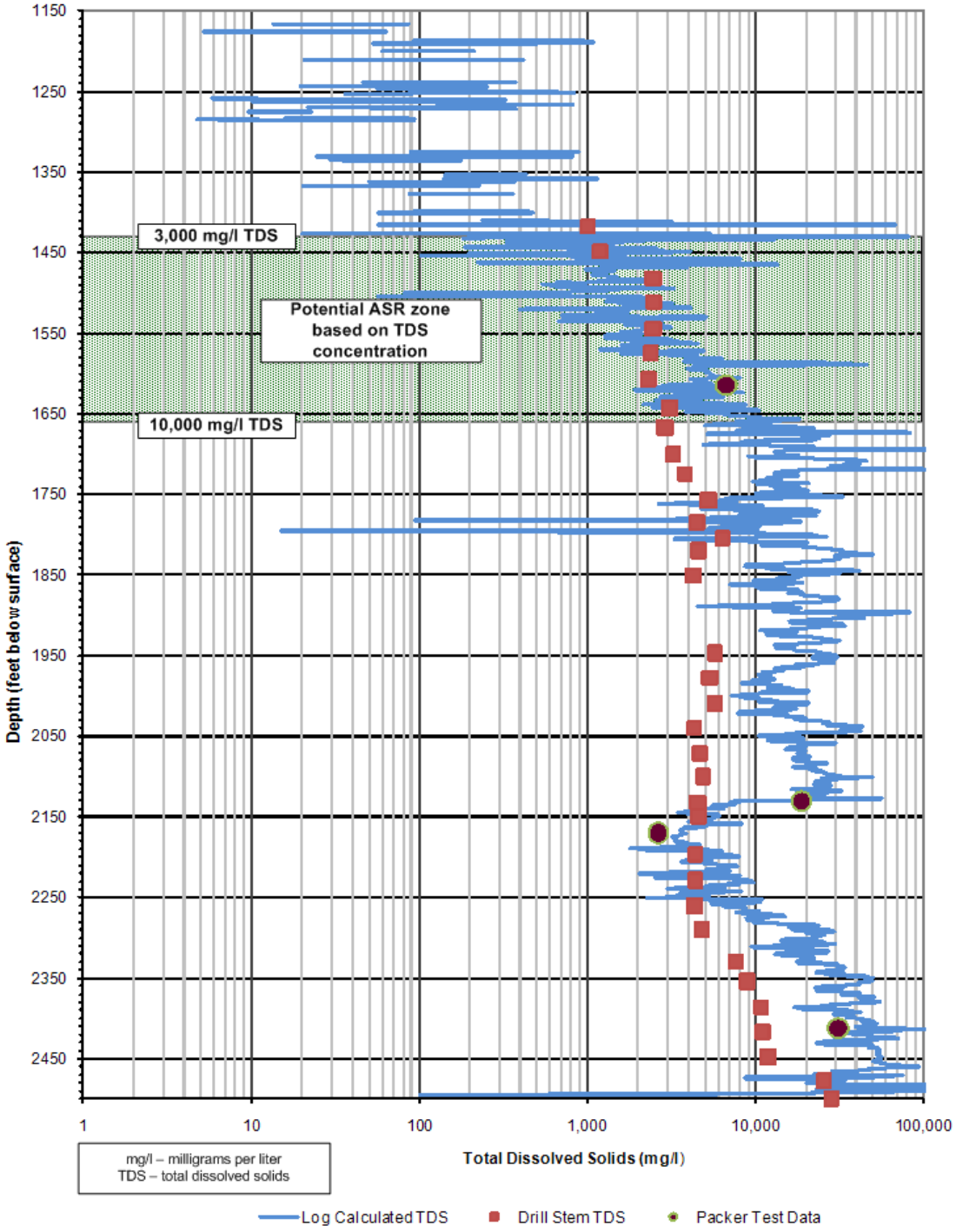


Figure 11. Calculated and drill stem TDS of the formation water, OKF-105.

5.1.4 OKF-105 Optical Borehole Image Log

The SFWMD contracted the USGS to run an OBI log (Advanced Logic Technology OBI40 tool) in the borehole. The OBI log generates a continuous, 360-degree image of the borehole and can orientate features such as fractures and bedding planes. One

limiting condition is that the water in the borehole needs to have a low turbidity. The nominal diameter of the borehole was kept to 8 inches in diameter to improve the quality of the image log.

The USGS ran an OBI log in OKF-105 on June 17, 2009. FDD allowed the borehole to flow for approximately 48 hours before the logging event per the SFWMD's request. The natural artesian flow in the well was approximately 700 gallons per minute (gpm), and flowing the well for 48 hours resulted in turbid-free water, allowing a high quality image. The borehole also flowed during the running of the OBI log to make sure the water remained clear.

The USGS ran the OBI log from 1,150 to 2,500 feet bls. The log showed the sedimentary layers, lithologic changes, secondary permeability features, and accessory minerals in detail. Sections where the depositional environment was low in energy are visible, as these sediments are fine grained and uniformly deposited. Some of the vugs between 1,520 and 1,640 feet bls may have been areas where gypsum and anhydrite were present at some time and later eroded away. These areas are seen as small cavities in the OBI log of similar shape to, but smaller than, the anhydrite and gypsum sections deeper in the borehole. Anhydrite and gypsum are visible in the lower sections of the borehole, and the rock type surrounding most of these mineral sequences is dolostone with numerous horizontal and vertical cracks. These sections are indicative of sabkha-type environments, where seawater washed over the area, became highly mineralized as it evaporated, leading to the formation of anhydrite and gypsum. The cracks surrounding the evaporite minerals are probably due to desiccation as evaporation continued and the area dried out. Other sections with anhydrite do not have the cracks, indicating that the formation of the evaporite minerals may have occurred in a different environment than the aforementioned sabkha conditions. The large fracture zones seen in the OBI log typically show smaller fractures above and below the major zone of fractures. Some of these smaller fractures are often vertical, indicating that karst conditions may have existed when the fractures formed on top of the limestone and eroded through it.

5.1.5 OKF-42 Geophysical Logging

The documentation of OKF-42 first appears in a publication by Shaw and Trost (1984) documenting the hydrogeology of the Kissimmee planning area. The well was listed as a SFWMD well in this report and was probably installed to supplement data for the United States Geological Survey's potentiometric mapping of the FAS. On April 15, 1982, the SFWMD ran a suite of geophysical logs in OKF-42. ABS ran a second suite of logs on October 1, 2008 that included a flow meter log and a video log, as these were not run in 1982. This second suite of logging took place during the second phase of well construction for OKF-105.

The caliper, natural gamma, resistivity, and fluid conductivity/resistivity logs from 1982 matched the set completed on October 1, 2008. In OKF-42, the caliper log did not show any distinctive features until 1,000 feet bls when a noticeable "kick" to the

right occurs, indicating a fracture or washout in the hole. Generally, the caliper log shows that the hole does not have many fractures or washouts. The natural gamma log showed little activity after encountering the rocks of the Ocala Limestone and Avon Park Formation. The resistivity log for OKF-42 differs from OKF-105, as it is uniform through the borehole. There is no section of harder rock near the bottom of the hole as there is in OKF-105, where drilling encountered a dolostone section. The fluid conductivity log shows that the conductivity of the water in the well is also uniform and ranges between 900 and 1,000 µS/cm. The flow meter log indicates a significant production zone for this well around 800 feet bls. The sonic log shows an area of higher porosity in this interval. Based on the geophysical logging and lithologic log, OKF-42 covers both the upper Floridan aquifer and the middle Floridan semi-confining unit. This well is not deep enough to penetrate the productive horizons of the APPZ. **Figure 12** is a lithologic and hydrogeologic profile of OKF-42.

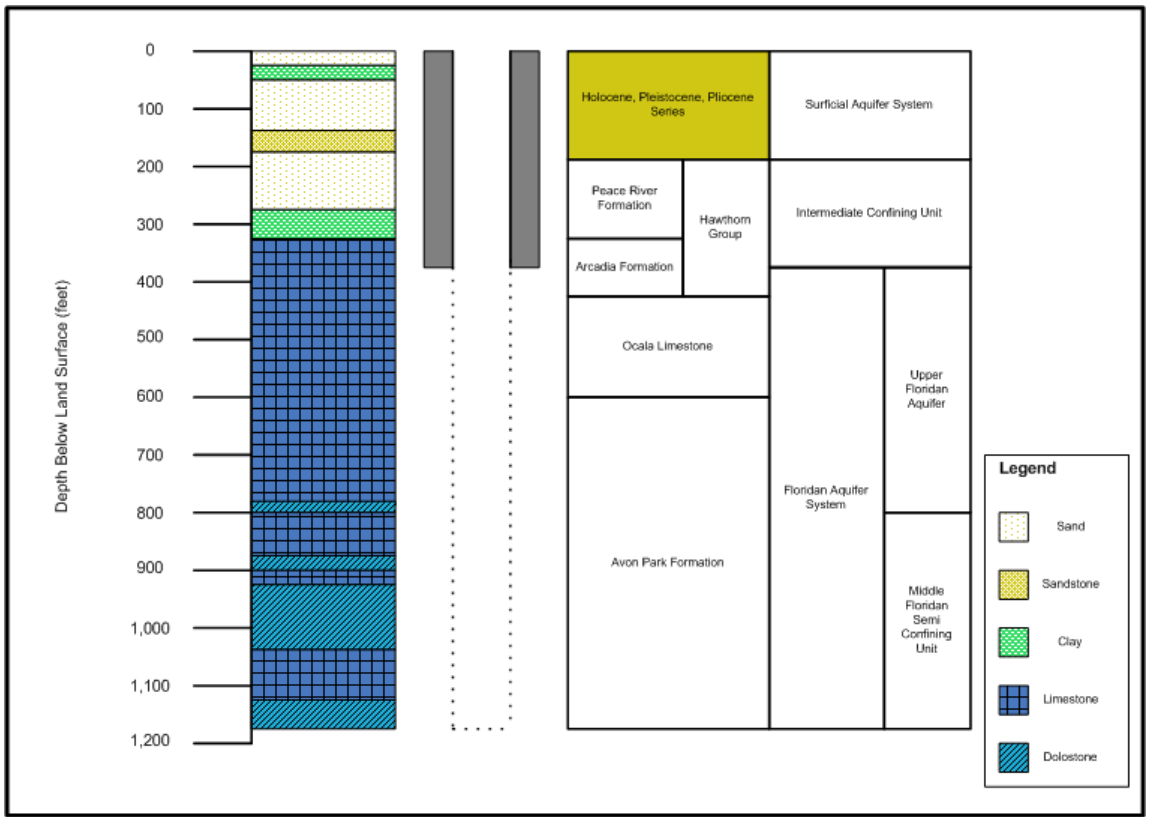


Figure 12. Geologic and hydrogeologic profile of OKF-42.

Appendix B contains the geophysical logs from OKF-105 and OKF-42 (from Phase II of this project), as well as copies of the original logs run in OKF-42 in 1982.

5.2 Rock Core Analysis

FDD collected two rock cores during the third phase of drilling. The first core came from the interval between 1,700 and 1,710 feet bls. This core was 10-feet long, and

the field description states it consisted of a tan to light brown, vuggy dolostone. The second core came from the interval between 2,100 and 2,115 feet bls. This core was 15-feet long, and the field analysis described it as a white mudstone with a few sections of packstone. The packstone section contained moldic to interclastic porosity. The SFWMD sent both cores to Core Laboratories (CL) in Midland, Texas, for thin section petrography and vertical permeability testing.

CL used the following methods to determine the listed characteristics of the cores.

- Porosity of the full diameter cores: direct pore volume measurement using Boyle's law helium expansion.
- Bulk volume: Archimedes' principle.
- Grain density: calculated using dry weight, bulk volume, and pore volume measurements.
- Intrinsic permeability: measured in two directions horizontally, and also vertically.
- Hydraulic conductivity: calculated using **Equation 1** (below).
- Thin sections and x-ray diffraction analysis to determine the mineralogy of the cores and the nature of the pore systems.

The results of the above-listed characteristics for both cores are presented in the CL report in **Appendix F**.

CL analyzed four sections from the 1,700 to 1,710 feet bls core interval. Porosity values for this interval ranged from 19.6% to 30.2%, confirming the vuggy nature of this core interval provided in the field description. The grain density of these core sections were fairly uniform ranging from 2.81 to 2.83 grams per cubic centimeter (gm/cc). The horizontal intrinsic permeability of these four sections ranged from 248 to 8,085 millidarcies (md), and the vertical intrinsic permeability ranged from 213 to 2,839 md. The calculated horizontal and vertical hydraulic conductivity values ranged from 38 to 1,241 feet per day (ft/day) and 33 to 436 ft/day, respectively. CL calculated the hydraulic conductivity values using the following equation. The hydraulic conductivity values were converted from meters per second to feet per day by CL.

$$K = (V + L)/(A + T + P) \qquad (\textit{Equation 1})$$

Where:

K = Hydraulic conductivity in meters per second

V = Incremental produced volume in cubic meters

L = Length in meters

A = Cross-sectional area of the core

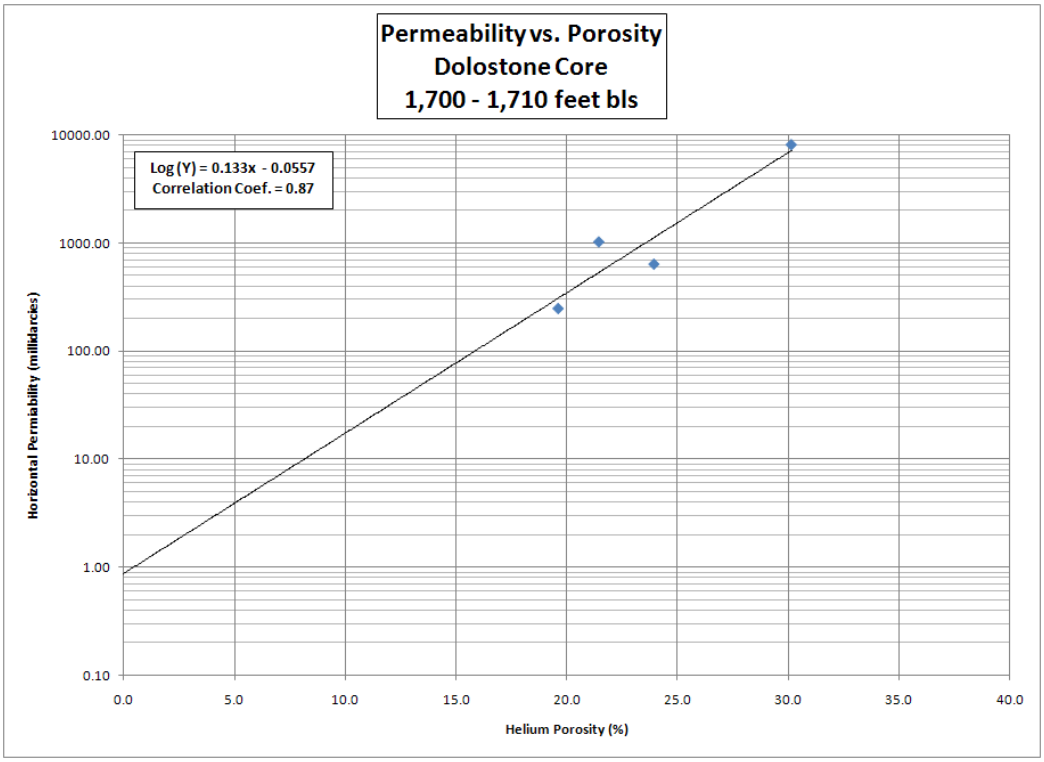
T = Incremental time in seconds

P = Differential pressure in meters of water

CL analyzed 11 sections from the 2,100 to 2,115 feet bls core interval. Porosity values for these intervals ranged from 16.1% to 32.7%, with the lower porosity occurring in a dolostone section of the core between 2,109 and 2,110 feet bls. The grain density of these core sections was fairly uniform, except for the dolostone section, ranging from 2.70 to 2.79 gm/cc. The horizontal intrinsic permeability of these 11 sections ranged from 3 to 213 md, and the vertical intrinsic permeability ranged from 2.5 to 125 md, confirming the lower permeability of this core compared to the shallower section. The calculated horizontal and vertical hydraulic conductivity values ranged from 0.4 to 33 ft/day and 0.4 to 19 ft/day, respectively.

In their report to the SFWMD, CL provided a cross plot of the measured porosity against horizontal intrinsic permeability of the core sections. The plot has a trend line intended to show the correlation between intrinsic permeability and porosity in the core sections. However, the plot contained data from both cores, which have different lithologic characteristics, so the correlation coefficient is low. CL calculated a correlation coefficient of 0.239 between the two data sets for all of the core data. A correlation coefficient of 1.0 suggests a strong relationship between two sets of data. Thus there is a weak relationship between the two complete data sets.

The SFWMD's staff created separate plots of the measured porosity against horizontal intrinsic permeability for the dolostone (1,700 to 1,710 feet bls) and limestone (2,100 to 2,115 feet bls), which yielded correlation coefficients of 0.87 and 0.53, respectively. The relationship between porosity and intrinsic permeability is strong in the dolostone core and inconclusive for the limestone core. **Figure 13** shows the porosity versus intrinsic permeability cross plots for both the dolostone and limestone cores.



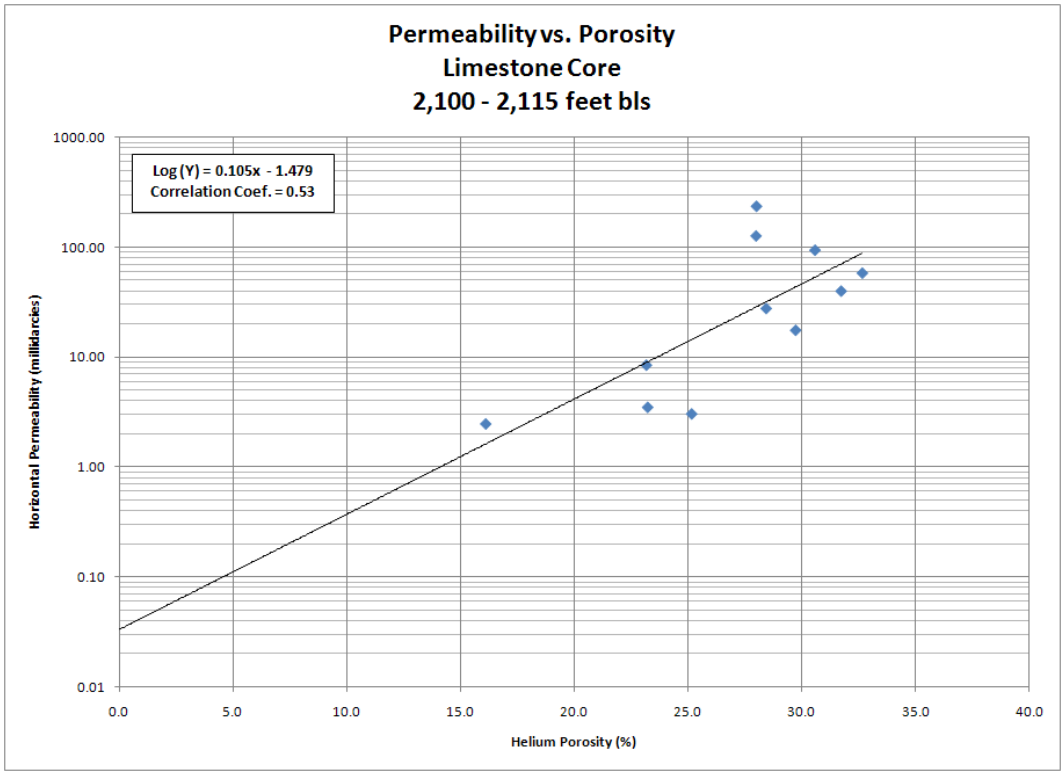


Figure 13. Porosity versus intrinsic permeability cross plots for dolostone and limestone cores.

CL shipped sections of both cores to Houston, Texas, for thin-section preparation and description and X-ray diffraction (XRD) analysis. Fifteen samples from both cores underwent these analyses, as well as four sections from the dolostone core, and eleven from the limestone core. CL used Alizarin Red-S to distinguish between calcite (stains red) and dolomite (stains blue or purple) in the thin section samples. Core samples submitted for XRD were prepared as described in CL's report (**Appendix F**) and analyzed using a Scintag or Phillips automated powder diffractometer with a copper source and a solid state or scintillation detector.

Analysis of the core from 1,700 to 1,710 feet bls showed that dolomite was the primary mineral. CL noted some pyrite in the thin sections and determined that it was present before dolomitization took place. The coarse dolomite crystals in the samples and the preservation of the original depositional rock fabric indicated that dolomitization took place slowly, according to CL, and was a result of meteoric water/seawater interaction. The primary pore types, under the Choquette and Pray (1970) classification system, are moldic and vuggy. The depositional environment, according to the CL report, appears to have been high energy on a open, shallow carbonate shelf.

Analysis of the core from 2,100 to 2,115 feet bls showed that calcite was the primary mineral for the upper 10 feet of the core. Dolomite becomes dominant in the bottom five feet of the core, although there is still a substantial (30%) calcite component. The primary pore types in this core are inter- and intra-granular, with some sections of moldic and vuggy porosity. The depositional environment, according to the CL report, appears to have been a low energy, subtidal carbonate shelf.

A copy of the CL reports along with photographs of the cores are included in **Appendix F.**

5.3 Water Quality and Inorganic Chemistry

This section presents the water quality data collected during the construction and testing of OKF-105. Data include the results of samples collected during aquifer and packer testing, drill stem testing, and sampling from the completed intervals.

5.3.1 Drill Stem Water Quality Sampling

During the third phase of well construction, the SFWMD collected water quality samples approximately every 30 feet during reverse-air drilling. After reaching the end of a drilling rod, FDD circulated the borehole to remove rock cuttings. Once the water was clear (no suspended solids), the SFWMD collected a water sample in a clean five gallon bucket and screened the water in the field with a calibrated YSI 6920 multi-parameter probe for pH, temperature, and specific conductance. After collecting the field parameter measurements, the SFWMD's hydrogeologists collected water quality samples for chloride, sulfate, and TDS analysis. The TDS samples were filtered in the field with a 0.45 micron (μm) filter at the time of

collection. All samples were placed in a cooler, on ice, and delivered to the SFWMD's water quality laboratory for analysis.

Figure 14 is a plot showing the distribution of TDS with depth as drilling advanced from 1,400 to 2,500 feet bls.

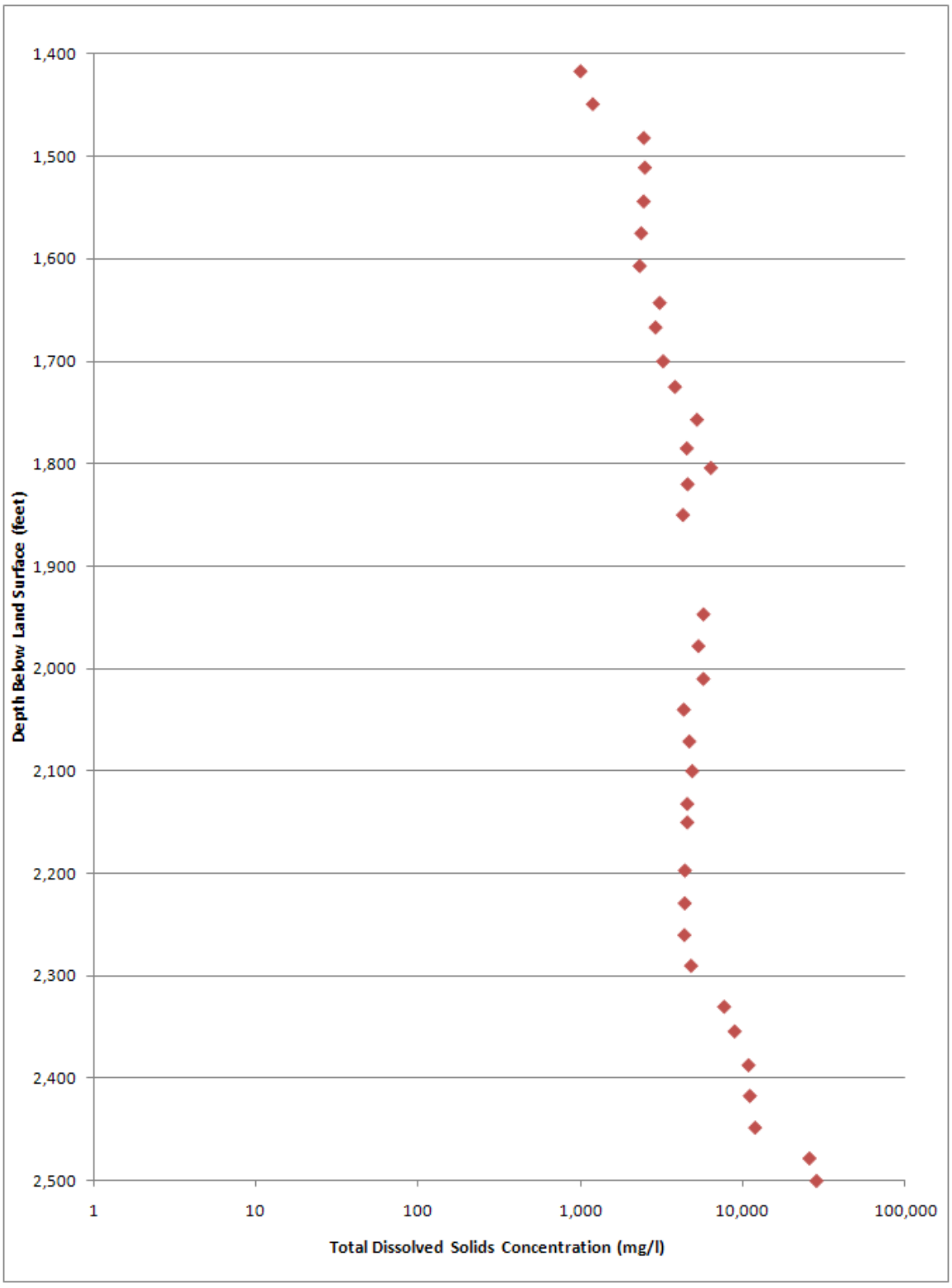


Figure 14. OKF-105 TDS data from drill stem water quality samples.

Figure 14 shows a slight increase in the TDS concentration around 1,480 feet bls, below the second major flow zone in the borehole. The dominance of this flow zone

and the shallower one at 1,425 feet bls, corresponding to the APPZ, is noted by the fact that the TDS concentration remains fairly constant from this point until 2,300 feet bls, where it starts to increase. The drill stem TDS values show less variability than the geophysical log derived TDS shown in **Figure 11**. The lack of variability in the drill stem TDS values is probably due to mixing of water from different zones in the borehole during reverse-air drilling. The geophysical log derived TDS values probably provide a more accurate location of the 3,000 and 10,000 mg/l TDS lines. The TDS concentrations of the water samples collected during packer testing confirm this.

Figure 15 is a plot showing the concentrations of chloride and sulfate ions with depth, collected every 30 feet from the drill stem sampling.

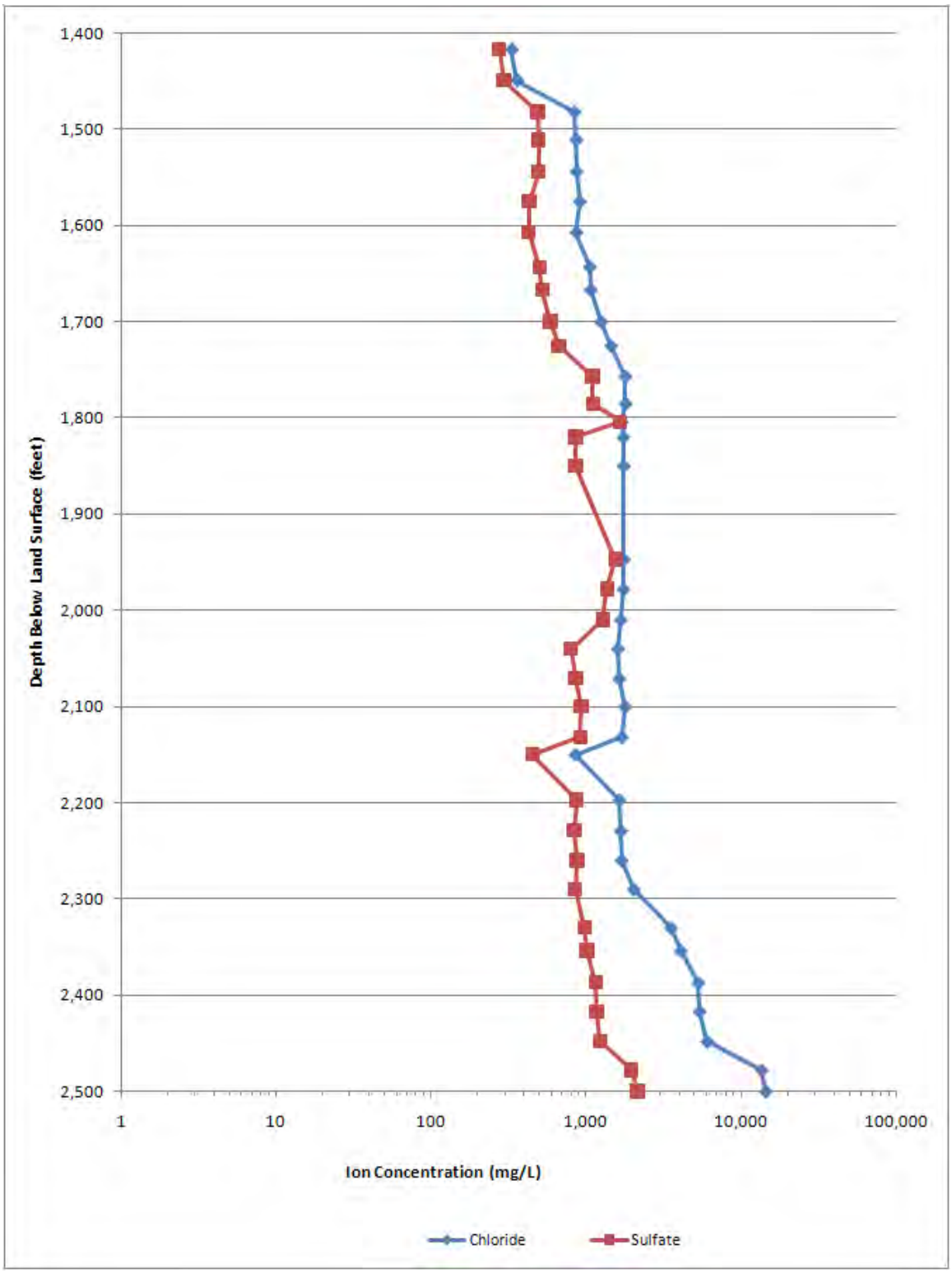


Figure 15. OKF-105 laboratory chloride and sulfate concentrations with depth.

There are two areas of interest in **Figure 15**: one around 1,750 to 1,800 feet bls and the other around 2,150 feet bls. Between 1,750 and 1,800 feet bls there is a spike in the sulfate concentration. It is in this area that evaporite minerals first appeared in

the drill cuttings, which may have resulted in the increase in sulfate concentration. The second area of interest occurs around 2,150 feet bls, in the lower Floridan aquifer. In this area, there is a decrease in both the sulfate and chloride ion concentrations. This zone of fresher water is also seen in **Figure 11**, the calculated TDS concentration from the dual induction log.

Figure 16 is a plot of the fluid conductivity log plotted with the specific conductance data collected during drilling. The data for both logs are in μS/cm. The fluid conductivity log represented the well under static (no artesian flow) conditions. The SFWMD's staff collected the specific conductance data at the end of each drill rod during drilling. During the collection, the well was flowing naturally, and mixing probably occurred in the borehole because of the reverse air circulation drilling method.

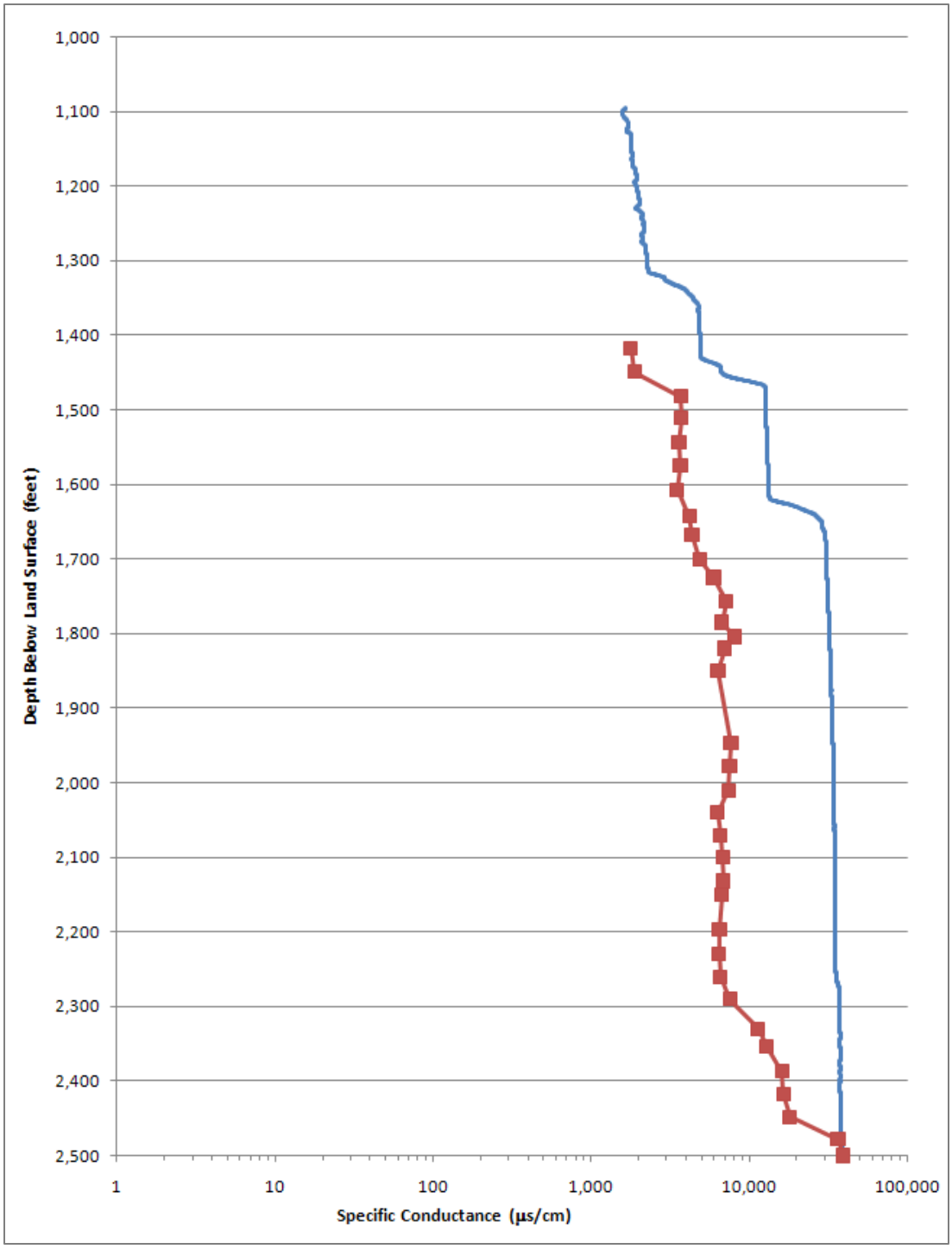


Figure 16. Geophysical log: fluid conductivity log and drill stem conductivity data with depth for OKF-105.

In **Figure 16**, a water quality change around 1,450 feet bls is seen in both data sets. There is a noticeable increase in specific conductance data at this interval, corresponding with the high flow zones of the APPZ. The first production horizon in the lower Floridan aquifer occurs around 1,625 feet bls and is identified by an

increase in specific conductance on the fluid conductivity log. There appears to be a lag of approximately 100 feet before this increase is detected in the drill stem water quality data. This lag can be attributed to mixing of water in the borehole from reverse air drilling.

5.3.2 Water Quality During Aquifer Testing

This section presents the water quality data collected during the 24-hour, single well aquifer test completed during the second phase of well construction. The SFWMD contracted Tetra Tech EC, Inc. (Tetra Tech) from Stuart, Florida, to collect the water quality samples. Tetra Tech personnel collected the sample on October 31, 2008, approximately 20 hours into the aquifer test following the FDEP quality assurance/quality control (QA/QC) protocols. Jupiter Environmental Laboratories, Inc. (JEL) analyzed the samples for total anions, total cations, and TDS. The results are shown in **Table 6** and a copy of the laboratory report is included in **Appendix G**.

Table 7. Aquifer test water quality data, OKF-105, 1,150 to 1,400 feet bls.

FIELD DATA AND TDS					
Date	**Interval (feet bls)**	**pH**	**Temperature (°C)**	**Specific Conductance (µS/cm)**	**Total Dissolved Solids (mg/l)**
10/31/2008	1,150 - 1,400	7.85	28.41	1045	670

ANIONS						
Date	**Interval (feet bls)**	**Alkalinity (mg/l)**	**Chloride (mg/l)**	**Flouride (mg/l)**	**Sulfate (mg/l)**	**Bromide (mg/l)**
10/31/2008	1,150 - 1,400	80	140	BDL	190	BDL

CATIONS						
Date	**Interval (feet bls)**	**Sodium (mg/l)**	**Potassium (mg/l)**	**Calcium (mg/l)**	**Magnesium (mg/l)**	**Total Dissolved Strontium (mg/l)**
10/31/2008	1,150 - 1,400	74	1.5	27	35	23

Notes:
bls below land surface
°C degrees Celsius
µS/cm microsiemens per centimeter
mg/l milligrams per liter
BDL below detection limit

The data in **Table 7** were plotted on a Piper trilinear diagram (Piper 1944) and appear as small red circles in **Figure 17**. Frazee (1982) developed a method of determining the origin of water in the Floridan aquifer when plotted on a Piper trilinear diagram using an overlay pattern. The Frazee overlay pattern, when placed on **Figure 17**, shows that the groundwater collected from the 1,150 to 1,400 foot zone in OKF-105 is connate water. Connate water is seawater that was trapped in a sedimentary formation around the time of its deposition (Hem 1985). Frazee (1982) describes this type of water as highly mineralized fresh water, with a high TDS concentration, and dominated by calcium sulfate. **Figure 17** shows how the water quality data from the aquifer test relate to the Frazee overlay.

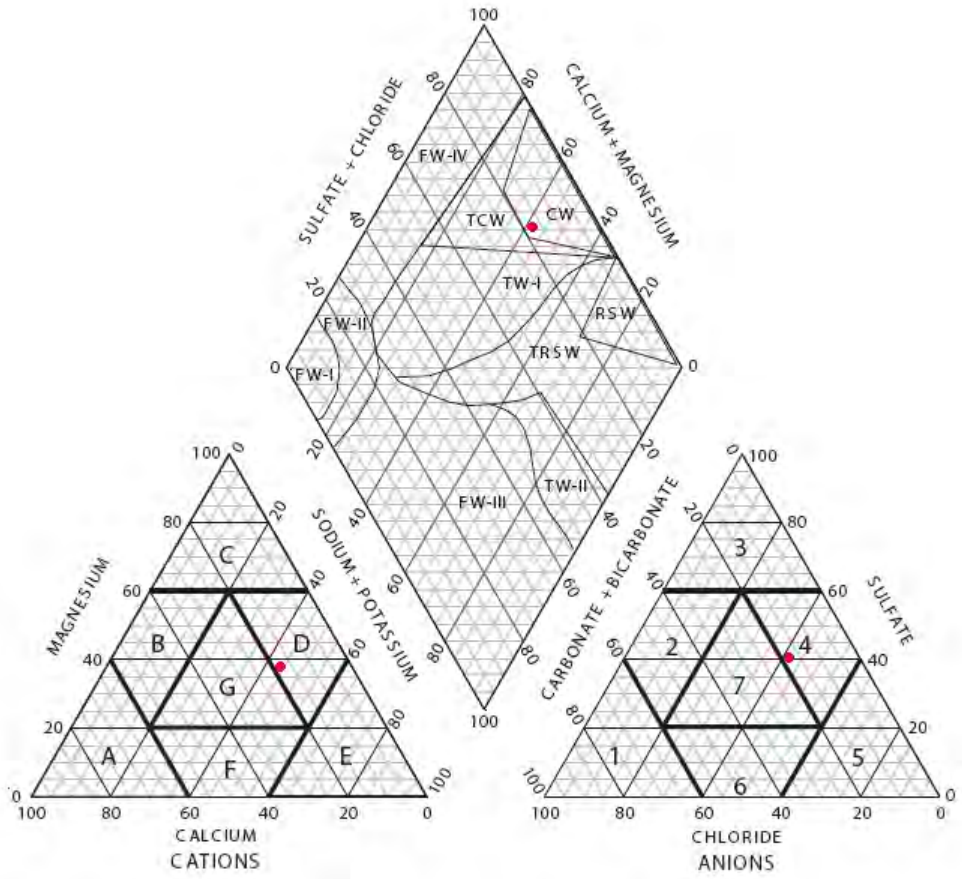


Figure 17. Classification of aquifer test water quality data in OKF-105.

Table 8 provides a brief description of the different water types determined by Frazee and present in **Figure 17**.

Table 8. Description of Frazee water types.

Abbreviation	Description	Characteristics
FW-I	Fresh Recharge Water Type I	Rapid infiltration through sands, high calcium bicarbonate ($CaHCO_3$).
FW-II	Fresh Recharge Water Type II	Infiltration through sands and clay lenses, $CaHCO_3$ with sodium (Na), sulfate (SO_4), and chloride (Cl).
FW-III	Fresh Recharge Water Type III	Infiltration through clay-silt estuarine depositional environment, high sodium bicarbonate ($CaHCO_3$).
FW-IV	Fresh Recharge Water Type IV	Fresh water, low calcium (Ca), magnesium (Mg), sulfate (SO_4), and chloride (Cl).
TW-I	Transitional Water Type I	Seawater begins to dominate source water; chloride (Cl) begins to dominate bicarbonate (HCO_3) with increasing NaCl percentage.
TW-II	Transitional Water Type II	Transitional water with source water still dominant, $HCO_4 – SO_4$ mixing zone with increasing chloride (Cl).
TCW	Transitional Connate Water	Connate water dominates source water, sulfate (SO_4) begins to dominate HCO_3 with increasing chloride (Cl).
TRSW	Transitional Seawater	Transitional water with seawater dominating source water.
CW	Connate Water	Highly mineralized fresh water with high TDS and $CaSO_4$ dominance.
RSW	Relict Seawater	Unflushed seawater with NaCl .

Stiff (1951) developed a method of plotting water quality data to compare water samples. This technique uses four parallel axes extending beyond zero, the single vertical axis. Milliequivalents of each cation plot on the left side of the vertical axis and milliequivalents of each anion plot on the right. **Figure 18** is a Stiff plot for the water quality sample collected during the single well aquifer test in OKF-105. The plot confirms the water quality seen in the Piper trilinear diagram, with sodium, magnesium, chloride, and sulfate being the dominant ions in this sample.

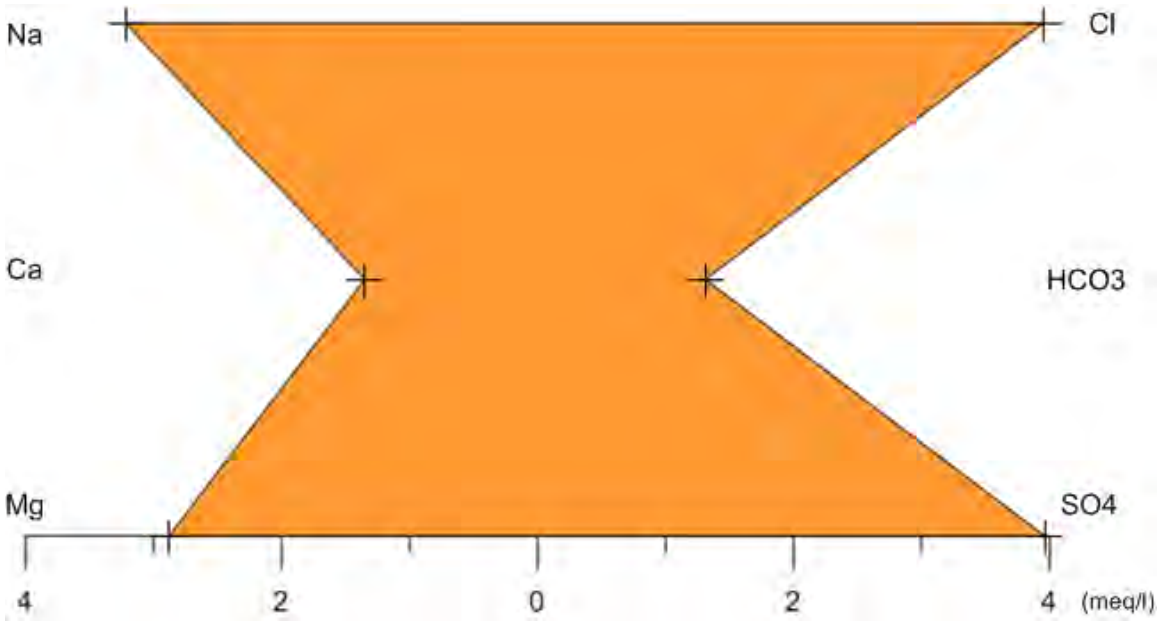


Figure 18. Stiff plot for the aquifer test water quality data (OKF-105), 1,150 to 1,400 feet bls.

5.3.3 Water Quality Testing During Packer Testing

This section presents the water quality data collected during the four packer tests completed during the third phase of well construction. The SFWMD's hydrogeologists collected water quality samples after one hour of pumping, and transported them in an ice filled cooler to the SFWMD's water quality laboratory for analysis. The SFWMD analyzed these samples for total anions, total cations, and TDS. Columbia Analytical Services (CAS) analyzed the samples for bromide. **Table 9** presents the results for the packer test sampling, and copies of the CAS laboratory reports for bromide are included in **Appendix H**.

Table 9. OKF-105 Packer test water quality data.

FIELD DATA AND TDS						
Packer Test Number	Date	Interval (feet bls)	pH	Temperature (°C)	Specific Conductance (µS/cm)	Total Dissolved Solids (mg/l)
1	06/19/09	2,412-2,472	7.13	30.98	47,223	31,033
2	06/23/09	2,170-2,230	6.74	30.67	3,210	2,644
3	06/24/09	1,614-1,674	6.38	29.99	10,931	6,681
4	07/24/09	2,130-2,251	6.65	31.19	27,668	18,836

ANIONS							
Packer Test Number	Date	Interval (feet bls)	Alkalinity (mg/l)	Chloride (mg/l)	Fluoride (mg/l)	Sulfate (mg/l)	Bromide (mg/l)
1	06/19/09	2,412-2,472	109	17,502	0.12	2,439	80
2	06/23/09	2,170-2,230	68	708	0.46	380	2
3	06/24/09	1,614-1,674	89	3,193	0.65	722	14
4	07/24/09	2,130-2,251	42	8,783	-	2,358	36

CATIONS							
Packer Test Number	Date	Interval (feet bls)	Sodium (mg/l)	Potassium (mg/l)	Calcium (mg/l)	Magnesium (mg/l)	Total Dissolved Strontium (mg/l)
1	06/19/09	2,412-2,472	9,200	329	589	1,049	19.6
2	06/23/09	2,170-2,230	366	11	136	85	23.2
3	06/24/09	1,614-1,674	1,681	56	239	240	27.4
4	07/24/09	2,130-2,251	4,890	180	1,067	419	21.0

Notes:
bls below land surface
°C degrees Celsius
µS/cm microsiemens per centimeter
mg/l milligrams per liter
BDL below detection limit

The data in **Table 9** were plotted on a Piper trilinear diagram (Piper 1944) and the result appears as colored dots in **Figure 19**. The samples are identified in the legend by packer test number. Frazee (1982) developed a method of determining the origin of water plotted on a Piper trilinear diagram using an overlay pattern. As described in **Section 5.3.1**, the Frazee overlay patterns, when placed on a Piper trilinear diagram, show the groundwater types for the packer test data. The water from packer tests 1, 3, and 4 lie in the relict seawater area on the overlay. Frazee (1982) describes this type of water as unflushed seawater with sodium chloride. The water from packer test 2 lies in the connate water area of the overlay. Frazee (1982)

describes this water type as highly mineralized fresh water with high TDS and calcium sulfate dominance. The lithologic and hydrogeologic conditions agree with this description, as the packer test 2 was in a zone of low hydraulic conductivity. The OBI log showed very tight, laminated layers of dolostone and limestone with very few vugs. The water quality (TDS) derived from the induction log indicated that the water in the packer test 2 zone was fresher than the over and underlying areas (see **Figure 11**.) **Figure 19** shows how the water quality data from the aquifer test relates to the Frazee overlay. **Table 8** provides a description of the water types on the overlay.

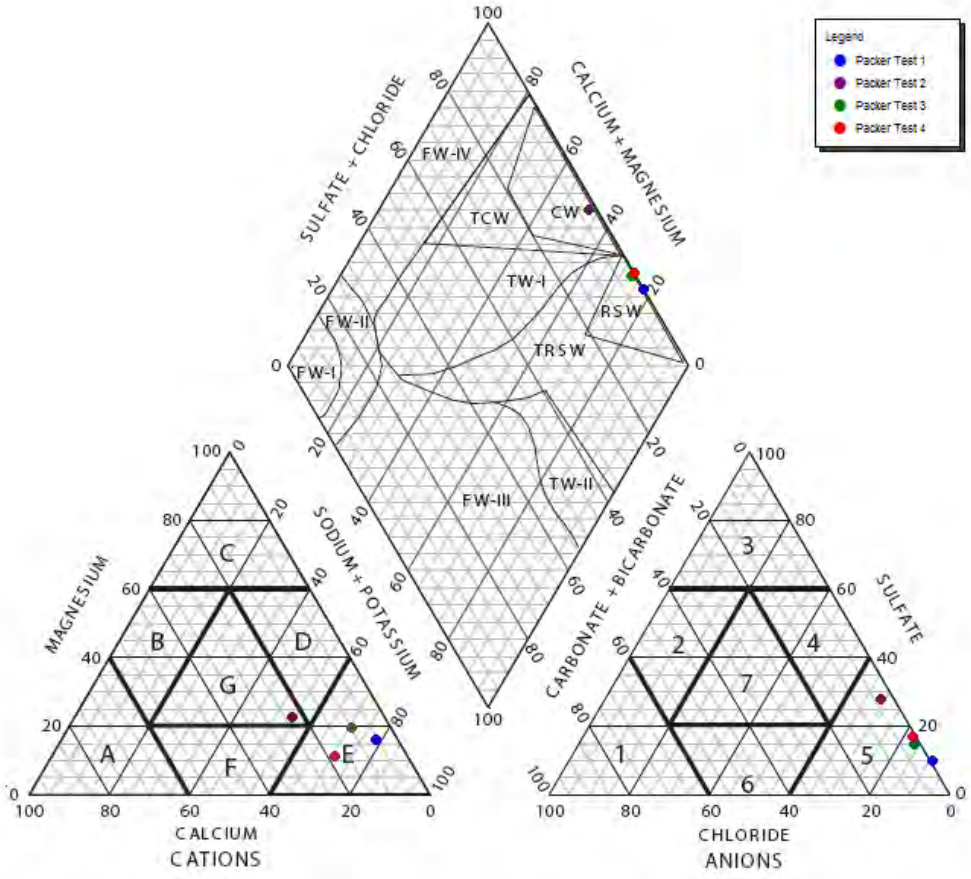


Figure 19. Classification of packer test water quality data, OKF-105.

Figure 20 shows Stiff plots for the packer-test water quality samples. The plots generally confirm the different water quality origins seen in the Piper trilinear diagram (**Figure 19**). The Stiff plots for packer tests 1, 3, and 4 have a similar pattern, indicating water of a similar composition. The plot for packer test 2 has a different shape compared to the other plots, showing a different composition. Not only are the ionic concentrations lower in packer test 2, but calcium also is a larger component. Although packer tests 2 and 4 cover a similar zone in the well, the interval for packer test 4 was greater than for packer test 2. Packer test 2 covered the interval from 2,130 to 2,230 feet bls, while packer test 4 covered the completed lower monitor zone of the well from 2,130 to 2,251 feet bls. Thus the water composition from packer test 4 differs from packer test 2 because the tested interval

covers a deeper zone that had a different water quality. As a result, the Stiff diagrams for the two tests are different due to mixing of water from the deeper zone in packer test 4.

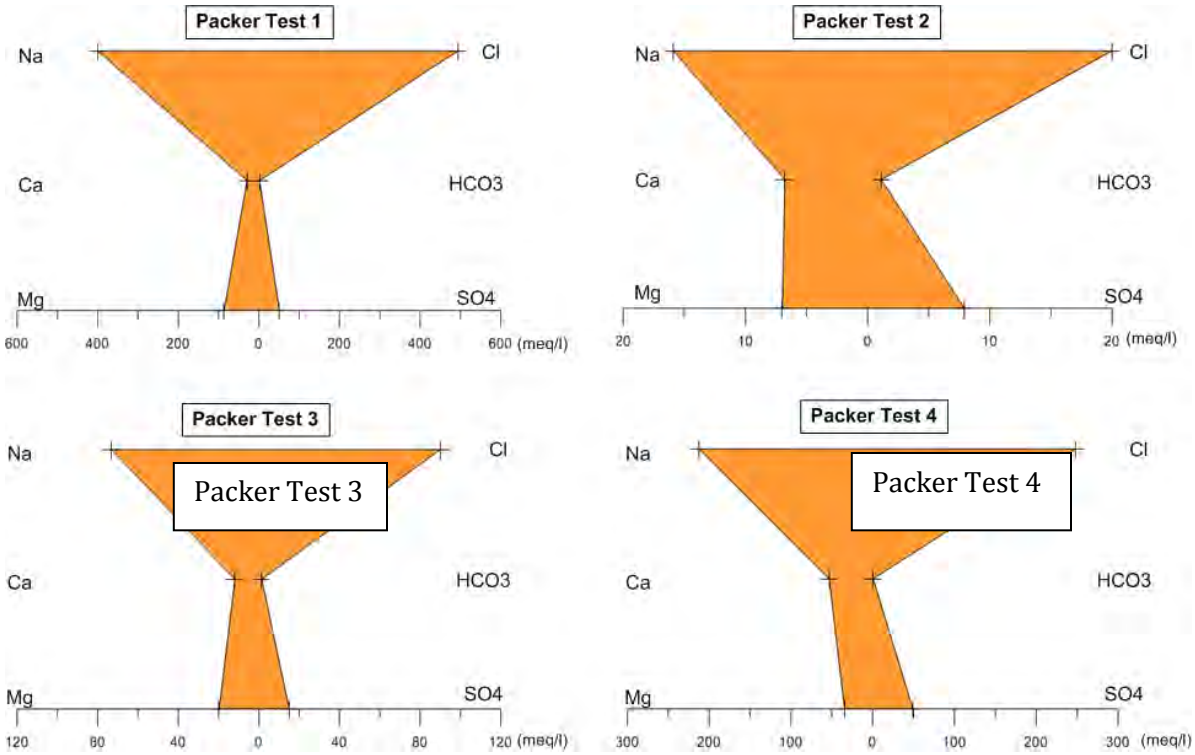


Figure 20. Stiff plots for the packer test water quality data, OKF-105.

5.3.4 Water Quality Testing From Completed Monitor Zones

This section presents the water quality data collected from the final monitoring intervals in OKF-105. The SFWMD's hydrogeologists collected the water quality samples from the upper and middle zones on December 12, 2009. The water quality sample from the packer test completed on the final string of well casing represented the lower monitor interval. At the time of the December 12, 2009 sampling event, the pH of the final monitor zone was high, indicating the cement plug at the bottom of the well affected the water in the well. Purging the well sufficiently to return the well to it ambient conditions was difficult, as this zone has a very low permeability. High pH was initially a problem in all three monitor zones, but the higher artesian flow rate in the upper and middle zones allowed the SFWMD's staff to purge the well sufficiently to restore the water to its natural quality. Before collecting the water quality samples, the SFWMD's hydrogeologists screened the water from each zone with a calibrated YSI 6920 multiparameter probe to ensure that the water quality was stable and that the pH had returned to ambient levels. Once three consecutive readings were stable (within 5% of the previous reading), the SFWMD collected the water quality samples and placed them in a cooler with ice. The SFWMD analyzed these samples for total anions, total cations, and TDS. CAS analyzed the samples for

bromide. **Table 10** presents the results for this sampling, and copies of the CAS laboratory reports for bromide are included in **Appendix H**.

Table 10. Final monitor zone water quality data, OKF-105.

FIELD DATA AND TDS							
Monitor Zone	**Interval (feet bls)**	**Date**	**pH**	**Temperature (°C)**	**Specific Conductance (µS/cm)**	**Total Dissolved Solids (mg/l)**	**Hardness (mg/l)**
OKF-105U	373 – 525	12/10/09	7.6	26.2	2,818	1,473	188
OKF-105M	1,150 – 1,468	12/10/09	7.8	28.8	2,444	1,495	623
OKF-105L	2,130 – 2,251	7/24/09	6.7	31.2	27,668	18,836	4,388

ANIONS							
Packer Test Number	**Interval (feet bls)**	**Date**	**Alkalinity (mg/l)**	**Chloride (mg/l)**	**Fluoride (mg/l)**	**Sulfate (mg/l)**	**Bromide (mg/l)**
OKF-105U	373 - 525	12/10/09	233	729	1.0	0	0.38
OKF-105M	1,1,50 – 1,468	12/10/09	79	495	0.4	343	1.7
OKF-105L	2,130 – 2,251	7/24/09	42	8,783	BD	2,358	36

CATIONS							
Packer Test Number	**Interval (feet bls)**	**Date**	**Sodium (mg/l)**	**Potassium (mg/l)**	**Calcium (mg/l)**	**Magnesium (mg/l)**	**Total Dissolved Strontium (mg/l)**
OKF-105U	373 - 525	12/10/09	504	8	28	29	11
OKF-105M	1,150 – 1,468	12/10/09	258	7	128	74	21
OKF-105L	2,130 – 2,251	7/24/09	4,890	180	1,067	419	21

Notes:
bls below land surface
°C degrees Celsius
µS/cm microsiemens per centimeter
mg/l milligrams per liter
BDL below detection limit

The data in **Table 10** were plotted on a Piper trilinear diagram (Piper 1944) with the Frazee (1982) water types, and the results appear as colored dots in **Figure 21**. The samples are identified by the monitor zone in the legend in **Figure 21**.

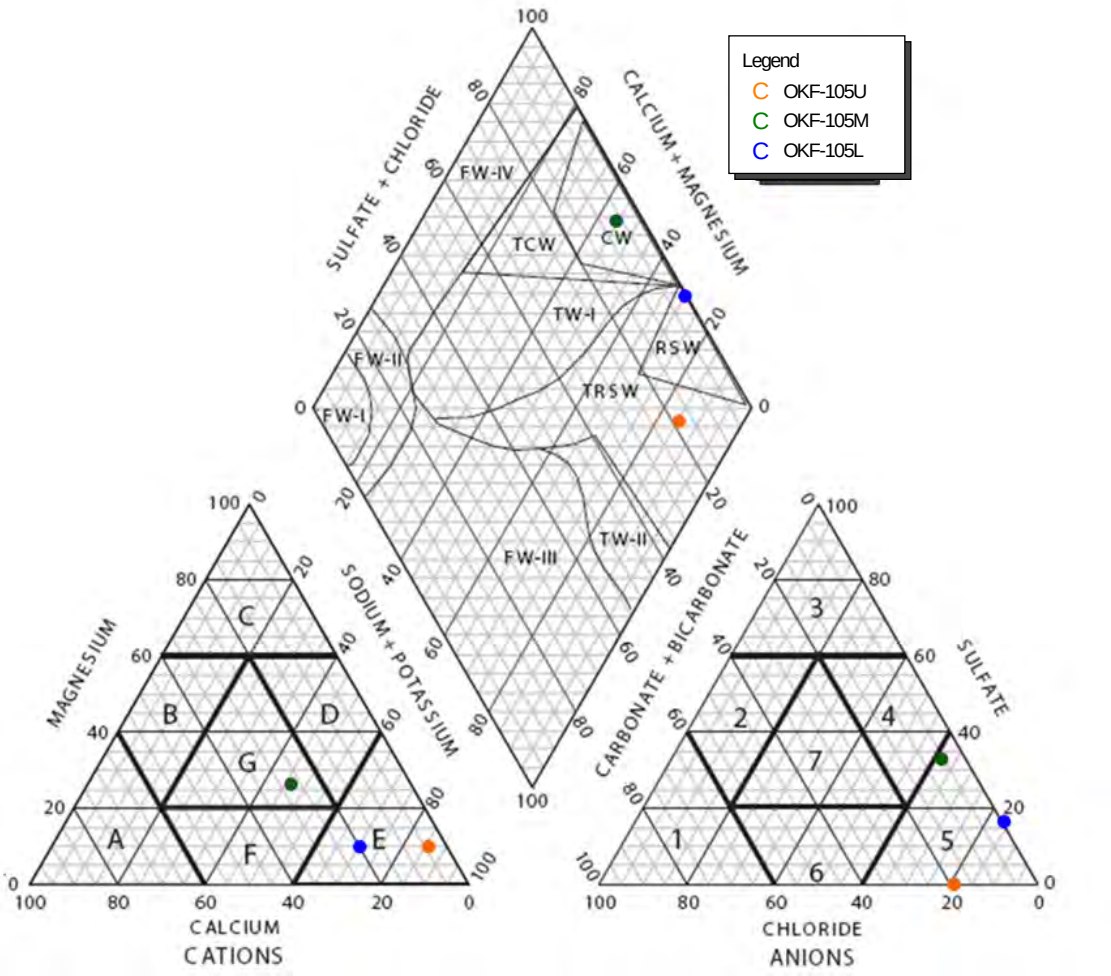


Figure 21. Piper trilinear diagram for the final monitor zones data, OKF-105.

The water from the upper monitor zone in OKF-105 is classified as transitional relict seawater. Frazee (1982) describes this type of water as transitional water with seawater dominating the source water. In other words, the water that originally recharged the aquifer is mixing with seawater that laterally invaded the aquifer in the past. The water from the middle monitor zone lies in the connate water area of the overlay. The characteristic of this water type is highly mineralized fresh water with high TDS and calcium sulfate dominance. The lower monitor zone has a water quality classed as relic seawater. Frazee (1982) classifies this water type as unflushed seawater with sodium chloride.

Figure 22 shows Stiff plots for the water quality samples for the three final monitor zones in OKF-105. The plots confirm the water quality seen in the Piper trilinear diagram. The Stiff plot for the upper monitor zone has a low concentration of dissolved ions, but sodium and chloride dominate, showing the change from transitional water to seawater. The plot for the middle monitor zone is similar to the upper zone except it has higher calcium, magnesium, and sulfate concentrations,

which differs from transitional relic seawater. The higher calcium concentration and the presence of sulfate distinguishes connate water from transitional relict seawater. The occurrence of connate water in the formation could indicate that there is low groundwater circulation, thus it has not been flushed from the formation. The lower monitor zone is highly mineralized, and sodium and chloride dominate. The size of the lower zone Stiff plot is larger than the ones for the upper and middle monitor zones, indicating a much higher concentration of dissolved ions.

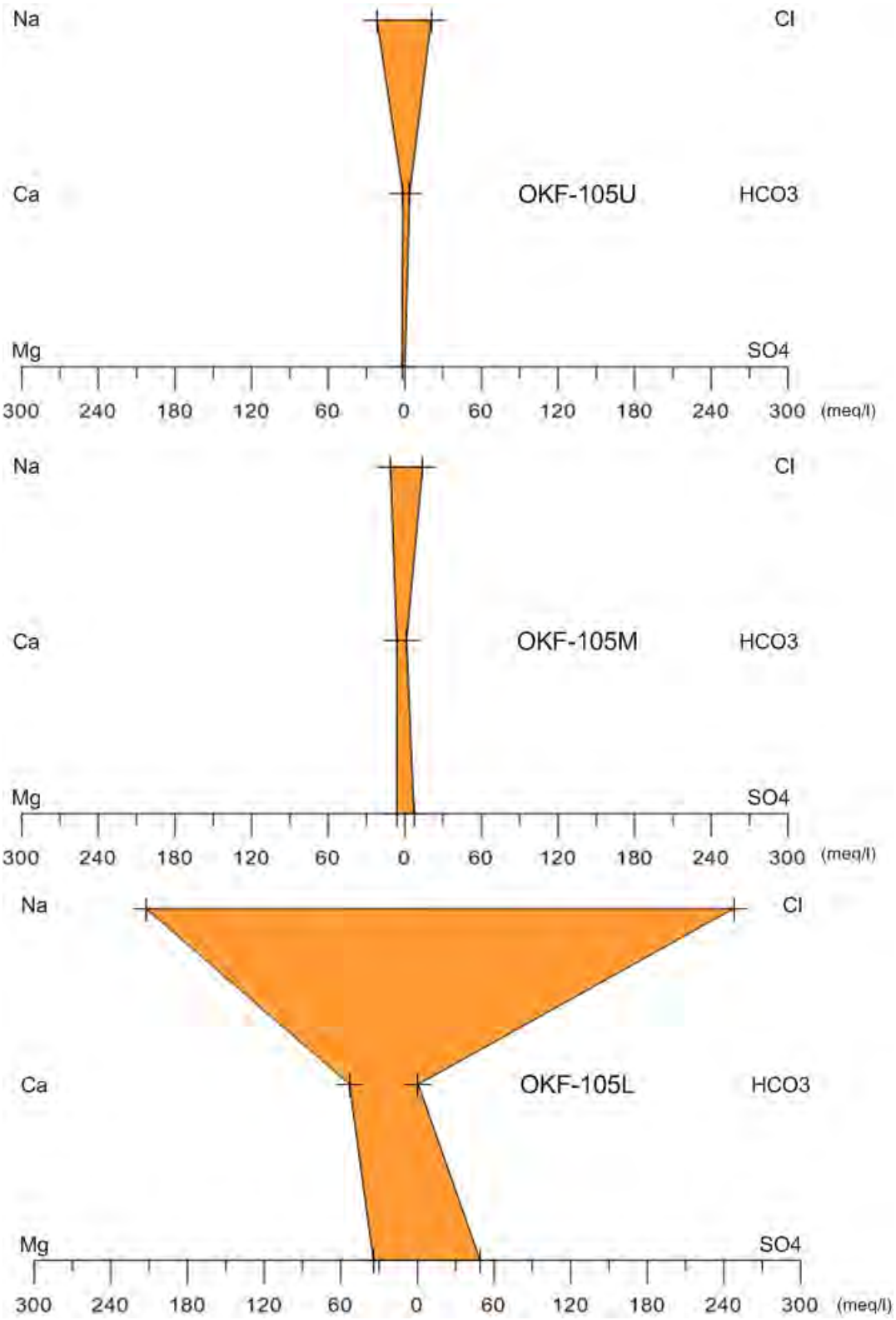


Figure 22. Stiff plots for the final monitor zones, OKF-105.

5.4 Aquifer Performance Testing

The SFWMD's staff ran a constant-rate APT after completing the second phase of OKF-105. This APT involved pumping the open-hole section of the well (1,150 to 1,400 feet bls) and monitoring water levels in both the upper (372 to 525 feet bls) and middle (1,150 to 1,400 feet bls) zones of OKF-105 and the adjacent well OKF-42, located 597 feet to the southwest, as seen in **Figure 23**. The purpose of this test was to determine the hydraulic parameters of the Floridan aquifer between 1,150 and 1,400 feet bls in OKF-105 and to see if the pumping would influence OKF-42. The drawdown phase of the APT started on October 30, 2008, and ran for 24 hours. The recovery phase started on October 31, and lasted until November 3, 2008.

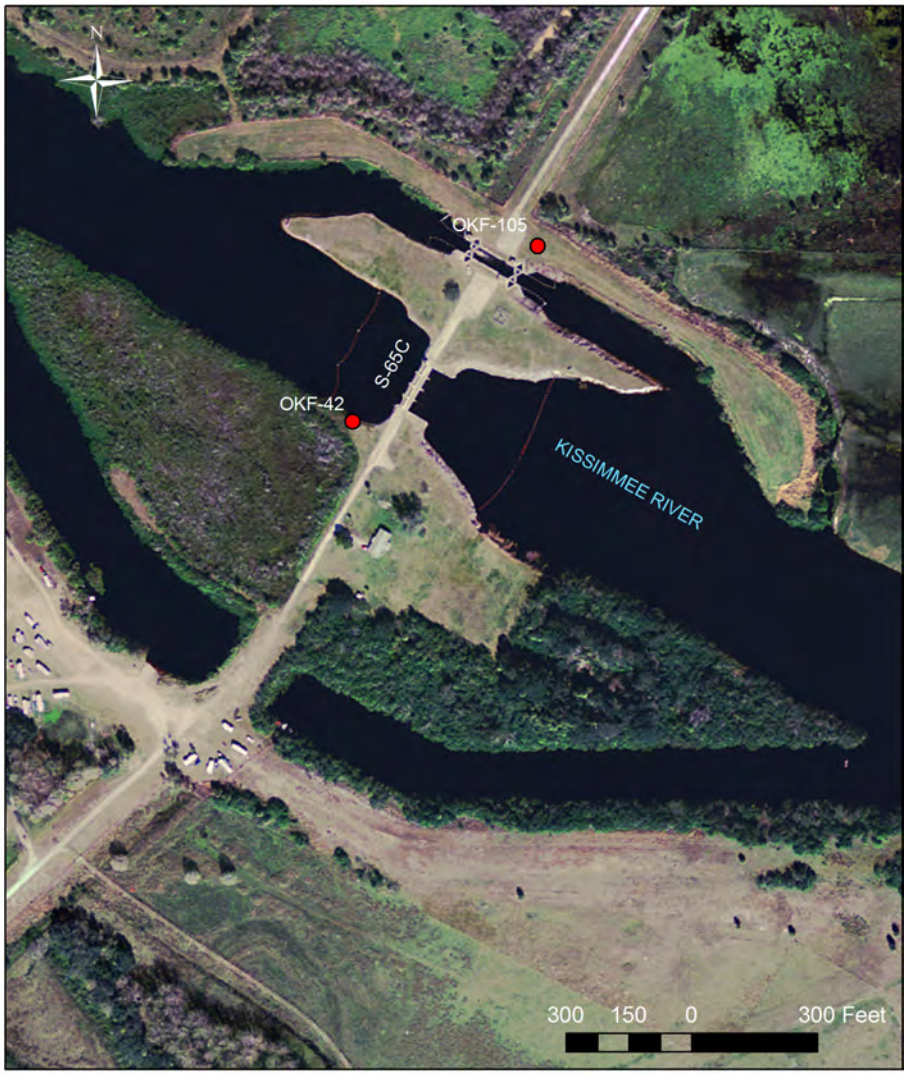


Figure 23. Layout of monitor and production wells at the S65C Site.

During all phases of this APT, the SFWMD's staff used an In-Situ Inc. Hermit® 3000 data logger connected to In-Situ Inc. PXD-261 pressure transducers to collect water

level data in both monitor zones of OKF-105. Since OKF-42 was on the opposite bank of the Kissimmee River, an In-Situ Inc. Level TROLL® 700, a stand-alone instrument, collected the water level data in this well before, during, and after the APT.

5.4.1 Background Water Level Data

The SFWMD collected background water level in OKF-42 before the APT, as the well drilling contractor was removing drilling tools and setting a pump in OKF-105. The data logger collected background data every 15 minutes for approximately two weeks starting on October 16, 2008. **Figure 24** shows the water level fluctuations during the background monitoring period. These data allowed the SFWMD to determine the barometric efficiency of the FAS monitor zones for this APT.

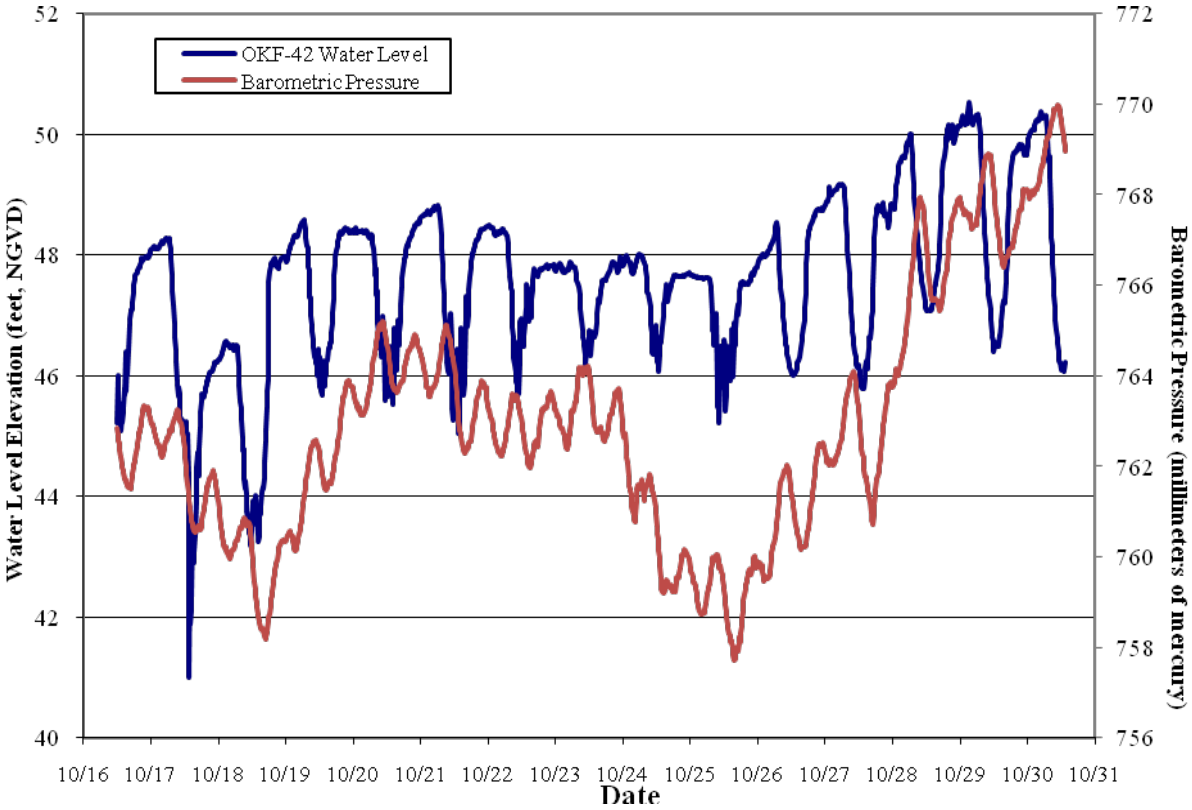


Figure 24. Background water level data in OKF-42.

Figure 24 shows the daily water level fluctuations in OKF-42. The barometric efficiency is very low (around 2%), and the atmospheric pressure changes appear out of phase with the water level changes. Therefore, no barometric compensation was made to the aquifer test data.

5.4.2 OKF-105 Aquifer Performance Test

The SFWMD began the drawdown phase of the APT on October 30, 2008. Staff set pressure transducers in the pumped zone of OKF-105 and in both the upper monitor zone (372 to 525 feet bls) of OKF-105 and in OKF-42 (372 to 1,150 feet bls). The SFWMD programmed all water level monitoring instruments to record water level data on a logarithmic scale during the drawdown and recovery phases of the APT. A logarithmic scale collects numerous data points rapidly for the first 10 minutes of the test when drawdown occurs quickly. After ten minutes, the data logger collects data on a linear time scale, and in both phases, this time interval was one minute.

ADE set a nominal 10-inch diameter submersible pump (Goulds Model 10RJMC) in OKF-105 and pumped the well at a constant rate of 350 gpm for 24 hours. The first section of the discharge line from the test production well consisted of 6-inch diameter PVC pipe. This PVC pipe connected to a 6-inch diameter calibrated flow meter (Water Specialties Model ML-04-06) and then to 6-inch diameter lay-flat hose that carried the discharge water to the Kissimmee River. The SFWMD and ADE determined this flow rate for the APT by running a quick maximum sustainable yield test on October 29, 2008. A full step-drawdown test could not be run, as the production capacity of the borehole was low and the 350 gpm rate used during the constant rate test was the minimum discharge rate the 10-inch submersible pump could handle. Closing the valve that regulated the discharge rate more would increase the pressure in the pipe down the well, increasing the risk that it would come apart at a joint. The drawdown phase of this test lasted 24 hours because water level in the pumped zone stabilized with approximately 105 feet of drawdown and the other monitored zones did not respond to the pumping. **Figure 25** shows the configuration of the monitor and test-production wells used in the first APT.

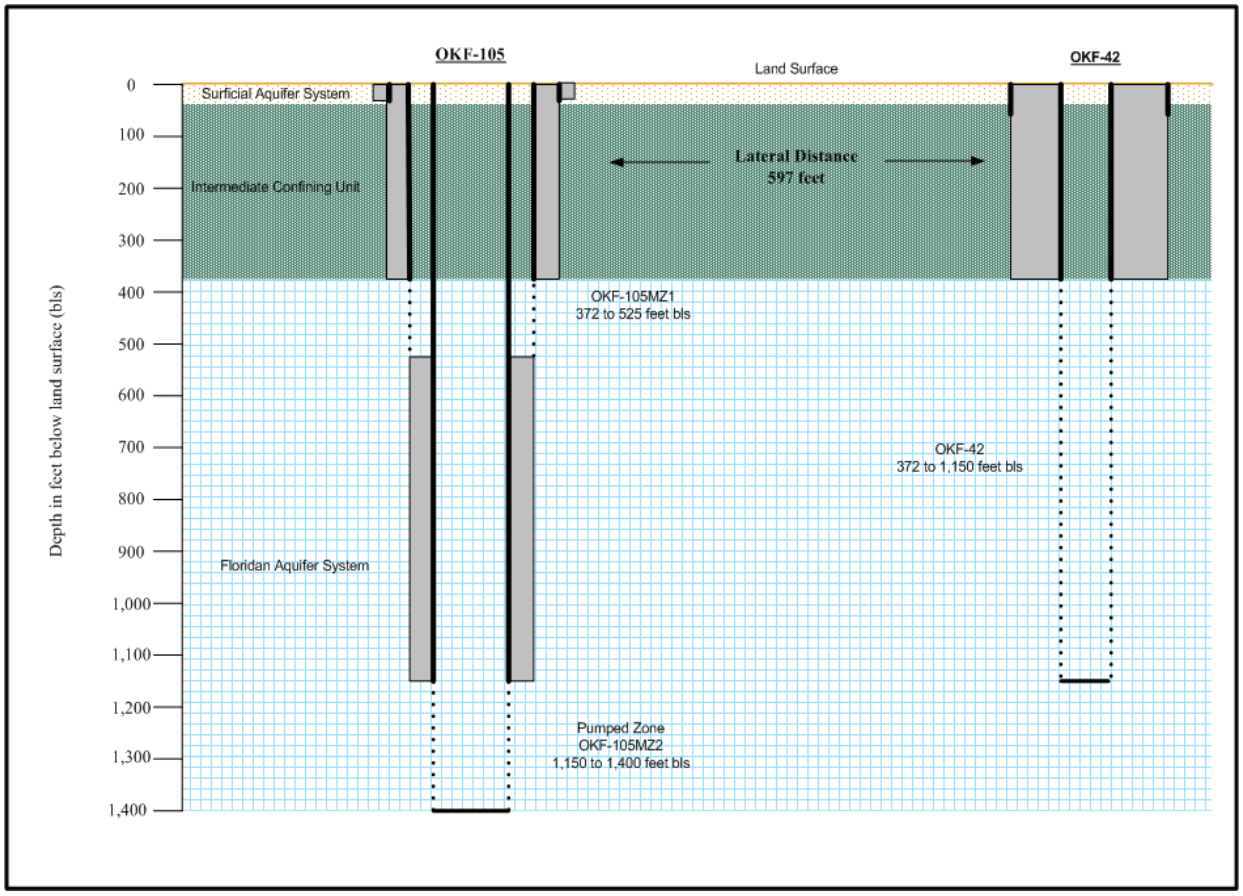


Figure 25. Cross-section showing the pumped and monitored intervals during the APT.

Before the drawdown phase ended, the SFWMD's staff reconfigured the various data loggers to record the recovery data in both the test production well and the monitor well. After stopping the pump, ADE manually closed the discharge port from OKF-105, allowing the water levels to recover to static conditions. The recovery phase of the APT ended on November 3, 2008. Electronic copies of the original drawdown and recovery data for the APT are available at the SFWMD's headquarters in West Palm Beach, Florida.

The SFWMD applied various analytical models to the drawdown data collected during the APT to determine the hydraulic properties of the pumped zone. Since only the water levels in the pumped zone responded to the induced stress, staff analyzed the APT as a single-well test, thus calculating only transmissivity. **Figure 26** is a semi-log plot of the drawdown data in the pumped zone. The shape of the drawdown curve indicates that the aquifer is leaky. As time progresses in **Figure 26**, more and more water comes from the leaking layer until the line on the drawdown curve flattens, indicating that all of the water comes from leakage (Kruseman and deRidder 2000). Geophysical logging of the borehole during the third phase of drilling showed a major production zone at 1,425 feet bls, 25 feet below the base of the pumped zone. Since the water level in the upper monitor zone did not respond

during the APT, one can presume that the deeper production zone at 1,425 feet bls contributed to the leakance.

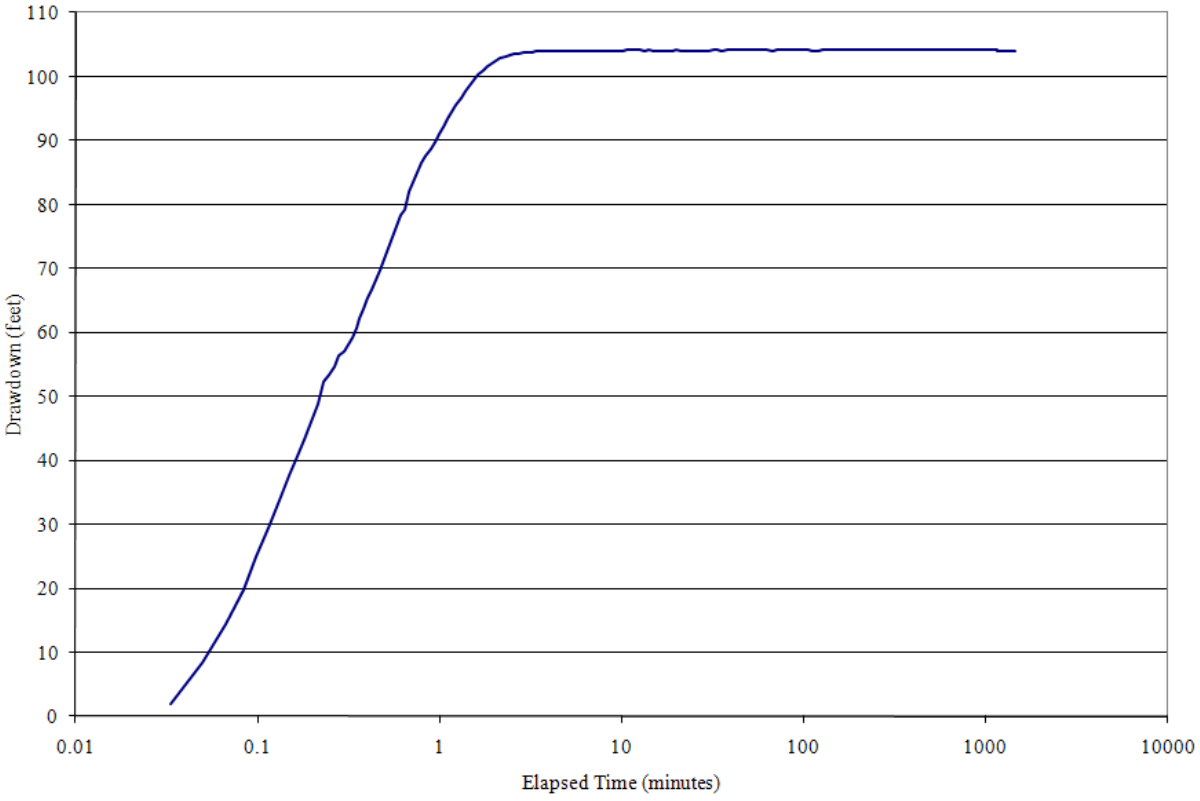


Figure 26. Semi-log plot of drawdown data in the pumped zone of OKF-105.

Figure 27 is a log/log plot of drawdown versus time for the pumped zone of OKF-105. As seen in the semi-log plot of the drawdown data, the shape of the drawdown curve of OKF-105 shows the pumped horizon is a leaky-type aquifer. This determination is verified by the fact that the drawdown curve for this well does not follow the Theis curve (orange line in **Figure 27**).

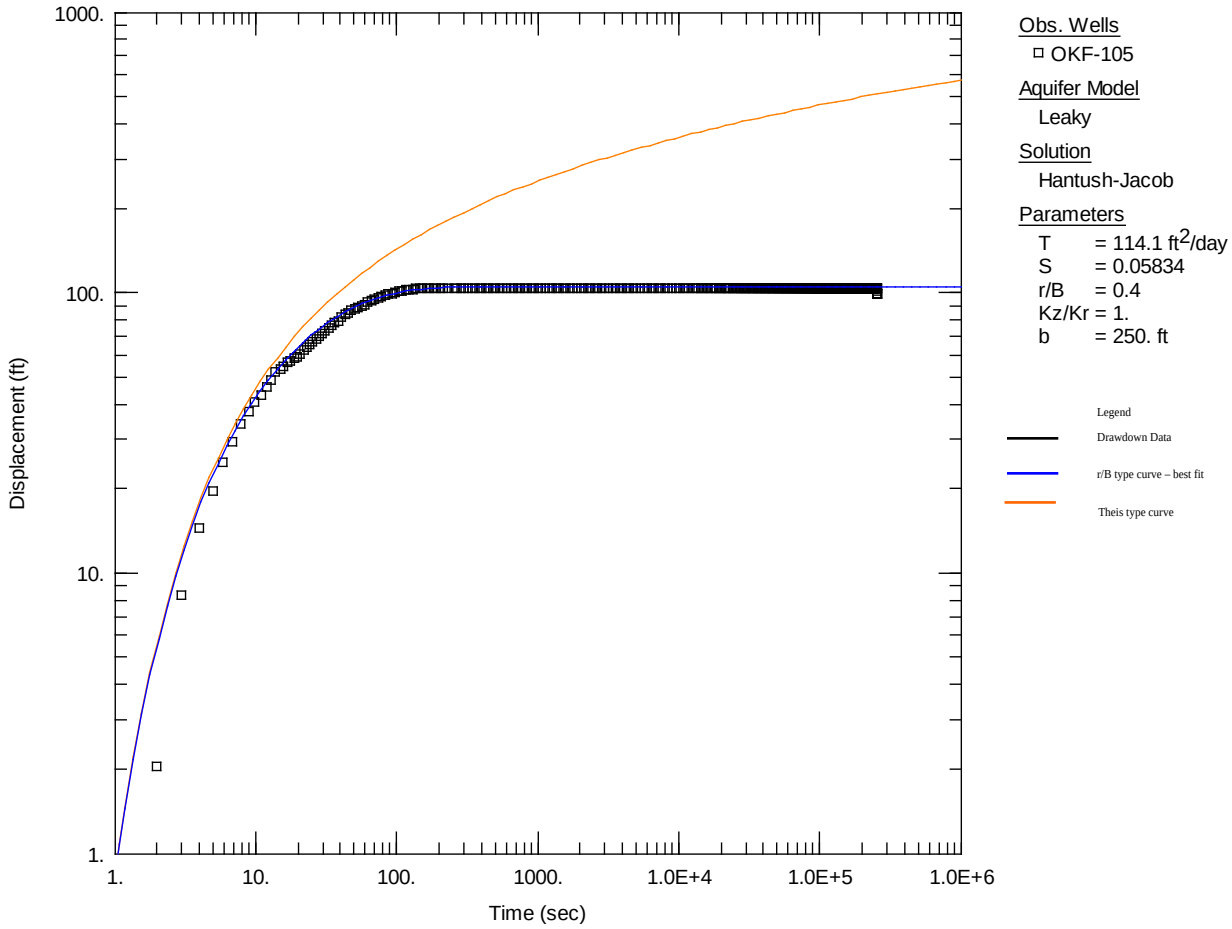


Figure 27. Log-log plot of drawdown data in OKF-105 using the Hantush-Jacob (1955) solution.

Hantush and Jacob (1955) derived an analytical solution for predicting water level displacements in response to pumping a well that fully penetrates a leaky-confined aquifer. Hantush (1960) modified the solution to account for partial penetration. The solution neglects well bore storage and assumes no storage in the aquitard(s). Based on the assumptions of the Hantush-Jacob method (1955) and the site-specific hydrogeologic data collected during drilling and aquifer testing, this analytical solution best represents the conditions present at this site. The analysis yielded a transmissivity value of 114 square feet per day (ft^2/day), and an r/B value of 0.4. The dimensionless parameter r/B characterizes the leakance across the semi-confining unit(s) to the pumped aquifer. However, since the source of the leakance is unknown and is only presumed to come from a deeper source, as well as the fact that this was the pumped well not an observation well, a leakance value was not calculated. The storativity value show in **Figure 27** should be ignored, as one cannot calculate this value from a single well test. For reference, the Theis (1935) non-equilibrium method calculated a transmissivity value of 194 ft^2/day.

5.5 Packer Testing

The SFWMD ran four packer tests during the third phase of well construction; three tests in the drilled borehole and one over the final interval in the completed well. The purpose of the packer testing was to collect water quality samples from discrete intervals in the borehole and estimate the specific capacity and transmissivity of the tested zone. The SFWMD's staff used the Hazen-Williams equation (Finnemore and Franzini 2002) to calculate the head loss due to friction in the pipe for each packer test. Correcting for the head loss is necessary to calculate an accurate specific capacity for each tested interval, otherwise the specific capacity would be underestimated. The SFWMD did not use curve-matching techniques to determine transmissivity for each test because of several factors, such as partial penetration, short pumping times, and significant head losses, all of which do not meet the criteria for the analytical formulas for these tests. The SFWMD's staff estimated transmissivity based on an empirical formula presented in Driscoll (1986) and shown as **Equation 2**.

$$T = 2{,}000\ Q/s \qquad (\textbf{\textit{Equation 2}})$$

Where:

T = Transmissivity (gpd/ft)

Q = Discharge Rate (gpm)

s = Drawdown (feet)

FDD used a pair of Tam (model 775-LI-01) packers separated by 60 feet of perforated pipe for the three borehole tests. The packer test on the completed well used a single Tam (model 775-LI-01) packer over the open-hole interval of the lower monitor zone. After lowering the packer assembly to the desired testing depth, FDD inflated the packers to seal off the test interval from the remaining annular intervals and set a 3-inch diameter submersible pump approximately 160 feet bls in the drill stem. The SFWMD's staff installed two 100-psi pressure transducers (In-Situ Inc. PXD-261) to record water level changes during pumping. One was set at 150 feet bls in the drill stem to record the drawdown and recovery of the pumped water level. The other was set 100 feet bls in the annular space above the packer assembly to show the tested zone was sealed from the remaining borehole by the packers. The pressure transducers connected to an In-Situ Inc. Hermit® 3000 data logger recorded both the drawdown and recovery data on a logarithmic time scale. FDD purged a minimum of three drill stem volumes before starting each packer test. The water in the drill stem recovered to its static level before starting each test. The drawdown phase for each packer test lasted 60 minutes, and the recovery phase lasted a minimum of 60 minutes, or until the water returned to its static level. The SFWMD collected water quality samples at the end of the drawdown phase for each test. Testing of the water samples included screening

in the field for pH, temperature, and specific conductance, as well as laboratory analysis for major anions, major cations, TDS, and bromide. Each sample sent for laboratory analysis was collected in the appropriate container, field filtered and preserved (if necessary), and placed in a cooler on ice for shipping to a certified facility for analysis. The SFWMD's staff measured the field parameters with a YSI 6920 multi-parameter probe, calibrated for pH and specific conductance the day of sample collection.

The following sections provide a summary of the individual packer tests and their results.

5.5.1 Packer Test #1 (2,412 to 2,472 feet bls)

The SFWMD's staff selected this interval because it was near the bottom of the pilot hole where the water became very saline. The purpose of this packer test was to collect water quality in a discrete interval and obtain initial head readings to help determine the vertical gradient in the well. The test also allowed the calculation of the specific capacity of this interval to determine the production capacity of the zone at the tested flow rate.

During this test, FDD pumped the interval for 60 minutes at a discharge rate of 118 gpm with a sustained drawdown of 28.7 feet of drawdown (corrected using the Hazen-Williams equation). The specific capacity of this interval, calculated using **Equation 3**, was 4.1 gallons per minute per foot of drawdown (gpm/ft) at 60 minutes, indicating low production capacity.

$$SC = Q/s \qquad (\textbf{\textit{Equation 3}})$$

Where:

SC = Specific Capacity (gpm/ft)

Q = Discharge Rate (gpm)

s = Drawdown (feet)

The transmissivity for this zone was 8,200 gallons per day per foot (gpd/ft), or 1,096 ft^2/day, calculated using **Equation 2** (Driscoll, 1986), presented in the previous subsection.

The SFWMD's staff calculated the static water level in this zone (before pumping started) to be approximately 23.00 feet NGVD, based on the final well pad survey elevation. The water quality data collected from this packer test interval is discussed in **Section 5.3**. The saline nature of this zone results in a lower static water level compared to the other packer tests in shallower zones, due to its greater density.

5.5.2 Packer Test #2 (2,170 to 2,230 feet bls)

The SFWMD's staff selected this interval because it was a zone of fresher water in what appeared to be a confining zone. The purpose of this packer test was to collect water quality in a discrete interval and obtain initial head readings to help determine the vertical gradient in the well. The test also allowed the calculation of the specific capacity of this interval to determine the production capacity of the zone at the tested flow rate.

During this test, FDD pumped the interval for 60 minutes at a discharge rate of 19 gpm, with a sustained drawdown of 134.3 feet of drawdown (corrected using the Hazen-Williams equation). The specific capacity of this interval was 0.14 gpm/ft at 60 minutes, and the estimated transmissivity was 280 gpd/ft (37 ft^2/day), confirming the confining nature of this zone.

The SFWMD's staff calculated the static water level in this zone (before pumping started) to be approximately 38.95 feet NGVD, based on the final well pad survey elevation. The water quality data collected from this packer test interval is discussed in **Section 5.3**.

5.5.3 Packer Test #3 (1,614 to 1,674 feet bls)

The SFWMD's staff selected this interval because it was a production zone deep in the Avon Park Formation covering the upper production interval in the lower Floridan aquifer. The purpose of this packer test was to collect water quality in a discrete interval and obtain initial head readings to help determine the vertical gradient in the well. The test also allowed the calculation of the specific capacity of this interval to determine the production capacity of the zone at the tested flow rate.

During this test, FDD pumped the interval for 60 minutes at a discharge rate of 120 gpm with negligible drawdown. The specific capacity and estimated transmissivity could not be calculated due to the lack of drawdown but confirmed that this horizon was a production zone as the measured drawdown for this test was mainly due to frictional losses in the down-hole piping and not from pumping. Due to the small diameter of the down-hole piping, the submersible pump used for the packer testing was the largest that could fit in the borehole, and 120 gpm was the maximum capacity.

The SFWMD's staff calculated the static water level in this zone (before pumping started) to be approximately 30.23 feet NGVD, based on the final well pad survey elevation. The water quality data collected from this packer test interval is discussed in **Section 5.3**.

5.5.4 Packer Test #4 (2,130 to 2,251 feet bls)

This packer test was run in the completed 5-inch diameter FRP well casing over the open hole interval, between 2,130 and 2,250 feet bls. The purpose of this packer test was to collect water quality data and obtain initial head readings over the lower monitor zone of the well. The test also allowed the calculation of the specific capacity of this interval to determine the production capacity of the zone at the tested flow rate.

During this test, FDD pumped the interval for 60 minutes at a discharge rate of 12 gpm with a sustained drawdown of 130.6 feet of drawdown (corrected using the Hazen-Williams equation). The specific capacity of this interval was 0.93 gpm/ft at 60 minutes, and the estimated transmissivity was 1,860 gpd/ft (249 ft^2/day), confirming the confining nature of this zone and agreeing with packer test #2.

The SFWMD's staff calculated the static water level in this zone (before pumping started) to be approximately 46.25 feet NGVD based on the final well pad survey elevation. **Section 5.3** discusses the water quality data collected from this packer test interval.

5.6 Hydraulic Heads

By October 31, 2009, the SFWMD's SCADA Engineering Group had a contractor install a Campbell Scientific CR-10X data logger and In-Situ Level TROLL® 500 pressure sensors to monitor long-term water levels in the three zones of the well. The monitoring system records water level elevation data in the three zones every 15 minutes starting at the top of the hour. **Figure 28** is a hydrograph showing water fluctuations in the three monitor zones in OKF-105 from January 22 to February 1, 2010. The values in the hydrograph are equivalent freshwater heads (Lusczynski 1961), calculated based on the pressure reading (in psi) from each sensor and based on the groundwater density on each zone (calculated using temperature and TDS data).

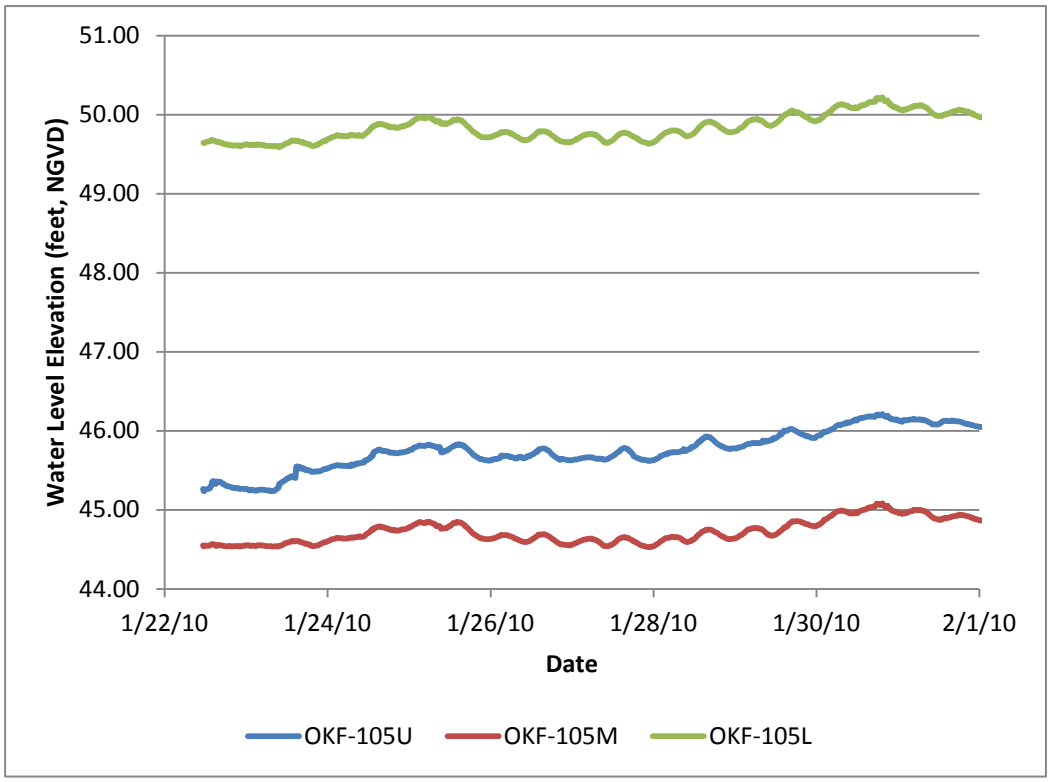


Figure 28. Hydrograph for the three monitor zones in OKF-105 between January 22 and February 1, 2010.

Figure 28 shows that the water level elevations in the upper and lower monitor zones of OKF-105 are higher than the level in the middle zone. The data in the hydrograph indicate that water is flowing from both the upper and lower monitor intervals to the middle interval. It is difficult to say that this is a true indication of the groundwater flow pattern for the area, since the upper and lower monitor zones for this well are in low permeability zones in the Floridan aquifer, while the middle zone is in a highly fractured interval (high permeability). The lower head in the middle zone may be due to lower resistance to horizontal flow in this monitor zone compared to the other two zones in the well. As a result, it has a lower pressure reading on the sensor, resulting in a lower water level elevation compared to the upper and lower monitor zones in the well.

6
Summary

The SFWMD completed OKF-105 with three intervals monitoring different zones in the FAS. The upper monitor zone covers two wash out zones in the upper Floridan aquifer between 372 and 520 feet bls. Water in this zone comes from the rock matrix permeability because there are no distinct fractures. The middle monitor zone covers the APPZ and the two most productive horizons encountered during drilling between 1,150 to 1,468 feet bls. Two large fractures produce the water emanating in this dolostone interval. The lower monitor zone covers a zone of fresher water in a semi-confining layer in the lower Floridan aquifer between 2,130 and 2,251 feet bls. Water is this zone was fresher than that of the over- and underlying flow zones of the lower Floridan aquifer, based on TDS concentrations calculated from the induction log. The formation evaluation logs, OBI log, and lithologic descriptions correlated well.

Water quality in the upper monitor zone was brackish (TDS concentration of 1,473 mg/l) and has a makeup of water transitioning to seawater. The middle monitor zone had water quality that was also brackish (TDS concentration of 1,495 mg/l). Water quality in the lower monitor zone was saline (TDS concentration of 18,836 mg/l).

A single-well aquifer test yielded a low transmissivity, confirming the lack of production capacity between 372 and 1,400 feet bls. Packer tests 1, 2, and 4 yielded low specific capacities, while the specific capacity for test 3 (1,614 to 1,674 ft bls) was too high to measure with the equipment used. The OBI log confirms the high specific capacity in packer test 3. There are numerous vugs and fractures in this interval, and it marks the top of the first productive zone in the lower Floridan aquifer.

The base of the top of the underground source of drinking water, where the total dissolved solids concentration in the groundwater is 10,000 milligrams per liter, occurs around 1,660 feet bls at this site. The top of the G-II aquifer is 1,430 feet bls, based on the TDS concentrations calculated from the induction log. Water quality data collected from packer tests confirmed the calculated TDS concentrations from the induction log in the lower sections of the borehole.

All three zones in the well are artesian. Water levels in the three monitor zones as of January 31, 2009 were 46.08, 44.87, and 49.94 feet above the National Geodetic

Vertical Datum of 1929 for the upper, middle, and lower monitor zones, respectively.

OKF-105 will be beneficial to the SFWMD when it is included in the Regional Groundwater Monitoring Network. The site is located in the center of the state where there are gaps in geologic and hydrogeologic data.

7
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Appendix A

CASING MILL CERTIFICATES

(See Separate link on the left hand menu of this PDF)

Appendix B

GEOPHYSICAL LOGS

(See Separate link on the left hand menu of this PDF)

Appendix C

GENERIC DISCHARGE PERMIT

(See Separate link on the left hand menu of this PDF)

Appendix D

FINAL WELLHEAD SURVEY

(See Separate link on the left hand menu of this PDF)

Appendix E

LITHOLOGIC DESCRIPTION

(See Separate link on the left hand menu of this PDF)

Appendix F

CORE LAB REPORT

Note: All core lab data references OKF-150, when it should say OKF-105.

(See Separate link on the left hand menu of this PDF)

Appendix G

AQUIFER TEST/WATER QUALITY DATA LABORATORY REPORT

(See Separate link on the left hand menu of this PDF)

Appendix H

LABORATORY REPORTS FOR BROMIDE SAMPLES

Note: All CAS analysis makes reference to OKF-10, when it should be OKF-105.

(See Separate link on the left hand menu of this PDF)

EDGEN MURRAY CORPORATION — Bill of Lading — Date: 10-SEP-08 10:32 AM

BOL-470504 — Page: 1 of 2

Ship From:
LAKELAND, FL
3595 Highway 60 West
Bartow, FL 33830, United States

Phone: 863-869-9716
Fax: 863-869-8520

Ship To:
APPLIED DRILLING
ENGINEERING, IN
TAYLOR CREEK JOB/SFWMD
PAUL: 813-695-4358
CALL & MEET
OKEECHOBEE, FL 34972-0000, United States

Order # 2187353
PO # 8025
Order Type: LKD STANDARD

Customer Attachments:

Delivery Name: 258605 — Pick Up Date:
FOB:
Way Bill:
Freight Class: 50 (Unless otherwise noted.)
Freight Terms: Prepaid
Ship Method: EDGEN TRUCK-Truck-Ground

Customer Requirements:

1. LOADS MUST BE STRIPPED ::::: NO PYRAMIDING ALLOWED ::::: 9/5/08 ::::: LJP---- JOBSITE DELVY ---- MICCO BLUFF RD IN OKEECHOBEE, FL ---- DRIVER MUST CALL AHEAD ---PAUL PETRY 813-695-4358 ((WILL MEET THE TRUCK DRIVER AT THE GATE OF ENTRANCE))

Item Number	Description
CP123220TS	12.750" OD X .375 WALL ERW A53B;API 5LB X42----21 FT

Shipping Instruction Number	Packing Instruction Number	Line Number	UOM	Qty Requested	Lot Qty Shipped	Pcs	Weight
04C03597	J07069	2.1	FT	21.00	21.00	1.00	1041.77
04C03599	J07069	2.1	FT	21.00	21.00	1.00	1041.77
04C03601	J07069	2.1	FT	21.00	21.00	1.00	1041.77

The property described above, in apparent good order, except as noted (contents and condition of contents of packages unknown), marked, consigned, and destined as indicated below, which said carrier (the word carrier being understood throughout this contract as meaning any person or corporation in possession under the contract) agrees to carry to its usual place of deliver at said destination, if on its route, otherwise to deliver to another carrier on the route to said destination, it is mutually agreed, as to each carrier of all or any said property over all or any portion of said route to destination, and as each party at any time interested in all or any of said property, that every service to be performed hereunder shall be subject to all the terms and conditions of the Uniform Domestic Straight Bill of Lading set forth (1) in Official, Southern, Western and Illinois Freight Classifications in effect on the date hereof, if this is a rail or a rail-water shipment, or (2) in the applicable motor carrier classification or tariff if this is a carrier shipment.

Shipper hereby certifies that he is familiar with all the terms and conditions of the said bill of lading, including those on the back thereof, set forth in the classification or tariff which governs the transportation of this shipment, and the said terms and conditions are hereby agreed to by the shipper and accepted for himself and his assigns.

Subject to Section 7 of Conditions of applicable bill of lading, if this shipment is to be delivered to the consignee without recourse on the consignor, the consignor shall sign the following statement: The carrier shall not make delivery of this shipment without payment of freight and all other lawful charges.		CARRIER	FREIGHT Prepaid ☐ Collect ☐
SIGNATURE OF CONSIGNOR		AGENT PER (Driver's Signature)	
If charges are to be prepaid, write or stamp here, "To be Prepaid."	RECEIVED $ To apply in payment of the charges on the property described hereon.	AGENT OR CASHIER (The signature here acknowledges only the amount prepaid.)	CHARGES ADVANCED $

Bill of Lading Date: 10-SEP-08 10:32 AM

BOL-470504 Page: 2 of 2

n Number	Description
CP123220TS	12.750" OD X .375 WALL ERW A53B;API 5LB X42----21 FT

Shipping Instructions Number	Packing Instructions Number	Line Number	UOM	Qty Requested	Lot Qty Shipped	Pcs	Weight
04C03602	J07069	2.1	FT	21.00	21.00	1.00	1041.77
04C03605	J07069	2.1	FT	21.00	21.00	1.00	1041.77
04C03606	J07069	2.1	FT	21.00	21.00	1.00	1041.77
04C03608	J07069	2.1	FT	21.00	21.00	1.00	1041.77
04C03612	J07069	2.1	FT	21.00	21.00	1.00	1041.77
04C03613	J07069	2.1	FT	21.00	21.00	1.00	1041.77
04C03618	J07069	2.1	FT	21.00	21.00	1.00	1041.77

Total Qty Shipped: 210.00 Line Number: 2.1 210.00

Gross Weight: 10417.74 LBS Net Weight: 10417.74 LBS Total Pcs 10.00

Additional
Information:
MTR'S SENT W/SHIPMENT - 1 ENVELOPE

ALL PREPAID FREIGHT INVOICES ARE TO BE SENT TO:
Edgen Corporation,C/O Broussard Logistics, POB 230370, Houston,TX 77223-0370

The items covered by this quotation/order/invoice may be subject to various laws including U.S. and foreign export controls. EDGEN MURRAY CORPORATION is committed to compliance with all relevant export control laws. If the items are being, or will be exported or re-exported, the following language applies: "These commodities, technology or software were exported from the United States of America in accordance with the Export Administration Regulations. Diversion contrary to U.S. law is prohibited."

The property described above, in apparent good order, except as noted (contents and condition of contents of packages unknown), marked, consigned, and destined as indicated below, which said carrier (the word carrier being understood throughout this contract as meaning any person or corporation in possession under the contract) agrees to carry to its usual place of deliver at said destination, if on its route, otherwise to deliver to another carrier on the route to said destination, it is mutually agreed, as to each carrier of all or any said property over all or any portion of said route to destination, and as each party at any time interested in all or any of said property, that every service to be performed hereunder shall be subject to all the terms and conditions of the Uniform Domestic Straight Bill of Lading set forth (1) in Official, Southern, Western and Illinois Freight Classifications in effect on the date hereof, if this is a rail or a rail-water shipment, or (2) in the applicable motor carrier classification or tariff if this is a carrier shipment.

Shipper hereby certifies that he is familiar with all the terms and conditions of the said bill of lading, including those on the back thereof, set forth in the classification or tariff which governs the transportation of this shipment, and the said terms and conditions are hereby agreed to by the shipper and accepted for himself and his assigns.

Subject to Section 7 of Conditions of applicable bill of lading, if this shipment is to be delivered to the consignee without recourse on the consignor, the consignor shall sign the following statement: The carrier shall not make delivery of this shipment without payment of freight and all other lawful charges.		CARRIER	FREIGHT Prepaid ☐ Collect ☐
NATURE OF CONSIGNOR		AGENT PER (Driver's Signature)	
If charges are to be prepaid, write or stamp here, "To be Prepaid."	RECEIVED $ To apply in payment of the charges on the property described hereon.	AGENT OR CASHIER (The signature here acknowledges only the amount prepaid.)	CHARGES ADVANCED $

성적서 번호
CERTIFICATE NO. : 8100473
발행일자
DATE OF ISSUE. : 2008-01-07
계약번호
CONTRACT(P/O) NO. :
품명
COMMODITY : E.R.W. STEEL PIPE
제품규격
SPECIFICATION : API 5L X42/API 5LB PSL1/ASTM A53B/ASME SA53B

검 사 증 명 서 (A)

MILL INSPECTION CERTIFICATE

200013975

고 객 사 CUSTOMER : 현대종합상사

HYUNDAI HYSCO 현대하이스코주식회사
HYUNDAI HYSCO
본사·공장 (ULSAN PLANT) : 울산광역시 북구 염포동 265번지 683-040
265 YUMPO-DONG, BUK-KU, ULSAN,KOREA
TEL:82-52-280-014, FAX:82-52-287-8916
서울사무소 (SEOUL OFFICE) : 서울시 강남구 역삼동 837-36번지 랜드마크타워 135-080
LANDMARK TOWER 837-36, YEOKSAM-DONG, GANGNAM-KU, SEOUL, KOREA
TEL:82-2-2112-8114, FAX:82-2-775-7095

끝단 TYPE OF PIPE END	치수 DIMENSION 외경 × 두께 × 길이 (OUTDIA × THICK × LENGTH)			수량 QUAN-TITY	중량 WEIGHT	수압시험 HYDRO-STATIC TEST		제강번호 HEAT NO.	인장시험 TENSILE TEST (Gage Length : 2 INCH)				화학성분(%) CHEMICAL COMPOSITION														경도 HARD-NESS	충격시험 IMPACT TEST (℃)		도막시험 COATING TEST			비고 REM-ARK
						PSI	※5		항복강도 YIELD STRENGTH	인장강도 TENSILE STRENGTH ※7 B	인장강도 TENSILE STRENGTH ※7 W	연신율 E.L		C	Si	Mn	P	S	Cu	Ni	Cr	Mo	V	Ti	Nb		Al	CEQ ※9		흡수에너지 ABSORBED ENERGY	전단파면율 SHEAR AREA	아연부착량 WEIGHT OF ZINC COAT	균일성 DIP TEST	TIMES	
※1	※2	※3	※4	(PCS)	(KG)				※6	Mpa/PSI		%	※8	×100			×1000		×100									×1000		HV	JOULE	%	g/㎡		※5	
EB	BE	NB	10-3/4" X .365" X 42.000'	113	87,516	2,420	G	J07068		332	476	495	35		14	2	88	12	4	2	2	i	i	TR	TR	TR									
										48,300	69,100	72,000																					
EB	BE	NB	12-3/4" X .250" X 21.000'	69	18,920	1,400	G	H14774		383	440	482	34		5	i	79	5	2	2	2	i	i	TR	TR	TR									
										55,500	64,000	69,900																					
EB	BE	NB	12-3/4" X .250" X 42.000'	14	6,979	1,400	G	H14774		383	440	482	34		5	i	79	5	2	2	2	i	i	TR	TR	TR									
										55,500	64,000	69,900																					
EB	BE	NB	12-3/4" X .375" X 21.000'	84	39,602	2,100	G	J07055		318	457	479	35		16	2	70	14	7	2	i	2	i	TR	TR	TR									
										45,900	66,300	69,700																					
				283	133,420	2,100	G	J07069		330	481	482	35		17	0	69	16	4	2	2	i	i	TR	TR	TR									
										49,300	69,800	69,700																					
EB	BE	NB	12-3/4" X .375" X 42.000'	26	24,515	2,100	G	J07069		302	429	451	36		15	3	67	14	5	2	2	i	i	TR	TR	TR									
										64,000	62,300	64,400																					
				51	49,088	2,100	G	J07070		329	467	488	36		15	3	68	14	6	2	2	i	i	TR	TR	TR									

※10 HEAT TREATMENT	※11 VISUAL & DIMENSION TEST	※12 FLATTENING, BEND, GUIDED BEND TEST	※13 R-FLATTENING TEST	※14 FLARING TEST	※15 NONDESTRUCTIVE TEST (U.T)	※16 R.M.T	※17 CRUSH TEST	※18 DRIFT TEST	※19 FLANGE TEST
GOOD	GOOD	GOOD			GOOD	GOOD			

NOTE 1 ※1 Type of pipe End 끝단

EB:ERW Black End	RB:SAW Black	TC:Thread Coupling
EA:ERW Annealing	RG:SAW Galvanizing	RG:Roll Grooving
EG:ERW Galvanizing	RS:SAW Spiral	VG:Victaulic Grooving
EC:ERW Black Thread	PE:Plain End	PC:Plain End + Coupled
ED:ERW Galvanizing Thread	BE:Bevel End	PB:Plain End + Bevel End
EN:ERW Galvanizing Scaffolding	TE:Thread End	BD:Ball End

※2 NB:Norminal Bore 호칭경, OD:Outside Diameter
※3 Unit 단위(M:mm, I:Inch)
※4 Unit 단위(M:Meter, F:Feet, I:Inch)
※5 G:GOOD
※6 L:Longitudinal 압연방향, T:Transverse 압연방향
※7 B:Base Metal 모재부, W:Weld Part 용접부
※8 H:Heat(Ladle) Analysis 입연분석, P:Product Analysis 제품분석, WP:Weld Product Analysis 용접부 제품분석
※9 CEQ=C+Mn/6+(Ni+Cu)/15+(Cr+Mo+V)/5 등가탄소절
※10:Heat Treatment 열처리
※11 Visual & Dimension Test 육안 및 치수검사
※12 Flattening/Band/Guided Band Test 압평/밴드/굽힘시험
※13:Reverse Flattening Test 전개시험
※14 Flaring Test 압확시험
※15 Nondestructive Test 비파괴검사
※16:Residual Magnetism Test 잔류자장시험 ※17:Crush Test 압압시험
※18:Drift Test 관통시험
※19:Flange Test 플랜지시험

NOTE 2 * SPEC YEAR – API 2004/ASTM 2006/ASME 2004

본 제품은 검정 규격에 합격되었음을 보증합니다.
WE HEREBY CERTIFY THAT MATERIAL DESCRIBED HEREIN HAS BEEN ACCEPTED IN ACCORDANCE WITH THE PRESCRIBED SPECIFICATION AND ORDER
* 본 검사증명서에 명기된 규격등도의 사용시 인장상 문제가 발생될 수 있으며, 검사증명서 위.변조시 사문서 위조로 불이익을 당하실 수 있습니다.

SURVEYOR

H. J. KIM
INSPECTION MANAGER

EDGEN MURRAY CORPORATION — Bill of Lading — Date: 08-SEP-08 02:22 PM

BOL-469816 — Page: 1 of 3

Ship From:
ALDINE RD, HOUSTON, TX
3004 Aldine Bender Rd.
Houston, TX 77032, United States

Ship To:
APPLIED DRILLING ENGINEERING, IN
TAYLOR CREEK JOB/SFWMD
PAUL: 813-695-4358
CALL & MEET
OKEECHOBEE, FL 34972-0000, United States

Order # 2187353
PO # 8025
Order Type: LKD STANDARD

Customer Attachments:

Delivery Name: 258200 — Pick Up Date:
FOB:
Way Bill: PACER TRANSPORT
Freight Class: 50 (Unless otherwise noted.)
Freight Terms: Prepaid
Ship Method: EASTMAN LOGISTICS-TL-Ground

Customer Requirements:

ALL LOADS MUST BE STRIPPED ;;;; NO PYRAMIDING ALLOWED ;;;; 9/5/08 ;;;;
LJP---- JOBSITE DELVY --- MICCO BLUFF RD IN OKEECHOBEE, FL --- DRIVER MUST CALL AHEAD --PAUL PETRY 813-695-4358 ((WILL MEET THE TRUCK DRIVER AT THE GATE)ENTRANCE))

Item Number	Description
CP123300T	12.750" OD X .375 WALL ERW API5LB/X42, A-SA53B---42 FT

Shipping Instructions Number	Instructions at Number	Line Number	Packing Instructions	Qty UOM	Requested	Lot Qty Shipped	Pcs	Weight
05C22506	J11005	1.1		FT	42.00	42.00	1.00	2083.55
05C22507	J11005	1.1		FT	42.00	42.00	1.00	2083.55
05C22508	J11005	1.1		FT	42.00	42.00	1.00	2083.55
05C22509	J11005	1.1		FT	42.00	42.00	1.00	2083.55
05C22510	J11005	1.1		FT	42.00	42.00	1.00	2083.55

(The property described above, in apparent good order, except as noted (contents and condition of contents of packages unknown) marked, consigned, and destined as indicated below which said carrier (the word carrier being understood throughout this contract as meaning any person or corporation in possession under the contract) agrees to carry to its usual place of deliver at said destination, if on its route, otherwise to deliver to another carrier on the route to said destination, it is mutually agreed, as to each carrier of all or any said property over all or any portion of said route to destination, and as each party at any time interested in all or any of said property, that every service to be performed hereunder shall be subject to all the terms and conditions of the Uniform Domestic Straight Bill of Lading set forth (1) in Official, Southern, Western and Illinois Freight Classifications in effect on the date hereof, if this is a rail or a rail-water shipment, or (2) in the applicable motor carrier classification or tariff if this is a carrier shipment. Shipper hereby certifies that he is familiar with all the terms and conditions of the said bill of lading, including those on the back thereof, set forth in the classification or tariff which governs the transportation of this shipment, and the said terms and conditions are hereby agreed to by the shipper and accepted for himself and his assigns.

Subject to Section 7 of Conditions of applicable bill of lading, if this shipment is to be delivered to the consignee without recourse on the consignor, the consignor shall sign the following statement: The carrier shall not make delivery of this shipment without payment of freight and all other lawful charges.	CARRIER	FREIGHT Prepaid [] Collect []
SIGNATURE OF CONSIGNOR	AGENT OR (Driver's Signature) X	
If charges are to be prepaid, write or stamp here: "To be Prepaid."	RECEIVED $ To apply in payment of the charges on the property described hereon.	AGENT OR CASHIER (The signature here acknowledges only the amount prepaid.)	CHARGES ADVANCED $

Bill of Lading Date: 08-SEP-08 02:22 PM

BOL-469816 Page: 3 of 3

Gross Weight: 43754.50 LBS Net Weight: 43754.50 LBS Total Pcs 21.00

Additional
Information:
MTR'S SENT W/SHIPMENT - 1 ENVELOPE

ALL PREPAID FREIGHT INVOICES ARE TO BE SENT TO:
Edgen Corporation,C/O Broussard Logistics, POB 230370, Houston,TX 77223-0370

The items covered by this quotation/order/invoice may be subject to various laws including U.S. and foreign export controls. EDGEN MURRAY CORPORATION is committed to compliance with all relevant export control laws. If the items are being, or will be exported or re-exported, the following language applies: "These commodities, technology or software were exported from the United States of America in accordance with the Export Administration Regulations. Diversion contrary to U.S. law is prohibited."

The property described above, in apparent good order, except as noted (contents and condition of contents of packages unknown), marked, consigned, and destined as indicated below which said carrier (the word carrier being understood throughout this contract as meaning any person or corporation in possession under the contract) agrees to carry to its usual place of delivery at said destination, if on its route, otherwise to deliver to another carrier on the route to said destination. It is mutually agreed, as to each carrier of all or any said property over all or any portion of said route to destination, and as each party at any time interested in all or any of said property, that every service to be performed hereunder shall be subject to all the terms and conditions of the Uniform Domestic Straight Bill of Lading set forth (1) in Official, Southern, Western and Illinois Freight Classifications in effect on the date hereof, if this is a rail or a rail-water shipment, or (2) in the applicable motor carrier classification or tariff if this is a carrier shipment.
Shipper hereby certifies that he is familiar with all the terms and conditions of the said bill of lading, including those on the back thereof, set forth in the classification or tariff which governs the transportation of this shipment, and the said terms and conditions are hereby agreed to by the shipper and accepted for himself and his assigns.

Subject to Section 7 of Conditions of applicable bill of lading, if this shipment is to be delivered to the consignee without recourse on the consignor, the consignor shall sign the following statement: The carrier shall not make delivery of this shipment without payment of freight and all other lawful charges.	CARRIER	FREIGHT Prepaid ☐ Collect ☐
SIGNATURE OF CONSIGNOR	AGENT PER (Driver's Signature) X	
If charges are to be prepaid, write or stamp here, "To be Prepaid."	RECEIVED $ To apply in payment of the charges on the property described hereon.	AGENT OR CARRIER (The signature here acknowledges only the amount prepaid.)	CHARGES ADVANCED $

Bill of Lading Date: 08-SEP-08 02:22 PM

BOL-469816 Page: 2 of 3

Item Number	Description
CP123300T	12.750" OD X .375 WALL ERW API5LB/X42, A-SA530---42 FT

Shipping Instruction Number	Customer Item Number	Line Number	Packing Instruction UOM	Qty Requested	Lot Qty Shipped	Pcs	Weight
05C22511	J11005	1.1	FT	42.00	42.00	1.00	2083.55
05C22512	J11005	1.1	FT	42.00	42.00	1.00	2083.55
05C22513	G021565	1.1	FT	42.00	42.00	1.00	2083.55
05C22514	J11005	1.1	FT	42.00	42.00	1.00	2083.55
05C22515	J11005	1.1	FT	42.00	42.00	1.00	2083.55
05C22516	J11005	1.1	FT	42.00	42.00	1.00	2083.55
05C22517	J11005	1.1	FT	42.00	42.00	1.00	2083.55
05C22518	J11005	1.1	FT	42.00	42.00	1.00	2083.55
05C22519	J11005	1.1	FT	42.00	42.00	1.00	2083.55
05C22520	J11005	1.1	FT	42.00	42.00	1.00	2083.55
05C22521	J11005	1.1	FT	42.00	42.00	1.00	2083.55
05C22523	J11005	1.1	FT	42.00	42.00	1.00	2083.55
05C22524	J11005	1.1	FT	42.00	42.00	1.00	2083.55
05C22526	J11005	1.1	FT	42.00	42.00	1.00	2083.55
05C24568	J11154	1.1	FT	42.00	42.00	1.00	2083.55
05C24571	J11154	1.1	FT	42.00	42.00	1.00	2083.55

Total Qty Shipped: 882.00 Line Number: 1.1 882.00

The property described above, in apparent good order, except as noted (contents and condition of contents of packages unknown), marked, consigned, and destined as indicated below, which said carrier (the word carrier being understood throughout this contract as meaning any person or corporation in possession under the contract) agrees to carry to its usual place of delivery at said destination, if on its route, otherwise to deliver to another carrier on the route to said destination, it is mutually agreed, as to each carrier of all or any said property over all or any portion of said route to destination, and as each party at any time interested in all or any of said property, that every service to be performed hereunder shall be subject to all the terms and conditions of the Uniform Domestic Straight Bill of Lading set forth (1) in Official, Southern, Western and Illinois Freight Classifications in effect on the date hereof, if this is a rail or a rail-water shipment, or (2) in the applicable motor carrier classification or tariff if this is a carrier shipment.

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SIGNATURE OF CONSIGNOR	AGENT PER (Driver's Signature) X	
If charges are to be prepaid, write or stamp here, "To be Prepaid."	RECEIVED $ To apply in payment of the charges on the property described hereon.	AGENT OR CASHIER (The signature here acknowledges only the amount prepaid.)	CHARGES ADVANCED $

성적서 번호
CERTIFICATE NO. : 8702076
발행일자
DATE OF ISSUE. : 2008-07-17
계약번호
CONTRACT(P/O) NO. :
품명
COMMODITY : E.R.W. STEEL PIPE
제품규격
SPECIFICATION : API 5L X42/API 5LB PSL1/ASTM A53B/ASME SA53B

검 사 증 명 서(A)

MILL INSPECTION CERTIFICATE

MILL INSPECTION CERTIFICATE

200021031

고 객 사 CUSTOMER : 현대종합상사

HYUNDAI HYSCO 현대하이스코주식회사 HYUNDAI HYSCO

본사·공장 (ULSAN PLANT) : 울산광역시 북구 염포동 265번지 683-040
#265 YUMPO-DONG, BUK-KU, ULSAN,KOREA
TEL:82-52-280-014, FAX:82-52-287-8916

서울사무소 (SEOUL OFFICE) : 서울시 서초구 잠원동 28-6번지 137-904
28-6, JAMWON-DONG, SEOCHO-KU, SEOUL 137-904, KOREA
TEL:82-2-2112-9114, FAX:82-2-775-7095

관종 TYPE OF PIPE END ※1	치수 DIMENSION 외경 × 두께 × 길이 (OUTDIA × THICK × LENGTH) ※2 ※3 ※4	수량 QUAN-TITY (PCS)	중량 WEIGHT (KG)	수압시험 HYDRO-STATIC TEST PSI	※5	제강번호 HEAT NO.	인장시험 TENSILE TEST (Gage Length : 2 INCH) 항복강도 YIELD STRENGTH ※6 Mpa/PSI	인장강도 TENSILE STRENGTH ※7 B Mpa/PSI	※7 W Mpa/PSI	연신율 E.L %	원소성분(%) CHEMICAL COMPOSITION ※8 C ×100	Si ×100	Mn ×100	P ×1000	S ×1000	Cu ×100	Ni ×100	Cr ×100	Mo ×100	V ×100	Ti ×100	Nb ×100	Al ×1000	CEQ ※9	경도 HARD-NESS HV	충격시험 IMPACT TEST (℃) 흡수에너지 ABSORBED ENERGY JOULE	전단파면율 SHEAR AREA %	도막시험 COATING TEST 아연부착량 WEIGHT OF ZINC COAT g/㎡	균일성 DIP TEST TIMES	※5	비고 REMARK
EB BE	NB 2-7/8" X 0.203" X 42.000'	96	10,685	3,000	G	C831145	300 (44,000)	460 (66,800)		33	15	2	80	9	6	2	2	1	1	TR	TR	TR								
EB BE	NB 8-5/8" X 0.322" X 42.000'	80	43,680	2,350	G	J11343	304 (44,000)	438 (64,000)	462 (66,800)	35	15	3	71	16	4	2	2	1	1	TR	TR	TR								
EB BE	NB 8-5/8" X 0.322" X 42.000'	110	60,060	2,350	G	J11343	300 (44,000)	438 (64,000)	459 (65,900)	35	15	3	71	16	4	2	2	1	1	TR	TR	TR								
EB BE	NB 12-3/4" X 0.375" X 42.000'	100	94,290	2,100	G	J11154	301 (44,000)	445 (64,000)	469 (68,200)	36	15	3	69	11	7	2	1	2	1	TR	TR	TR								
EB BE	NB 12-3/4" X 0.375" X 42.000'	56	52,802	2,100	G	J11005	352 (51,200)	473 (68,200)	490 (71,100)	34	7	4	85	12	4	2	2	1	1	TR	TR	TR								
		37	34,888	2,100	G	G021565	353 (51,200)	440 (64,000)	462 (66,800)	37	15	2	66	7	18	2	2	1	1	TR	TR	TR								
EB BE	NB 16" X 0.375" X 42.000'	3	3,571	1,670	G	H17679	351 (51,200)	430 (64,000)	454 (65,800)	35	6	2	78	11	3	2	1	2	1	TR	TR	TR								

※10 HEAT TREATMENT: GOOD
※11 VISUAL & DIMENSION TEST: GOOD
※12 FLATTENING, BEND, GUIDED BEND TEST: GOOD
※13 R-FLATTENING TEST
※14 FLARING TEST
※15 NONDESTRUCTIVE TEST (E.C.T/U.T): GOOD
※16 R.M.T: GOOD
※17 CRUSH TEST
※18 DRIFT TEST
※19 FLANGE TEST

NOTE 1 ※1 Type of pipe End 관종

EB:ERW Black End	RB:SAW Black	TC:Thread Coupling
EA:ERW Anmealing	RG:SAW Galvanizing	RG:Roll Grooving
EG:ERW Galvanizing	RS:SAW Sprial	VG:Victaulic Grooving
EC:ERW Black Thread	PE:Plain End	PC:Plain End + Coupled
ED:ERW Galvanizing Thread	BE:Bevel End	PB:Plain End + Bevel End
EN:ERW Galvanizing Scaffolding	TE:Thread End	BD:Bell End

※2 NB:Norminal Bore 호칭경, OD:Outside Diameter
※3 Unit 단위(M:mm, I:Inch)
※4 Unit 단위(M:Meter, F:Feet, I:Inch)
※5 G:GOOD
※6 L:Longitudinal 압연방향, T:Transverse 원주방향
※7 B:Base Metal 모재부, W:Weld Part 용접부
※8 H:Heat(Ladle) Analysis 열연분석, P:Product Analysis 제품분석, WP:Weld Product Analysis 용접부 제품분석
※9 CEQ=C+Mn/6+(Ni+Cu)/15+(Cr+Mo+V)/5 등가탄소량
※10:Heat Treatment 열처리
※11 Visual & Dimension Test 육안 및 치수검사
※12 Flattening/Bend/Guided Bend Test 편평/벤드/굽힘시험
※13:Reverse Flattening Test 전개시험
※14 Flaring Test 압확시험
※15 Nondestructive Test 비파괴검사
※16:Residual Magnetism Test 잔류자장시험 ※17:Crush Test 압괴시험
※18:Drift Test 관통시험
※19:Flange Test 플랜지시험

NOTE 2 * SPEC YEAR - API 2004/ASTM 2006/ASME 2004
* NACE MR-0175

본 제품은 관련 규격에 합격되었음을 보증합니다.
WE HEREBY CERTIFY THAT MATERIAL DESCRIBED HEREIN HAS BEEN ACCEPTED IN ACCORDANCE WITH THE PRESCRIBED SPECIFICATION AND ORDER
* 본 검사증명서에 명기된 규격용도외 사용시 안전상 문제가 발생할 수 있으며, 검사증명서 위.변조시 사문서 위조로 불이익을 당하실 수 있습니다.

H. J. KIM
INSPECTION MANAGER

SURVEYOR

HYUNDAI HYSCO

HYS - B301 - 631 - 1 - QLT

A4(210×2

성적서 번호
CERTIFICATE NO. : 8702076
발행일자
DATE OF ISSUE. : 2008-07-17
계약번호
CONTRACT(P/O) NO. :
품명
COMMODITY : E.R.W. STEEL PIPE
제품규격
SPECIFICATION : API 5L X42/API 5LB PSL1/ASTM A53B/ASME SA53B

200021031

검 사 증 명 서(A)

MILL INSPECTION CERTIFICATE

MILL INSPECTION CERTIFICATE

고 객 사
CUSTOMER : 현대종합상사

HYUNDAI HYSCO 현대하이스코주식회사 HYUNDAI HYSCO

본사·공장 (ULSAN PLANT) : 울산광역시 북구 염포동 265번지 683-040
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28-6, JAMWON-DONG, SEOCHO-KU, SEOUL 137-904, KOREA
TEL:82-2-2112-9114, FAX:82-2-775-7095

관종 TYPE OF PIPE END ※1	칫수 DIMENSION 외경 × 두께 × 길이 (OUTDIA × THICK × LENGTH) ※2 ※3 ※4	수량 QUAN-TITY (PCS)	중량 WEIGHT (KG)	수압시험 HYDRO-STATIC TEST PSI	※5	제강번호 HEAT NO.	인장시험 TENSILE TEST (Gage Length : 2 INCH) 항복강도 YIELD STRENGTH ※6 Mpa/PSI	인장강도 TENSILE STRENGTH ※7 B Mpa/PSI	※7 W Mpa/PSI	연신율 E.L %	화학성분(%) CHEMICAL COMPOSITION ※8 C ×100	Si ×100	Mn ×100	P ×1000	S ×1000	Cu ×100	Ni ×100	Cr ×100	Mo ×100	V ×100	Ti ×100	Nb ×100	Al ×1000	CEQ ※9 ×1000	경도 HARD-NESS HV	충격시험 IMPACT TEST (℃) 흡수에너지 ABSORBED ENERGY JOULE	전단파면율 SHEAR AREA %	도막시험 COATING TEST 아연부착량 WEIGHT OF ZINC COAT g/㎡	굽힘성 DIP TEST TIMES	※5	비고 REMARK
		41	48,801	1,670	G	C812242	51,200 325 48,900	62,500 480 69,700	65,400 508 73,000	37	16	1	79	15	6	2	2	1	1	TR	TR	TR								
		19	22,615	1,670	G	C821672	315 45,500	460 66,800	475 69,700	36	15	1	78	20	9	2	2	1	1	TR	TR	TR								
		23	27,377	1,670	G	C832011	315 45,500	470 68,200	490 71,100	36	16	1	76	11	8	2	2	1	1	TR	TR	TR								
	TOTAL →	565	398,769																											

※10 HEAT TREATMENT	※11 VISUAL & DIMENSION TEST	※12 FLATTENING, BEND, GUIDED BEND TEST	※13 R-FLATTENING TEST	※14 FLARING TEST	※15 NONDESTRUCTIVE TEST (E.C.T/U.T)	※16 R.M.T	※17 CRUSH TEST	※18 DRIFT TEST	※19 FLANGE TEST
GOOD	GOOD	GOOD			GOOD	GOOD			

NOTE 1 ※1 Type of pipe End 관종

EB:ERW Black End	RB:SAW Black	TC:Thread Coupling
EA:ERW Annealing	RG:SAW Galvanizing	RG:Roll Grooving
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EN:ERW Galvanizing Scaffolding	TE:Thread End	BD:Bell End

※2 NB:Norminal Bore 호칭경, OD:Outside Diameter
※3 Unit 단위(M:mm, I:Inch)
※4 Unit 단위(M:Meter, F:Feet, I:Inch)
※5 G:GOOD
※6 L:Longitudinal 압연방향, T:Transverse 횡주방향
※7 B:Base Metal 모재부, W:Weld Part 용접부
※8 H:Heat(Ladle) Analysis 열연분석, P:Product Analysis 제품분석, WP:Weld Product Analysis 용접부 제품분석
※9 CEQ=C+Mn/6+(Ni+Cu)/15+(Cr+Mo+V)/5 등가탄소량
※10:Heat Treatment 열처리
※11 Visual & Diemension Test 육안 및 치수검사
※12 Flattening/Bend/Guided Bend Test 편평/밴드/굽힘시험
※13:Reverse Flattening Test 전개시험
※14 Flaring Test 압확시험
※15 Nondestructive Test 비파괴검사
※16:Residual Magnetism Test 잔류자장시험 ※17:Crush Test 충압시험
※18:Drift Test 관통시험
※19:Flange Test 플랜지시험

NOTE 2 • SPEC YEAR – API 2004/ASTM 2006/ASME 2004
• NACE MR-0175

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H. J. KIM
INSPECTION MANAGER

SURVEYOR

EDGEN MURRAY CORPORATION

Bill of Lading

Date: 10-SEP-08 10:32 AM

BOL-470604

Ship From:
LAKELAND, FL
3595 Highway 60 West
Bartow, FL 33830, United States

Phone: 863-869-9716
Fax: 863-869-8520

Ship To:
APPLIED DRILLING
ENGINEERING, IN
TAYLOR CREEK JOB/SFWMD
PAUL: 813-695-4358
CALL & MEET
OKEECHOBEE, FL 34972-0000, United States

Order # 2187353
PO # 8025
Order Type: LKD STANDARD

Customer Attachments:

Delivery Name: 258605
FOB:
Way Bill:

Pick Up Date:

Freight Class: 60 (Unless otherwise noted.)
Freight Terms: Prepaid
Ship Method: EDGEN TRUCK-Truck-Ground

Customer Requirements:

LOADS MUST BE STRIPPED ::::: NO PYRAMIDING ALLOWED ::::: 9/6/08 ::::: LOP---- JOBSITE DELVY ---- MICCO BLUFF RD IN OKEECHOBEE, FL ---- DRIVER MUST CALL AHEAD ---PAUL PETRY 813-695-4358 ((WILL MEET THE TRUCK DRIVER AT THE GATE OF ENTRANCE))

Item Number	Description
CP123220TS	12.750" OD X .375 WALL ERW A53B;API 5LB X42----21 FT

Shipping Instruction Number	Packing Instruction Number	Line Number	UOM	Qty Requested	Lot Qty Shipped	Pcs	Weight
04C03597	J07069	2.1	FT	21.00	21.00	1.00	1041.77
04C03599	J07069	2.1	FT	21.00	21.00	1.00	1041.77
04C03601	J07069	2.1	FT	21.00	21.00	1.00	1041.77

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SIGNATURE OF CONSIGNOR		AGENT PER (Driver's Signature)	
If charges are to be prepaid, write or stamp here, "To be Prepaid."	RECEIVED $ To apply in payment of the charges on the property described hereon.	AGENT OR CASHIER (The signature here acknowledges only the amount prepaid.)	CHARGES ADVANCED $

Item Number	Description
CP123220TS	12.750" OD X .375 WALL ERW A53B;API 5LB X42----21 FT

Shipping Instructions Number	Packing Instructions Number	Line Number	UOM	Qty Requested	Lot Qty Shipped	Pcs	Weight
04C03602	J07069	2.1	FT	21.00	21.00	1.00	1041.77
04C03605	J07069	2.1	FT	21.00	21.00	1.00	1041.77
04C03606	J07069	2.1	FT	21.00	21.00	1.00	1041.77
04C03608	J07069	2.1	FT	21.00	21.00	1.00	1041.77
04C03612	J07069	2.1	FT	21.00	21.00	1.00	1041.77
04C03613	J07069	2.1	FT	21.00	21.00	1.00	1041.77
04C03618	J07069	2.1	FT	21.00	21.00	1.00	1041.77

Total Qty Shipped: 210.00 Line Number: 2.1 210.00

Gross Weight: 10417.74 LBS Net Weight: 10417.74 LBS Total Pcs 10.00

Additional
Information:
MTR'S SENT W/SHIPMENT - 1 ENVELOPE

ALL PREPAID FREIGHT INVOICES ARE TO BE SENT TO:
Edgen Corporation,C/O Brousward Logistics, POB 230370, Houston,TX 77223-0370

The items covered by this quotation/order/invoice may be subject to various laws including U.S. and foreign export controls. EDGEN MURRAY CORPORATION is committed to compliance with all relevant export control laws. If the items are being, or will be exported or re-exported, the following language applies: "These commodities, technology or software were exported from the United States of America in accordance with the Export Administration Regulations. Diversion contrary to U.S. law is prohibited."

The property described above, in apparent good order, except as noted (contents and condition of contents of packages unknown), marked, consigned, and destined as indicated below, which said carrier (the word carrier being understood throughout this contract as meaning any person or corporation in possession under the contract) agrees to carry to its usual place of deliver at said destination, if on its route, otherwise to deliver to another carrier on the route to said destination, it is mutually agreed, as to each carrier of all or any said property over all or any portion of said route to destination, and as each party at any time interested in all or any of said property, that every service to be performed hereunder shall be subject to all the terms and conditions of the Uniform Domestic Straight Bill of Lading set forth (1) in Official, Southern, Western and Illinois Freight Classifications in effect on the date hereof, if this is a rail or a rail-water shipment, or (2) in the applicable motor carrier classification or tariff if this is a carrier shipment.

Shipper hereby certifies that he is familiar with all the terms and conditions of the said bill of lading, including those on the back thereof, set forth in the classification or tariff which governs the transportation of this shipment, and the said terms and conditions are hereby agreed to by the shipper and accepted for himself and his assigns.

Subject to Section 7 of Conditions of applicable bill of lading, if this shipment is to be delivered to the consignee without recourse on the consignor, the consignor shall sign the following statement: The carrier shall not make delivery of this shipment without payment of freight and all other lawful charges.		CARRIER	FREIGHT Prepaid [] Collect []
NATURE OF CONSIGNOR X		AGENT PER (Driver's Signature) X	
If charges are to be prepaid, write or stamp here, "To be Prepaid."	RECEIVED $	To apply in payment of the charges on the property described hereon.	AGENT OR CASHIER (The signature here acknowledges only the amount prepaid.)	CHARGES ADVANCED $

EDGEN MURRAY CORPORATION — Bill of Lading — Date: 02-SEP-08 02:22 PM

ROL-469816 — Page: 1 of 1

Ship From:
ALDINE RD, HOUSTON, TX
3004 Aldine Bender Rd
Houston, TX 77032, United States

Ship To:
APPLIED DRILLING ENGINEERING, IN
TAYLOR CREEK JOB/9EWWD
PAUL: 813-695-4358
CALL & MEET
OKEECHOBEE, FL 34972-0000, United States

Order #: 2187553
PO #: 8035
Order Type: LKD STANDARD

Customer Attachments:

Delivery Name: 258200 — Pick Up Date:
FOR:
Way Bill: PACER TRANSPORT
Freight Class: 50 (Unless otherwise noted.)
Freight Terms: Prepaid
Ship Method: EASTMAN LOGISTICS-TL-Ground

Customer Requirements:

ALL LOADS MUST BE STRIPPED ;;;; NO PYRAMIDING ALLOWED ;;;; 9/5/08 ;;;; LJP--- JOBSITE DELVY --- MICCO BLUFF RD IN OKEECHOBEE, FL --- DRIVER MUST CALL AHEAD --PAUL PETRY 813-695-4358 ((WILL MEET THE TRUCK DRIVER AT THE GATE ENTRANCE))

Item Number	Description
CP123300T	12.750" OD X .375 WALL ERW API5LB/X42, A-SA53B---42 FT

Shipping Instructions Number	Lot Number	Line Number	Packing Instructions	Qty UOM	Requested	Lot Qty Shipped	Pcs	Weight
05C22506	J11005	1.1		FT	42.00	42.00	1.00	2083.55
05C22507	J11005	1.1		FT	42.00	42.00	1.00	2083.55
05C22508	J11005	1.1		FT	42.00	42.00	1.00	2083.55
05C22509	J11005	1.1		FT	42.00	42.00	1.00	2083.55
05C22510	J11005	1.1		FT	42.00	42.00	1.00	2083.55

Received, subject to individually determined rates or contracts that have been agreed upon in writing between the carrier and shipper, or in effect on the date hereof, if this is a rail or a rail-water shipment, or (2) in the applicable motor carrier classification or tariff if this is a motor shipment.
Shipper hereby certifies that he is familiar with all the terms and conditions of the said bill of lading, including those on the back hereof, set forth in the classification or tariff which governs the transportation of this shipment, and the said terms and conditions are hereby agreed to by the shipper and accepted for himself and his assigns.

Subject to Section 7 of Conditions of applicable bill of lading, if this shipment is to be delivered to the consignee without recourse on the consignor, the consignor shall sign the following statement: The carrier shall not make delivery of this shipment without payment of freight and all other lawful charges.	CARRIER	FREIGHT: Prepaid ☐ Collect ☐
SEE BACK OF CONSIGNOR	AGENT OR Driver's signature X	
If charges are to be prepaid, write or stamp here: "To be Prepaid."	RECEIVED $ To apply in payment of the charges on the property described hereon.	AGENT OR CASHIER (The signature here acknowledges only the amount prepaid.)	CHARGES ADVANCED $

Bill of Lading Date: 08-SEP-08 03:22 PM

BOL 4000616 Page: 2 of 3

Gross Weight: 43754.00 LBS Net Weight: 43754.00 LBS Total Pcs: 21.00

Additional Information:
MTR'S SENT W/SHIPMENT - 1 ENVELOPE

ALL PREPAID FREIGHT INVOICES ARE TO BE SENT TO:
Edgen Corporation,C/O Broussard Logistics, POB 230370, Houston,TX 77223-0370

The items covered by this quotation/order/invoice may be subject to various laws including U.S. and foreign export controls. EDGEN MURRAY CORPORATION is committed to compliance with all relevant export control laws. If the items are being, or will be exported or re-exported, the following language applies: "These commodities, technology or software were exported from the United States of America in accordance with the Export Administration Regulations. Diversion contrary to U.S. law is prohibited."

The carrier(s) described herein, in consideration of certain rates, contents and condition or contents of packages unknown, marked, consigned and destined as indicated below, which said carrier (the word carrier being understood throughout this contract as meaning any person or corporation in possession of the property under the contract) agrees to carry to its usual place of delivery at said destination, if on its route, otherwise to deliver to another carrier on the route to said destination. It is hereby agreed as to each carrier of all or any part of said property, over all or any portion of said route to destination, and as to each party at any time interested in all or any of said property, that every service to be performed hereunder shall be subject to all the terms and conditions of the Uniform Domestic Straight Bill of Lading set forth in Official, Southern, Western and Illinois Freight Classifications in effect on the date hereof, if this is a rail or a rail-water shipment, or (2) in the applicable motor carrier classification or tariff if this is a motor carrier shipment.

Shipper hereby certifies that he is familiar with all the terms and conditions of the said bill of lading, including those on the back hereof, set forth in the classification or tariff which governs the transportation of this shipment, and the said terms and conditions are hereby agreed to by the shipper and accepted for himself and his assigns.

Subject to Section 7 of Conditions of applicable bill of lading, if this shipment is to be delivered to the consignee without recourse on the consignor, the consignor shall sign the following statement: The carrier shall not make delivery of this shipment without payment of freight and all other lawful charges. SIGNATURE OF CONSIGNOR	CARRIER AGENT OR PER (Carrier's Signature) X	FREIGHT Prepaid ☐ Collect ☐
If charges are to be prepaid, write or stamp here, "To be Prepaid."	RECEIVED $ to apply in payment of the charges on the property described hereon.	AGENT OR CARRIER (The signature here acknowledges only the amount prepaid.)	CHARGES ADVANCED $

Bill of Lading Date: 08-SEP-08 02:22 PM

BOL-469016 Page: 2 of 3

Item Number	Description
CP1233007	12.750" OD X .375 WALL ERW API5LB/X42, A-SA53B---42 FT

Shipping Instruction Number	Line Number	Packing Instruction	Qty UOM	Qty Requested	Qty Shipped	Pcs	Weight
05C22511	J11005	1.1	FT	42.00	42.00	1.00	2083.55
05C22512	J11005	1.1	FT	42.00	42.00	1.00	2083.55
05C22513	G021565	1.1	FT	42.00	42.00	1.00	2083.55
05C22514	J11005	1.1	FT	42.00	42.00	1.00	2083.55
05C22515	J11005	1.1	FT	42.00	42.00	1.00	2083.55
05C22516	J11005	1.1	FT	42.00	42.00	1.00	2083.55
05C22517	J11005	1.1	FT	42.00	42.00	1.00	2083.55
05C22518	J11005	1.1	FT	42.00	42.00	1.00	2083.55
05C22519	J11005	1.1	FT	42.00	42.00	1.00	2083.55
05C22520	J11005	1.1	FT	42.00	42.00	1.00	2083.55
05C22521	J11005	1.1	FT	42.00	42.00	1.00	2083.55
05C22523	J11005	1.1	FT	42.00	42.00	1.00	2083.55
05C22524	J11005	1.1	FT	42.00	42.00	1.00	2083.55
05C22526	J11005	1.1	FT	42.00	42.00	1.00	2083.55
05C24568	J11154	2.1	FT	42.00	42.00	1.00	2083.55
05C24571	J11154	1.1	FT	42.00	42.00	1.00	2083.55

Total Qty Shipped: 882.00 Line Number: 1.1 882.00

The property described above, in apparent good order, except as noted (contents and condition of contents of packages unknown), marked, consigned, and destined as indicated below, which said carrier (the word carrier being understood throughout this contract as meaning any person or corporation in possession under the contract) agrees to carry to its usual place of delivery at said destination, if on its route, otherwise to deliver to another carrier on the route to said destination, it is mutually agreed, as to each carrier of all or any said property over all or any portion of said route to destination, and as each party at any time interested in all or any of said property, that every service to be performed hereunder shall be subject to all the terms and conditions of the Uniform Domestic Straight Bill of Lading set forth (1) in Official, Southern, Western and Illinois Freight Classifications in effect on the date hereof, if this is a rail or a rail-water shipment, or (2) in the applicable motor carrier classification or tariff if this is a carrier shipment.

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Subject to Section 7 of Conditions of applicable bill of lading, if this shipment is to be delivered to the consignee without recourse on the consignor, the consignor shall sign the following statement: The carrier shall not make delivery of this shipment without payment of freight and all other lawful charges.		CARRIER	FREIGHT Prepaid ☐ Collect ☐
SIGNATURE OF CONSIGNOR		AGENT PER (Driver's Signature) X	
If charges are to be prepaid, write or stamp here, "To be Prepaid."	RECEIVED $ To apply in payment of the charges on the property described hereon.	AGENT OR CASHIER (The signature here acknowledges only the amount prepaid.)	CHARGES ADVANCED $

성적서 번호
CERTIFICATE NO. : B702076
발행일자
DATE OF ISSUE. : 2008-07-17
계약번호
CONTRACT(P/O) NO. :
품명
COMMODITY : E.R.W. STEEL PIPE
제품규격
SPECIFICATION : API 5L X42/API 5LB PSL1/ASTM A53B/ASME SA53B

검 사 증 명 서(A)

MILL INSPECTION CERTIFICATE

200021031

MILL INSPECTION CERTIFICATE

고 객 사
CUSTOMER : 현대종합상사

HYUNDAI HYSCO 현대하이스코주식회사 HYUNDAI HYSCO

본사·공장 (ULSAN PLANT) : 울산광역시 북구 염포동 265번지 683-040
#265 YUMPO-DONG, BUK-KU, ULSAN,KOREA
TEL:82-52-280-014, FAX:82-52-287-8916

서울사무소 (SEOUL OFFICE) : 서울시 서초구 잠원동 28-6번지 137-904
28-6, JAMWON-DONG, SEOCHO-KU, SEOUL 137-904, KOREA
TEL:82-2-2112-9114, FAX:82-2-775-7095

관종 TYPE OF PIPE END	치수 DIMENSION 외경 × 두께 × 길이 (OUTDIA × THICK × LENGTH)			수량 QUAN-TITY	중량 WEIGHT	수압시험 HYDRO-STATIC TEST		제강번호 HEAT NO.	인장시험 TENSILE TEST (Gage Length : 2 INCH)				화학성분(%) CHEMICAL COMPOSITION															경도 HARD-NESS	충격시험 IMPACT TEST (℃)		도막시험 COATING TEST			비고 REMARK
						PSI	※5		항복강도 YIELD STRENGTH	인장강도 TENSILE STRENGTH ※7 B	인장강도 TENSILE STRENGTH ※7 W	연신율 E.L		C	Si	Mn	P	S	Cu	Ni	Cr	Mo	V	Ti	Nb			Al	CEQ ※9		흡수에너지 ABSORBED ENERGY	전단파면율 SHEAR AREA	아연부착량 WEIGHT OF ZINC COAT	굽힘성 DIP TEST		
※1	※2	※3	※4	(PCS)	(KG)				※6	Mpa/PSI		%	※8	×100			×1000		×100									×1000		HV	JOULE	%	g/㎡	TI-MES	※5	
EB BE	NB	2-7/8" X 0.203" X 42.000'		96	10,685	3,000	G	C831145		300 (44,000)	460 (66,800)	33		15	2	80	9	6	2	2	1	1	TR	TR	TR									
EB BE	NB	8-5/8" X 0.322" X 42.000'		80	43,680	2,350	G	J11343		304 (44,000)	438 (64,000)	462 (66,800)	35		15	3	71	16	4	2	2	1	1	TR	TR	TR									
EB BE	NB	8-5/8" X 0.322" X 42.000'		110	60,060	2,350	G	J11343		300 (44,000)	438 (64,000)	459 (66,900)	35		15	3	71	16	4	2	2	1	1	TR	TR	TR									
EB BE	NB	12-3/4" X 0.375" X 42.000'		100	94,290	2,100	G	J11154		301 (44,000)	445 (64,000)	469 (68,200)	36		15	3	69	11	7	2	1	2	1	TR	TR	TR									
EB BE	NB	12-3/4" X 0.375" X 42.000'		56	52,802	2,100	G	J11005		352 (51,200)	473 (68,200)	490 (71,100)	34		7	4	85	12	4	2	2	1	1	TR	TR	TR									
				37	34,888	2,100	G	G021565		353 (51,200)	440 (64,000)	462 (66,900)	37		15	2	66	7	18	2	2	1	1	TR	TR	TR									
EB BE	NB	16" X 0.375" X 42.000'		3	3,571	1,670	G	H17679		351	430	454	35		6	2	78	11	3	2	1	2	1	TR	TR	TR									

※10 HEAT TREATMENT	※11 VISUAL & DIMENSION TEST	※12 FLATTENING, BEND, GUIDED BEND TEST	※13 R-FLATTENING TEST	※14 FLARING TEST	※15 NONDESTRUCTIVE TEST (E.C.T/U.T)	※16 R.M.T	※17 CRUSH TEST	※18 DRIFT TEST	※19 FLANGE TEST
GOOD	GOOD	GOOD			GOOD	GOOD			

NOTE 1 ※1 Type of pipe End 관종

EB:ERW Black End	RB:SAW Black	TC:Thread Coupling
EA:ERW Annealing	RG:SAW Galvanizing	RG:Roll Grooving
EG:ERW Galvanizing	RS:SAW Sprial	VG:Victaulic Grooving
EC:ERW Black Thread	PE:Plain End	PC:Plain End + Coupled
ED:ERW Galvanizing Thread	BE:Bevel End	PB:Plain End + Bevel End
EN:ERW Galvanizing Scaffolding	TE:Thread End	BD:Bell End

※2 NB:Noriminal Bore 호칭경, OD:Outside Diameter
※3 Unit 단위(M:mm, I:Inch)
※4 Unit 단위(M:Meter, F:Feet, I:Inch)
※5 G:GOOD
※6 L:Longitudinal 압연방향, T:Transverse 횡주방향
※7 B:Base Metal 모재부, W:Weld Part 용접부
※8 H:Heat(Ladle) Analysis 열연분석, P:Product Analysis 제품분석, WP:Weld Product Analysis 용접부 제품분석
※9 CEQ=C+Mn/6+(Ni+Cu)/15+(Cr+Mo+V)/5 등가탄소량
※10:Heat Treatment 열처리
※11 Visual & Dimension Test 육안 및 치수검사
※12 Flattening/Bend/Guided Bend Test 편평/벤드/굽힘시험
※13:Reverse Flattening Test 전개시험
※14 Flaring Test 입확시험
※15 Nondestructive Test 비파괴검사
※16:Residual Magnetism Test 전류자장시험
※17:Crush Test 충압시험
※18:Drift Test 관통시험
※19:Flange Test 플랜지시험

NOTE 2 • SPEC YEAR – API 2004/ASTM 2006/ASME 2004
• NACE MR-0175

본 제품은 관련 규격에 합격되었음을 보증합니다.
WE HEREBY CERTIFY THAT MATERIAL DESCRIBED HEREIN HAS BEEN ACCEPTED IN ACCORDANCE WITH THE PRESCRIBED SPECIFICATION AND ORDER
• 본 검사증명서에 명기된 규격용도외 사용시 안전상 문제가 발생할 수 있으며, 검사증명서 위,변조시 사문서 위조로 불이익을 당하실 수 있습니다.

SURVEYOR

H. J. KIM
INSPECTION MANAGER

성적서 번호
CERTIFICATE NO. : 8702076
발행일자
DATE OF ISSUE. : 2008-07-17
계약번호
CONTRACT(P/O) NO. :
품명
COMMODITY : E.R.W. STEEL PIPE
제품규격
SPECIFICATION : API 5L X42/API 5LB PSL1/ASTM A53B/ASME SA53B

200021031

검 사 증 명 서(A)

MILL INSPECTION CERTIFICATE

MILL INSPECTION CERTIFICATE

고 객 사
CUSTOMER : 현대종합상사

HYUNDAI HYSCO 현대하이스코주식회사 HYUNDAI HYSCO

본사·공장 (ULSAN PLANT) : 울산광역시 북구 염포동 265번지 683-040
#265 YUMPO-DONG, BUK-KU, ULSAN,KOREA
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28-6, JAMWON-DONG, SEOCHO-KU, SEOUL 137-904, KOREA
TEL:82-2-2112-9114, FAX:82-2-775-7095

관종 TYPE OF PIPE END ※1	치수 DIMENSION 외경 × 두께 × 길이 (OUTDIA × THICK × LENGTH) ※2 ※3 ※4	수량 QUAN-TITY (PCS)	중량 WEIGHT (KG)	수압시험 HYDRO-STATIC TEST PSI	※5	제강번호 HEAT NO.	인장시험 TENSILE TEST (Gage Length : 2 INCH) 항복강도 YIELD STRENGTH ※6 Mpa/PSI	인장강도 TENSILE STRENGTH ※7 B Mpa/PSI	※7 W Mpa/PSI	연신율 E.L %	화학성분(%) CHEMICAL COMPOSITION ※8	C ×100	Si	Mn ×1000	P	S	Cu ×100	Ni	Cr	Mo	V	Ti	Nb	Al ×1000	CEQ ※9	경도 HARD-NESS HV	충격시험 IMPACT TEST (V) 흡수에너지 ABSORBED ENERGY JOULE	전단파면율 SHEAR AREA %	도막시험 COATING TEST 아연부착량 WEIGHT OF ZINC COAT g/㎡	균일성 DIP TEST TIMES	※5	비고 REMARK
		41	48,801	1,670	G	C812242		51,200 325 48,900	52,500 480 69,700	65,400 508 73,900	37		16	1	79	15	6	2	2	1	1	TR	TR	TR								
		19	22,615	1,670	G	C821672		315 45,300	460 66,800	475 69,700	36		15	1	78	20	9	2	2	1	1	TR	TR	TR								
		23	27,377	1,670	G	C832011		315 45,500	470 68,200	490 71,100	36		16	1	76	11	8	2	2	1	1	TR	TR	TR								
	TOTAL →	565	398,769																												

※10 HEAT TREATMENT	※11 VISUAL & DIMENSION TEST	※12 FLATTENING, BEND, GUIDED BEND TEST	※13 R-FLATTENING TEST	※14 FLARING TEST	※15 NONDESTRUCTIVE TEST (E.C.T/U.T)	※16 R.M.T	※17 CRUSH TEST	※18 DRIFT TEST	※19 FLANGE TEST
GOOD	GOOD	GOOD			GOOD	GOOD			

NOTE 1 ※1 Type of pipe End 관종

EB:ERW Black End	RB:SAW Black	TC:Thread Coupling
EA:ERW Annealing	RG:SAW Galvanizing	RG:Roll Grooving
EG:ERW Galvanizing	RS:SAW Sprial	VG:Victaulic Grooving
EC:ERW Black Thread	PE:Plain End	PC:Plain End + Coupled
ED:ERW Galvanizing Thread	BE:Bevel End	PB:Plain End + Bevel End
EN:ERW Galvanizing Scaffolding	TE:Thread End	BD:Bell End

※2 NB:Norminal Bore 호칭경, OD:Outside Diameter
※3 Unit 단위(M:mm, I:Inch)
※4 Unit 단위(M:Meter, F:Feet, I:Inch)
※5 G:GOOD
※6 L:Longitudinal 압연방향, T:Transverse 횡주방향
※7 B:Base Metal 모재부, W:Weld Part 용접부
※8 H:Heat(Ladle) Analysis 열연분석, P:Product Analysis 제품분석, WP:Weld Product Analysis 용접부 제품분석
※9 CEQ=C+Mn/6+(Ni+Cu)/15+(Cr+Mo+V)/5 등가탄소량
※10:Heat Treatment 열처리
※11 Visual & Dimension Test 육안 및 치수검사
※12 Flattening/Bend/Guided Bend Test 편평/벤드/굽힘시험
※13:Reverse Flattening Test 전개시험
※14 Flaring Test 압확시험
※15 Nondestructive Test 비파괴검사
※16:Residual Magnetism Test 잔류자장시험 ※17:Crush Test 충압시험
※18:Drift Test 관통시험
※19:Flange Test 플랜지시험

NOTE 2 • SPEC YEAR – API 2004/ASTM 2006/ASME 2004
• NACE MR-0175

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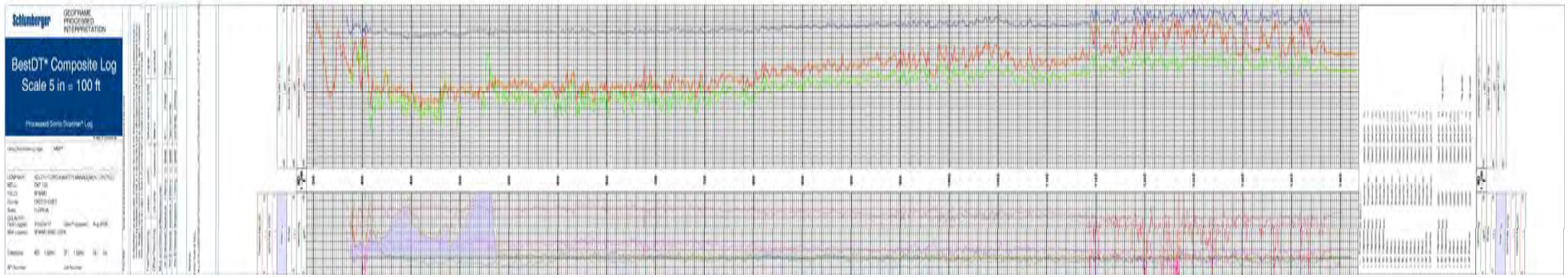
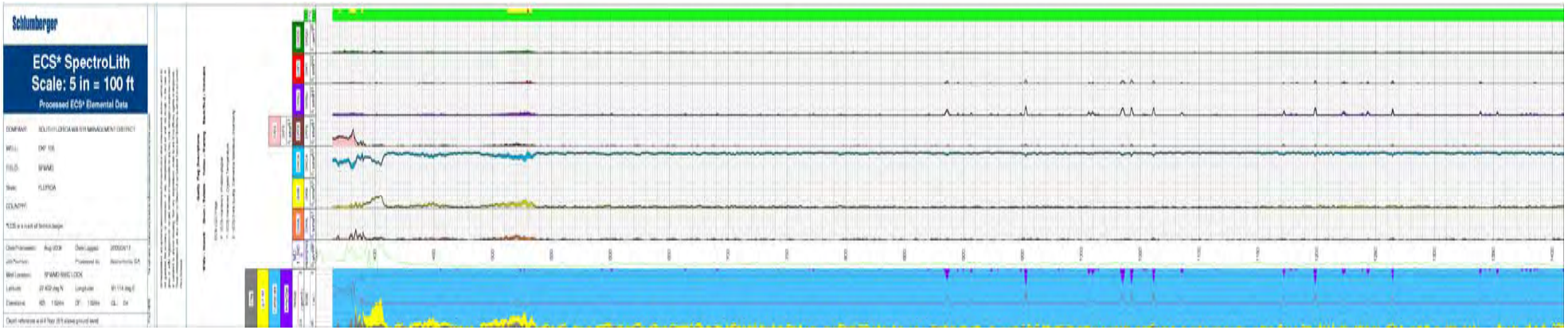
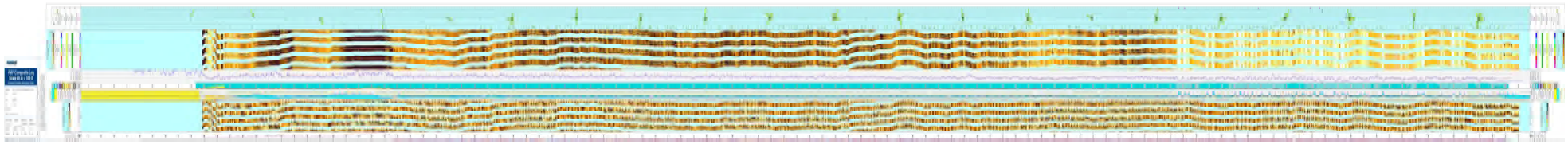
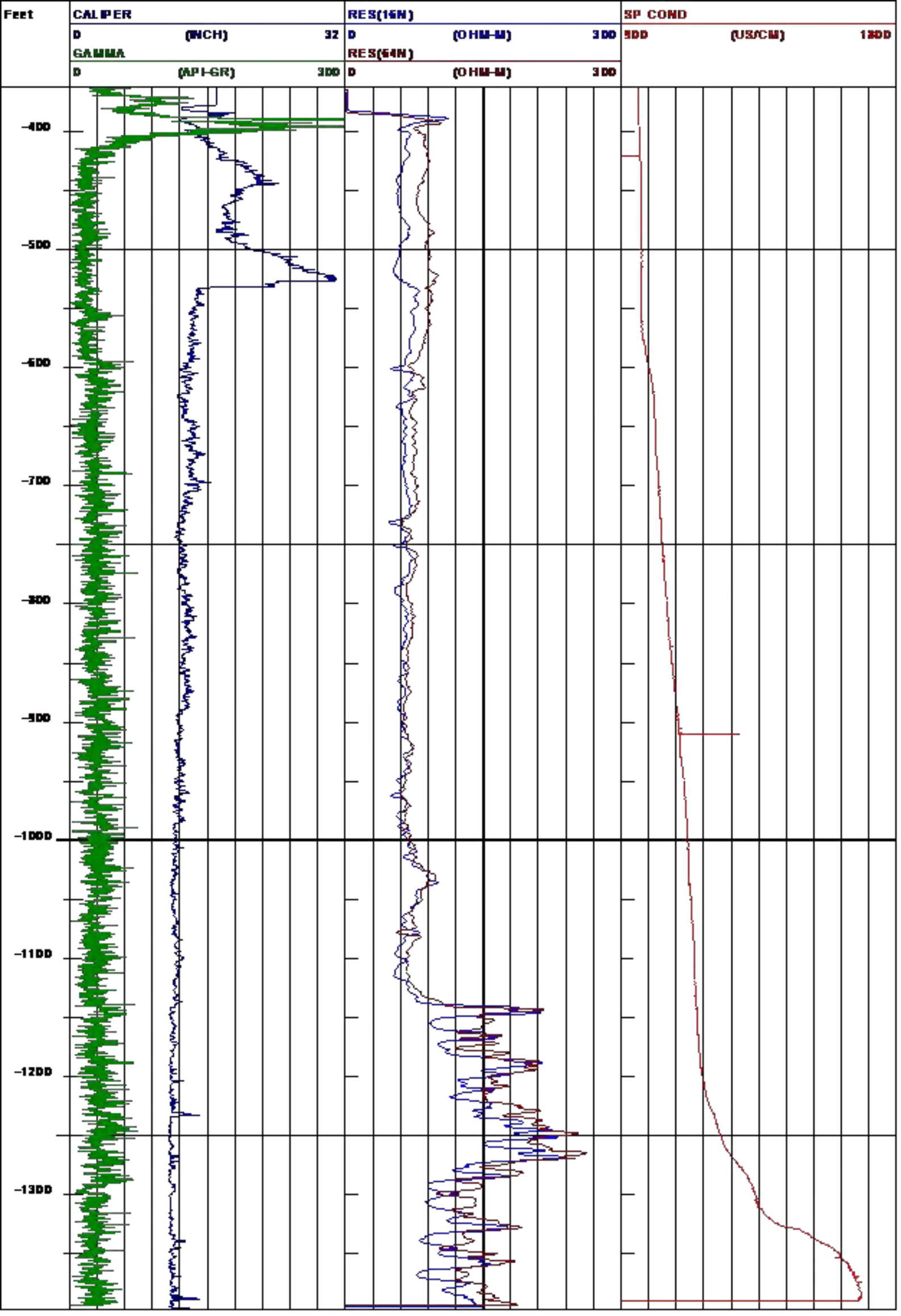
SURVEYOR

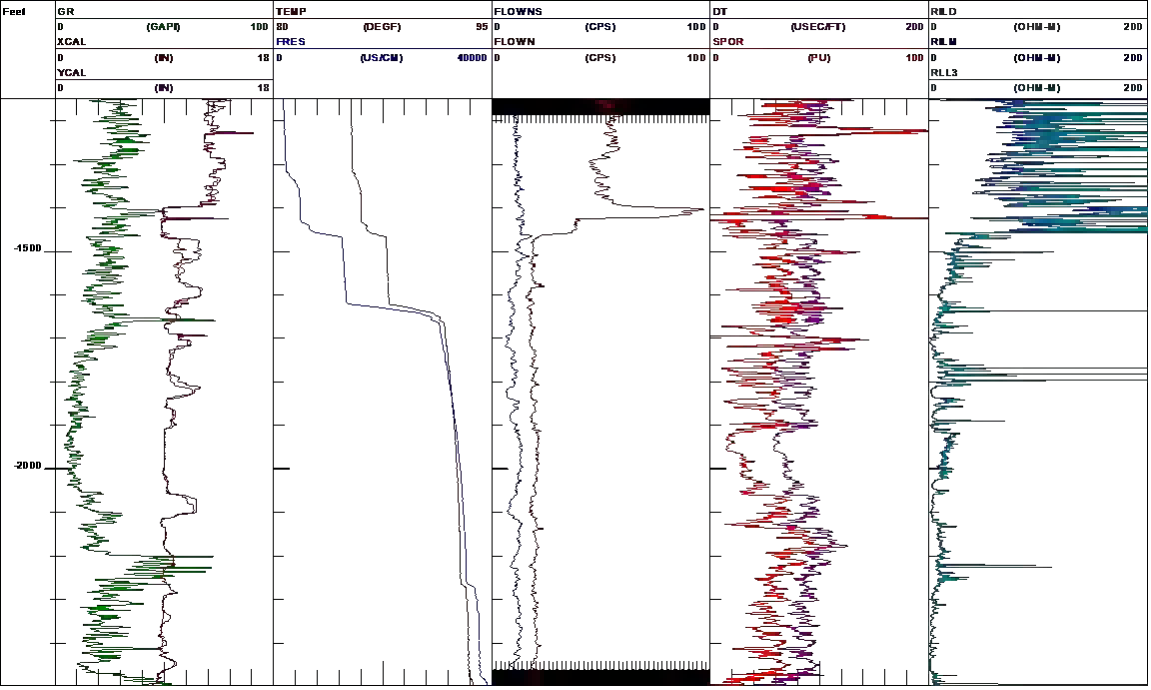
H. J. KIM
INSPECTION MANAGER


Schlumberger
GEOFRAME
PROCESSED
INTERPRETATION
BestDT* Composite Log
Scale 5 in = 100 ft
Processed Sonic Dipolmet Log


Schlumberger
ECS* SpectroLith
Scale: 5 in = 100 ft
Processed ECS* Elemental Data




Feet
CALIPER
0
(INCH)
32
GAMMA
0
(API-GR)
300
RES(16N)
0
(OHM-M)
300
RES(64N)
0
(OHM-M)
300
SP COND
500
(US/CM)
1500
-400
-500
-600
-700
-800
-900
-1000
-1100
-1200
-1300


Feet
GR
0 (GAPI) 100
XCAL
0 (IN) 18
YCAL
0 (IN) 18
TEMP
80 (DEGF) 95
FRES
0 (US/CM) 40000
FLOWNS
0 (CPS) 100
FLOWN
0 (CPS) 100
DT
0 (USEC/FT) 200
SPOR
0 (PU) 100
RILD
0 (OHM-M) 200
RILM
0 (OHM-M) 200
RLL3
0 (OHM-M) 200
-1500
-2000

Feet

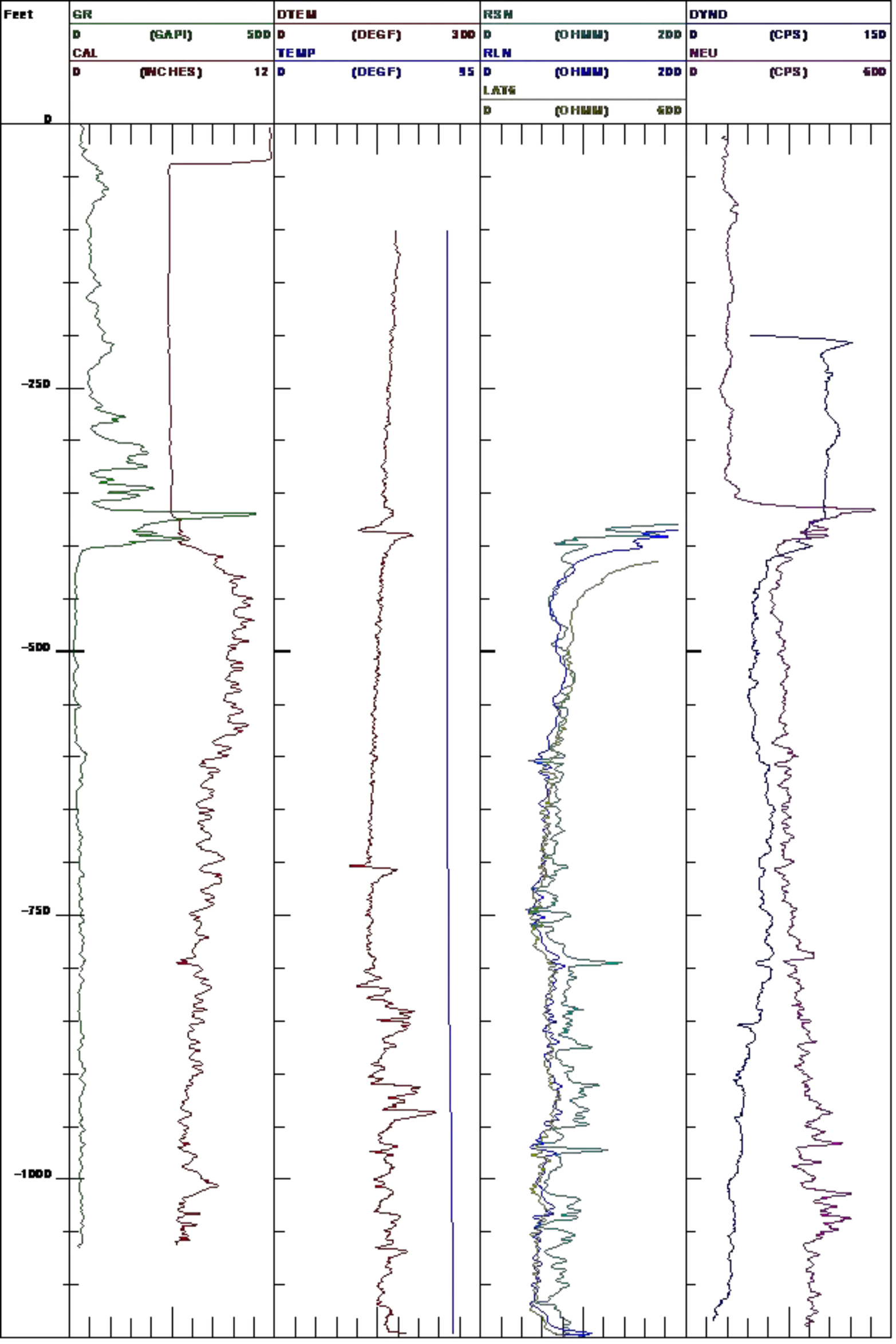
CALIPER	SP COND	UFLOW	TIME(F)	RES(16N)
0 (INCH) 12	0 (US/CM) 1200	0 (CPS) 400	0 (USEC) 600	0 (OHM-M) 300
GAMMA	TEMP	DFLOW	POR(SON)	RES(64N)
0 (API-GR) 700	75 (DEG F) 50	0 (CPS) 400	0 (PERCENT) 50	0 (OHM-M) 300
				LATERAL
				0 (OHM-M) 300

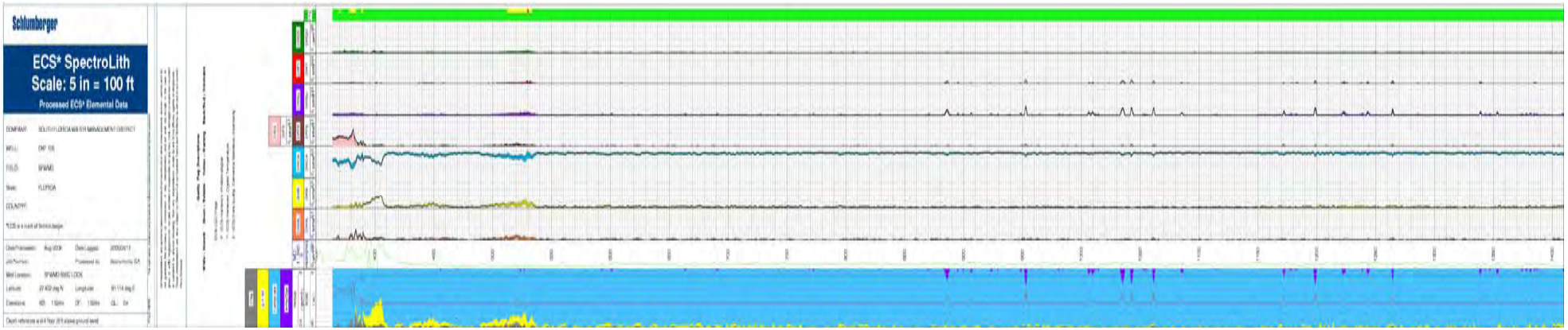
-250

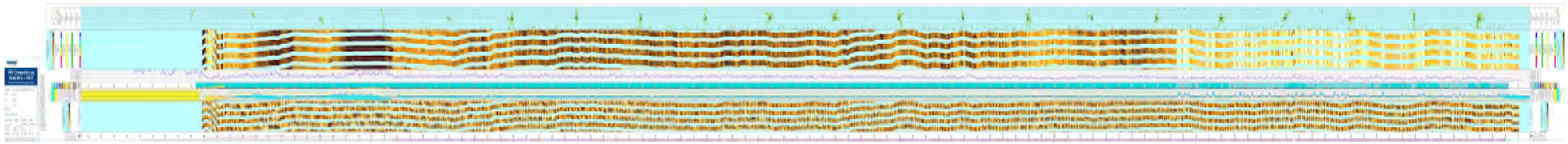
-500

-750

-1000


Feet
GR
0 (GAPI) 500
CAL
0 (INCHES) 12
DTEM
0 (DEGF) 300
TEMP
0 (DEGF) 55
RSN
0 (OHMM) 200
RLN
0 (OHMM) 200
LAT6
0 (OHMM) 600
DYND
0 (CPS) 150
NEU
0 (CPS) 600
0
-250
-500
-750
-1000


Schlumberger
ECS* SpectroLith
Scale: 5 in = 100 ft
Processed ECS* Elemental Data



Feet

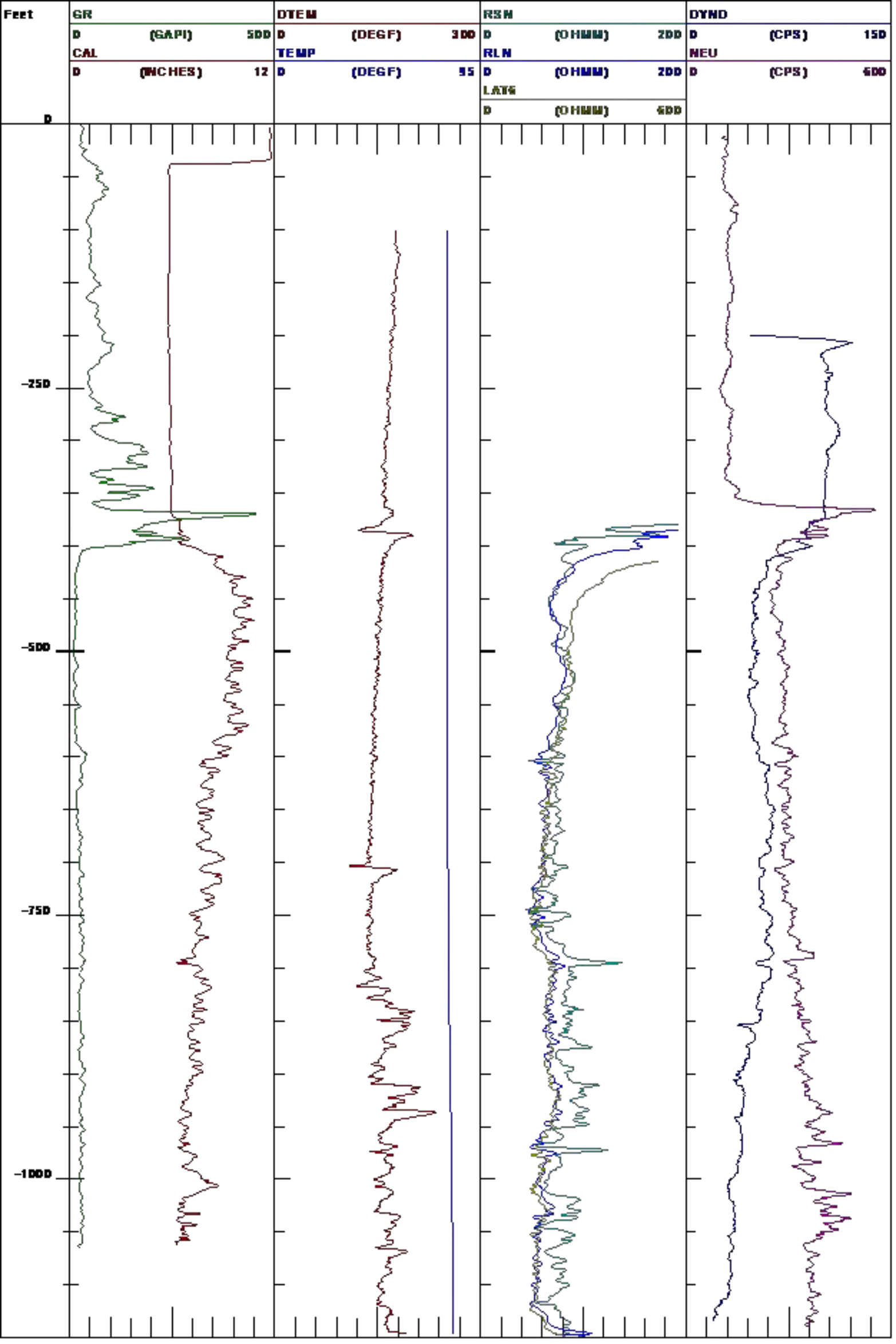
CALIPER	SP COND	UFLOW	TIME(F)	RES(16N)
0 (INCH) 12	0 (US/CM) 1200	0 (CPS) 400	0 (USEC) 600	0 (OHM-M) 300
GAMMA	TEMP	DFLOW	POR(SON)	RES(64N)
0 (API-GR) 700	75 (DEG F) 50	0 (CPS) 400	0 (PERCENT) 50	0 (OHM-M) 300
				LATERAL
				0 (OHM-M) 300

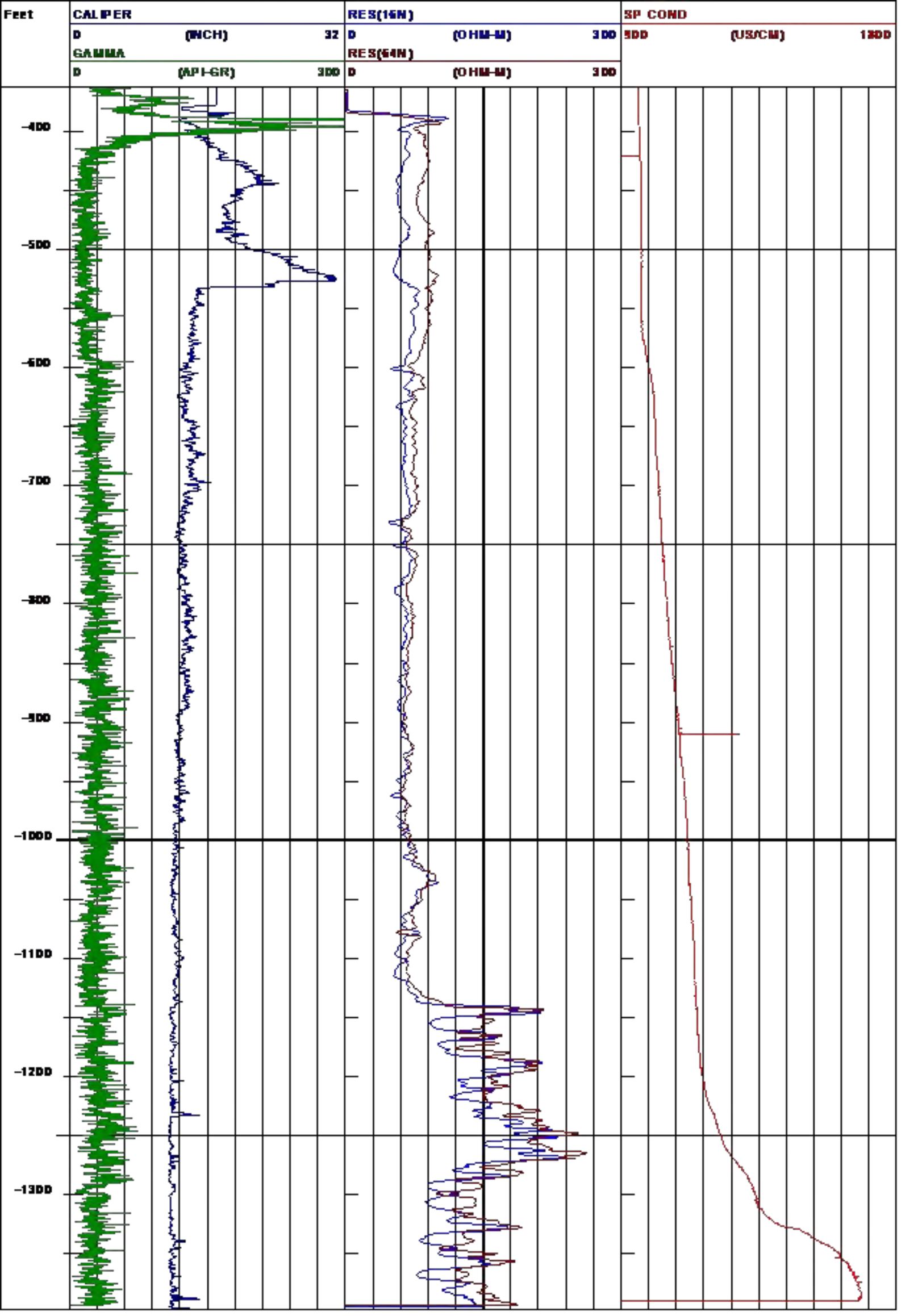
-250

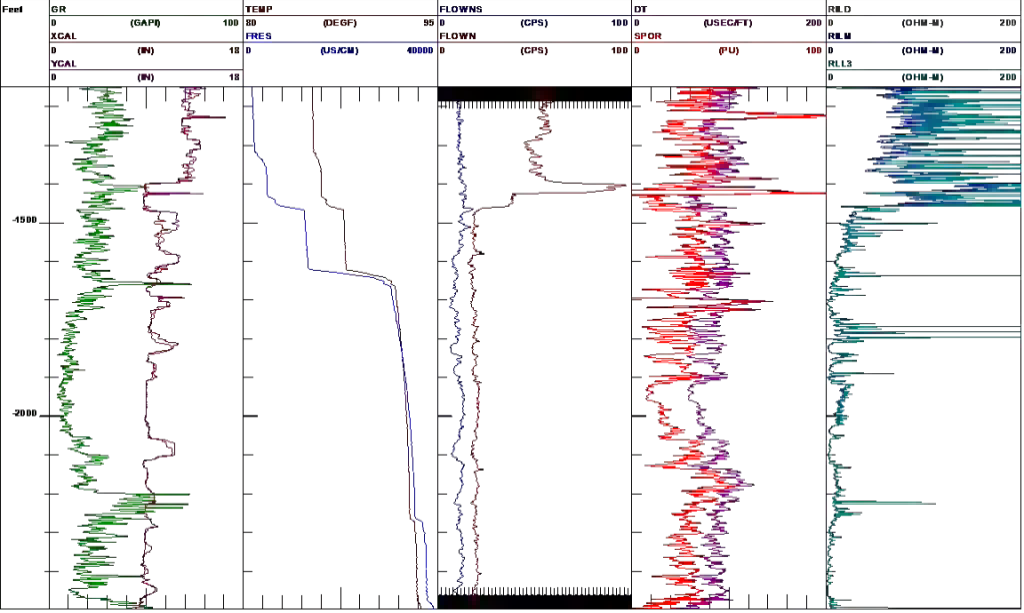
-500

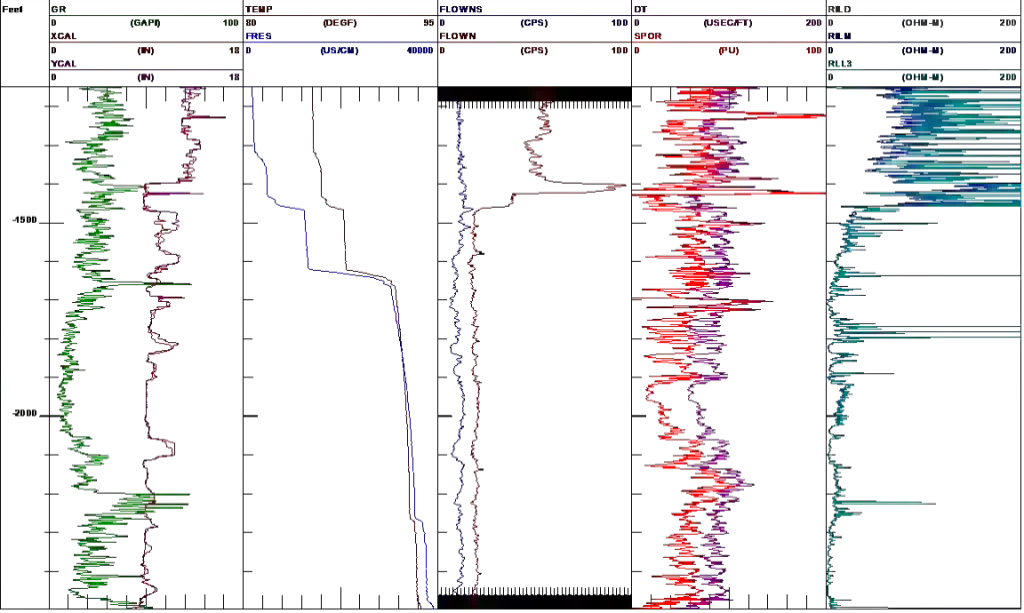
-750

-1000


Feet
GR
0 (GAPI) 500
CAL
0 (INCHES) 12
DTEM
0 (DEGF) 300
TEMP
0 (DEGF) 55
RSN
0 (OHMM) 200
RLN
0 (OHMM) 200
LAT6
0 (OHMM) 600
DYND
0 (CPS) 150
NEU
0 (CPS) 600
0
-250
-500
-750
-1000


Feet
CALIPER
0
(INCH)
32
GAMMA
0
(API-GR)
300
RES(16N)
0
(OHM-M)
300
RES(64N)
0
(OHM-M)
300
SP COND
500
(US/CM)
1500
-400
-500
-600
-700
-800
-900
-1000
-1100
-1200
-1300


Feet
GR
0 (GAPI) 100
XCAL
0 (IN) 18
YCAL
0 (IN) 18
TEMP
80 (DEGF) 95
FRES
0 (US/CM) 40000
FLOWNS
0 (CPS) 100
FLOWN
0 (CPS) 100
DT
0 (USEC/FT) 200
SPOR
0 (PU) 100
RILD
0 (OHM-M) 200
RILM
0 (OHM-M) 200
RLL3
0 (OHM-M) 200
-1500
-2000


Feet
GR
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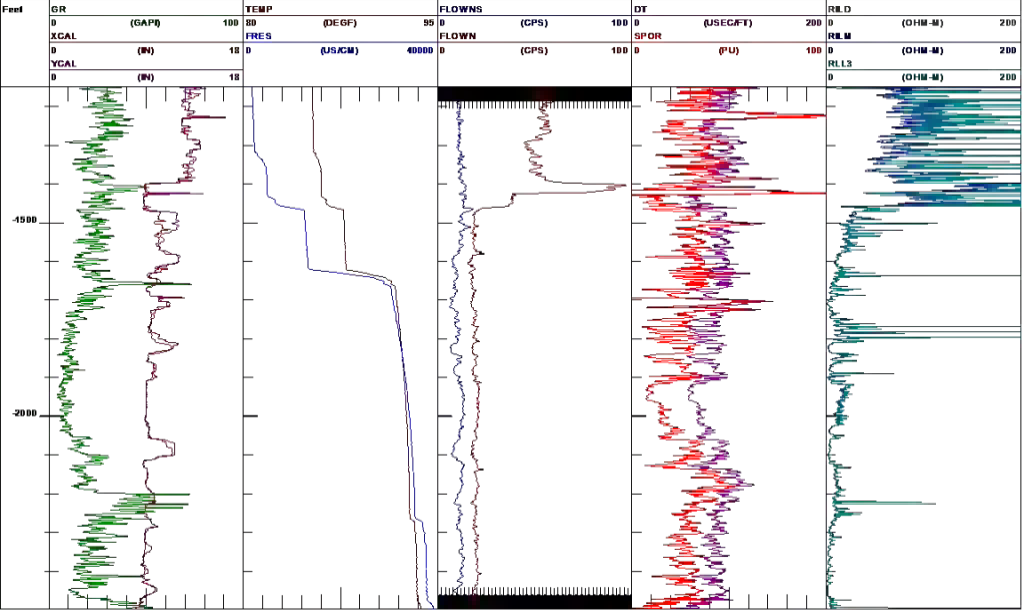
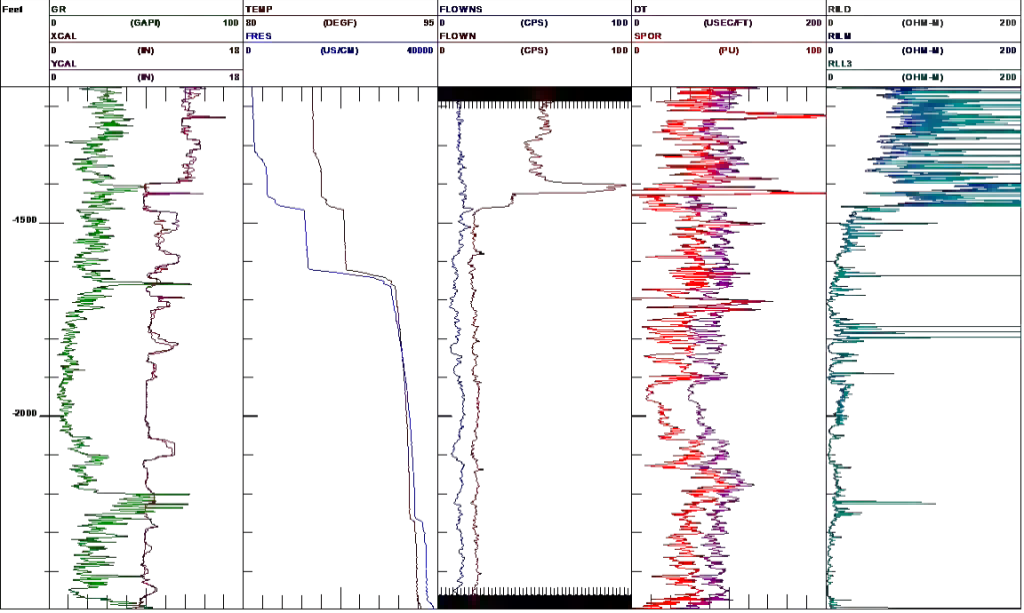
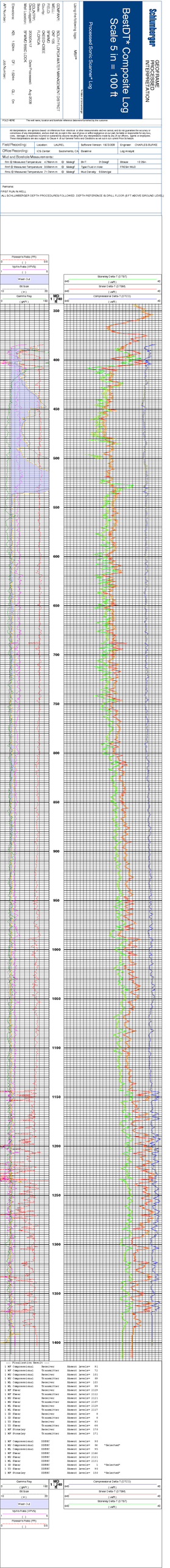
XCAL
0 (IN) 18
YCAL
0 (IN) 18
TEMP
80 (DEGF) 95
FRES
0 (US/CM) 40000
FLOWNS
0 (CPS) 100
FLOWN
0 (CPS) 100
DT
0 (USEC/FT) 200
SPOR
0 (PU) 100
RILD
0 (OHM-M) 200
RILM
0 (OHM-M) 200
RLL3
0 (OHM-M) 200
-1500
-2000


Feet
GR
0 (GAPI) 100
XCAL
0 (IN) 18
YCAL
0 (IN) 18
TEMP
80 (DEGF) 95
FRES
0 (US/CM) 40000
FLOWNS
0 (CPS) 100
FLOWN
0 (CPS) 100
DT
0 (USEC/FT) 200
SPOR
0 (PU) 100
RILD
0 (OHM-M) 200
RILM
0 (OHM-M) 200
RLL3
0 (OHM-M) 200
-1500
-2000


Feet
GR
0 (GAPI) 100
XCAL
0 (IN) 18
YCAL
0 (IN) 18
TEMP
80 (DEGF) 95
FRES
0 (US/CM) 40000
FLOWNS
0 (CPS) 100
FLOWN
0 (CPS) 100
DT
0 (USEC/FT) 200
SPOR
0 (PU) 100
RILD
0 (OHM-M) 200
RILM
0 (OHM-M) 200
RLL3
0 (OHM-M) 200
-1500
-2000


Schlumberger
GEOFRAME
PETROPHYSICAL
INTERPRETATION
BestIDT* Composite Log
Scale 5 in = 100 ft
Processed Sonic Scanner* Log
Logging Engineer: MSP*
Interpretation Engineer:
Logging Company: SCHLUMBERGER
Main Log Interval: DEPTH
Drilling Measured Depth: DEPTH
Bottom Log Interval: DEPTH
Top Log Interval: DEPTH
Casing Driller Size @ Depth: 20 @ 1,000 ft
Casing Logger Size @ Depth: 20 @ 1,000 ft
Bit Size: 17.5 in
Type Fluid in Hole: FRESH MUD
Density: 9.6 lbm/gal
Viscosity: 0 s/qt
PH: 0
Fluid Loss: 0 cm3
Source of Sample: FLOWLINE
Rm @ Measured Temperature: 0.78 @ 70 degF
Rmf @ Measured Temperature: 0.59 @ 70 degF
Rmc @ Measured Temperature: 1.7 @ 70 degF
Source of Rmf and Rmc: MEAS
Rm @ BHT: 0.39 @ 200 degF
Time Circulation Stopped: 12:00
Time Logger on Bottom: 16:30
Maximum Recorded Temperature: 200 degF
Equipment Number: 3DGA-A
Location: 0
Recorded By: MSP
Witnessed By: DAVE
API Number:
Elevations:
KB: 1.68m
DF: 1.68m
GL: 0m
Job Number:
Permanent Datum: Sea Level
Log Measured From: KB
Drilling Measured From: KB
Date: 20/10/17
Run Number: ONE
Depth Driller: 1,000m
Depth Logger: 1,000m
Bottom Logged Interval: 1,000m
Top Log Interval: 0m
Casing Driller: 1,000m @ 1,000m
Casing Logger: 1,000m @ 1,000m
Bit Size: 17.5in
Type Fluid in Hole: FRESH MUD
Density: 9.6lbm/gal
Viscosity: 0s/qt
PH: 0
Fluid Loss: 0cm3
Source of Sample: FLOWLINE
Rm @ Measured Temperature: 0.78@70degF
Rmf @ Measured Temperature: 0.59@70degF
Rmc @ Measured Temperature: 1.7@70degF
Source of Rmf and Rmc: MEAS
Rm @ BHT: 0.39@200degF
Time Circulation Stopped: 12:00
Time Logger on Bottom: 16:30
Maximum Recorded Temperature: 200degF
Equipment Number: 3DGA-A
Location: 0
Recorded By: MSP
Witnessed By: DAVE
FOLD HERE
The well name, location and borehole reference data were furnished by the customer.
All interpretations, are opinions based on inferences from electrical or other measurements and we cannot, and do not guarantee the accuracy or correctness of any interpretation, and we shall not, except in the case of gross or wilful negligence on our part, be liable or responsible for any loss, costs, damages or expenses incurred or sustained by anyone resulting from any interpretation made by any of our officers, agents or employees. These interpretations are also subject to Clause 4 of our General Terms and Conditions as set out in our current Price Schedule.
Field Recording:
Location: LAUREL
Software Version: 19C0-309
Engineer: CHARLES BURKE
Office Recording:
Schlumberger, CA
Baseline
Log Analyst:
Mud and Borehole Measurements:
Rm @ Measured Temperature: 4.78@mm @ 50degF
BHT: 213degF
Bitsize: 12.38in
Rmf @ Measured Temperature: 3.09@mm @ 50degF
Type Fluid in Hole: FRESH MUD
Rmc @ Measured Temperature: 7.17@mm @ 50degF
Mud Density: 8.6lbm/gal
Remarks:
FIRST RUN IN WELL
ALL SCHLUMBERGER DEPTH PROCEDURES FOLLOWED. DEPTH REFERENCE IS DRILL FLOOR (9.6 FT ABOVE GROUND LEVEL)
Poisson's Ratio (PR)
Vp/Vs Ratio (VPVS)
Wiper Out
Bit Size
Gamma Ray
Stoneley Delta-T (DTST)
Shear Delta-T (DTSM)
Compressional Delta-T (DTCO)
MD
ft
Processing Remarks
1 MP Checkpoint Baseline Absent Jamie= 91
1 MP Checkpoint Transmitter Absent Jamie= 72
1 MD Checkpoint Baseline Absent Jamie= 101
1 MD Checkpoint Transmitter Absent Jamie= 89
1 MG Checkpoint Baseline Absent Jamie= 103
1 MG Checkpoint Transmitter Absent Jamie= 89
1 MP Shear Baseline Absent Jamie= 2129
1 MP Shear Transmitter Absent Jamie= 2132
1 MD Shear Baseline Absent Jamie= 2121
1 MD Shear Transmitter Absent Jamie= 2123
1 MG Shear Baseline Absent Jamie= 2119
1 MG Shear Transmitter Absent Jamie= 0
1 TD Shear Baseline Absent Jamie= 0
1 TD Shear Transmitter Absent Jamie= 95
1 MP Stoneley Baseline Absent Jamie= 44
1 MP Stoneley Transmitter Absent Jamie= 173
1 MP Checkpoint DOEBC Absent Jamie= 90
1 MD Checkpoint DOEBC Absent Jamie= 95 *Selected*
1 MG Checkpoint DOEBC Absent Jamie= 95
1 MP Shear DOEBC Absent Jamie= 2166
1 MD Shear DOEBC Absent Jamie= 2121
1 MG Shear DOEBC Absent Jamie= 2131
1 TD Shear DOEBC Absent Jamie= 1 *Selected*
1 TD Shear DOEBC Absent Jamie= 90
1 MP Stoneley DOEBC Absent Jamie= 116 *Selected*

Schlumberger

GEOFRAME
PROCESSED
INTERPRETATION

BestDT* Composite Log
Scale 5 in = 100 ft

Processed Sonic Scanner* Log

*A Mark of Schlumberger

Using the following logs: MSIP*

COMPANY:	SOUTH FLORIDA WATER MANAGEMENT DISTRICT		
WELL:	OKF 105		
FIELD:	SFWMD		
County:	OKEECHOBEE		
State:	FLORIDA		
COUNTRY:			
Date Logged:	2005/04/17	Date Processed:	Aug-2008
Well Location:	SFWMD S65C LOCK		

Elevations: KB: 1.524m DF: 1.524m GL: 0m

API Number: Job Number:

FOLD HERE

The well name, location and borehole reference data were furnished by the customer.

All interpretations are opinions based on inferences from electrical or other measurements and we cannot, and do not guarantee the accuracy or correctness of any interpretation, and we shall not, except in the case of gross or willful negligence on our part, be liable or responsible for any loss, costs, damages or expenses incurred or sustained by anyone resulting from any interpretation made by any of our officers, agents or employees. These interpretations are also subject to Clause 4 of our General Terms and Conditions as set out in our current Price Schedule.

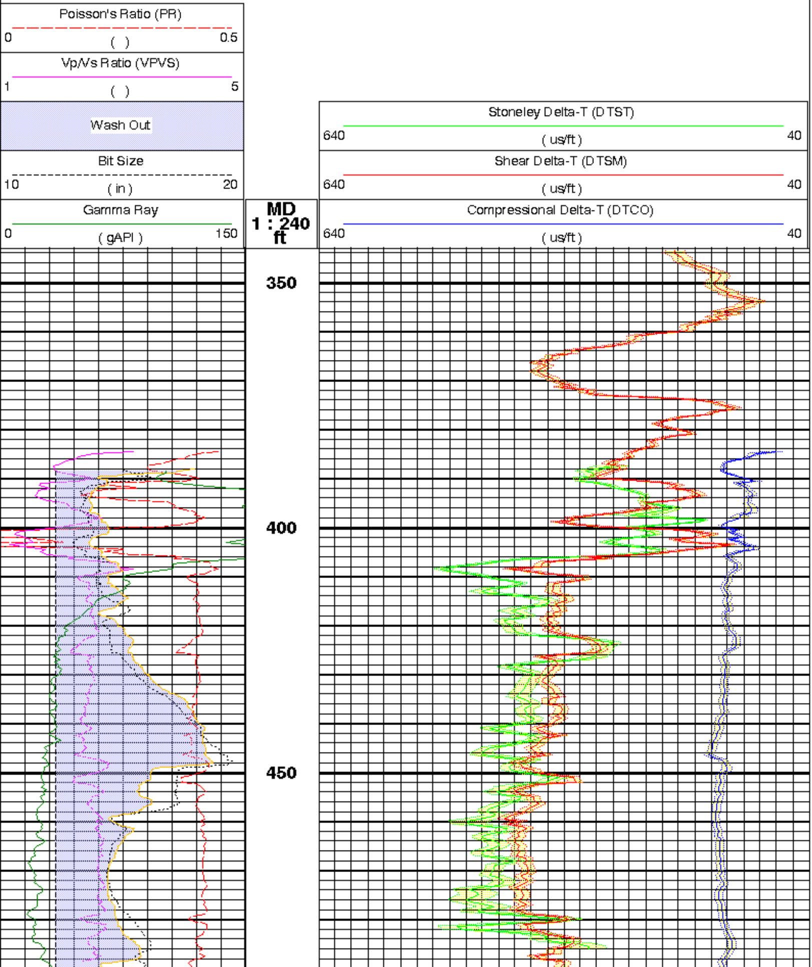
Field Recording:	Location: LAUREL	Software Version: 15C0-309	Engineer: CHARLES BURKE
Office Recording:	ICS Center: Sacramento, CA	Baseline:	Log Analyst:

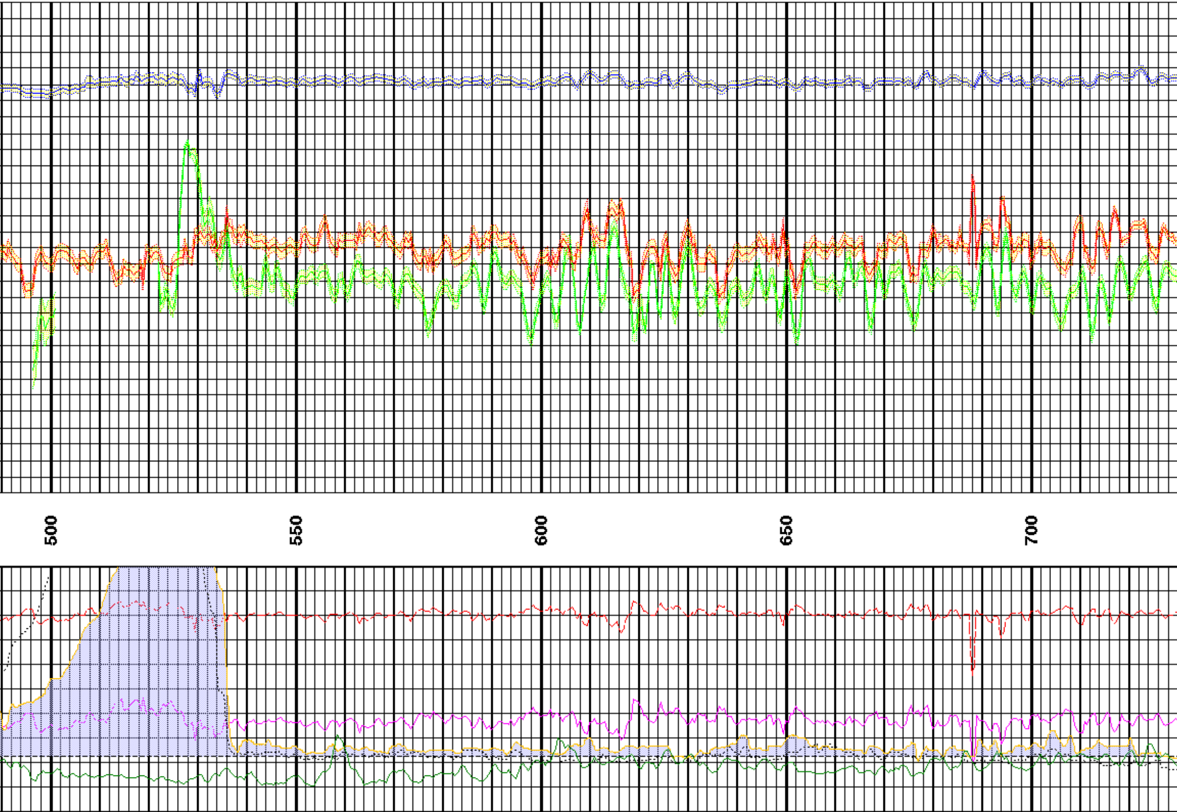
Mud and Borehole Measurements:

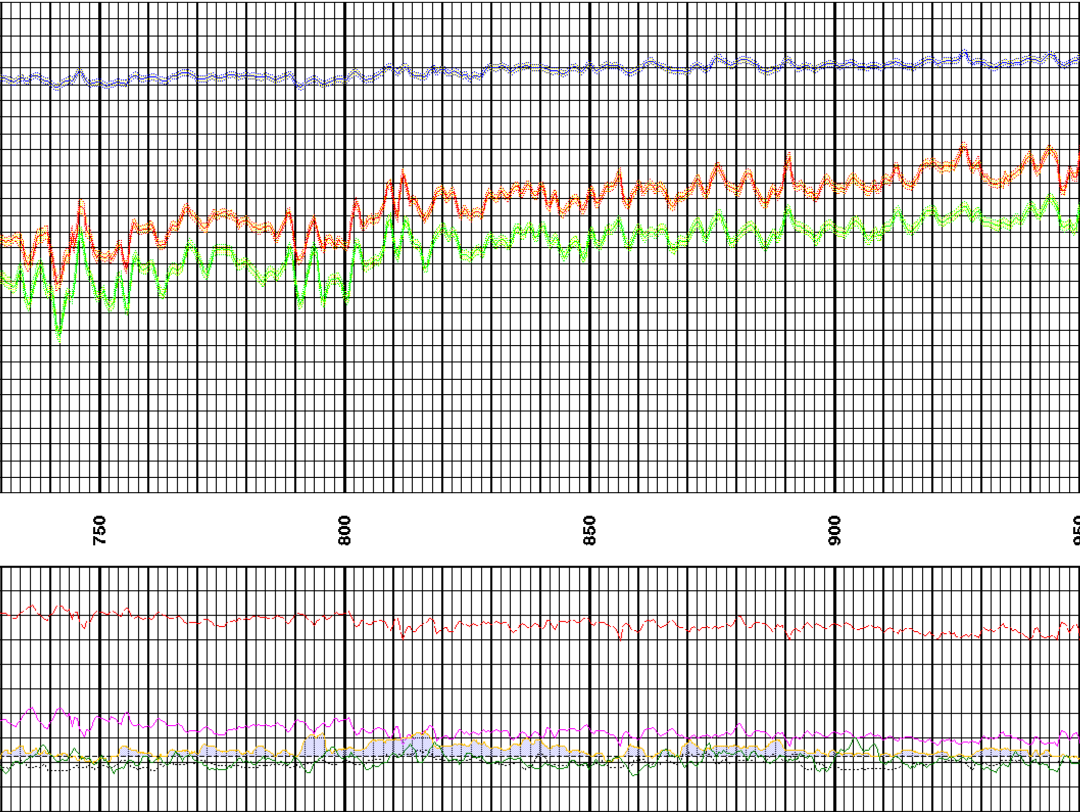
Rm @ Measured Temperature:	4.78ohm.m @ 56degF	BHT: 212degF	Bitsize: 12.25in
Rmf @ Measured Temperature:	3.59ohm.m @ 56degF	Type Fluid in Hole:	FRESH MUD
Rmc @ Measured Temperature:	7.17ohm.m @ 56degF	Mud Density: 9.5lbm/gal	

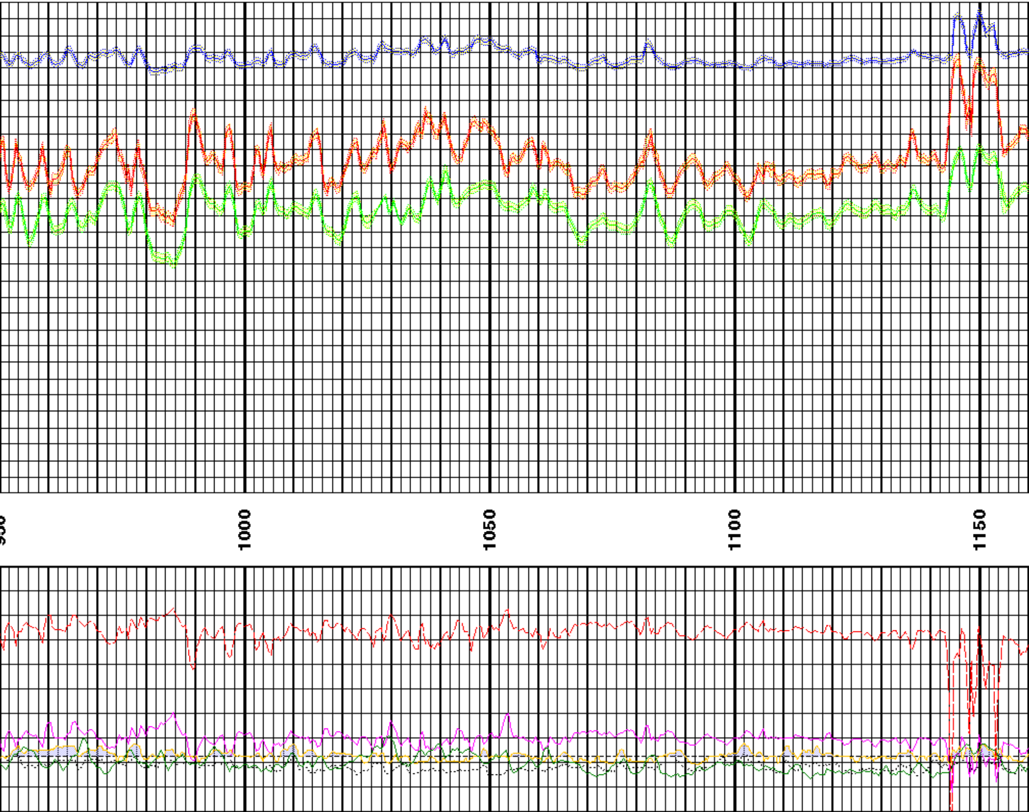
Remarks:

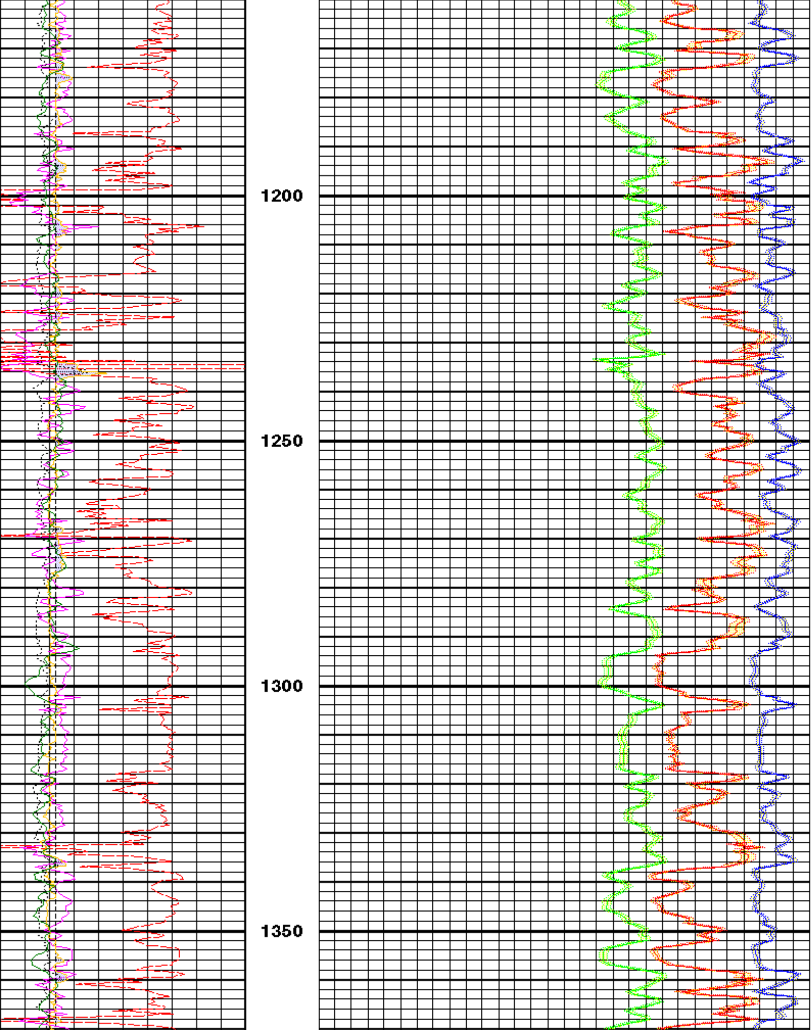
FIRST RUN IN WELL
ALL SCHLUMBERGER DEPTH PROCEDURES FOLLOWED. DEPTH REFERENCE IS DRILL FLOOR (5 FT ABOVE GROUND LEVEL)

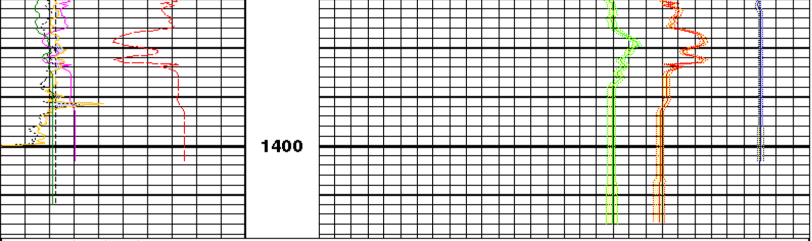












```
 --- Finalization Result ---
1 MF Compressional     Receiver         Absent levels=   91
1 MF Compressional     Transmitter      Absent levels=   72
1 MU Compressional     Receiver         Absent levels=  101
1 MU Compressional     Transmitter      Absent levels=   89
1 ML Compressional     Receiver         Absent levels=  103
1 ML Compressional     Transmitter      Absent levels=   99
1 MF Shear             Receiver         Absent levels= 2129
1 MF Shear             Transmitter      Absent levels= 2112
1 MU Shear             Receiver         Absent levels= 2121
1 MU Shear             Transmitter      Absent levels= 2107
1 ML Shear             Receiver         Absent levels= 2129
1 ML Shear             Transmitter      Absent levels= 2117
1 XD Shear             Receiver         Absent levels=    8
1 XD Shear             Transmitter      Absent levels=    8
1 YD Shear             Receiver         Absent levels=   93
1 YD Shear             Transmitter      Absent levels=   64
1 MF Stoneley          Receiver         Absent levels=  178
1 MF Stoneley          Transmitter      Absent levels=  171

1 MF Compressional     DDBHC            Absent levels=   90
1 MU Compressional     DDBHC            Absent levels=   86    *Selected*
1 ML Compressional     DDBHC            Absent levels=   95
1 MF Shear             DDBHC            Absent levels= 2146
1 MU Shear             DDBHC            Absent levels= 2121
1 ML Shear             DDBHC            Absent levels= 2131
1 XD Shear             DDBHC            Absent levels=    1    *Selected*
1 YD Shear             DDBHC            Absent levels=   90
1 MF Stoneley          DDBHC            Absent levels=  150    *Selected*
```

Gamma Ray
0 (gAPI) 150

Bit Size
10 (in) 20

Wash Out

Vp/Vs Ratio (VPVS)
1 ( ) 5

Poisson's Ratio (PR)
0 ( ) 0.5

MD
1 : 240
ft

Compressional Delta-T (DTCO)
640 (us/ft) 40

Shear Delta-T (DTSM)
640 (us/ft) 40

Stoneley Delta-T (DTST)
640 (us/ft) 40

Schlumberger

ECS* SpectroLith Scale: 5 in = 100 ft

Processed ECS* Elemental Data

COMPANY: SOUTH FLORIDA WATER MANAGEMENT DISTRICT

WELL: OKF 105

FIELD: SFWMD

State: FLORIDA

COUNTRY:

*ECS is a mark of Schlumberger

Date Processed:	Aug-2008	Date Logged:	2005/04/17
Job Number:		Processed at:	Sacramento, CA
Well Location:	SFWMD S65C LOCK		
Latitude:	27.402 deg N	Longitude:	81.114 deg E
Elevations:	KB: 1.524m	DF: 1.524m	GL: 0m

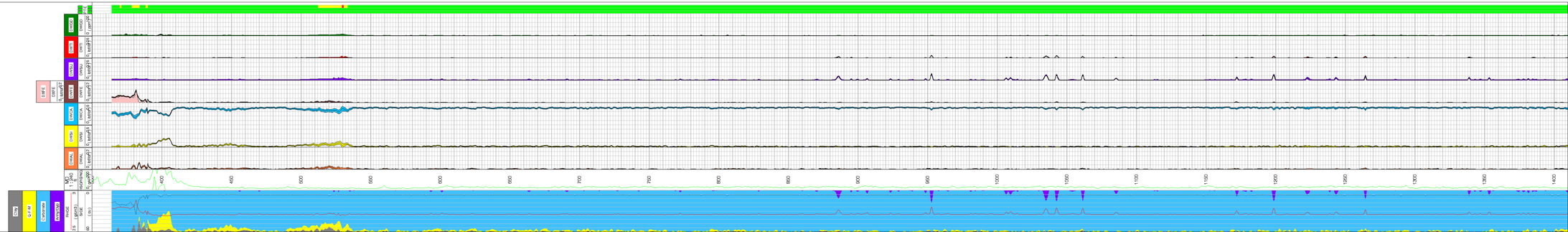
Depth reference is drill floor (5 ft above ground level).

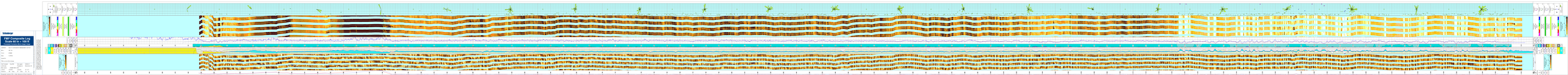
The well data, tools and services listed are subject to the terms and conditions of the Schlumberger Price Schedule.

All interpretations, are opinions based on inferences from electrical or other measurements and we cannot, and do not, guarantee the accuracy or correctness of any interpretation, and we shall not, except in the case of gross or wilful negligence on our part, be liable or responsible for any loss, cost, damages or expenses incurred or sustained by anyone resulting from any interpretation made by any of our officers, agents or employees. These interpretations are also subject to our general terms and conditions set out in our current Price Schedule.

Quality Flag Descriptions
Within - Allowed Green - Possible Yellow - Warning Black/Red - Unreliable

ECS LOG Flags
E ECS Hardware Photomultiplier
T E ECS Hardware Crystal Temperature
E E ECS Data Quality Elemental Statistical Uncertainty


ECS LOG
ECSCA
ECSFE
ECSSI
ECSTI
ECSCL
ECSGD
ECSTH
ECSAL
ECSMG
ECSK
ECSTOT
ECSSUM
ECSSIG
ECSFLAG
MD (ft)
Depth (ft)
Ratio
Sandstone
Limestone
Dolomite
Anhydrite
Clay
Salt
Porosity
Gas
Oil
Water
Fluid Type
Lithology
Porosity
Fluid Saturation
Gamma Ray
Caliper
Bit Size
Resistivity
Density
Neutron
Photoelectric Factor
Delta Rho
Sonic
Mud Weight
Temperature
Pressure
Hydrocarbon Density
Gas Ratio
Shale Volume
Permeability
Rock Type
Flag
Flag
Flag


Schlumberger
FBP Composite Log
Scale 60 in = 100 ft
Pressure Points | Mini-Frac | Flow
Company
Well
Field
County
State
API or UWI
Coordinates
Permanent Datum
Log Measured From
Drilling Measured From
Elevation
Date
Run
Depth Driller
Depth Logger
Bottom Logged Interval
Top Logged Interval
Casing Driller
Casing Logger
Bit Size
Type Fluid in Hole
Density
Viscosity
Fluid Loss
Source of Sample
Rm @ Measured Temp
Rmf @ Measured Temp
Rmc @ Measured Temp
Source of Rmf and Rmc
Rm @ BHT
Time Since Circulation
Max Recorded Temp
Equipment Number
Location
Recorded By
Witnessed By
Pressure
Flow
Temperature
Gamma Ray
Casing Collar Locator
Cable Tension
Fluid Density
Proppant Concentration
Slurry Rate
Perforation Friction
Near Wellbore Friction
Tortuosity
Fracture Gradient
Fracture Width
Fracture Height
Fracture Length
Net Pressure
Fracture Conductivity
Proppant Number
Proppant Pack Width
Proppant Pack Height
Proppant Pack Porosity
Proppant Pack Permeability
Proppant Pack Conductivity
Reservoir Permeability
Reservoir Pressure
Reservoir Temperature
Skin
Flow Efficiency
Productivity Index
Net Pay
Gross Pay
Net to Gross
Reservoir Porosity
Reservoir Water Saturation
Reservoir Oil Saturation
Reservoir Gas Saturation
Reservoir Fluid Density
Reservoir Fluid Viscosity
Reservoir Fluid Compressibility
Reservoir Fluid Formation Volume Factor
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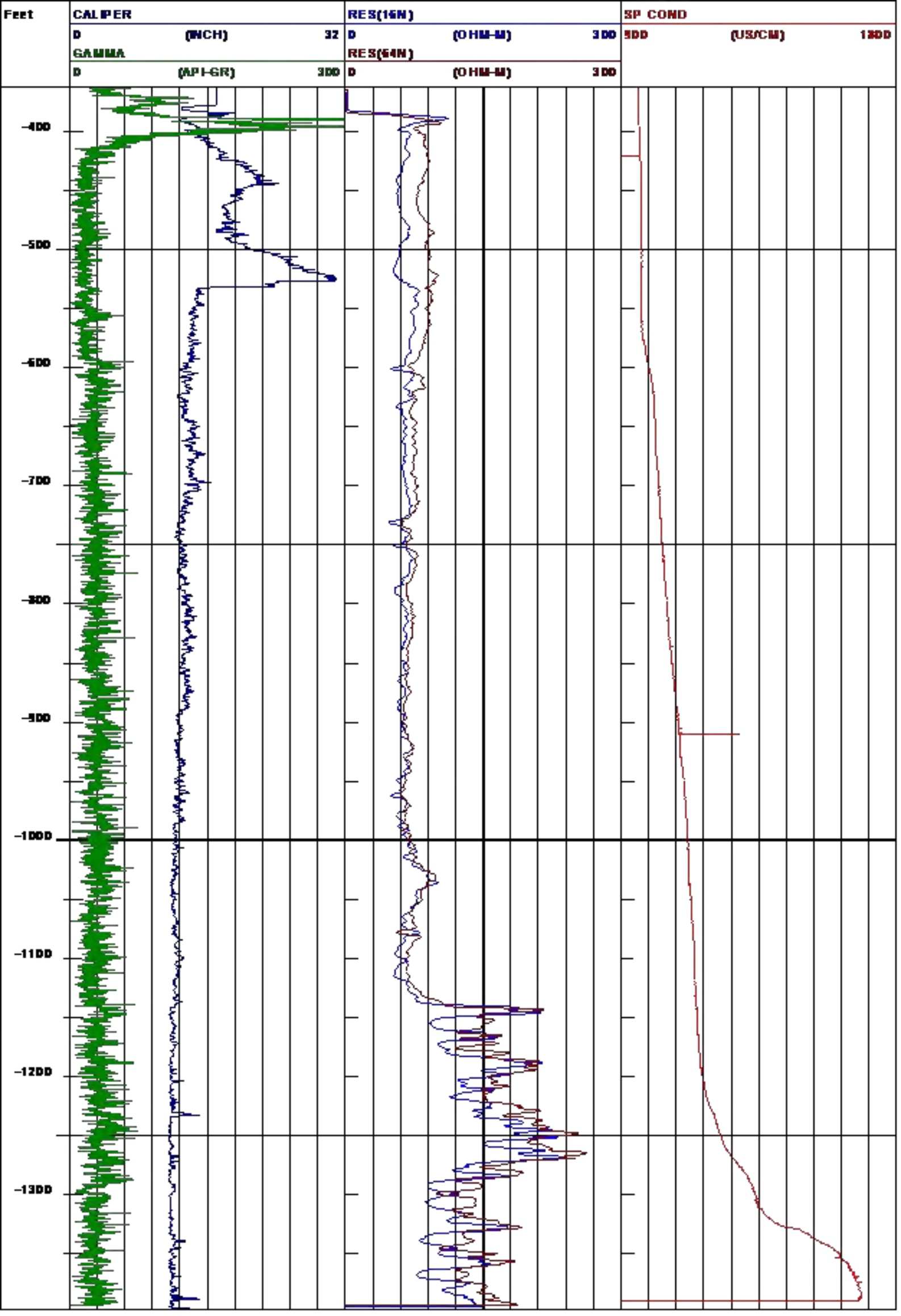
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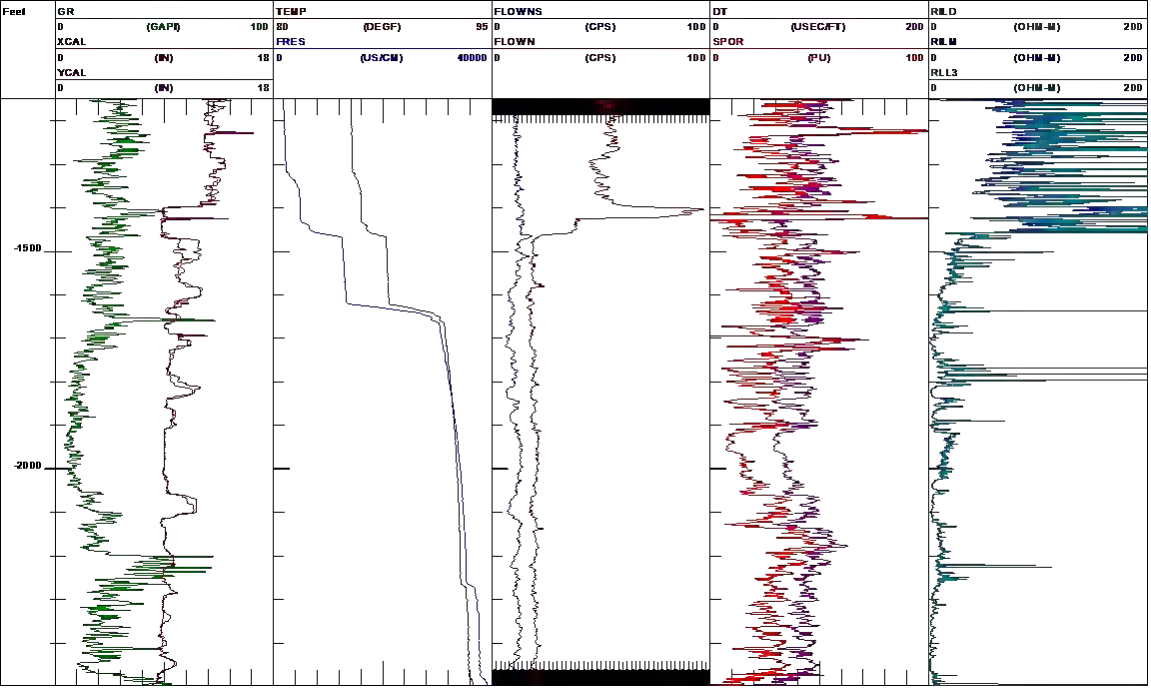
(INCH)
32
GAMMA
0
(API-GR)
300
RES(16N)
0
(OHM-M)
300
RES(64N)
0
(OHM-M)
300
SP COND
500
(US/CM)
1500
-400
-500
-600
-700
-800
-900
-1000
-1100
-1200
-1300


Feet
GR
0 (GAPI) 100
XCAL
0 (IN) 18
YCAL
0 (IN) 18
TEMP
80 (DEGF) 95
FRES
0 (US/CM) 40000
FLOWNS
0 (CPS) 100
FLOWN
0 (CPS) 100
DT
0 (USEC/FT) 200
SPOR
0 (PU) 100
RILD
0 (OHM-M) 200
RILM
0 (OHM-M) 200
RLL3
0 (OHM-M) 200
-1500
-2000

Feet

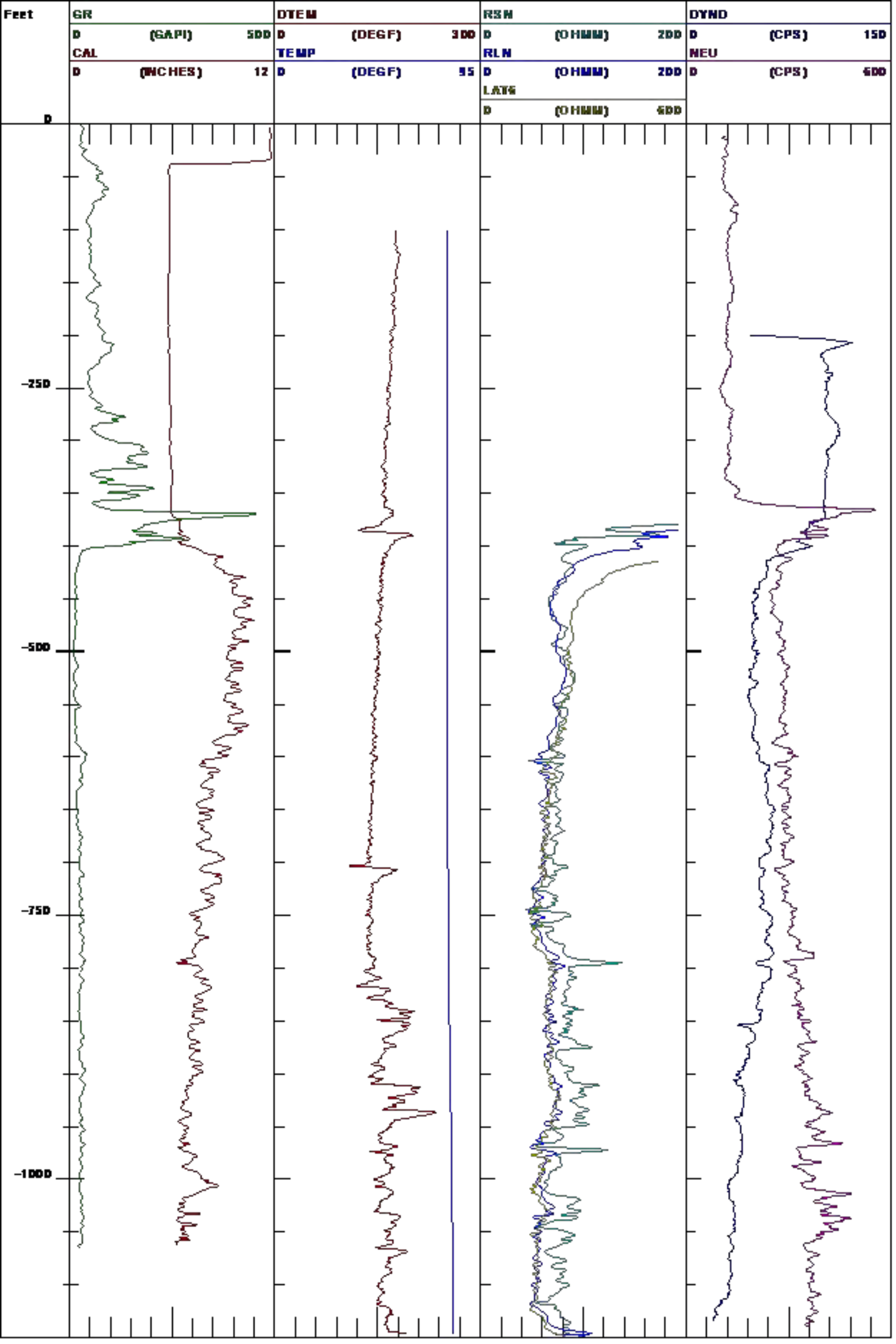
CALIPER	SP COND	UFLOW	TIME(F)	RES(16N)
0 (INCH) 12	0 (US/CM) 1200	0 (CPS) 400	0 (USEC) 600	0 (OHM-M) 300
GAMMA	TEMP	DFLOW	POR(SON)	RES(64N)
0 (API-GR) 700	75 (DEG F) 50	0 (CPS) 400	0 (PERCENT) 50	0 (OHM-M) 300
				LATERAL
				0 (OHM-M) 300

-250

-500

-750

-1000


Feet
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CAL
0 (INCHES) 12
DTEM
0 (DEGF) 300
TEMP
0 (DEGF) 55
RSN
0 (OHMM) 200
RLN
0 (OHMM) 200
LAT6
0 (OHMM) 600
DYND
0 (CPS) 150
NEU
0 (CPS) 600
0
-250
-500
-750
-1000

Florida Department of Environmental Protection

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

Charlie Crist
Governor

Jeff Kottkamp
Lt. Governor

Michael W. Sole
Secretary

August 8, 2008 ELECTRONIC CORRESPONDENCE

Mr. R. Simon A. Sunderland, P.G.
SFWMD Water Supply Department
3301 Gun Club Road / P.O. Box 24680
West Palm Beach, FL 33416-4680
Email: ssunder@sfwmd.gov

Re: Generic Permit for Discharge of Produced Ground Water
OKF – 105 Kissimmee River Floridan Aquifer Well Site
DEP File No. FLG070576-001-IWF-GN
Okeechobee County

Dear Mr. Sunderland:

In response to your request for coverage under the Generic Permit for Discharges of Produced Ground Water, dated July 11, 2008, the Department of Environmental Protection hereby grants your request effective on the date of this letter. You permit number is FLG070576. Please refer to this number in all correspondence or permit inquiries. Under F.A.C. Rule 62-621.250(19), coverage granted under this permit shall expire after five years from the issuance date of this letter.

The discharge will occur intermittently over approximately four months during well construction and aquifer testing. The location of the outfall is:

Latitude: 27 24' 07.3" North

Longitude: 81 06' 51.1" West

Enclosed is a copy of the final permit. You should review the permit to become familiar with the terms and conditions of the permit. In addition to the rule requirements, the discharge for this project shall be subject to the following conditions:

- Provisions for treatment/removal of solids and/or turbidity shall be made in accordance with Construction and Testing Technical Specifications Section 02450 that was submitted with the request.
- Provisions for maintaining Dissolved Oxygen concentrations at 5 mg/L or above in the discharge shall be made in accordance with Construction and Testing Technical Specifications Section 02450.
- Turbidity and specific conductance shall be measured in the receiving waters 150 meters upstream and downstream of the outfall pipe every four hours during discharge. The discharge shall be discontinued immediately if water quality criteria is exceeded. Water quality criteria, as given in FAC Rule 62-302, are:

  Turbidity: No more than 29 NTU above background.

  Specific Conductance: No more than 50% above background or 1275 umhos/cm, whichever is greatest.

If you have any questions, please contact Bradley Akers at (561) 681-6690 or by email at Bradley.Akers@dep.state.fl.us..

Executed in West Palm Beach, Florida.

STATE OF FLORIDA
DEPARTMENT OF ENVIRONMENTAL PROTECTION

Linda A. Brien, P.G. Date
Water Facilities Administrator
Southeast District

LAB/TP/ba/ FLG070576-001-IWF-GN

Attachment: Generic Permit for Discharge of Produced Ground Water

ec: Todd Brown, DEP/SED, todd.brown@dep.state.fl.us
Greg Kennedy, DEP/Okeechobee, greg.a.kennedy@dep.state.fl.us

STATE OF FLORIDA

DEPARTMENT OF ENVIRONMENTAL PROTECTION

GENERIC PERMIT

FOR THE

DISCHARGE OF PRODUCED GROUND WATER

FROM ANY NON-CONTAMINATED SITE ACTIVITY

Document number 62-621.300(2)
Effective Date: February 14, 2000

Generic Permit for the Discharge of Produced Ground Water from any Non-Contaminated Site Activity

(1) The facility is authorized to discharge produced ground water from any non-contaminated site activity which discharges by a point source to surface waters of the State, as defined in Chapter 62-620, F.A.C., only if the reported values for the parameters listed in Table 1 do not exceed any of the listed screening values. Before discharge of produced ground water can occur from such sites, analytical tests on samples of the proposed untreated discharge water shall be performed to determine if contamination exists.

(2) Minimum reporting requirements for all produced ground water dischargers. The effluent shall be sampled before the commencement of discharge, again within thirty (30) days after commencement of discharge, and then once every six (6) months for the life of the project to maintain continued coverage under this generic permit. Samples taken in compliance with the provisions of this permit shall be taken prior to actual discharge or mixing with the receiving waters. The effluent shall be sampled for the parameters listed in Table 1.

Table 1

	Screening Values for Discharges into:	
Parameter	Fresh Waters	Coastal Waters
Total Organic Carbon (TOC)	10.0 mg/l	10.0 mg/l
pH, standard units	6.0-8.5	6.5-8.5
Total Recoverable Mercury	0.012 μg/l	0.025 μg/l
Total Recoverable Cadmium	9.3 μg/l	9.3 μg/l
Total Recoverable Copper	2.9 μg/l	2.9 μg/l
Total Recoverable Lead	0.03 mg/l	5.6 μg/l
Total Recoverable Zinc	86.0 μg/l	86.0 μg/l
Total Recoverable Chromium (Hex.)	11.0 μg/l	50.0 μg/l
Benzene	1.0 μg/l	1.0 μg/l
Naphthalene	100.0 μg/l	100.0 μg/l

(3) If any of the analytical test results exceed the screening values listed in Table 1, except TOC, the discharge is not authorized by this permit.

(a) For initial TOC values that exceed the screening values listed in Table 1, which may be caused by naturally-occurring, high molecular weight organic compounds, the permittee may request to be exempted from the TOC requirement. To request this exemption, the permittee shall submit additional information with a Notice of Intent (NOI),

described below, which describes the method used to determine that these compounds are naturally occurring. The Department shall grant the exemption if the permittee affirmatively demonstrates that the TOC values are caused by naturally-occurring, high molecular weight organic compounds.

(b) The NOI shall be submitted to the appropriate Department district office thirty (30) days prior to discharge, and contain the following information:

1. the name and address of the person that the permit coverage will be issued to;

2. the name and address of the facility, including county location;

3. any applicable individual wastewater permit number(s);

4. a map showing the facility and discharge location (including latitude and longitude);

5. the name of the receiving water; and

6. the additional information required by paragraph (3)(a) of this permit.

(c) Discharge shall not commence until notification of coverage is received from the Department.

(4) For fresh waters and coastal waters, the pH of the effluent shall not be lowered to less than 6.0 units for fresh waters, or less than 6.5 units for coastal waters, or raised above 8.5 units, unless the permittee submits natural background data confirming a natural background pH outside of this range. If natural background of the receiving water is determined to be less than 6.0 units for fresh waters, or less than 6.5 units in coastal waters, the pH shall not vary below natural background or vary more than one (1) unit above natural background for fresh and coastal waters. If natural background of the receiving water is determined to be higher than 8.5 units, the pH shall not vary above natural background or vary more than one (1) unit below natural background of fresh and coastal waters. The permittee shall include the natural background pH of the receiving waters with the results of the analyses required under paragraph (2) of this permit. For purposes of this section only, fresh waters are those having a chloride concentration of less than 1500 mg/l, and coastal waters are those having a chloride concentration equal to or greater than 1500 mg/l.

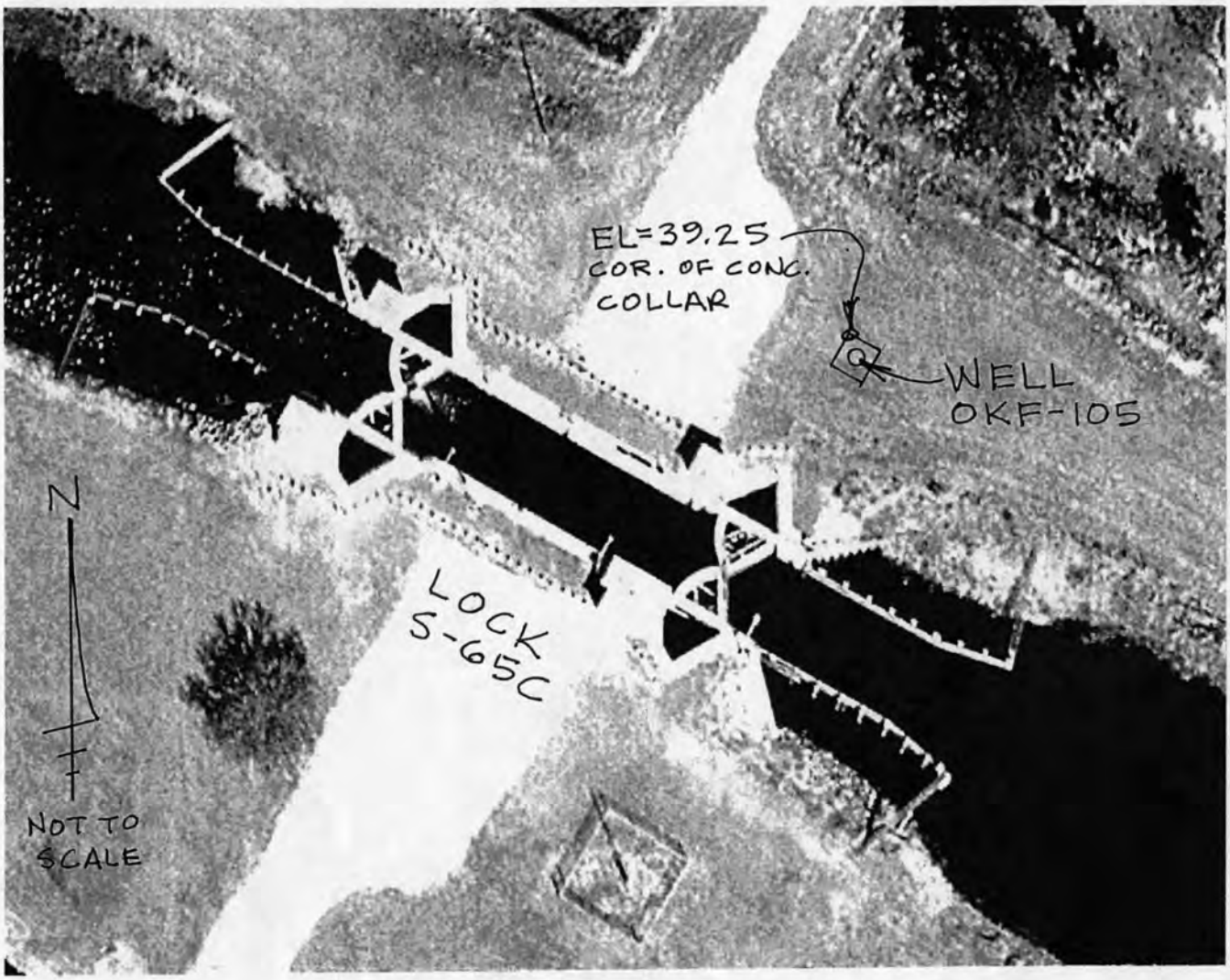
(5) In accordance with Rule 62-302.500(1)(a-c), F.A.C., the discharge shall at all times be free from floating solids, visible foam, turbidity, or visible oil in such amounts as to form nuisances on surface waters.

(6) If contamination exists, as indicated by the results of the analytical tests required by paragraph (2), the discharge cannot be covered by this generic permit. The facility shall apply for an individual wastewater permit at least ninety (90) days prior to the date discharge to surface waters of the State is expected, or, if applicable, the facility may seek coverage under any other applicable Department generic permit. No discharge is permissible without an effective permit.

(7) If the analytical tests required by paragraph (2) reveal that no contamination exists from any source, the facility can begin discharge immediately and is covered by this permit without having to submit an NOI request for coverage to the Department. A short summary of the proposed activity and copy of the analytical tests shall be sent to the applicable Department district office within one (1) week after discharge begins. These analytical tests shall be kept on site during discharge and made available to the Department if requested. Additionally, no Discharge Monitoring Report forms are required to be submitted to the Department.

(8) All of the general conditions listed in Rule 62-621.250, F.A.C., are applicable to this generic permit.

(9) There are no annual fees associated with the use of this generic permit.



SURVEYOR'S NOTES:

1. ELEVATIONS SHOWN HEREON ARE IN FEET AND DECIMAL PARTS THEREOF AND ARE BASED ON NGVD-1929 DATUM. BENCH MARK IS A BRASS DISC SET IN THE SOUTHWEST WING WALL OF STRUCTURE S-65C DESIGNATED "FCD H4" ELEV= 39.54

2. LOCATION OF WELL OKF-105 IS APPROXIMATE.

LIDBERG LAND SURVEYING, INC.
LB 4431
675 West Indiantown Road, Suite 200,
Jupiter, Florida 33458 TEL. 561-746-8454

WRAY D. JORDAN
PROFESSIONAL SURVEYOR & MAPPER
FLORIDA CERTIFICATE No. 4244

RECORD DRAWING

South Florida Water Management District 3301 Gun Club Road West Palm Beach, Florida 33406	OKF-105 Tri-Zone Floridan Aquifer Monitor Well	Figure 4. A Wellhead Design Drawing

LLS FILE: A09-080

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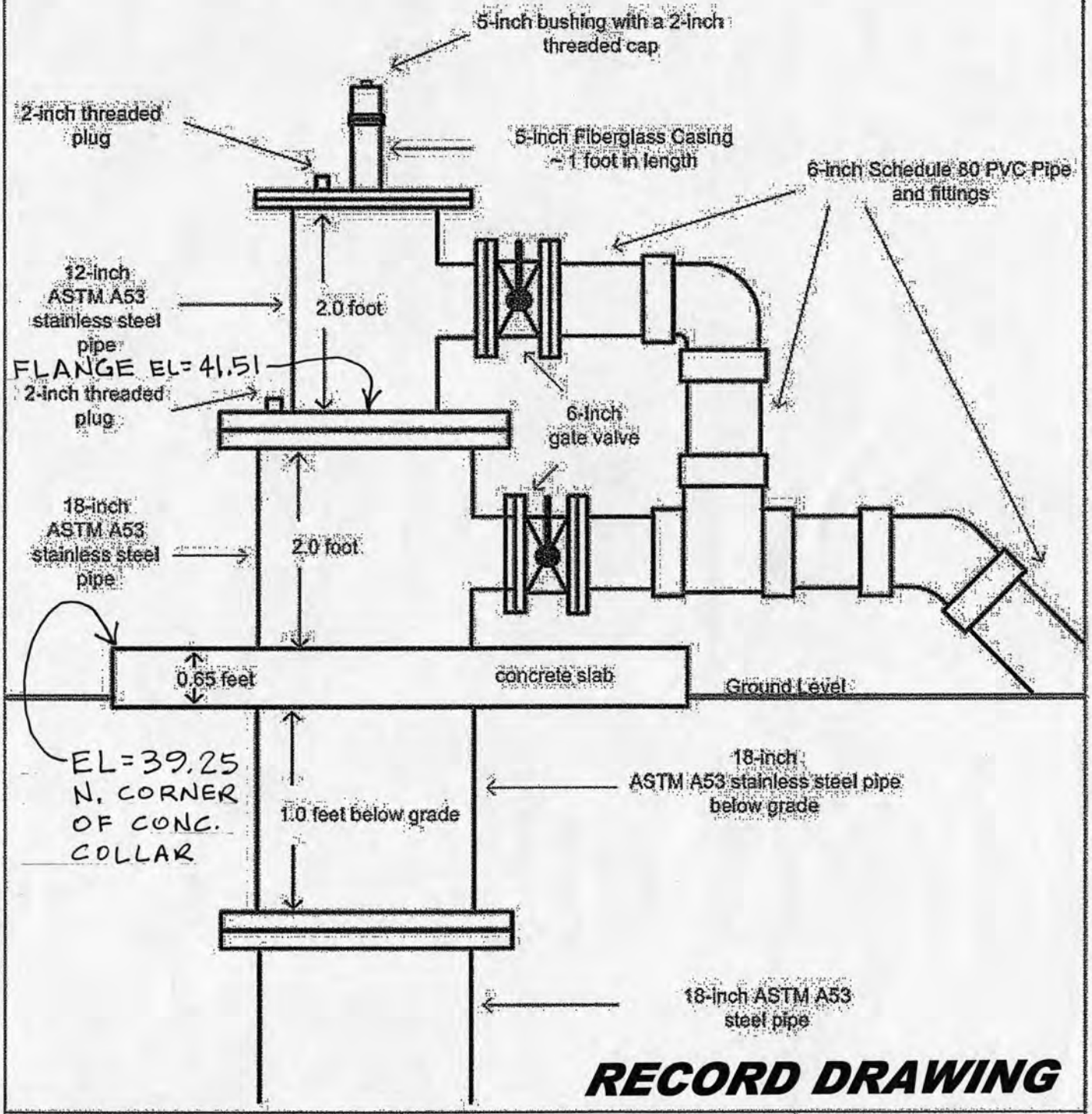

RECORD DRAWING

South Florida Water Management District
3301 Gun Club Road
West Palm Beach, Florida 33406

OKF-105
Tri-Zone Floridan
Aquifer Monitor Well

Figure 4.
Wellhead Design Drawing

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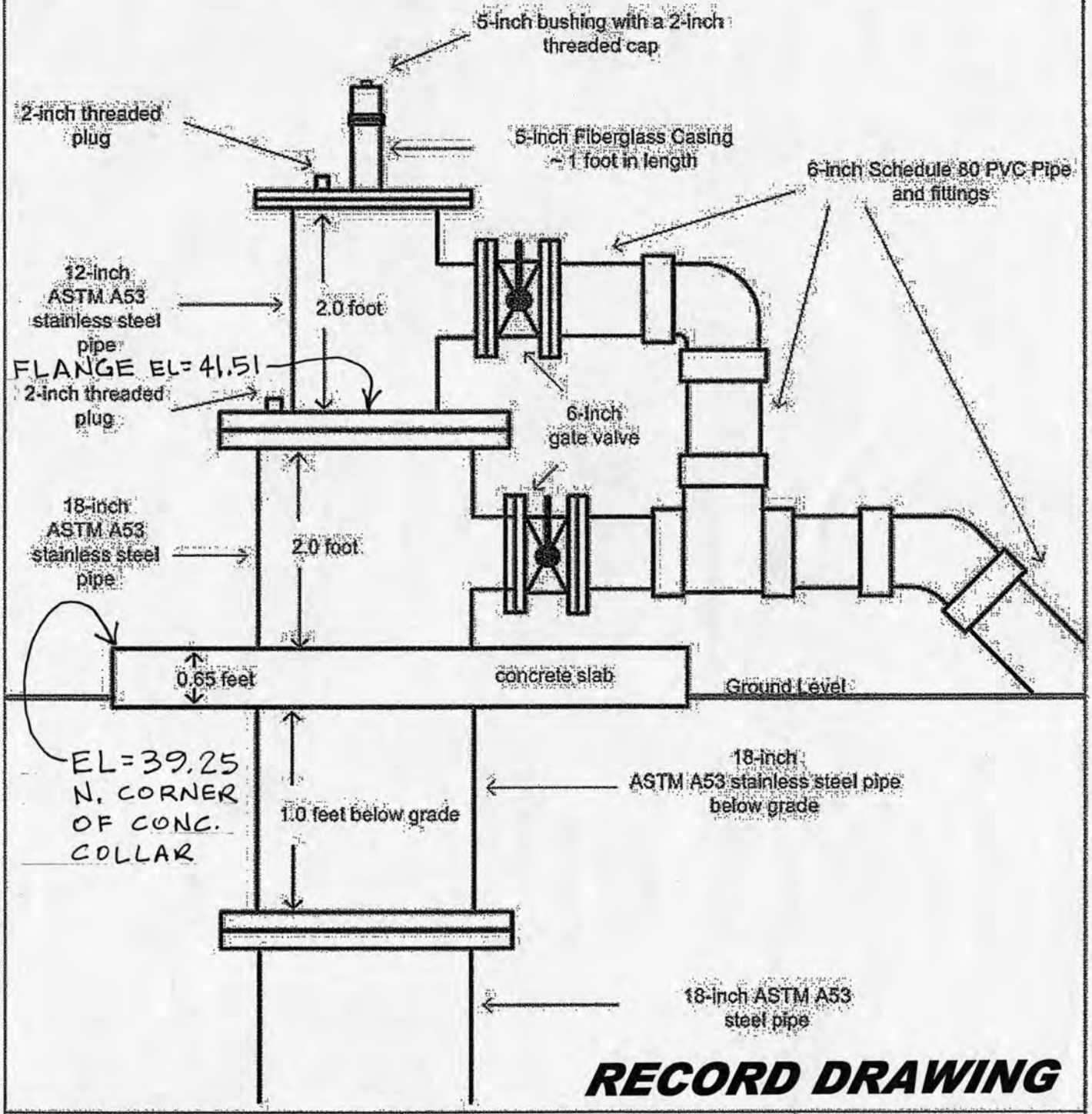

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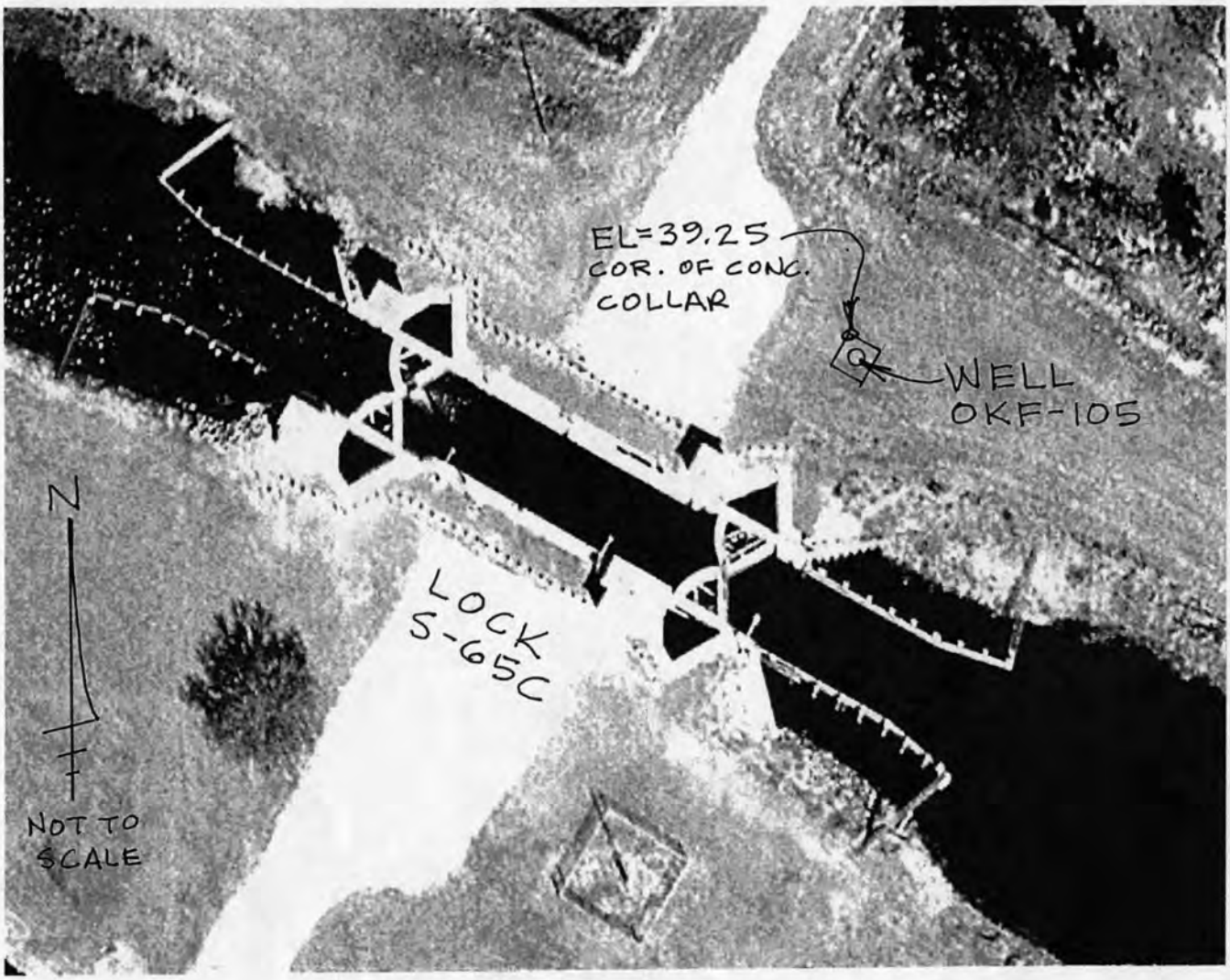

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South Florida Water Management District 3301 Gun Club Road West Palm Beach, Florida 33406	OKF-105 Tri-Zone Floridan Aquifer Monitor Well	Figure 4. A Wellhead Design Drawing

LLS FILE: A09-080

SOUTH FLORIDA WMD - LITHO LOG PRINTOUT

W-0KF42
HIGHLANDS CO. T34S R31E SEC 23 27 30 07 N 81 11 46 W
TOTAL DEPTH- 1180 FT. ELEV.- FT. 118 SAMPLES- 0- 1180 FT.
COMPLETED- 82.04.21 DEPTH WORKED 1180 FT.

WELL NAME-
S65C- SFWMD EXPLORATORY WELL- ALVIN WOOSTER, DRILLER
REMARKS-
CUTTING COLLECTED AND DESCRIBED BY
JON SHAW, SFWMD, APRIL 30, 1982
GEOPHYSICAL LOGS AVAILABLE

HYDROGEOLOGIC UNITS

0.0-	180.0	SHALLOW AQUIFER SYSTEM
180.0-	370.0	HAWTHORN CONFINING BED
370.0-	1100.0	FLORIDAN AQUIFER SYSTEM

STRATIGRAPHIC FORMATIONS -

0.0-	180.0	UNDIFFERENTIATED SAND, CLAY AND SHELLS
180.0-	420.0	HAWTHORN FORMATION
420.0-	590.0	OCALA GROUP
590.0-	1180.0	AVON PARK LIMESTONE

LITHOLOGIC LOG
W-0KF42 . HIGHLANDS CO. T34S, R31E, SEC 23

0.0-	20.0	SAND, DARK BROWN TO MODERATE BROWN, POROSITY, INTERGRANULAR, GRAIN SIZE: MEDIUM, RANGE: FINE TO COARSE, SUB-ANGULAR, UNCONSOLIDATED, ORGANIC MATRIX, 05% IRON STAIN, NO FOSSIL, ORGANICS,
20.0-	40.0	SHELL BED, MODERATE GRAY TO LIGHT GRAY, POROSITY, INTERGRANULAR, MOLDIC, UNCONSOLIDATED, 40% QUARTZ SAND, 05% CLAY, VARVED, MOLLUSKS,
40.0-	50.0	CLAY, LIGHT OLIVE GRAY, POROSITY, LOW PERMEABILITY, UNCONSOLIDATED, CLAY MATRIX, CALCILUTITE MATRIX, 05% QUARTZ SAND, 03% PHOSPHATIC SAND, CALCAREOUS, MOLLUSKS,
50.0-	60.0	SAND, LIGHT OLIVE GRAY TO VERY LIGHT GRAY, POROSITY, INTERGRANULAR, LOW PERMEABILITY, GRAIN SIZE: FINE, RANGE: MICROCRYSTALLINE TO MEDIUM, ANGULAR, UNCONSOLIDATED, CLAY MATRIX, 05% PHOSPHATIC SAND, CALCAREOUS, MOLLUSKS, SHARK TEETH,
60.0-	70.0	SAND, GREENISH GRAY TO VERY LIGHT GRAY, POROSITY, INTERGRANULAR, MOLDIC, GRAIN SIZE: MEDIUM, RANGE: MICROCRYSTALLINE TO VERY COARSE, SUB-ANGULAR, UNCONSOLIDATED, CLAY MATRIX, 07% PHOSPHATIC SAND, 20% CLAY, MOLLUSKS, SHARK TEETH, CRUSTACEA,

LITHOLOGIC LOG
W-0KF42 . HIGHLANDS CO. T34S, R31E, SEC 23

70.0- 80.0 SAND, LIGHT OLIVE GRAY, POROSITY, INTERGRANULAR, GRAIN SIZE: MEDIUM, RANGE: MICROCRYSTALLINE TO COARSE, ANGULAR, UNCONSOLIDATED, CLAY MATRIX, 15% PHOSPHATIC SAND, 20% CLAY, MOLLUSKS,

SHELL BED, WHITE, POROSITY, MOLDIC, UNCONSOLIDATED, MOLLUSKS,

80.0- 90.0 SAND, LIGHT OLIVE GRAY, POROSITY, INTERGRANULAR, GRAIN SIZE: MEDIUM, RANGE: MICROCRYSTALLINE TO COARSE, ANGULAR, UNCONSOLIDATED, CLAY MATRIX, 15% PHOSPHATIC SAND, 15% CLAY, CALCAREOUS, MOLLUSKS,

PHOSPHATE RUBBLE

90.0- 100.0 SAND, LIGHT OLIVE GRAY, POROSITY, INTERGRANULAR, LOW PERMEABILITY, GRAIN SIZE: FINE, RANGE: MICROCRYSTALLINE TO MEDIUM, SUB-ANGULAR, UNCONSOLIDATED, CLAY MATRIX, 03% PHOSPHATIC SAND, 15% CLAY, CALCAREOUS, MOLLUSKS,

ARAGONITE NEEDLES

100.0- 110.0 SAND, GRAYISH OLIVE, POROSITY, INTERGRANULAR, LOW PERMEABILITY, GRAIN SIZE: VERY FINE, RANGE: MICROCRYSTALLINE TO MEDIUM, UNCONSOLIDATED, CLAY MATRIX, 03% PHOSPHATIC SAND, 20% CLAY, CALCAREOUS, MOLLUSKS,

110.0- 140.0 AS ABOVE,

140.0- 150.0 SANDSTONE, YELLOWISH GRAY, POROSITY, POSSIBLY HIGH PERMEABILITY, MODERATE INDURATION, SPARRY CALCITE CEMENT, SILICIC CEMENT, 75% QUARTZ SAND, 03% PHOSPHATIC SAND, CALCAREOUS, MOLLUSKS,

POSSIBLE GOOD AQUIFER

150.0- 170.0 AS ABOVE,

170.0- 180.0 SAND, GRAYISH OLIVE, POROSITY, INTERGRANULAR, LOW PERMEABILITY, GRAIN SIZE: FINE, RANGE: MICROCRYSTALLINE TO MEDIUM, SUB-ANGULAR, UNCONSOLIDATED, CLAY MATRIX, 25% CLAY, 01% PHOSPHATIC SAND, NO FOSSIL,

TOP OF CONFINING ZONE

180.0- 210.0 AS ABOVE,

SHELL CAVINGS FROM ABOVE

210.0- 240.0 AS ABOVE,

240.0- 250.0 SAND, LIGHT OLIVE GRAY, POROSITY, LOW PERMEABILITY, GRAIN SIZE: FINE, SUB-ANGULAR, UNCONSOLIDATED, CLAY MATRIX, 02% PHOSPHATIC SAND, NO FOSSIL,

LITHOLOGIC LOG
W-0KF42 . HIGHLANDS CO. T34S, R31E, SEC 23

250.0- 260.0 AS ABOVE,

260.0- 270.0 CLAY, OLIVE GRAY, POROSITY, LOW PERMEABILITY, UNCONSOLIDATED, 15% PHOSPHATIC SAND, 05% QUARTZ SAND, NO FOSSIL,

270.0- 310.0 AS ABOVE,

310.0- 320.0 CLAY, VERY LIGHT GRAY TO LIGHT GRAY, POROSITY, LOW PERMEABILITY, UNCONSOLIDATED, 30% PHOSPHATIC SAND, 05% QUARTZ SAND, CALCAREOUS, MOLLUSKS,

320.0- 330.0 LIMESTONE, VERY LIGHT GRAY, POROSITY, LOW PERMEABILITY, UNCONSOLIDATED, 25% PHOSPHATIC SAND, 15% QUARTZ SAND, 20% CLAY, CALCAREOUS, FOSSIL MOLDS,

LARGE PHOSPHATE PEBBLES

330.0- 350.0 AS ABOVE,

350.0- 360.0 SAND, YELLOWISH GRAY, POROSITY, LOW PERMEABILITY, GRAIN SIZE: FINE, RANGE: MICROCRYSTALLINE TO MEDIUM, ROUNDED, UNCONSOLIDATED, CLAY MATRIX, CALCILUTITE MATRIX, 05% PHOSPHATIC SAND, 10% CLAY, CALCAREOUS, FOSSIL FRAGMENTS,

360.0- 370.0 AS ABOVE,

SOME SPARRY CALCITE

370.0- 380.0 LIMESTONE, WHITE, POROSITY, POSSIBLY HIGH PERMEABILITY, GRAIN TYPE: CALCILUTITE, CRYSTALS, 10% ALLOCHEMICAL CONSTITUENTS, GRAIN SIZE: FINE, RANGE: MICROCRYSTALLINE TO MEDIUM, MODERATE INDURATION, CALCILUTITE MATRIX, SPARRY CALCITE CEMENT, 10% PHOSPHATIC SAND, CHALKY, MOLLUSKS,

TOP OF FLORIDAN AQUIFER SYSTEM

380.0- 390.0 AS ABOVE,

390.0- 400.0 LIMESTONE, WHITE TO GRAYISH BROWN, GRAIN TYPE: CALCILUTITE, CRYSTALS, INTRACLASTS, 05% ALLOCHEMICAL CONSTITUENTS, GRAIN SIZE: FINE, GOOD INDURATION, CALCILUTITE MATRIX, SPARRY CALCITE CEMENT, 15% PHOSPHATIC SAND, 02% QUARTZ SAND, CHALKY, MEDIUM RECRYSTALLIZATION, MOLLUSKS,

MIXTURE OF A CHALKY WHITE LIMESTONE AND A WELL INDURATED LIGHT BROWN LIMESTONE WITH QUARTZ AND PHOSPHATE INTERCLASTS

400.0- 410.0 AS ABOVE,

LITHOLOGIC LOG
W-OKF42 . HIGHLANDS CO. T34S, R31E, SEC 23

410.0- 420.0 LIMESTONE, WHITE TO VERY LIGHT GRAY, POROSITY, INTERGRANULAR, GRAIN TYPE: BIOGENIC, CRYSTALS, CALCILUTITE, 25% ALLOCHEMICAL CONSTITUENTS, GRAIN SIZE: MEDIUM, RANGE: FINE TO COARSE, MODERATE INDURATION, CALCILUTITE MATRIX, CHALKY, BENTHONIC FORAMINIFERA, BRYOZOA,

FIRST OCCURRENCE OF LEPIDOCYLINA SP.

420.0- 430.0 AS ABOVE,

WITH NUMULITES SP.

430.0- 440.0 LIMESTONE, WHITE, POROSITY, LOW PERMEABILITY, GRAIN TYPE: CALCILUTITE, BIOGENIC, 05% ALLOCHEMICAL CONSTITUENTS, GRAIN SIZE: VERY FINE, POOR INDURATION, CHALKY, BENTHONIC FORAMINIFERA, BRYOZOA,

EXTREMEY CHALKY

440.0- 450.0 LIMESTONE, WHITE, POROSITY, INTERGRANULAR, GRAIN TYPE: BIOGENIC, INTRACLASTS, CALCILUTITE, 25% ALLOCHEMICAL CONSTITUENTS, GRAIN SIZE: MEDIUM, RANGE: FINE TO COARSE, MODERATE INDURATION, CALCILUTITE MATRIX, CHALKY, BENTHONIC FORAMINIFERA, BRYOZOA,

LEPIDOCYLINA OCALANA

450.0- 460.0 AS ABOVE,

460.0- 470.0 LIMESTONE, WHITE, POROSITY, INTERGRANULAR, GRAIN TYPE: BIOGENIC, INTRACLASTS, 75% ALLOCHEMICAL CONSTITUENTS, GRAIN SIZE: MEDIUM, RANGE: FINE TO COARSE, MODERATE INDURATION, CALCILUTITE MATRIX, COQUINA, CHALKY, BENTHONIC FORAMINIFERA, BRYOZOA, MOLLUSKS,

LEP HASH

470.0- 520.0 AS ABOVE,

520.0- 530.0 LIMESTONE, WHITE TO VERY LIGHT GRAY, POROSITY, INTERGRANULAR, GRAIN TYPE: BIOGENIC, CRYSTALS, 85% ALLOCHEMICAL CONSTITUENTS, GRAIN SIZE: COARSE, RANGE: FINE TO VERY COARSE, POOR INDURATION, CALCILUTITE MATRIX, SPARRY CALCITE CEMENT, CLAY MATRIX, CHALKY, COQUINA, BENTHONIC FORAMINIFERA, BRYOZOA,

OPERCULINOIDES SP.
MANY LEPS ARE REPLACED WITH BLACK (ORGANIC OR PHOSPHATIC)MATERIAL

530.0- 580.0 AS ABOVE,

LITHOLOGIC LOG
W-OKF42 . HIGHLANDS CO. T34S, R31E, SEC 23

580.0- 590.0 LIMESTONE, VERY LIGHT GRAY TO VERY LIGHT ORANGE, POROSITY, INTERGRANULAR, VUGULAR, GRAIN TYPE: BIOGENIC, CRYSTALS, 75% ALLOCHEMICAL CONSTITUENTS, GRAIN SIZE: MEDIUM, RANGE: VERY FINE TO COARSE, POOR INDURATION, CALCILUTITE MATRIX, SPARRY CALCITE CEMENT, CHALKY, LOW RECRYSTALLIZATION, ECHINOID, BENTHONIC FORAMINIFERA, BRYOZOA, WORM TRACES, CONES,

FIRST OCCURRENCE OF DICTYOCONUS SP.
ECHINOIDS REPLACED BY BLOCKY SPARRY CALCITE

590.0- 600.0 LIMESTONE, VERY LIGHT ORANGE TO VERY LIGHT GRAY, POROSITY, INTERGRANULAR, VUGULAR, POSSIBLY HIGH PERMEABILITY, GRAIN TYPE: CRYSTALS, CALCILUTITE, BIOGENIC, 50% ALLOCHEMICAL CONSTITUENTS, GRAIN SIZE: MEDIUM, RANGE: VERY FINE TO COARSE, POOR INDURATION, SPARRY CALCITE CEMENT, CALCILUTITE MATRIX, CHALKY, LOW RECRYSTALLIZATION, ECHINOID, CONES, BENTHONIC FORAMINIFERA, BRYOZOA, WORM TRACES,

600.0- 620.0 AS ABOVE,

620.0- 630.0 LIMESTONE, VERY LIGHT ORANGE, POROSITY, VUGULAR, PIN POINT VUGS, GRAIN TYPE: CALCILUTITE, CRYSTALS, 30% ALLOCHEMICAL CONSTITUENTS, GRAIN SIZE: FINE, RANGE: MICROCRYSTALLINE TO COARSE, POOR INDURATION, CALCILUTITE MATRIX, SPARRY CALCITE CEMENT, CHALKY, ECHINOID, BENTHONIC FORAMINIFERA,

630.0- 660.0 AS ABOVE,

660.0- 670.0 LIMESTONE, VERY LIGHT ORANGE, POROSITY, PIN POINT VUGS, INTERGRANULAR, GRAIN TYPE: CALCILUTITE, CRYSTALS, IK% ALLOCHEMICAL CONSTITUENTS, GRAIN SIZE: FINE, RANGE: MICROCRYSTALLINE TO COARSE, POOR INDURATION, CALCILUTITE MATRIX, SPARRY CALCITE CEMENT, CHALKY, ECHINOID, BENTHONIC FORAMINIFERA, CONES, BRYOZOA,

670.0- 710.0 AS ABOVE,

710.0- 720.0 LIMESTONE, VERY LIGHT ORANGE TO GRAYISH ORANGE, POROSITY, INTERGRANULAR, VUGULAR, GRAIN TYPE: CRYSTALS, BIOGENIC, CALCILUTITE, 30% ALLOCHEMICAL CONSTITUENTS, GRAIN SIZE: FINE, RANGE: MICROCRYSTALLINE TO COARSE, POOR INDURATION, SPARRY CALCITE CEMENT, CALCILUTITE MATRIX, CHALKY, LOW RECRYSTALLIZATION, CONES, ECHINOID, BENTHONIC FORAMINIFERA, BRYOZOA,

720.0- 730.0 LIMESTONE, GRAYISH BROWN TO GRAYISH ORANGE, POROSITY, INTERGRANULAR, VUGULAR, GRAIN TYPE: CRYSTALS, CALCILUTITE, 25% ALLOCHEMICAL CONSTITUENTS, GRAIN SIZE: FINE, RANGE: MICROCRYSTALLINE TO COARSE, POOR INDURATION, SPARRY CALCITE CEMENT, DOLOMITE CEMENT, 01% QUARTZ SAND, DOLOMITIC, CHALKY, CONES, ECHINOID, BENTHONIC FORAMINIFERA, BRYOZOA,

LITHOLOGIC LOG
W-OKF42 . HIGHLANDS CO. T34S, R31E, SEC 23

730.0- 740.0 LIMESTONE, VERY LIGHT GRAY TO VERY LIGHT ORANGE, POROSITY, INTERGRANULAR, VUGULAR, GRAIN TYPE: CRYSTALS, CALCILUTITE, 25% ALLOCHEMICAL CONSTITUENTS, GRAIN SIZE: FINE, RANGE: MICROCRYSTALLINE TO COARSE, POOR INDURATION, SPARRY CALCITE CEMENT, 01% QUARTZ SAND, CHALKY, CONES, BENTHONIC FORAMINIFERA, BRYOZOA,

740.0- 750.0 LIMESTONE, VERY LIGHT GRAY TO LIGHT OLIVE GRAY, POROSITY, INTERGRANULAR, VUGULAR, GRAIN TYPE: CRYSTALS, CALCILUTITE, GRAIN SIZE: FINE, RANGE: MICROCRYSTALLINE TO COARSE, POOR INDURATION, SPARRY CALCITE CEMENT, CLAY MATRIX, 03% CLAY, 01% QUARTZ SAND, CHALKY, CONES, BENTHONIC FORAMINIFERA, BRYOZOA,

750.0- 760.0 LIMESTONE, VERY LIGHT GRAY TO MODERATE GRAY, POROSITY, INTERGRANULAR, VUGULAR, LOW PERMEABILITY, GRAIN TYPE: CRYSTALS, CALCILUTITE, 10% ALLOCHEMICAL CONSTITUENTS, GRAIN SIZE: VERY FINE, RANGE: MICROCRYSTALLINE TO COARSE, POOR INDURATION, SPARRY CALCITE CEMENT, CLAY MATRIX, 05% CLAY, 02% QUARTZ SAND, CHALKY, CONES, ECHINOID, BENTHONIC FORAMINIFERA, BRYOZOA,

760.0- 770.0 LIMESTONE, VERY LIGHT ORANGE, POROSITY, INTERGRANULAR, VUGULAR, GRAIN TYPE: CRYSTALS, CALCILUTITE, 25% ALLOCHEMICAL CONSTITUENTS, GRAIN SIZE: FINE, RANGE: MICROCRYSTALLINE TO COARSE, POOR INDURATION, SPARRY CALCITE CEMENT, CALCILUTITE MATRIX, CHALKY, CONES, ECHINOID, BENTHONIC FORAMINIFERA, BRYOZOA,

770.0- 790.0 AS ABOVE,

790.0- 800.0 DOLOMITE, GRAYISH BROWN TO MODERATE YELLOWISH BROWN, POROSITY, INTERGRANULAR, FRACTURE, POSSIBLY HIGH PERMEABILITY, 10-50% ALTERED, SUBHEDRAL, GRAIN SIZE: FINE, MODERATE INDURATION, SPARRY CALCITE CEMENT, CALCILUTITE MATRIX, BENTHONIC FORAMINIFERA, BRYOZOA,

800.0- 810.0 LIMESTONE, WHITE TO VERY LIGHT ORANGE, POROSITY, INTERGRANULAR, GRAIN TYPE: CRYSTALS, CALCILUTITE, BIOGENIC, 25% ALLOCHEMICAL CONSTITUENTS, GRAIN SIZE: FINE, RANGE: MICROCRYSTALLINE TO COARSE, POOR INDURATION, SPARRY CALCITE CEMENT, CALCILUTITE MATRIX, CHALKY, DOLOMITIC, LOW RECRYSTALLIZATION, BENTHONIC FORAMINIFERA, ECHINOID, BRYOZOA,

810.0- 820.0 LIMESTONE, WHITE TO VERY LIGHT ORANGE, POROSITY, INTERGRANULAR, PIN POINT VUGS, GRAIN TYPE: CRYSTALS, CALCILUTITE, BIOGENIC, 20% ALLOCHEMICAL CONSTITUENTS, GRAIN SIZE: VERY FINE, RANGE: MICROCRYSTALLINE TO MEDIUM, MODERATE INDURATION, SPARRY CALCITE CEMENT, CALCILUTITE MATRIX, CHALKY, DOLOMITIC, LOW RECRYSTALLIZATION, BENTHONIC FORAMINIFERA, ECHINOID, BRYOZOA, CONES,

820.0- 860.0 AS ABOVE,

LITHOLOGIC LOG
W-OKF42 . HIGHLANDS CO. T34S, R31E, SEC 23

860.0- 870.0 LIMESTONE, VERY LIGHT GRAY TO MODERATE LIGHT GRAY, POROSITY, INTERGRANULAR, PIN POINT VUGS, GRAIN TYPE: CRYSTALS, CALCILUTITE, BIOGENIC, 20% ALLOCHEMICAL CONSTITUENTS, GRAIN SIZE: VERY FINE, RANGE: MICROCRYSTALLINE TO MEDIUM, MODERATE INDURATION, SPARRY CALCITE CEMENT, CALCILUTITE MATRIX, CHALKY, DOLOMITIC, LOW RECRYSTALLIZATION, BENTHONIC FORAMINIFERA, ECHINOID, BRYOZOA, CONES,

870.0- 880.0 DOLOMITE, VERY LIGHT ORANGE TO GRAYISH BROWN, POROSITY, INTERGRANULAR, PIN POINT VUGS, MODERATE INDURATION, SPARRY CALCITE CEMENT, CALCILUTITE MATRIX, CHALKY, DOLOMITIC, MEDIUM RECRYSTALLIZATION, BENTHONIC FORAMINIFERA, ECHINOID, BRYOZOA, CONES,

880.0- 890.0 LIMESTONE, VERY LIGHT GRAY TO MODERATE LIGHT GRAY, POROSITY, INTERGRANULAR, PIN POINT VUGS, GRAIN TYPE: CRYSTALS, CALCILUTITE, BIOGENIC, 20% ALLOCHEMICAL CONSTITUENTS, GRAIN SIZE: VERY FINE, RANGE: MICROCRYSTALLINE TO MEDIUM, MODERATE INDURATION, SPARRY CALCITE CEMENT, CALCILUTITE MATRIX, CHALKY, DOLOMITIC, LOW RECRYSTALLIZATION, BENTHONIC FORAMINIFERA, ECHINOID, BRYOZOA, CONES,

890.0- 900.0 DOLOMITE, GRAYISH ORANGE TO GRAYISH BROWN, POROSITY, PIN POINT VUGS, POOR INDURATION, CALCILUTITE MATRIX, SPARRY CALCITE CEMENT, CHALKY, DOLOMITIC, LOW RECRYSTALLIZATION, BENTHONIC FORAMINIFERA, ECHINOID, BRYOZOA, CONES,

ABUNDANT SMALL FRAGMENTS OF ECHNOIDS SPINES, AND OTHER BIOGENIC MATERIAL

900.0- 910.0 LIMESTONE, WHITE TO VERY LIGHT GRAY, POROSITY, INTERGRANULAR, VUGULAR, GRAIN TYPE: CRYSTALS, CALCILUTITE, BIOGENIC, 15% ALLOCHEMICAL CONSTITUENTS, GRAIN SIZE: VERY FINE, RANGE: MICROCRYSTALLINE TO COARSE, POOR INDURATION, CALCILUTITE MATRIX, SPARRY CALCITE CEMENT, CHALKY, CONES, ECHINOID, BENTHONIC FORAMINIFERA, BRYOZOA,

DOLOMITE, VERY LIGHT ORANGE TO GRAYISH BROWN, POROSITY, INTERGRANULAR, FRACTURE, VUGULAR, 10-50% ALTERED, SUBHEDRAL, GRAIN SIZE: VERY FINE, RANGE: MICROCRYSTALLINE TO COARSE, MODERATE INDURATION, CALCILUTITE MATRIX, SPARRY CALCITE CEMENT, CHALKY, CONES, ECHINOID, BENTHONIC FORAMINIFERA, BRYOZOA,

910.0- 920.0 AS ABOVE,

920.0- 930.0 LIMESTONE, VERY LIGHT GRAY TO LIGHT GRAY, POROSITY, INTERGRANULAR, VUGULAR, GRAIN TYPE: CRYSTALS, CALCILUTITE, BIOGENIC, 10% ALLOCHEMICAL CONSTITUENTS, GRAIN SIZE: VERY FINE, RANGE: MICROCRYSTALLINE TO COARSE, POOR INDURATION, CALCILUTITE MATRIX, SPARRY CALCITE CEMENT, CHALKY, CONES, ECHINOID, BENTHONIC FORAMINIFERA, BRYOZOA,

LITHOLOGIC LOG
W-OKF42 . HIGHLANDS CO. T34S, R31E, SEC 23

930.0- 940.0 DOLOMITE, GRAYISH ORANGE TO GRAYISH BROWN, POROSITY, INTERGRANULAR, VUGULAR, 10-50% ALTERED, SUBHEDRAL, GRAIN SIZE: VERY FINE, RANGE: MICROCRYSTALLINE TO COARSE, MODERATE INDURATION, CALCILUTITE MATRIX, DOLOMITE CEMENT, MEDIUM RECRYSTALLIZATION, CONES, ECHINOID, BENTHONIC FORAMINIFERA, BRYOZOA,

ABUNDANT DOLOMITIZED LOOSELY CEMENTED BENTHONIC FORAMS

940.0- 980.0 AS ABOVE,

980.0- 990.0 DOLOMITE, MODERATE YELLOWISH BROWN TO GRAYISH ORANGE, POROSITY, INTERGRANULAR, VUGULAR, 50-90% ALTERED, EUHEDRAL, GRAIN SIZE: FINE, RANGE: VERY FINE TO COARSE, POOR INDURATION, CALCILUTITE MATRIX, DOLOMITE CEMENT, 03% QUARTZ SAND, CHALKY, CONES, BENTHONIC FORAMINIFERA, BRYOZOA, ALGAE,

990.0- 1000.0 AS ABOVE,

1000.0- 1010.0 DOLOMITE, GRAYISH BROWN TO MODERATE YELLOWISH BROWN, POROSITY, VUGULAR, INTERGRANULAR, 50-90% ALTERED, EUHEDRAL, GRAIN SIZE: FINE, RANGE: MICROCRYSTALLINE TO MEDIUM, MODERATE INDURATION, CALCILUTITE MATRIX, DOLOMITE CEMENT, 02% QUARTZ SAND, MEDIUM RECRYSTALLIZATION, CONES, BENTHONIC FORAMINIFERA, BRYOZOA, ALGAE,

1010.0- 1040.0 AS ABOVE,

1040.0- 1050.0 LIMESTONE, VERY LIGHT GRAY TO VERY LIGHT ORANGE, POROSITY, INTERGRANULAR, GRAIN TYPE: CALCILUTITE, CALCILUTITE, BIOGENIC, 20% ALLOCHEMICAL CONSTITUENTS, GRAIN SIZE: FINE, RANGE: VERY FINE TO COARSE, MODERATE INDURATION, CALCILUTITE MATRIX, SPARRY CALCITE CEMENT, MEDIUM RECRYSTALLIZATION, CONES, BENTHONIC FORAMINIFERA,

ABUNDANT CONES WITH WORN TESTS

1050.0- 1060.0 AS ABOVE,

1060.0- 1070.0 LIMESTONE, VERY LIGHT ORANGE TO GRAYISH ORANGE, POROSITY, INTERGRANULAR, VUGULAR, GRAIN TYPE: CALCILUTITE, CRYSTALS, BIOGENIC, 10% ALLOCHEMICAL CONSTITUENTS, GRAIN SIZE: FINE, RANGE: MICROCRYSTALLINE TO COARSE, POOR INDURATION, CALCILUTITE MATRIX, SPARRY CALCITE CEMENT, CHALKY, MEDIUM RECRYSTALLIZATION, CONES, BENTHONIC FORAMINIFERA,

1070.0- 1090.0 AS ABOVE,

CAVINGS FROM OCALA

1090.0- 1100.0 LIMESTONE, VERY LIGHT ORANGE, POROSITY, INTERGRANULAR, GRAIN TYPE: CRYSTALS, CALCILUTITE, 20% ALLOCHEMICAL CONSTITUENTS, GRAIN SIZE: FINE, RANGE: VERY FINE TO COARSE, POOR INDURATION, CHALKY, CONES, ECHINOID, BENTHONIC FORAMINIFERA,

LITHOLOGIC LOG
W-OKF42 . HIGHLANDS CO. T34S, R31E, SEC 23

1100.0- 1110.0 LIMESTONE, WHITE TO VERY LIGHT GRAY, POROSITY, INTERGRANULAR, VUGULAR, GRAIN TYPE: CRYSTALS, CALCILUTITE, 10% ALLOCHEMICAL CONSTITUENTS, GRAIN SIZE: FINE, RANGE: VERY FINE TO COARSE, POOR INDURATION, CHALKY, CONES, ECHINOID, BENTHONIC FORAMINIFERA,

1110.0- 1130.0 AS ABOVE,

1130.0- 1140.0 DOLOMITE, VERY LIGHT ORANGE TO GRAYISH ORANGE, POROSITY, INTERGRANULAR, VUGULAR, 10-50% ALTERED, ANHEDRAL, GRAIN SIZE: FINE, RANGE: VERY FINE TO COARSE, MODERATE INDURATION, DOLOMITE CEMENT, SPARRY CALCITE CEMENT, MEDIUM RECRYSTALLIZATION, CONES, BENTHONIC FORAMINIFERA,

1140.0- 1150.0 DOLOMITE, VERY LIGHT ORANGE TO GRAYISH ORANGE, POROSITY, INTERGRANULAR, VUGULAR, 10-50% ALTERED, SUBHEDRAL, GRAIN SIZE: FINE, MODERATE INDURATION, DOLOMITE CEMENT, SPARRY CALCITE CEMENT, MEDIUM RECRYSTALLIZATION, CONES, BENTHONIC FORAMINIFERA,

1150.0- 1160.0 DOLOMITE, MODERATE YELLOWISH BROWN TO DARK YELLOWISH BROWN, POROSITY, INTERGRANULAR, FRACTURE, 50-90% ALTERED, EUHEDRAL, GRAIN SIZE: FINE, GOOD INDURATION, DOLOMITE CEMENT, SPARRY CALCITE CEMENT, HIGH RECRYSTALLIZATION,

1160.0- 1180.0 FROM 1160 TO 1180 IS A FINE, UNCONSOLIDATED DOLOSILT. THIS FINE MATERIAL WAS CLOGGING THE DRILL RODS. CAVED IN BACK TO 1152 WHEN GEOPHYSICALLY LOGGED

OKF-105 Lithologic Description
0 to 1,398 feet below land surface

LITHOLOGIC WELL LOG PRINTOUT SOURCE - FGS

WELL NUMBER: W-18777 COUNTY - OKEECHOBEE
TOTAL DEPTH: 1398 FT. LOCATION: T.35S R.32E S.27 BC
271 SAMPLES FROM 40 TO 1398 FT. LAT = 27D 24M 07S
LON = 81D 06M 51S
COMPLETION DATE: N/A ELEVATION: 35 FT
OTHER TYPES OF LOGS AVAILABLE - NONE

OWNER/DRILLER:SFWMD

WORKED BY:DAVID WAGNER
ALSO KNOWN AS 565-C SFWMD FLORIDAN AQUIFER TEST WELL AT 565-C
OTHER WELL NAME IS OKF-105
ELEVATION OBTAINED FROM ARCGIS MAP WGS84 USING LAT/LON GIVEN
TOWNSHIP AND RANGE OBTAINED FROM ARCGIS MAP NAD83 USING LAT/LON GIVEN
LOCATION ON GIS MAP APPEARS TO BE ALONG THE KISSIMEE RIVER JUST OFF CHANDLER RANCH RD. ON THE NORTH SIDE OF THE RIVER.
DEFINITE ARCADIA AT DEPTH 350'. TOP COULD BE HIGHER BUT IS DIFFICULT TO DETERMINE BECAUSE THERE IS MUCH HIGHER SAND CONTENT THAN CHARACTERISTICALLY PRESENT IN ARCADIA ABOVE THE 350'-355'. SAMPLE.
TOP OF AVON PARK CHOSEN AT 805 FT. BUT COULD BE HIGHER. MILLER PLACES TOP OF AVON PARK AT 600'-700' BELOW MSL. DICTYOCONUS FORAMS FOUN IN SAMPLE
725'-730', BUT 725'-730' CONSISTS MOSTLY OF LEPIDOCYCLINA AND NUMMULITES FROM 765'-805', SAMPLES SHOW LARGE DECREASE IN LEPIDOCYCLINA AND NUMMULITES,
HOWEVER, THIS IS DIFFICULT TO TELL BECAUSE SAMPLES WERE POORLY PROCESSED.

0.	-	40.	000NOSM	NO SAMPLES
40.	-	350.	122PCRV	PEACE RIVER FM.
350.	-	485.	122ARCA	ARCADIA FM.
485.	-	805.	124OCAL	OCALA GROUP
805.	-	.	124AVPK	AVON PARK FM.

0 - 40 NO SAMPLES

40 - 45 SAND; LIGHT OLIVE GRAY TO YELLOWISH GRAY
POROSITY: INTERGRANULAR
GRAIN SIZE: FINE; RANGE: VERY FINE TO MEDIUM
ROUNDNESS: ANGULAR TO SUB-ANGULAR; MEDIUM SPHERICITY
UNCONSOLIDATED
ACCESSORY MINERALS: CALCILUTITE-15%, SHELL-05%
PHOSPHATIC SAND-03%, LIMESTONE-03%
FOSSILS: MOLLUSKS, BARNACLES, ECHINOID
GOOD PRESERVATION OF BARNICLES-COUPLE GRAVEL SIZED PHOSPHATES. ECHINOID FRAGMENTS FOUND INCLUDE ONLY SPINES.
INDURATION RANGES FROM UNCONSOLIDATED TO POORLY CONSOLIDATED DUE TO THE COHESIVE CLAY CONTENT AND MICRITE MOSTLY UNCONSOLIDATED. ~1% SILT CONTENT. MOST PHOSPHATE

GRAIN SIZES RANGE FROM VERY FINE TO FINE. ~2% CLAY CONTENT AND 1% ORGANICS. SOME SHELLS STILL RETAIN RED/NATURAL COLORS AND ARE NOT COMPLETLEY FOSSILIZED.

45 - 50 CALCILUTITE; YELLOWISH GRAY TO LIGHT OLIVE GRAY
POROSITY: INTERGRANULAR
MODERATE INDURATION
ACCESSORY MINERALS: QUARTZ SAND-15%, PHOSPHATIC SAND-03% CLAY-02%, SHELL-05%
FOSSILS: MOLLUSKS, BARNACLES, ECHINOID
SAND CONTENT DESCRIBED AS FOLLOWS: SIZE MODE IS FINE, SIZE RANGES FROM VERY FINE TO MEDIUM, ROUNDESS RANGES FROM ANGULAR TO SUBANGULAR, SPERICITY IS MEDIUM. SHELLS AND FOSSILS APPEAR TO BE A COMPONENT OF THE SAND AND NOT OF THE LIMESTONE. GRAVEL PHOSPHATE PRESENT (~2% OF SAMPLE INTERVAL). LIMESTONE IS VARIABLY SANDY, RANGING FROM ~0-5% QUARTZ SAND. VERY FINE PHOSPHATES ARE PRESENT THROUGHOUT THE LIMESTONE. SOME SHELLS STILL RETAIN RED/NATURAL COLORS AND ARE NOT COMPLETLEY FOSSILIZED.

50 - 55 SHELL BED; YELLOWISH GRAY TO LIGHT OLIVE GRAY
POROSITY: INTERGRANULAR; UNCONSOLIDATED
ACCESSORY MINERALS: QUARTZ SAND-15%, PHOSPHATIC SAND-02% CLAY-01%, CALCILUTITE-07%
FOSSILS: MOLLUSKS, BARNACLES, CORAL, ECHINOID
ON AVERAGE, SHELLS ARE WELL PRESERVED. ~10% OF SHELLS ARE RECRYSTALLIZED. ~3% OF SHELLS RETAIN ORIGINAL COLOR. SAND CONTENT DESCRIBED AS FOLLOWS: SIZE MODE IS FINE, SIZE RANGES FROM VERY FINE TO MEDIUM, ROUNDESS RANGES FROM ANGULAR TO SUBANGULAR, SPERICITY IS MEDIUM. CALCILUTITE COMPRISES 2% OF INTERVAL.

55 - 60 SAND; LIGHT OLIVE GRAY TO LIGHT OLIVE GRAY
POROSITY: INTERGRANULAR
GRAIN SIZE: FINE; RANGE: VERY FINE TO VERY COARSE
ROUNDNESS: ANGULAR TO SUB-ROUNDED; MEDIUM SPHERICITY
UNCONSOLIDATED
ACCESSORY MINERALS: CALCILUTITE-03%, SHELL-15% PHOSPHATIC SAND-03%, CLAY-03%
FOSSILS: MOLLUSKS, BARNACLES, ECHINOID
A FEW SHELLS ARE PURE WHITE. TRACE CALCILUTITE CONTAINING ~1% SILT.

60 - 65 AS ABOVE
HIGHER CONTENT OF PURE WHITE SHELLS.

65 - 70 SAND; LIGHT OLIVE GRAY TO YELLOWISH GRAY
GRAIN SIZE: MEDIUM; RANGE: VERY FINE TO VERY COARSE
ROUNDNESS: ANGULAR TO SUB-ROUNDED; MEDIUM SPHERICITY
UNCONSOLIDATED
ACCESSORY MINERALS: ORGANICS-1O%, PHOSPHATIC SAND-03% CLAY-05%, CALCILUTITE-02%
FOSSILS: MOLLUSKS, BARNACLES, ECHINOID
ECHINOIDS STIL ONLY PRESENT BY SPINES. DECREASING ECHINOID SPINE CONTENT MAY BE EXPLAINED BY CAVINGS INTO THIS DEPTH INTERVAL. COLOR IS VARIABLE. ~20% OF SHELLS ARE PURE WHITE AND ARE LOCALLY POORLY CONSOLIDATED FROM COHESIVE CLAY AND MICRITE.

70 - 75 AS ABOVE

75 - 80 SAND; LIGHT OLIVE GRAY TO YELLOWISH GRAY
POROSITY: INTERGRANULAR, MOLDIC
GRAIN SIZE: MEDIUM; RANGE: VERY FINE TO COARSE
ROUNDNESS: ANGULAR TO SUB-ROUNDED; MEDIUM SPHERICITY
POOR INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX, SPARRY CALCITE CEMENT
ACCESSORY MINERALS: SHELL-07%, PHOSPHATIC SAND-02%
CALCILUTITE-07%, CLAY-02%
OTHER FEATURES: CALCAREOUS
FOSSILS: MOLLUSKS, FOSSIL MOLDS
SHELLS LESS ABUNDANT AND NOT AS WELL PRESERVED AND MEDIAN RECRYSTALLIZED SAMPLE CONTAINS ~1% SILT. GRAVEL SIZED PHOSPHATES PRESENT.

80 - 85 SAND; LIGHT OLIVE GRAY TO YELLOWISH GRAY
POROSITY: INTERGRANULAR, MOLDIC
GRAIN SIZE: FINE; RANGE: VERY FINE TO COARSE
ROUNDNESS: ANGULAR TO SUB-ROUNDED; MEDIUM SPHERICITY
MODERATE INDURATION
CEMENT TYPE(S): CLAY MATRIX, CALCILUTITE MATRIX
SPARRY CALCITE CEMENT
ACCESSORY MINERALS: CLAY-15%, PHOSPHATIC SAND-02%
SHELL-03%, CALCILUTITE-05%
OTHER FEATURES: CALCAREOUS
FOSSILS: MOLLUSKS, BARNACLES, SHARKS TEETH, FOSSIL MOLDS
BENTHIC FORAMINIFERA
1% SILT CONTENT. ECHINOID SPINES PRESENT. THERE MAY BE SOME CORALS. TRACE AMOUNTS OF GRAVEL SIZE, ROUNDED QUARTZ GRAINS. THERE ARE PREDOMINANT LITHOLOGIES PRESENT. ONE IS A POOR INDURATED/CONSOLOIDATED, SANDY, SILTY, CALCAREOUS CLAY, AND THE SECOND IS A MEDIUM INDURATED, CALCAREOUS SAND WITH LOW CLAY CONTENT. A COUPLE GRAVEL SIZED PHOSPHATES ARE PRESENT.

85 - 90 CLAY; LIGHT OLIVE GRAY
POROSITY: INTERGRANULAR, LOW PERMEABILITY; POOR INDURATION
CEMENT TYPE(S): CLAY MATRIX, CALCILUTITE MATRIX
ACCESSORY MINERALS: PHOSPHATIC SAND-01%, SHELL-02%
CALCILUTITE-03%, QUARTZ SAND-30%
OTHER FEATURES: CALCAREOUS
FOSSILS: BARNACLES, MOLLUSKS, BENTHIC FORAMINIFERA
ECHINOID, CRUSTACEA
TRACE ORGANICS AND MICAS PRESENT. SAND CONTENT DESCRIBED AS FOLLOWS: SIZE MODE IS VERY FINE, SIZE RANGES FROM VERY FINE TO COARSE, ROUNDESS RANGES FROM ANGULAR TO SUBROUNDED SPERICITY IS MEDIUM. SILT COMPRISES 1% OF SAMPLE. 2% OF INTERVAL IS A MEDIUM INDURATED, CALCAREOUS SAND WITH LOW CLAY CONTENT.

90 - 95 AS ABOVE
LOWER BARNACLE CONTENT.

95 - 100 CLAY; LIGHT OLIVE GRAY TO YELLOWISH GRAY

POROSITY: INTERGRANULAR, LOW PERMEABILITY; POOR INDURATION
CEMENT TYPE(S): CLAY MATRIX, CALCILUTITE MATRIX
ACCESSORY MINERALS: PHOSPHATIC SAND-01%, SHELL-03% CALCILUTITE-03%, QUARTZ SAND-03%
OTHER FEATURES: CALCAREOUS
FOSSILS: MOLLUSKS, BARNACLES, FOSSIL MOLDS BENTHIC FORAMINIFERA, ECHINOID
COLOR #86 IN INTERVAL DESCRIPTION IS FOUND ONLY IN SHELLS. SAND CONTENT IS DESCRIBED AS FOLLOWS: SIZE MODE IS FINE SIZE RANGES FROM VERY FINE TO COARSE, ROUNDNESS RANGES FROM ANGULAR TO SUBROUNDED, SPERICITY IS MEDIUM. 3% OF INTERVAL IS COMPRISED OF FRAGMENTS OF A CALCAREOUS SAND STONE DESCRIBED AS FOLLOWS: SIZE MODE IS MEDIUM, SIZE RANGES FROM VERY FINE TO COARSE, ROUNDNESS RANGES FROM ANGULAR TO SUBROUNDED SPERICITY IS MEDIUM (APPEARS TO BE SAME SAND STONE AS DESCRIBED AS THE PRIMARY LITHOLOGY FOR THE 80'INTERVAL). 1% OF INTERVAL IS COMPRISED OF SILT. TRACE MICAS PRESENT.

100 - 105 CLAY; LIGHT OLIVE GRAY TO YELLOWISH GRAY
POROSITY: INTERGRANULAR, LOW PERMEABILITY; POOR INDURATION
CEMENT TYPE(S): CLAY MATRIX, CALCILUTITE MATRIX
ACCESSORY MINERALS: PHOSPHATIC SAND-01%, ORGANICS-02% CALCILUTITE-03%, QUARTZ SAND-30%
OTHER FEATURES: CALCAREOUS
FOSSILS: MOLLUSKS, BARNACLES, BENTHIC FORAMINIFERA ECHINOID
COLOR #86 IN INTERVAL DESCRIPTION IS FOUND ONLY IN SHELLS.
1% SILT CONTENT FOR INTERVAL. 1-2% OF INTERVAL IS COMPRISED OF FRAGMENTS OF A CALCAREOUS SAND STONE DESCRIBED AS FOLLOWS: SIZE MODE IS MEDIUM, SIZE RANGES FROM VERY FINE TO COARSE, ROUNDNESS RANGES FROM ANGULAR TO SUBROUNDED SPERICITY IS MEDIUM (APPEARS TO BE SAME SAND STONE AS DESCRIBED AS THE PRIMARY LITHOLOGY FOR THE 80' INTERVAL). SAND CONTENT IS DESCRIBED AS FOLLOWS: SIZE MODE IS FINE SIZE RANGES FROM VERY FINE TO COARSE, ROUNDNESS RANGES FROM ANGULAR TO SUBROUNDED, SPERICITY IS MEDIUM.

105 - 110 SAND; LIGHT OLIVE GRAY TO YELLOWISH GRAY
POROSITY: INTERGRANULAR
GRAIN SIZE: FINE; RANGE: VERY FINE TO VERY COARSE
ROUNDNESS: ANGULAR TO SUB-ROUNDED; MEDIUM SPHERICITY
UNCONSOLIDATED
ACCESSORY MINERALS: SHELL-30%, PHOSPHATIC SAND-02% CALCILUTITE-02%, CLAY-01%
OTHER FEATURES: CALCAREOUS
FOSSILS: MOLLUSKS, BARNACLES, ECHINOID BENTHIC FORAMINIFERA
1% SILT CONTENT FOR INTERVAL. IN THE CEMENTED SANDS, THERE IS A MOLDIC POROSITY FROM WEATHERED SHELLS. THE INDURATION IS POOR WITH SPARRY CALCITE AND MICRITE MATRIX.

110 - 115 SAND; LIGHT OLIVE GRAY TO YELLOWISH GRAY

POROSITY: INTERGRANULAR
GRAIN SIZE: FINE; RANGE: VERY FINE TO VERY COARSE
ROUNDNESS: ANGULAR TO SUB-ROUNDED; MEDIUM SPHERICITY
UNCONSOLIDATED
ACCESSORY MINERALS: SHELL-25%, PHOSPHATIC SAND-02%
CALCILUTITE-02%, CLAY-02%
OTHER FEATURES: CALCAREOUS
FOSSILS: MOLLUSKS, BARNACLES, ECHINOID
BENTHIC FORAMINIFERA
1% SILT CONTENT FOR INTERVAL. THE CEMENTED SANDS/SANDY LIMESTONE HAS MOLDIC POROSITY FROM WEATHERED SHELLS. THESE FRAGMENTS MAY BE SAME LITHOLOGY, HOWEVER, IS POORLY CEMENTED AND CONTAINS SPARRY CALCITE AND MICRITE. ALTHOUGH THE MODAL GRAINSIZE IN THE CEMENTED SANDS ARE LARGER WHICH COULD INDICATE DIFFERENT LITHOLOGIES.

115 - 120 SAND; LIGHT OLIVE GRAY TO YELLOWISH GRAY
POROSITY: INTERGRANULAR
GRAIN SIZE: FINE; RANGE: VERY FINE TO VERY COARSE
ROUNDNESS: ANGULAR TO SUB-ROUNDED; MEDIUM SPHERICITY
ACCESSORY MINERALS: SHELL-20%, PHOSPHATIC SAND-03%
CALCILUTITE-02%, CLAY-02%
OTHER FEATURES: CALCAREOUS
FOSSILS: MOLLUSKS, BARNACLES, ECHINOID
BENTHIC FORAMINIFERA
1% SILT CONTENT FOR INTERVAL. HIGHER PHOSPHATE CONTENT IN THE CEMENTED SANDS AND SANDY LIMESTONE. POSSIBLE GRADATIONAL PEACE RIVER CONTACT. HIGH CONTENT OF MICRITE AND MOLDIC SECONDARY POROSITY IS BECOMING MORE PRONOUNCED AND REPRESENTS ~20% OF SAMPLE INTERVAL. SAND AND SHELLS AND CALCILUTITE COULD BE FROM CAVINGS. 1% GRAVEL AND GRANULE SIZE PHOSPHATE CONTENT.

120 - 125 AS ABOVE

125 - 130 SAND; LIGHT OLIVE GRAY TO YELLOWISH GRAY
POROSITY: INTERGRANULAR
GRAIN SIZE: FINE; RANGE: VERY FINE TO VERY COARSE
ROUNDNESS: ANGULAR TO SUB-ROUNDED; MEDIUM SPHERICITY
UNCONSOLIDATED
ACCESSORY MINERALS: ORGANICS-15%, PHOSPHATIC SAND-03%
CALCILUTITE-02%, CLAY-03%
OTHER FEATURES: CALCAREOUS
FOSSILS: MOLLUSKS, BARNACLES, ECHINOID
BENTHIC FORAMINIFERA, PLANKTONIC FORAMINIFERA
SILT 1% GRANULE AND GRAVEL SIZE PHOSPHATE CONTENT. THE CEMENTED SANDS CONTENT HAS INCREASED TO ~30%.

130 - 135 AS ABOVE

135 - 140 SAND; LIGHT OLIVE GRAY TO YELLOWISH GRAY
POROSITY: INTERGRANULAR, MOLDIC; MODERATE INDURATION
CEMENT TYPE(S): SPARRY CALCITE CEMENT
ACCESSORY MINERALS: SHELL-10%, PHOSPHATIC SAND-03%
CALCILUTITE-03%, CLAY-03%
OTHER FEATURES: CALCAREOUS
FOSSILS: MOLLUSKS, BARNACLES, ECHINOID
BENTHIC FORAMINIFERA, PLANKTONIC FORAMINIFERA

INDURATION IS MOSTLY POOR BUT RANGES FROM POOR TO MODERATE. SOME SILT PRESENT. 1% GRAVEL AND GRANULE SIZE PHOSPHATE CONTENT. CARBONATE CEMENTED SANDS HAVE BECOME DOMINANT LITHOLOGY. LOOSE SANDS ARE ANGULAR AND MODAL SIZE IS FINE. SOME CAST FOSSILS PRESENT REPRESENTING LESS THAN 1% OF INTERVAL.

140 - 145 SAND; LIGHT OLIVE GRAY TO VERY LIGHT GRAY
POROSITY: INTERGRANULAR, MOLDIC
GRAIN SIZE: COARSE; RANGE: MEDIUM TO VERY COARSE
ROUNDNESS: ANGULAR TO SUB-ROUNDED; MEDIUM SPHERICITY
POOR INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX, SPARRY CALCITE CEMENT
ACCESSORY MINERALS: SHELL-10%, CLAY-05%
PHOSPHATIC SAND-05%, CALCILUTITE-03%
OTHER FEATURES: CALCAREOUS
FOSSILS: MOLLUSKS, BARNACLES
DECREASING MODAL GRAIN SIZE FOR LOOSE SANDS (POSSIBLY CAVINGS) AND WEATHERED AND CRUSHED CEMENTED SAND HAS A SMALLER MODAL GRAIN SIZE. LESS THAN 1% GRANUAL AND GRAVEL PHOSPHATE CONTENT.

145 - 150 SAND; LIGHT OLIVE GRAY TO VERY LIGHT GRAY
POROSITY: INTERGRANULAR, MOLDIC; POOR INDURATION
CEMENT TYPE(S): SPARRY CALCITE CEMENT, CALCILUTITE MATRIX
ACCESSORY MINERALS: SHELL-15%, CLAY-03%
PHOSPHATIC SAND-05%, CALCILUTITE-03%
OTHER FEATURES: CALCAREOUS
FOSSILS: MOLLUSKS, BARNACLES
LITHOLOGY VARIES RANGING FROM QUARTZ AND PHOSPHATE SAND CEMENTED WITH CARBONATE MATRIX TO A WEATHERED AND RECRYSTALIZED, SANDY COQUINA IN SOME FRAGMENTS. QUARTZ SAND STILL APPEARS TO BE THE DOMINANT COMPOSITION. LOOSE SAND HAS SMALLER MODAL GRAIN SIZE, SOME OF WHICH IS PROBABLY CAVINGS. SILTY AND VERY FINE SANDY CLAY NODULES WITH SIMULARITY TO COMPONENTS OF LAST 15-20'. 1-2% WEATHERED CALCITE CONTENT. 1% GRAVEL PHOSPHATE CONTENT.

150 - 155 SHELL BED; LIGHT OLIVE GRAY TO YELLOWISH GRAY
POROSITY: INTERGRANULAR, MOLDIC; POOR INDURATION
CEMENT TYPE(S): SPARRY CALCITE CEMENT, CALCILUTITE MATRIX
ACCESSORY MINERALS: PHOSPHATIC SAND-05%, CLAY-01%
QUARTZ SAND-30%
FOSSILS: BARNACLES, MOLLUSKS
DECREASING SAND CONTENT. MAIN LITHOLOGY APPEARS TO BE A SANDY WEATHERED COQUINA. SAMPLE IS WELL COMPACTED. SOME FRAGMENTS ARE PURE SAND WITH CALCAREOUS CEMENT. 1% GRAVEL/GRANULE PHOSPHATE CONTENT.

155 - 160 GRAINSTONE; LIGHT OLIVE GRAY TO YELLOWISH GRAY
POROSITY: INTERGRANULAR, MOLDIC
GRAIN TYPE: SKELETAL, CRYSTALS, CALCILUTITE
90% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: VERY COARSE; RANGE: COARSE TO GRAVEL
MODERATE INDURATION
CEMENT TYPE(S): SPARRY CALCITE CEMENT, CALCILUTITE MATRIX
ACCESSORY MINERALS: PHOSPHATIC SAND-03%, SHELL-40%
CLAY-03%, QUARTZ SAND-25%

OTHER FEATURES: HIGH RECRYSTALLIZATION
FOSSILS: MOLLUSKS, ECHINOID, BARNACLES, FOSSIL MOLDS CORAL
VARIABLY SANDY, FRAGMENTS RANGING FROM NEARLY NO SAND TO COMPLETELY COMPRISED OF SAND. INDURATION VARIES ~50/50 POOR TO MODERATE. 1% CALCITE CONTENT. ~2% GRAVEL PHOSPHATE CONTENT. SAND CONTENT IS DESCRIBED AS FOLLOWS: IS COARSE SIZE RANGES FROM FINE TO COARSE, ROUNDNESS RANGES FROM SUBANGULAR TO SUBROUNDED, SPERICITY IS MEDIUM.

160 - 165 GRAINSTONE; LIGHT OLIVE GRAY TO YELLOWISH GRAY
POROSITY: INTERGRANULAR, MOLDIC
GRAIN TYPE: SKELETAL, CRYSTALS, CALCILUTITE
90% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: VERY COARSE; RANGE: COARSE TO GRAVEL
POOR INDURATION
CEMENT TYPE(S): SPARRY CALCITE CEMENT, CALCILUTITE MATRIX
ACCESSORY MINERALS: PHOSPHATIC SAND-03%, SHELL-40% CLAY-02%, QUARTZ SAND-30%
OTHER FEATURES: HIGH RECRYSTALLIZATION
FOSSILS: MOLLUSKS, ECHINOID, BARNACLES, FOSSIL MOLDS CORAL
VARIABLY SANDY. ~20-30% OF INTERVAL IS MODERATELY INDURATED BUT INDURATION RANGES FROM POOR TO MODERATE OVERALL. SAND CONTENT IS DESCRIBED AS FOLLOWS: SIZE MODE IS MEDIUM, SIZE RANGES FROM FINE TO COARSE, ROUNDNESS RANGES FROM SUBANGULAR TO SUBROUNDED, SPERICITY IS MEDIUM. 2% GRAVEL AND GRANULE PHOSPHATE CONTENT. 1% CALCITE CONTENT. SHARK'S TOOTH FOUND.

165 - 170 SAND; LIGHT OLIVE GRAY TO YELLOWISH GRAY
POROSITY: INTERGRANULAR, MOLDIC
GRAIN SIZE: MEDIUM; RANGE: VERY FINE TO VERY COARSE
ROUNDNESS: SUB-ANGULAR TO SUB-ROUNDED; MEDIUM SPHERICITY
UNCONSOLIDATED
ACCESSORY MINERALS: PHOSPHATIC SAND-03%, SHELL-30% CLAY-02%, CALCILUTITE-05%
OTHER FEATURES: HIGH RECRYSTALLIZATION
FOSSILS: MOLLUSKS, BARNACLES, ECHINOID, FOSSIL MOLDS SHELLS ARE MOSTLY HIGHLY RECRYSTALLIZED. 1% OR LESS GRAVEL PHOSPHATE CONTENT. THERE ARE THREE LITHOLOGIES PRESENT: THE SAND DESCRIBED ABOVE WHICH MAY WHICH MAY BE POORLY CEMENTED BY SPARRY CALCITE AND MUD; FRAGEMENTS OF THE GRAINSTONE DESCRIBED ABOVE; FRAGMENTS OF A WELL INDURATED, MEDIUM TO LIGHT GRAY, VERY FINE GRAINED DOLOMITE WHICH REPRESENTS ~2-3% OF SAMPLE INTERVAL. TRACE SILT PRESENT.

170 - 180 SAND; LIGHT OLIVE GRAY TO YELLOWISH GRAY
POROSITY: INTERGRANULAR, MOLDIC
GRAIN SIZE: FINE; RANGE: VERY FINE TO VERY COARSE
ROUNDNESS: ANGULAR TO SUB-ROUNDED; MEDIUM SPHERICITY
UNCONSOLIDATED
ACCESSORY MINERALS: CALCILUTITE-05%, CLAY-03% PHOSPHATIC SAND-02%, SHELL-15%
OTHER FEATURES: CALCAREOUS
FOSSILS: MOLLUSKS, ECHINOID, FOSSIL MOLDS

BENTHIC FORAMINIFERA
1% GRAVEL PHOSPHATE CONTENT.

180 - 190 SAND; LIGHT OLIVE GRAY
POROSITY: INTERGRANULAR, MOLDIC
GRAIN SIZE: MEDIUM; RANGE: VERY FINE TO VERY COARSE
ROUNDNESS: ANGULAR TO SUB-ROUNDED; MEDIUM SPHERICITY
UNCONSOLIDATED
ACCESSORY MINERALS: SHELL-01%, PHOSPHATIC SAND-02%
FOSSILS: ECHINOID, BENTHIC FORAMINIFERA, FOSSIL FRAGMENTS
TRACE SILT AND MICA PRESENT.

190 - 195 AS ABOVE

195 - 200 AS ABOVE

200 - 205 SAND; LIGHT OLIVE GRAY
POROSITY: INTERGRANULAR, MOLDIC
GRAIN SIZE: MEDIUM; RANGE: VERY FINE TO VERY COARSE
ROUNDNESS: ANGULAR TO SUB-ANGULAR; MEDIUM SPHERICITY
UNCONSOLIDATED
ACCESSORY MINERALS: SHELL-01%, PHOSPHATIC SAND-02%
FOSSILS: ECHINOID, FOSSIL FRAGMENTS, BENTHIC FORAMINIFERA
OSTRACODS
TRACE SILT PRESENT.

205 - 210 SAND; LIGHT OLIVE GRAY
POROSITY: INTERGRANULAR, MOLDIC
GRAIN SIZE: MEDIUM; RANGE: VERY FINE TO VERY COARSE
ROUNDNESS: ANGULAR TO SUB-ANGULAR; MEDIUM SPHERICITY
UNCONSOLIDATED
ACCESSORY MINERALS: SHELL-01%, PHOSPHATIC SAND-02%
FOSSILS: ECHINOID, FOSSIL FRAGMENTS, BENTHIC FORAMINIFERA
TRACE SILT AND CLAY PRESENT.

210 - 215 AS ABOVE

215 - 220 SAND; LIGHT OLIVE GRAY
POROSITY: INTERGRANULAR, MOLDIC
GRAIN SIZE: MEDIUM; RANGE: VERY FINE TO VERY COARSE
ROUNDNESS: ANGULAR TO SUB-ROUNDED; MEDIUM SPHERICITY
UNCONSOLIDATED
ACCESSORY MINERALS: SHELL-02%, PHOSPHATIC SAND-02%
CLAY-01%
FOSSILS: ECHINOID, FOSSIL FRAGMENTS, BENTHIC FORAMINIFERA
FEW CAVINGS OF THE PREVIOUS LIMESTONE AND DOLOMITE.

220 - 225 SAND; LIGHT OLIVE GRAY
POROSITY: INTERGRANULAR, MOLDIC
GRAIN SIZE: MEDIUM; RANGE: VERY FINE TO VERY COARSE
ROUNDNESS: ANGULAR TO SUB-ANGULAR; MEDIUM SPHERICITY
UNCONSOLIDATED
ACCESSORY MINERALS: SHELL-03%, PHOSPHATIC SAND-02%
CLAY-01%
FOSSILS: ECHINOID, FOSSIL FRAGMENTS, BENTHIC FORAMINIFERA
MOLLUSKS, BARNACLES
TRACE SILT CONTENT.

225 - 230 AS ABOVE

230 - 235 SAND; LIGHT OLIVE GRAY
POROSITY: INTERGRANULAR, MOLDIC
GRAIN SIZE: MEDIUM; RANGE: VERY FINE TO VERY COARSE
ROUNDNESS: ANGULAR TO SUB-ANGULAR; MEDIUM SPHERICITY
UNCONSOLIDATED
ACCESSORY MINERALS: SHELL-03%, PHOSPHATIC SAND-02%
CLAY-01%
OTHER FEATURES: FOSSILIFEROUS
FOSSILS: ECHINOID, MOLLUSKS, BENTHIC FORAMINIFERA, CORAL
BARNACLES
HIGHER FOSSIL CONTENT.

235 - 240 SAND; LIGHT OLIVE GRAY
POROSITY: INTERGRANULAR, MOLDIC
GRAIN SIZE: MEDIUM; RANGE: VERY FINE TO VERY COARSE
ROUNDNESS: ANGULAR TO SUB-ANGULAR; MEDIUM SPHERICITY
UNCONSOLIDATED
ACCESSORY MINERALS: SHELL-02%, CLAY-01%
PHOSPHATIC SAND-02%
FOSSILS: ECHINOID, FOSSIL FRAGMENTS, BENTHIC FORAMINIFERA
TRACE SILT AND MICA CONTENT. FOSSIL CONTENT DECREASED
FROM LAST INTERVAL.

240 - 245 AS ABOVE

245 - 250 AS ABOVE

250 - 255 SAND; LIGHT OLIVE GRAY TO MODERATE LIGHT GRAY
POROSITY: INTERGRANULAR, MOLDIC
GRAIN SIZE: MEDIUM; RANGE: VERY FINE TO VERY COARSE
ROUNDNESS: ANGULAR TO SUB-ROUNDED; MEDIUM SPHERICITY
UNCONSOLIDATED
ACCESSORY MINERALS: SHELL-02%, CLAY-01%
PHOSPHATIC SAND-03%
OTHER FEATURES: FOSSILIFEROUS
FOSSILS: ECHINOID, BARNACLES, BENTHIC FORAMINIFERA
FOSSIL FRAGMENTS
INCREASED FOSSIL CONTENT. TRACE SILT PRESENT

255 - 260 SAND; LIGHT OLIVE GRAY
POROSITY: INTERGRANULAR, MOLDIC
GRAIN SIZE: MEDIUM; RANGE: VERY FINE TO VERY COARSE
ROUNDNESS: ANGULAR TO SUB-ROUNDED; MEDIUM SPHERICITY
UNCONSOLIDATED
ACCESSORY MINERALS: SHELL-03%, CLAY-01%
PHOSPHATIC SAND-03%
OTHER FEATURES: FOSSILIFEROUS
FOSSILS: ECHINOID, BARNACLES, BENTHIC FORAMINIFERA
FOSSIL FRAGMENTS
TRACE SILT AND CALCITE PRESENT. THERE IS A
MICROCRYSTALLINE CALCITE COATING ON SOME OF THE QUARTZ
SAND GRAINS.

260 - 265 SAND; LIGHT OLIVE GRAY
POROSITY: INTERGRANULAR, MOLDIC
GRAIN SIZE: MEDIUM; RANGE: VERY FINE TO VERY COARSE

ROUNDNESS: ANGULAR TO SUB-ROUNDED; MEDIUM SPHERICITY
UNCONSOLIDATED
ACCESSORY MINERALS: SHELL-02%, CLAY-01%
PHOSPHATIC SAND-03%
FOSSILS: ECHINOID, BARNACLES, FOSSIL FRAGMENTS
BENTHIC FORAMINIFERA
TRACE SILT AND CALCITE PRESENT. THERE IS A
MICROCRYSTALLINE CALCITE COATING ON SOME OF THE QUARTZ
SAND GRAINS.

265 - 270 SAND; LIGHT OLIVE GRAY TO DARK GRAY
POROSITY: INTERGRANULAR, MOLDIC
GRAIN SIZE: FINE; RANGE: VERY FINE TO VERY COARSE
ROUNDNESS: ANGULAR TO SUB-ROUNDED; MEDIUM SPHERICITY
UNCONSOLIDATED
ACCESSORY MINERALS: SHELL-03%, PHOSPHATIC SAND-15%
FOSSILS: ECHINOID, BARNACLES, MOLLUSKS
BENTHIC FORAMINIFERA, OSTRACODS
TRACE SILT AND CLAY PRESENT. SHARK'S TOOTH FOUND.
PHOSPHATE GRAIN SIZE RANGES FROM VERY FINE TO VERY COARSE
BUT THE VAST MAJORITY IS IN THE FINE TO MEDIUM RANGE.

270 - 275 AS ABOVE

275 - 280 AS ABOVE

280 - 285 SAND; LIGHT OLIVE GRAY TO DARK GRAY
POROSITY: INTERGRANULAR, MOLDIC
GRAIN SIZE: FINE; RANGE: VERY FINE TO VERY COARSE
ROUNDNESS: ANGULAR TO SUB-ROUNDED; MEDIUM SPHERICITY
UNCONSOLIDATED
ACCESSORY MINERALS: SHELL-05%, PHOSPHATIC SAND-15%
OTHER FEATURES: FOSSILIFEROUS
FOSSILS: ECHINOID, BENTHIC FORAMINIFERA, BARNACLES
SHARKS TEETH
TRACE SILT, CALCITE, CLAY, AND DOLOMITE.

285 - 290 SAND; LIGHT OLIVE GRAY TO DARK GRAY
POROSITY: INTERGRANULAR, MOLDIC
GRAIN SIZE: FINE; RANGE: VERY FINE TO VERY COARSE
ROUNDNESS: ANGULAR TO SUB-ROUNDED; MEDIUM SPHERICITY
UNCONSOLIDATED
ACCESSORY MINERALS: SHELL-03%, PHOSPHATIC SAND-15%
FOSSILS: ECHINOID, BENTHIC FORAMINIFERA, SHARKS TEETH
BARNACLES, OSTRACODS
TRACE SILT AND CLAY CONTENT. PHOSPHATE MODAL GRAIN SIZE
IS MEDIUM, BUT RANGES FROM VERY FINE TO VERY COARSE.

290 - 295 AS ABOVE

295 - 300 SAND; LIGHT OLIVE GRAY TO DARK GRAY
POROSITY: INTERGRANULAR, MOLDIC
GRAIN SIZE: FINE; RANGE: VERY FINE TO VERY COARSE
ROUNDNESS: ANGULAR TO SUB-ROUNDED; MEDIUM SPHERICITY
UNCONSOLIDATED
ACCESSORY MINERALS: SHELL-02%, PHOSPHATIC SAND-15%
FOSSILS: ECHINOID, BENTHIC FORAMINIFERA, SHARKS TEETH
BARNACLES, OSTRACODS

TRACE SILT AND CLAY PRESENT. PHOSPHATE MODAL GRAIN SIZE IS MEDIUM.

300 - 305 AS ABOVE

305 - 310 AS ABOVE

310 - 315 SAND; LIGHT OLIVE GRAY TO DARK GRAY
POROSITY: INTERGRANULAR, MOLDIC
GRAIN SIZE: FINE; RANGE: VERY FINE TO VERY COARSE
ROUNDNESS: ANGULAR TO SUB-ROUNDED; MEDIUM SPHERICITY
UNCONSOLIDATED
ACCESSORY MINERALS: SHELL-03%, PHOSPHATIC SAND-15%
FOSSILS: ECHINOID, BENTHIC FORAMINIFERA, OSTRACODS
BARNACLES, FOSSIL FRAGMENTS
TRACE SILT AND GRAVEL SIZE PHOSPHATE. PHOSPHATE MODAL SIZE IS MEDIUM.

315 - 320 AS ABOVE

320 - 325 SAND; LIGHT OLIVE GRAY TO DARK GRAY
POROSITY: INTERGRANULAR, MOLDIC
GRAIN SIZE: FINE; RANGE: VERY FINE TO VERY COARSE
ROUNDNESS: ANGULAR TO SUB-ROUNDED; MEDIUM SPHERICITY
UNCONSOLIDATED
ACCESSORY MINERALS: SHELL-02%, PHOSPHATIC SAND-20%
DOLOMITE-01%
OTHER FEATURES: FOSSILIFEROUS
FOSSILS: FOSSIL FRAGMENTS, ECHINOID, SHARKS TEETH
TRACE SILT CONTENT. PHOSPHATE MODAL GRAIN SIZE IS MEDIUM.

325 - 330 SAND; LIGHT OLIVE GRAY TO DARK GRAY
POROSITY: INTERGRANULAR, MOLDIC
GRAIN SIZE: FINE; RANGE: VERY FINE TO VERY COARSE
ROUNDNESS: ANGULAR TO SUB-ROUNDED; MEDIUM SPHERICITY
UNCONSOLIDATED
ACCESSORY MINERALS: SHELL-03%, PHOSPHATIC SAND-20%
DOLOMITE-01%
FOSSILS: MOLLUSKS, ECHINOID, SHARKS TEETH, BARNACLES
BENTHIC FORAMINIFERA
TRACE SILT CONTENT. PHOSPHATE MODAL GRAIN SIZE IS MEDIUM.

330 - 335 AS ABOVE

335 - 340 AS ABOVE
SMALL OSTRACODS PRESENT.

340 - 345 AS ABOVE
PLANKTIC FORAM PRESENT.

345 - 350 AS ABOVE
NO PLANKTIC FORAMS OR OSTRACODS SEEN IN THE INTERVAL.

350 - 355 SILT-SIZE DOLOMITE; YELLOWISH GRAY TO LIGHT OLIVE GRAY
POROSITY: INTERGRANULAR, MOLDIC; MODERATE INDURATION
CEMENT TYPE(S): DOLOMITE CEMENT, CLAY MATRIX
ACCESSORY MINERALS: CLAY-07%, PHOSPHATIC SAND-10%
SILT-01%, PHOSPHATIC GRAVEL-01%

OTHER FEATURES: SUCROSIC, MUDDY
FOSSILS: FOSSIL MOLDS, FOSSIL FRAGMENTS

355 - 360 AS ABOVE

360 - 365 SILT-SIZE DOLOMITE; YELLOWISH GRAY TO WHITE
POROSITY: INTERGRANULAR, MOLDIC; POOR INDURATION
CEMENT TYPE(S): CLAY MATRIX, CALCILUTITE MATRIX
DOLOMITE CEMENT
ACCESSORY MINERALS: PHOSPHATIC SAND-07%, CLAY-10%
LIMESTONE-03%, CALCILUTITE-05%
OTHER FEATURES: SUCROSIC, MUDDY
FOSSILS: BARNACLES, FOSSIL FRAGMENTS, FOSSIL MOLDS
ECHINOID
1% SILT AND PHOSPHATE GRAVEL CONTENT.

365 - 370 DOLOSTONE; YELLOWISH GRAY
POROSITY: INTERGRANULAR, INTERCRYSTALLINE, MOLDIC
10-50% ALTERED; SUBHEDRAL
GRAIN SIZE: MICROCRYSTALLINE
RANGE: MICROCRYSTALLINE TO VERY FINE; GOOD INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX, DOLOMITE CEMENT
CLAY MATRIX
ACCESSORY MINERALS: CLAY-03%, PHOSPHATIC SAND-07%
QUARTZ SAND-02%, CALCILUTITE-20%
OTHER FEATURES: VARIEGATED
FOSSILS: ECHINOID, CORAL, FOSSIL MOLDS
ALTERATION RANGES FROM LOW TO HIGH. PERCENTAGES OF
ALTERATION ARE DIFFICULT TO ESTIMATE BECAUSE OF MICRITE
AND DOLOSILT COATING THE SAMPLE. CRYSTALLINITY RANGES
FROM ANHEDRAL TO EUHEDRAL IN THE MORE HIGHLY ALTERED
DOLOMITES.

370 - 375 DOLOSTONE; LIGHT OLIVE GRAY TO YELLOWISH GRAY
POROSITY: INTERCRYSTALLINE, MOLDIC, INTERGRANULAR
10-50% ALTERED; SUBHEDRAL
GRAIN SIZE: MICROCRYSTALLINE
RANGE: MICROCRYSTALLINE TO VERY FINE; GOOD INDURATION
CEMENT TYPE(S): DOLOMITE CEMENT, CALCILUTITE MATRIX
ACCESSORY MINERALS: PHOSPHATIC SAND-03%, CLAY-02%
QUARTZ SAND-02%, CALCILUTITE-15%
OTHER FEATURES: MUDDY
FOSSILS: FOSSIL MOLDS, FOSSIL FRAGMENTS
INDURATION RANGES FROM MEDIUM TO GOOD WITH ~10% OF SAMPLE
SHOWING MEDIUM INDURATION. TRACE CALCITE CONTENT.
ALTERATION RANGES FROM MEDIUM TO HIGH. CRYSTALLINITY
RANGES FROM ANHEDRAL TO EUHEDRAL. ONE FOSSIL FRAGMENT
FOUND APPEARING TO BE OF A VERTEBRATE. 1% GRAVEL
PHOSPHATE AND DOLOSILT CONTENT.

375 - 380 AS ABOVE

380 - 385 DOLOSTONE; LIGHT OLIVE GRAY TO YELLOWISH GRAY
POROSITY: INTERCRYSTALLINE, MOLDIC, INTERGRANULAR
10-50% ALTERED; SUBHEDRAL
GRAIN SIZE: MICROCRYSTALLINE
RANGE: MICROCRYSTALLINE TO VERY FINE; GOOD INDURATION
CEMENT TYPE(S): DOLOMITE CEMENT, CALCILUTITE MATRIX

ACCESSORY MINERALS: PHOSPHATIC SAND-03%
PHOSPHATIC GRAVEL-02%, CALCILUTITE-15%, LIMESTONE-05%
OTHER FEATURES: MUDDY
FOSSILS: FOSSIL MOLDS, FOSSIL FRAGMENTS
ALTERATION VARIES FROM MEDIUM IN DOLOMITIC LIMESTONE TO HIGH ALTERATION. CRYSTALLINITY VARIES FROM ANHEDRAL TO EUHEDRAL IN THE MORE HIGHLY ALTERED DOLOMITE. 2% CLAY CONTENT. 1-2% QUARTZ SAND CONTENT.

385 - 390 AS ABOVE

390 - 395 DOLOSTONE; YELLOWISH GRAY TO LIGHT OLIVE GRAY
POROSITY: INTERGRANULAR, INTERCRYSTALLINE, MOLDIC
10-50% ALTERED; ANHEDRAL
GRAIN SIZE: MICROCRYSTALLINE
RANGE: MICROCRYSTALLINE TO VERY FINE; MODERATE INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX, DOLOMITE CEMENT
ACCESSORY MINERALS: PHOSPHATIC SAND-02%
PHOSPHATIC GRAVEL-01%, LIMESTONE-20%, QUARTZ SAND-01%
OTHER FEATURES: VARIEGATED
FOSSILS: FOSSIL MOLDS, FOSSIL FRAGMENTS
2% CLAY CONTENT. LIMESTONE PRESENT HAS GRAIN TYPE RANGING FROM MICROCRYSTALLINE TO GRAVEL AND CONTAINING 15% SILT CONTENT. MODAL GRAINSIZE IN LIMESTONE IS MICROCRYSTALLINE AND RANGES FROM MICROCRYSTALLINE TO GRAVEL SIZE. DOLOMITIC MUDSTONE AND WACKESTONE ALSO PRESENT. ALTERATION AND CRYSTALLINITY VARIES FROM MOSTLY LOW AND ANHEDRAL TO HIGH AND EUHEDRAL.

395 - 400 DOLOSTONE; LIGHT OLIVE GRAY
POROSITY: INTERCRYSTALLINE, INTERGRANULAR, MOLDIC
50-90% ALTERED; SUBHEDRAL
GRAIN SIZE: MICROCRYSTALLINE
RANGE: MICROCRYSTALLINE TO VERY FINE; GOOD INDURATION
CEMENT TYPE(S): DOLOMITE CEMENT, CALCILUTITE MATRIX
ACCESSORY MINERALS: PHOSPHATIC SAND-03%
PHOSPHATIC GRAVEL-01%, LIMESTONE-03%, QUARTZ SAND-02%
FOSSILS: FOSSIL MOLDS
1% DOLOSILT CONTENT.

400 - 405 WACKESTONE; YELLOWISH GRAY
POROSITY: INTERGRANULAR
GRAIN TYPE: SKELETAL, CALCILUTITE
50% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: MEDIUM; RANGE: VERY FINE TO GRANULE
POOR INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX, CLAY MATRIX
ACCESSORY MINERALS: PHOSPHATIC SAND-01%, QUARTZ SAND-02%
CLAY-05%
OTHER FEATURES: CHALKY
FOSSILS: BENTHIC FORAMINIFERA, FOSSIL FRAGMENTS, ECHINOID
TRACE SILT AND DOLOSILT PRESENT. LEPIDOCYLINA AND POSSIBLY SOME PLANKTONIC FORAMS PRESENT. ECHINOID SPINES PRESENT. FOSSILS ARE NOT WELL PRESERVED. PHOSPHATE IS MOSTLY FINE BUT SIZE RANGES FROM SILT TO FINE.

405 - 410 AS ABOVE

410 - 415 PACKSTONE; YELLOWISH GRAY
POROSITY: INTERGRANULAR
GRAIN TYPE: SKELETAL, CALCILUTITE
75% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: MEDIUM; RANGE: VERY FINE TO GRANULE
POOR INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX, CLAY MATRIX
ACCESSORY MINERALS: PHOSPHATIC SAND-01%, QUARTZ SAND-02%
CLAY-05%
OTHER FEATURES: CHALKY
FOSSILS: BENTHIC FORAMINIFERA, FOSSIL FRAGMENTS, ECHINOID
CORAL
LEPIDOCYCLINA PRESENT. PHOPHATE GRAIN SIZE IS GENERALLY
FINE TO VERY FINE.

415 - 420 AS ABOVE

420 - 425 PACKSTONE; YELLOWISH GRAY
POROSITY: INTERGRANULAR
GRAIN TYPE: SKELETAL, CALCILUTITE
75% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: MEDIUM; RANGE: VERY FINE TO GRANULE
POOR INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX, CLAY MATRIX
ACCESSORY MINERALS: PHOSPHATIC SAND-01%, QUARTZ SAND-02%
CLAY-05%
OTHER FEATURES: CHALKY
FOSSILS: BENTHIC FORAMINIFERA, ECHINOID, CORAL
FOSSIL FRAGMENTS
LEPIDOCYCLINA PRESENT. TRACE DOLOSILT CONTENT.

425 - 430 AS ABOVE

430 - 435 PACKSTONE; YELLOWISH GRAY
POROSITY: INTERGRANULAR
GRAIN TYPE: SKELETAL, CALCILUTITE
75% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: MEDIUM; RANGE: VERY FINE TO GRANULE
POOR INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX, CLAY MATRIX
ACCESSORY MINERALS: PHOSPHATIC SAND-01%, QUARTZ SAND-02%
CLAY-05%
OTHER FEATURES: CHALKY
FOSSILS: BENTHIC FORAMINIFERA, ECHINOID, MOLLUSKS
FOSSIL FRAGMENTS, OSTRACODS
LEPIDOCYCLINA PRESENT. TRACE DOLOSILT CONTENT.

435 - 440 AS ABOVE

440 - 445 AS ABOVE

445 - 450 PACKSTONE; YELLOWISH GRAY
POROSITY: INTERGRANULAR
GRAIN TYPE: SKELETAL, CALCILUTITE
75% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: MEDIUM; RANGE: VERY FINE TO GRANULE
POOR INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX, CLAY MATRIX

ACCESSORY MINERALS: PHOSPHATIC SAND-01%, QUARTZ SAND-03%
CLAY-05%
OTHER FEATURES: CHALKY
FOSSILS: BENTHIC FORAMINIFERA, ECHINOID, FOSSIL FRAGMENTS
LEPIDOCYCLINA PRESENT. TRACE DOLOSILT CONTENT. QUARTZ
SAND AND PHOSPHATE MAY BE CAVINGS AND CEMENTED DURING
OVEN DRYING.

450 - 455 AS ABOVE

455 - 460 PACKSTONE; YELLOWISH GRAY
POROSITY: INTERGRANULAR
GRAIN TYPE: SKELETAL, CALCILUTITE
75% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: FINE; RANGE: VERY FINE TO GRANULE
POOR INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX, CLAY MATRIX
ACCESSORY MINERALS: PHOSPHATIC SAND-01%, QUARTZ SAND-05%
CLAY-05%
OTHER FEATURES: CHALKY
FOSSILS: BENTHIC FORAMINIFERA, CORAL, MOLLUSKS
FOSSIL FRAGMENTS, ECHINOID
LEPIDOCYCLINA AND NUMMULITIES PRESENT. TRACE DOLOSILT
CONTENT.

460 - 465 AS ABOVE

465 - 470 PACKSTONE; YELLOWISH GRAY
POROSITY: INTERGRANULAR
GRAIN TYPE: SKELETAL, CALCILUTITE
75% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: FINE; RANGE: VERY FINE TO GRANULE
POOR INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX, CLAY MATRIX
ACCESSORY MINERALS: PHOSPHATIC SAND-01%, QUARTZ SAND-05%
CLAY-05%
OTHER FEATURES: CHALKY
FOSSILS: BENTHIC FORAMINIFERA, ECHINOID, FOSSIL FRAGMENTS
OSTRACODS, CORAL
TRACE DOLOSILT CONTENT. LEPIDOCYCLINA AND NUMMULITIES
PRESENT.

470 - 475 AS ABOVE

475 - 480 AS ABOVE

480 - 485 PACKSTONE; YELLOWISH GRAY
POROSITY: INTERGRANULAR
GRAIN TYPE: SKELETAL, CALCILUTITE
75% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: FINE; RANGE: VERY FINE TO GRANULE
POOR INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX, CLAY MATRIX
ACCESSORY MINERALS: PHOSPHATIC SAND-01%, QUARTZ SAND-05%
CLAY-05%
OTHER FEATURES: CHALKY
FOSSILS: BENTHIC FORAMINIFERA, ECHINOID, MOLLUSKS, CORAL
LEPIDOCYCLINA AND NUMMULITIES PRESENT. TRACE DOLOSILT

CONTENT.

485 - 490 PACKSTONE; YELLOWISH GRAY
POROSITY: INTERGRANULAR
GRAIN TYPE: SKELETAL, CALCILUTITE
85% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: GRAVEL; RANGE: COARSE TO GRAVEL
POOR INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX, CLAY MATRIX
ACCESSORY MINERALS: CLAY-03%, ORGANICS-01%
OTHER FEATURES: MEDIUM RECRYSTALLIZATION
FOSSILS: BENTHIC FORAMINIFERA, MOLLUSKS, CRUSTACEA, CORAL
LEPIDOCYCLINA AND NUMMULITIES PRESENT. TRACE QUARTZ SAND
CONTENT. DOLOMITE CONTENT REPRESENTING 203% OF SAMPLE
INTERVAL, APPEARS TO BE ARCADIA CAVINGS.

490 - 495 PACKSTONE; YELLOWISH GRAY
POROSITY: INTERGRANULAR
GRAIN TYPE: SKELETAL, CALCILUTITE
85% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: GRAVEL; RANGE: COARSE TO GRAVEL
POOR INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX, CLAY MATRIX
ACCESSORY MINERALS: CLAY-O3%, SHELL-01%
OTHER FEATURES: MEDIUM RECRYSTALLIZATION
FOSSILS: BENTHIC FORAMINIFERA, MOLLUSKS, CORAL
NO DOLOMITE IN INTERVAL. TRACE SAND, SILT, AND DOLOSILT
CONTENT.

495 - 500 AS ABOVE

500 - 505 PACKSTONE; YELLOWISH GRAY
POROSITY: INTERGRANULAR
GRAIN TYPE: SKELETAL, CALCILUTITE
85% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: GRAVEL; RANGE: COARSE TO GRAVEL
POOR INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX, CLAY MATRIX
ACCESSORY MINERALS: CLAY-03%, SHELL-01%
OTHER FEATURES: MEDIUM RECRYSTALLIZATION
FOSSILS: BENTHIC FORAMINIFERA, MOLLUSKS, ECHINOID
2% ARCADIA CAVINGS .

505 - 510 PACKSTONE; YELLOWISH GRAY
POROSITY: INTERGRANULAR
GRAIN TYPE: SKELETAL, CALCILUTITE
85% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: GRAVEL; RANGE: COARSE TO GRAVEL
POOR INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX, CLAY MATRIX
ACCESSORY MINERALS: CLAY-03%, SHELL-01%
OTHER FEATURES: MEDIUM RECRYSTALLIZATION
FOSSILS: BENTHIC FORAMINIFERA, MOLLUSKS, CORAL
1-2% DOLOMITE ARCADIA CAVINGS.

510 - 515 AS ABOVE

515 - 520 AS ABOVE

520 - 525 AS ABOVE
TRACE SAND SIZE PHOSPHATE CONTENT.

525 - 530 PACKSTONE; YELLOWISH GRAY
POROSITY: INTERGRANULAR
GRAIN TYPE: SKELETAL, CALCILUTITE
85% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: GRAVEL; RANGE: COARSE TO GRAVEL
POOR INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX, CLAY MATRIX
ACCESSORY MINERALS: SHELL-01%, CLAY-03%
OTHER FEATURES: MEDIUM RECRYSTALLIZATION
FOSSILS: BENTHIC FORAMINIFERA, MOLLUSKS
PROBABLE CAVINGS OF TRACE SAND SIZED PHOSPHATES AND SILT.
1% ARCADIA CAVINGS CONTENT.

530 - 535 PACKSTONE; YELLOWISH GRAY
POROSITY: INTERGRANULAR
GRAIN TYPE: SKELETAL, CALCILUTITE
85% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: GRAVEL; RANGE: COARSE TO GRAVEL
POOR INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX, CLAY MATRIX
ACCESSORY MINERALS: SHELL-01%, CLAY-03%
OTHER FEATURES: MEDIUM RECRYSTALLIZATION
FOSSILS: BENTHIC FORAMINIFERA, MOLLUSKS, CORAL
TRACE DOLOSILT CONTENT.

535 - 540 AS ABOVE

540 - 545 PACKSTONE; YELLOWISH GRAY
POROSITY: INTERGRANULAR
GRAIN TYPE: SKELETAL, CALCILUTITE
85% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: GRAVEL; RANGE: COARSE TO GRAVEL
POOR INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX, CLAY MATRIX
ACCESSORY MINERALS: SHELL-01%, CLAY-03%
OTHER FEATURES: MEDIUM RECRYSTALLIZATION
FOSSILS: BENTHIC FORAMINIFERA, MOLLUSKS, BRYOZOA, CORAL
TRACE DOLOSILT.

545 - 550 PACKSTONE; YELLOWISH GRAY
POROSITY: INTERGRANULAR
GRAIN TYPE: SKELETAL, CALCILUTITE
85% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: GRAVEL; RANGE: COARSE TO GRAVEL
POOR INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX, CLAY MATRIX
ACCESSORY MINERALS: SHELL-01%, CLAY-03%
OTHER FEATURES: MEDIUM RECRYSTALLIZATION
FOSSILS: BENTHIC FORAMINIFERA, MOLLUSKS, CORAL
TRACE DOLOSILT.

550 - 555 AS ABOVE

555 - 560 PACKSTONE; YELLOWISH GRAY

POROSITY: INTERGRANULAR
GRAIN TYPE: SKELETAL, CALCILUTITE
85% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: GRAVEL; RANGE: COARSE TO GRAVEL
POOR INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX, CLAY MATRIX
ACCESSORY MINERALS: SHELL-01%, CLAY-03%
OTHER FEATURES: MEDIUM RECRYSTALLIZATION
FOSSILS: BENTHIC FORAMINIFERA, MOLLUSKS
SOME ARCADIA CAVING PRESENT. TRACE DOLOSILT.

560 - 565 AS ABOVE

565 - 570 GRAINSTONE; YELLOWISH GRAY
POROSITY: INTERGRANULAR
GRAIN TYPE: SKELETAL, CALCILUTITE
93% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: GRAVEL; RANGE: COARSE TO GRAVEL
POOR INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX, CLAY MATRIX
ACCESSORY MINERALS: CLAY-03%, CALCILUTITE-05%
OTHER FEATURES: MEDIUM RECRYSTALLIZATION
FOSSILS: BENTHIC FORAMINIFERA, CORAL
SLIGHT COLOR CHANGE IN FOSSILS, BECOMING LIGHTER AND MORE WHITE.

570 - 575 GRAINSTONE; YELLOWISH GRAY
POROSITY: INTERGRANULAR
GRAIN TYPE: SKELETAL, CALCILUTITE
93% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: GRAVEL; RANGE: COARSE TO GRAVEL
POOR INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX, CLAY MATRIX
ACCESSORY MINERALS: CLAY-03%, CALCILUTITE-05%
OTHER FEATURES: MEDIUM RECRYSTALLIZATION
FOSSILS: BENTHIC FORAMINIFERA, ECHINOID, BRYOZOA

575 - 580 GRAINSTONE; YELLOWISH GRAY
POROSITY: INTERGRANULAR
GRAIN TYPE: SKELETAL, CALCILUTITE
GRAIN SIZE: GRAVEL; RANGE: COARSE TO GRAVEL
POOR INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX, CLAY MATRIX
ACCESSORY MINERALS: CLAY-01%
OTHER FEATURES: MEDIUM RECRYSTALLIZATION
FOSSILS: BENTHIC FORAMINIFERA

580 - 585 GRAINSTONE; YELLOWISH GRAY
POROSITY: INTERGRANULAR
GRAIN TYPE: SKELETAL, CALCILUTITE
93% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: GRAVEL; RANGE: COARSE TO GRAVEL
POOR INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX, CLAY MATRIX
ACCESSORY MINERALS: CLAY-02%
OTHER FEATURES: MEDIUM RECRYSTALLIZATION
FOSSILS: BENTHIC FORAMINIFERA, CORAL

585 - 590 AS ABOVE

590 - 595 GRAINSTONE; YELLOWISH GRAY
POROSITY: INTERGRANULAR
GRAIN TYPE: SKELETAL, CALCILUTITE
95% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: GRAVEL; RANGE: COARSE TO GRAVEL
POOR INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX, CLAY MATRIX
ACCESSORY MINERALS: CLAY-02%
OTHER FEATURES: HIGH RECRYSTALLIZATION
FOSSILS: BENTHIC FORAMINIFERA, MOLLUSKS, CORAL

595 - 600 AS ABOVE

600 - 605 GRAINSTONE; YELLOWISH GRAY
POROSITY: INTERGRANULAR
GRAIN TYPE: SKELETAL, CALCILUTITE
90% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: GRAVEL; RANGE: COARSE TO GRAVEL
POOR INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX, CLAY MATRIX
ACCESSORY MINERALS: CLAY-03%
OTHER FEATURES: HIGH RECRYSTALLIZATION
FOSSILS: BENTHIC FORAMINIFERA, CORAL

605 - 610 PACKSTONE; YELLOWISH GRAY
POROSITY: INTERGRANULAR
GRAIN TYPE: SKELETAL, CALCILUTITE
90% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: GRAVEL; RANGE: COARSE TO GRAVEL
POOR INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX, CLAY MATRIX
ACCESSORY MINERALS: CLAY-03%
OTHER FEATURES: HIGH RECRYSTALLIZATION
FOSSILS: BENTHIC FORAMINIFERA, MOLLUSKS, ECHINOID, CORAL

610 - 615 PACKSTONE; YELLOWISH GRAY
POROSITY: INTERGRANULAR
GRAIN TYPE: SKELETAL, CALCILUTITE
85% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: GRAVEL; RANGE: COARSE TO GRAVEL
POOR INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX, CLAY MATRIX
ACCESSORY MINERALS: CLAY-05%
OTHER FEATURES: HIGH RECRYSTALLIZATION
FOSSILS: BENTHIC FORAMINIFERA, MOLLUSKS, CORAL

615 - 620 PACKSTONE; YELLOWISH GRAY
POROSITY: INTERGRANULAR
GRAIN TYPE: SKELETAL, CALCILUTITE
80% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: GRAVEL; RANGE: COARSE TO GRAVEL
POOR INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX, CLAY MATRIX
ACCESSORY MINERALS: CLAY-03%
OTHER FEATURES: HIGH RECRYSTALLIZATION
FOSSILS: BENTHIC FORAMINIFERA, CORAL

620 - 625 PACKSTONE; YELLOWISH GRAY
POROSITY: INTERGRANULAR
GRAIN TYPE: SKELETAL, CALCILUTITE
85% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: GRAVEL; RANGE: COARSE TO GRAVEL
POOR INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX, CLAY MATRIX
ACCESSORY MINERALS: CLAY-03%
OTHER FEATURES: HIGH RECRYSTALLIZATION
FOSSILS: BENTHIC FORAMINIFERA, CORAL

625 - 630 GRAINSTONE; YELLOWISH GRAY
POROSITY: INTERGRANULAR
GRAIN TYPE: SKELETAL, CALCILUTITE
90% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: GRAVEL; RANGE: COARSE TO GRAVEL
POOR INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX, CLAY MATRIX
ACCESSORY MINERALS: CLAY-03%
OTHER FEATURES: HIGH RECRYSTALLIZATION
FOSSILS: BENTHIC FORAMINIFERA, CORAL

630 - 635 GRAINSTONE; YELLOWISH GRAY
POROSITY: INTERGRANULAR
GRAIN TYPE: SKELETAL, CALCILUTITE
90% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: GRAVEL; RANGE: COARSE TO GRAVEL
POOR INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX, CLAY MATRIX
ACCESSORY MINERALS: CLAY-01%
OTHER FEATURES: HIGH RECRYSTALLIZATION
FOSSILS: BENTHIC FORAMINIFERA, CORAL

635 - 640 AS ABOVE

640 - 645 PACKSTONE; YELLOWISH GRAY
POROSITY: INTERGRANULAR
GRAIN TYPE: SKELETAL, CALCILUTITE
85% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: GRAVEL; RANGE: COARSE TO GRAVEL
POOR INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX, CLAY MATRIX
ACCESSORY MINERALS: CLAY-01%
OTHER FEATURES: HIGH RECRYSTALLIZATION
FOSSILS: BENTHIC FORAMINIFERA, MOLLUSKS, CORAL

645 - 650 PACKSTONE; YELLOWISH GRAY
POROSITY: INTERGRANULAR
GRAIN TYPE: SKELETAL, CALCILUTITE
85% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: GRAVEL; RANGE: COARSE TO GRAVEL
POOR INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX, CLAY MATRIX
ACCESSORY MINERALS: CLAY-01%
OTHER FEATURES: HIGH RECRYSTALLIZATION
FOSSILS: BENTHIC FORAMINIFERA, CORAL, ECHINOID

650 - 655 PACKSTONE; YELLOWISH GRAY
POROSITY: INTERGRANULAR
GRAIN TYPE: SKELETAL, CALCILUTITE
85% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: GRAVEL; RANGE: COARSE TO GRAVEL
POOR INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX, CLAY MATRIX
ACCESSORY MINERALS: CLAY-02%
OTHER FEATURES: HIGH RECRYSTALLIZATION
FOSSILS: BENTHIC FORAMINIFERA

655 - 660 PACKSTONE; YELLOWISH GRAY
POROSITY: INTERGRANULAR
GRAIN TYPE: SKELETAL, CALCILUTITE
85% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: GRAVEL; RANGE: COARSE TO GRAVEL
POOR INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX, CLAY MATRIX
ACCESSORY MINERALS: CLAY-02%
OTHER FEATURES: HIGH RECRYSTALLIZATION
FOSSILS: BENTHIC FORAMINIFERA

660 - 665 PACKSTONE; YELLOWISH GRAY
POROSITY: INTERGRANULAR
GRAIN TYPE: SKELETAL, CALCILUTITE
80% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: GRAVEL; RANGE: COARSE TO GRAVEL
POOR INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX, CLAY MATRIX
ACCESSORY MINERALS: CLAY-02%
OTHER FEATURES: HIGH RECRYSTALLIZATION
FOSSILS: BENTHIC FORAMINIFERA

665 - 670 GRAINSTONE; YELLOWISH GRAY
POROSITY: INTERGRANULAR
GRAIN TYPE: SKELETAL, CALCILUTITE
90% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: GRAVEL; RANGE: FINE TO GRAVEL; POOR INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX, CLAY MATRIX
ACCESSORY MINERALS: CLAY-02%
OTHER FEATURES: HIGH RECRYSTALLIZATION
FOSSILS: BENTHIC FORAMINIFERA

670 - 675 GRAINSTONE; YELLOWISH GRAY
POROSITY: INTERGRANULAR
GRAIN TYPE: SKELETAL, CALCILUTITE
90% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: GRAVEL; RANGE: COARSE TO GRAVEL
POOR INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX, CLAY MATRIX
ACCESSORY MINERALS: CLAY-01%
OTHER FEATURES: HIGH RECRYSTALLIZATION
FOSSILS: BENTHIC FORAMINIFERA, BRYOZOA

675 - 680 GRAINSTONE; YELLOWISH GRAY
POROSITY: INTERGRANULAR
GRAIN TYPE: SKELETAL, CALCILUTITE

90% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: GRAVEL; RANGE: MEDIUM TO GRAVEL
POOR INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX, CLAY MATRIX
ACCESSORY MINERALS: CLAY-01%
OTHER FEATURES: HIGH RECRYSTALLIZATION
FOSSILS: BENTHIC FORAMINIFERA

680 - 685 PACKSTONE; YELLOWISH GRAY
POROSITY: INTERGRANULAR
GRAIN TYPE: SKELETAL, CALCILUTITE
87% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: GRAVEL; RANGE: COARSE TO GRAVEL
POOR INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX, CLAY MATRIX
ACCESSORY MINERALS: CLAY-02%
OTHER FEATURES: HIGH RECRYSTALLIZATION
FOSSILS: BENTHIC FORAMINIFERA, CORAL

685 - 690 AS ABOVE

690 - 695 AS ABOVE

695 - 700 PACKSTONE; YELLOWISH GRAY
POROSITY: INTERGRANULAR
GRAIN TYPE: SKELETAL, CALCILUTITE
85% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: GRAVEL; RANGE: COARSE TO GRAVEL
POOR INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX, CLAY MATRIX
ACCESSORY MINERALS: CLAY-03%
OTHER FEATURES: HIGH RECRYSTALLIZATION
FOSSILS: BENTHIC FORAMINIFERA, CORAL

700 - 705 PACKSTONE; YELLOWISH GRAY
POROSITY: INTERGRANULAR
GRAIN TYPE: SKELETAL, CALCILUTITE
93% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: GRAVEL; RANGE: COARSE TO GRAVEL
POOR INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX, CLAY MATRIX
ACCESSORY MINERALS: CLAY-01%
OTHER FEATURES: HIGH RECRYSTALLIZATION
FOSSILS: BENTHIC FORAMINIFERA

705 - 710 GRAINSTONE; YELLOWISH GRAY
POROSITY: INTERGRANULAR
GRAIN TYPE: SKELETAL, CALCILUTITE
90% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: GRAVEL; RANGE: COARSE TO GRAVEL
POOR INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX, CLAY MATRIX
ACCESSORY MINERALS: CLAY-02%
OTHER FEATURES: HIGH RECRYSTALLIZATION
FOSSILS: BENTHIC FORAMINIFERA, ECHINOID

710 - 715 GRAINSTONE; YELLOWISH GRAY
POROSITY: INTERGRANULAR

GRAIN TYPE: SKELETAL, CALCILUTITE
93% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: GRAVEL; RANGE: COARSE TO GRAVEL
POOR INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX, CLAY MATRIX
ACCESSORY MINERALS: CLAY-01%
OTHER FEATURES: HIGH RECRYSTALLIZATION
FOSSILS: BENTHIC FORAMINIFERA, CORAL

715 - 720 AS ABOVE

720 - 725 WACKESTONE; YELLOWISH GRAY
POROSITY: INTERGRANULAR, PIN POINT VUGS
GRAIN TYPE: CALCILUTITE, SKELETAL
25% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: VERY COARSE; RANGE: MEDIUM TO GRAVEL
CEMENT TYPE(S): CALCILUTITE MATRIX, CLAY MATRIX
ACCESSORY MINERALS: CLAY-01%
OTHER FEATURES: HIGH RECRYSTALLIZATION, MUDDY, DOLOMITIC
FOSSILS: BENTHIC FORAMINIFERA, ECHINOID
INDURATION RANGES FROM POOR TO MODERATE. LESS THAN 1% CALCITE CONTENT.

725 - 730 WACKESTONE; YELLOWISH GRAY
POROSITY: INTERGRANULAR, PIN POINT VUGS
GRAIN TYPE: CALCILUTITE, SKELETAL
20% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: VERY COARSE; RANGE: MEDIUM TO GRAVEL
POOR INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX, CLAY MATRIX
ACCESSORY MINERALS: CLAY-03%
OTHER FEATURES: MUDDY, DOLOMITIC
FOSSILS: BENTHIC FORAMINIFERA, FOSSIL MOLDS
DICTYOCONUS COOKEI PRESENT. SAMPLES DON'T LOOK LIKE THEY WERE WELL WASHED. HIGHER CLAY CONTENT IN THIS SAMPLE; SOME OF THE CLAY MAY BE DRILL MUD.

730 - 735 PACKSTONE; YELLOWISH GRAY TO VERY LIGHT ORANGE
POROSITY: INTERGRANULAR
GRAIN TYPE: SKELETAL, CALCILUTITE
60% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: GRAVEL; RANGE: MEDIUM TO GRAVEL
POOR INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX, CLAY MATRIX
ACCESSORY MINERALS: CLAY-05%
OTHER FEATURES: HIGH RECRYSTALLIZATION, MUDDY
FOSSILS: BENTHIC FORAMINIFERA, MOLLUSKS, BRYOZOA
SAMPLE LOOKS LIKE A MUDDY LEP BED FROM TABLE VIEW. SAMPLE IS MOSTLY A WACKESTONE CONTAINING 1-2% GRAINSTONE FRAGMENTS. SAMPLE APPEARS POORLY WASHED. FOSSILS ARE MAINLY LEPIDOCYCLINA AND NUMMULITIES.

735 - 740 PACKSTONE; YELLOWISH GRAY TO VERY LIGHT ORANGE
POROSITY: INTERGRANULAR
GRAIN TYPE: SKELETAL, CALCILUTITE
60% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: GRAVEL; RANGE: MEDIUM TO GRAVEL
POOR INDURATION

CEMENT TYPE(S): CALCILUTITE MATRIX, CLAY MATRIX
ACCESSORY MINERALS: CLAY-05%
OTHER FEATURES: HIGH RECRYSTALLIZATION, MUDDY
FOSSILS: BENTHIC FORAMINIFERA, MOLLUSKS, ECHINOID
POSSIBLE ECHINOID FRAGMENTS OF EUPATAGUS ANTILLARUM.
DARKER CLAY MAY BE DRILL MUD. FOSSILS PRESENT ARE MAINLY LEPIDOCYCLINA AND NUMMULITIES.

740 - 745 PACKSTONE; YELLOWISH GRAY TO VERY LIGHT ORANGE
POROSITY: INTERGRANULAR
GRAIN TYPE: SKELETAL, CALCILUTITE
60% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: GRAVEL; RANGE: MEDIUM TO GRAVEL
POOR INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX, CLAY MATRIX
ACCESSORY MINERALS: CLAY-05%
OTHER FEATURES: MUDDY, HIGH RECRYSTALLIZATION
FOSSILS: BENTHIC FORAMINIFERA, MOLLUSKS, BRYOZOA
FOSSIL CONTENT IS MAINLY LEPIDOCYCLINA AND NUMMULITIES.
SAMPLE IS POORLY WASHED.

745 - 750 AS ABOVE

750 - 755 PACKSTONE; YELLOWISH GRAY TO VERY LIGHT ORANGE
POROSITY: INTERGRANULAR
GRAIN TYPE: SKELETAL, CALCILUTITE
60% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: GRAVEL; RANGE: MEDIUM TO GRAVEL
POOR INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX, CLAY MATRIX
ACCESSORY MINERALS: CLAY-05%
OTHER FEATURES: MUDDY, HIGH RECRYSTALLIZATION
FOSSILS: BENTHIC FORAMINIFERA, ECHINOID, MOLLUSKS
ECHINOID FRAGMENTS, POSSIBLY OF NEOLAGANUM DALLI ARE PRESENT. SAMPLE IS POORLY WASHED.

755 - 760 AS ABOVE

760 - 765 WACKESTONE; YELLOWISH GRAY TO VERY LIGHT ORANGE
POROSITY: INTERGRANULAR, PIN POINT VUGS
GRAIN TYPE: CALCILUTITE, SKELETAL
20% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: GRAVEL; RANGE: MEDIUM TO GRAVEL
POOR INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX, CLAY MATRIX
ACCESSORY MINERALS: CLAY-05%
OTHER FEATURES: MUDDY, HIGH RECRYSTALLIZATION
FOSSILS: BENTHIC FORAMINIFERA, MOLLUSKS
DECREASED LEPIDACYCLINA AND NUMMULITIES CONTENT.
APPLICATION OF ALIZARIN RED MAY INDICATE TRACE DOLOSILT.
SAMPLE INTERVAL MAY BE DOLOMITIC. VUGS ARE COVERED BY MUD.
SAMPLE MAY NOT HAVE BEEN WASHED, OR IS POORLY WASHED.

765 - 770 AS ABOVE

770 - 775 PACKSTONE; YELLOWISH GRAY TO VERY LIGHT ORANGE
POROSITY: INTERGRANULAR, MOLDIC, PIN POINT VUGS

GRAIN TYPE: CALCILUTITE, SKELETAL
20% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: MEDIUM; RANGE: MEDIUM TO GRAVEL
POOR INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
ACCESSORY MINERALS: CLAY-05%
FOSSILS: BENTHIC FORAMINIFERA, ECHINOID, FOSSIL MOLDS
SAMPLE IS POORLY WASHED. FOSSIL PRESERVATION IS POOR, BUT THERE MAY BE SOME PLANKTONIC FORAMS PRESENT. SOME CAVINGS OF SAND AND PHOSPHATES.

775 - 780 WACKESTONE; YELLOWISH GRAY
POROSITY: INTERGRANULAR, PIN POINT VUGS, MOLDIC
GRAIN TYPE: CALCILUTITE, SKELETAL
15% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: MEDIUM; RANGE: FINE TO GRAVEL
CEMENT TYPE(S): CALCILUTITE MATRIX
ACCESSORY MINERALS: CLAY-01%
FOSSILS: BENTHIC FORAMINIFERA, ECHINOID
INDURATION IS POOR TO MODERATE. FOSSIL PRESERVATION IS POOR, BUT SOME FOSSILS RESEMBLE PLANKTONIC FORAMS. PRESENCE OF LEPIDACYCLINA AND NUMMULITIES MAY BE FROM CAVINGS OUT OF OCALA.

780 - 785 AS ABOVE

785 - 790 AS ABOVE

790 - 795 WACKESTONE; PINKISH GRAY
POROSITY: INTERGRANULAR, PIN POINT VUGS
GRAIN TYPE: CALCILUTITE, SKELETAL
25% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: MEDIUM; RANGE: FINE TO GRAVEL; POOR INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
ACCESSORY MINERALS: CLAY-02%
OTHER FEATURES: MUDDY
FOSSILS: BENTHIC FORAMINIFERA, ECHINOID
SAMPLE APPEARS TO BE POORLY WASHED. TRACE CALCITE CONTENT.

795 - 800 WACKESTONE; YELLOWISH GRAY TO LIGHT OLIVE GRAY
POROSITY: INTERGRANULAR, PIN POINT VUGS
GRAIN TYPE: CALCILUTITE, SKELETAL
30% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: MEDIUM; RANGE: FINE TO GRAVEL; POOR INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
ACCESSORY MINERALS: CLAY-03%
OTHER FEATURES: MUDDY
FOSSILS: BENTHIC FORAMINIFERA, ECHINOID, FOSSIL MOLDS
CORAL
SAMPLE APPEARS TO BE POORLY WASHED. TRACE CALCITE CONTENT.

800 - 805 WACKESTONE; YELLOWISH GRAY
POROSITY: INTERGRANULAR, PIN POINT VUGS, MOLDIC
GRAIN TYPE: CALCILUTITE, SKELETAL

30% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: MEDIUM; RANGE: FINE TO GRAVEL; POOR INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
ACCESSORY MINERALS: CLAY-01%
FOSSILS: BENTHIC FORAMINIFERA, FOSSIL MOLDS, ECHINOID OSTRACODS
TRACE CALCITE. 2% FINE GRAIN GRAINSTONE FRAGMENT CONTENT.

805 - 810 WACKESTONE; YELLOWISH GRAY
POROSITY: INTERGRANULAR, PIN POINT VUGS, MOLDIC
GRAIN TYPE: CALCILUTITE, SKELETAL
40% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: MEDIUM; RANGE: FINE TO GRAVEL; POOR INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
ACCESSORY MINERALS: CLAY-02%
OTHER FEATURES: MUDDY, MEDIUM RECRYSTALLIZATION
FOSSILS: BENTHIC FORAMINIFERA, ECHINOID
SPIROLINA PRESENT. DICTYOCONUS, POSSIBLY AMERICANUS IS PRESENT. ECHINOIDS ARE HIGHLY RECRYSTALLIZED. TRACE CALCITE
CONTENT. 3-5% FINE GRAIN GRAINSTONE FRAGMENT CONTENT.

810 - 815 AS ABOVE

815 - 820 WACKESTONE; YELLOWISH GRAY
POROSITY: INTERGRANULAR, PIN POINT VUGS, MOLDIC
GRAIN TYPE: CALCILUTITE, SKELETAL
30% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: MEDIUM; RANGE: FINE TO GRAVEL; POOR INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
ACCESSORY MINERALS: CLAY-02%
OTHER FEATURES: MUDDY, MEDIUM RECRYSTALLIZATION
FOSSILS: ECHINOID, BENTHIC FORAMINIFERA, FOSSIL MOLDS MOLLUSKS
ECHINOIDS ARE HIGHLY RECRYSTALLIZED. TRACE CALCITE CONTENT.
ALTHOUGH DIFFICULT TO ESTIMATE PERCENTAGE, ~2% FINE GRAIN GRAINSTONE FRAGMENT CONTENT.

820 - 825 PACKSTONE; YELLOWISH GRAY
POROSITY: INTERGRANULAR, PIN POINT VUGS, MOLDIC
GRAIN TYPE: SKELETAL, CALCILUTITE, INTRACLASTS
75% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: MEDIUM; RANGE: FINE TO GRAVEL; POOR INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
ACCESSORY MINERALS: CLAY-02%
OTHER FEATURES: MUDDY, MEDIUM RECRYSTALLIZATION
FOSSILS: ECHINOID, BENTHIC FORAMINIFERA, FOSSIL MOLDS MOLLUSKS
MAJORITY OF SAMPLE APPEARS TO BE A FINE GRAINED PACKSTONE OR GRAINSTONE WITH MICRITE AND POSSILBY MUD COATING.

825 - 830 AS ABOVE

830 - 835 PACKSTONE; YELLOWISH GRAY
POROSITY: INTERGRANULAR, PIN POINT VUGS, MOLDIC
GRAIN TYPE: SKELETAL, CALCILUTITE, INTRACLASTS
80% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: MEDIUM; RANGE: FINE TO GRAVEL; POOR INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
ACCESSORY MINERALS: CLAY-01%
OTHER FEATURES: MEDIUM RECRYSTALLIZATION
FOSSILS: BENTHIC FORAMINIFERA, ECHINOID, MOLLUSKS
ECHINOIDS ARE HIGHLY RECRYSTALLIZED. THE DEGREE OF RECRYSTALLIZATION IS CONSIDERABLY HIGH RELATIVE TO REST OF SAMPLE.

835 - 840 PACKSTONE; YELLOWISH GRAY
POROSITY: INTERGRANULAR, PIN POINT VUGS, MOLDIC
GRAIN TYPE: SKELETAL, CALCILUTITE, INTRACLASTS
75% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: MEDIUM; RANGE: FINE TO GRAVEL; POOR INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
ACCESSORY MINERALS: CLAY-02%
OTHER FEATURES: MUDDY, MEDIUM RECRYSTALLIZATION
FOSSILS: BENTHIC FORAMINIFERA, ECHINOID
SAMPLE APPEARS POORLY WASHED. ECHINOIDS ARE HIGHLY RECRYSTALLIZED.

840 - 845 AS ABOVE

845 - 850 AS ABOVE

850 - 855 AS ABOVE

855 - 860 PACKSTONE; YELLOWISH GRAY
POROSITY: INTERGRANULAR, PIN POINT VUGS, MOLDIC
GRAIN TYPE: SKELETAL, CALCILUTITE, INTRACLASTS
85% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: MEDIUM; RANGE: FINE TO GRAVEL; POOR INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
ACCESSORY MINERALS: CLAY-01%
OTHER FEATURES: MUDDY, MEDIUM RECRYSTALLIZATION
FOSSILS: BENTHIC FORAMINIFERA, ECHINOID
ECHINOIDS ARE HIGHLY RECRYSTALLIZED.

860 - 865 PACKSTONE; YELLOWISH GRAY
POROSITY: INTERGRANULAR, PIN POINT VUGS, MOLDIC
GRAIN TYPE: SKELETAL, CALCILUTITE, INTRACLASTS
80% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: GRAVEL; RANGE: FINE TO GRAVEL; POOR INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
ACCESSORY MINERALS: CLAY-01%
OTHER FEATURES: MUDDY, MEDIUM RECRYSTALLIZATION
FOSSILS: BENTHIC FORAMINIFERA, ECHINOID, CORAL FOSSIL MOLDS, ALGAE

865 - 870 PACKSTONE; YELLOWISH GRAY

POROSITY: INTERGRANULAR, PIN POINT VUGS
GRAIN TYPE: SKELETAL, CALCILUTITE, INTRACLASTS
80% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: GRAVEL; RANGE: FINE TO GRAVEL; POOR INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
ACCESSORY MINERALS: CLAY-01%
OTHER FEATURES: MUDDY, MEDIUM RECRYSTALLIZATION
FOSSILS: BENTHIC FORAMINIFERA, ECHINOID, CORAL

870 - 875 PACKSTONE; YELLOWISH GRAY
POROSITY: INTERGRANULAR, MOLDIC, PIN POINT VUGS
GRAIN TYPE: SKELETAL, CALCILUTITE, INTRACLASTS
80% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: GRAVEL; RANGE: FINE TO GRAVEL; POOR INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
ACCESSORY MINERALS: CLAY-02%
OTHER FEATURES: MUDDY, MEDIUM RECRYSTALLIZATION
FOSSILS: BENTHIC FORAMINIFERA, ECHINOID, CORAL

875 - 880 PACKSTONE; YELLOWISH GRAY
POROSITY: INTERGRANULAR, MOLDIC, PIN POINT VUGS
GRAIN TYPE: SKELETAL, CALCILUTITE, INTRACLASTS
85% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: GRAVEL; RANGE: FINE TO GRAVEL; POOR INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
ACCESSORY MINERALS: CLAY-02%
OTHER FEATURES: MUDDY, MEDIUM RECRYSTALLIZATION
FOSSILS: BENTHIC FORAMINIFERA, ECHINOID
NEOLAGANUM DALLI IS PRESENT. VARIABLE PACKSTONE AND GRAINSTONE

880 - 885 AS ABOVE

885 - 890 AS ABOVE

890 - 895 PACKSTONE; YELLOWISH GRAY
POROSITY: INTERGRANULAR, PIN POINT VUGS, MOLDIC
GRAIN TYPE: SKELETAL, CALCILUTITE, INTRACLASTS
85% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: GRAVEL; RANGE: FINE TO GRAVEL; POOR INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
ACCESSORY MINERALS: CLAY-01%
OTHER FEATURES: MEDIUM RECRYSTALLIZATION
FOSSILS: BENTHIC FORAMINIFERA, ECHINOID
NEOLAGANUM DALLI PRESENT. TRACE DOLOMITE CONTENT. ECHINOIDS
ARE HIGHLY RECRYSTALLIZED. VARIABLE PACKSTONE AND GRAINSTONE.

895 - 900 AS ABOVE

900 - 905 PACKSTONE; YELLOWISH GRAY
POROSITY: INTERGRANULAR, PIN POINT VUGS, MOLDIC
GRAIN TYPE: SKELETAL, CALCILUTITE, INTRACLASTS

75% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: GRAVEL; RANGE: FINE TO GRAVEL; POOR INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
ACCESSORY MINERALS: CLAY-02%
OTHER FEATURES: MUDDY, MEDIUM RECRYSTALLIZATION
FOSSILS: BENTHIC FORAMINIFERA, ECHINOID
ECHINOIDS ARE HIGHLY RECRYSTALLIZED.

905 - 910 PACKSTONE; YELLOWISH GRAY
POROSITY: INTERGRANULAR, MOLDIC, PIN POINT VUGS
GRAIN TYPE: SKELETAL, CALCILUTITE, INTRACLASTS
70% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: MEDIUM; RANGE: FINE TO GRAVEL; POOR INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
ACCESSORY MINERALS: CLAY-03%
OTHER FEATURES: MUDDY, MEDIUM RECRYSTALLIZATION
FOSSILS: BENTHIC FORAMINIFERA, ECHINOID
ECHINOIDS ARE HIGHLY RECRYSTALLIZED.

910 - 915 PACKSTONE; YELLOWISH GRAY
POROSITY: INTERGRANULAR, MOLDIC, PIN POINT VUGS
GRAIN TYPE: SKELETAL, CALCILUTITE, INTRACLASTS
80% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: MEDIUM; RANGE: FINE TO GRAVEL; POOR INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
ACCESSORY MINERALS: CLAY-02%
OTHER FEATURES: MUDDY, MEDIUM RECRYSTALLIZATION
FOSSILS: BENTHIC FORAMINIFERA, ECHINOID, FOSSIL MOLDS
ECHINOIDS ARE HIGHLY RECRYSTALLIZED.

915 - 920 PACKSTONE; YELLOWISH GRAY
POROSITY: INTERGRANULAR, MOLDIC, PIN POINT VUGS
GRAIN TYPE: SKELETAL, CALCILUTITE
85% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: FINE; RANGE: GRAVEL TO FINE; POOR INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
ACCESSORY MINERALS: CLAY-02%
OTHER FEATURES: MEDIUM RECRYSTALLIZATION, CHALKY
FOSSILS: BENTHIC FORAMINIFERA, ECHINOID, ALGAE
INCREASED ECHINOID CONTENT. ECHINOIDS ARE HIGHLY RECRYSTALLIZED. NEOLAGANUM DALLI PRESENT.

920 - 925 PACKSTONE; YELLOWISH GRAY
POROSITY: INTERGRANULAR, PIN POINT VUGS, MOLDIC
GRAIN TYPE: SKELETAL, CALCILUTITE, INTRACLASTS
70% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: GRAVEL; RANGE: FINE TO GRAVEL
CEMENT TYPE(S): CALCILUTITE MATRIX
ACCESSORY MINERALS: CLAY-02%
OTHER FEATURES: MEDIUM RECRYSTALLIZATION, CHALKY
FOSSILS: BENTHIC FORAMINIFERA, ECHINOID
ECHINOIDS ARE HIGHLY RECRYSTALLIZED. INDURATION VARIES BETWEEN POOR AND MODERATE.

925 - 930 PACKSTONE; YELLOWISH GRAY

POROSITY: INTERGRANULAR, MOLDIC
GRAIN TYPE: SKELETAL, CALCILUTITE, INTRACLASTS
65% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: MEDIUM; RANGE: FINE TO GRAVEL; POOR INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
ACCESSORY MINERALS: CLAY-02%
OTHER FEATURES: MUDDY, HIGH RECRYSTALLIZATION
FOSSILS: BENTHIC FORAMINIFERA, ECHINOID
INDURATION RANGES FROM POOR TO MODERATE. ECHINOIDS AND ALL OTHER FOSSILS APPEAR HIGHLY RECRYSTALLIZED. PLANKTONIC FORAMS MABY BE PRESENT.

930 - 935 PACKSTONE; YELLOWISH GRAY
POROSITY: INTERGRANULAR, PIN POINT VUGS, MOLDIC
GRAIN TYPE: SKELETAL, CALCILUTITE, INTRACLASTS
75% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: MEDIUM; RANGE: FINE TO GRAVEL; POOR INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
ACCESSORY MINERALS: CLAY-01%
OTHER FEATURES: CHALKY, HIGH RECRYSTALLIZATION
FOSSILS: BENTHIC FORAMINIFERA, ECHINOID
LEPIDOCYCLINA IS NOT SEEN IN SAMPLE.

935 - 940 AS ABOVE

940 - 945 AS ABOVE

945 - 950 PACKSTONE; YELLOWISH GRAY
POROSITY: INTERGRANULAR, PIN POINT VUGS, MOLDIC
GRAIN TYPE: SKELETAL, CALCILUTITE, INTRACLASTS
75% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: MEDIUM; RANGE: FINE TO GRAVEL; POOR INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
ACCESSORY MINERALS: CLAY-01%
OTHER FEATURES: CHALKY, HIGH RECRYSTALLIZATION
FOSSILS: BENTHIC FORAMINIFERA, ECHINOID
SAMPLE APPEARS TO BE A GRAINSTONE WITH A THICK MICRITE COATING. A FEW GRAVEL SIZED MOLLUSK CASTS PRESENT. NO SHELLS FOUND, ONLY CASTS.

950 - 955 PACKSTONE; YELLOWISH GRAY
POROSITY: INTERGRANULAR, PIN POINT VUGS, MOLDIC
GRAIN TYPE: SKELETAL, CALCILUTITE, INTRACLASTS
80% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: MEDIUM; RANGE: FINE TO GRAVEL; POOR INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
ACCESSORY MINERALS: CLAY-01%
OTHER FEATURES: CHALKY, HIGH RECRYSTALLIZATION
FOSSILS: BENTHIC FORAMINIFERA, ECHINOID, CORAL

955 - 960 PACKSTONE; YELLOWISH GRAY
POROSITY: INTERGRANULAR, PIN POINT VUGS, MOLDIC
GRAIN TYPE: SKELETAL, CALCILUTITE, INTRACLASTS
80% ALLOCHEMICAL CONSTITUENTS

GRAIN SIZE: MEDIUM; RANGE: FINE TO GRAVEL; POOR INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
ACCESSORY MINERALS: CLAY-01%
OTHER FEATURES: CHALKY, HIGH RECRYSTALLIZATION
FOSSILS: BENTHIC FORAMINIFERA, ECHINOID

960 - 965 AS ABOVE

965 - 970 AS ABOVE

970 - 975 PACKSTONE; YELLOWISH GRAY
POROSITY: INTERGRANULAR, PIN POINT VUGS, MOLDIC
GRAIN TYPE: SKELETAL, CALCILUTITE, INTRACLASTS
75% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: MEDIUM; RANGE: FINE TO GRAVEL; POOR INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
ACCESSORY MINERALS: CLAY-03%
OTHER FEATURES: MUDDY, HIGH RECRYSTALLIZATION
FOSSILS: BENTHIC FORAMINIFERA

975 - 980 AS ABOVE

980 - 985 PACKSTONE; YELLOWISH GRAY
POROSITY: INTERGRANULAR, PIN POINT VUGS, MOLDIC
GRAIN TYPE: SKELETAL, CALCILUTITE, INTRACLASTS
80% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: MEDIUM; RANGE: FINE TO GRAVEL; POOR INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
ACCESSORY MINERALS: CLAY-02%
OTHER FEATURES: MUDDY, HIGH RECRYSTALLIZATION
FOSSILS: BENTHIC FORAMINIFERA

985 - 990 PACKSTONE; YELLOWISH GRAY
POROSITY: INTERGRANULAR, PIN POINT VUGS, MOLDIC
GRAIN TYPE: SKELETAL, CALCILUTITE, INTRACLASTS
70% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: MEDIUM; RANGE: FINE TO GRAVEL; POOR INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
ACCESSORY MINERALS: CLAY-02%
OTHER FEATURES: MUDDY, HIGH RECRYSTALLIZATION
FOSSILS: BENTHIC FORAMINIFERA, ECHINOID
INDURATION IS MOSTLY POOR BUT RANGES FROM POOR TO MODERATE.

990 - 995 WACKESTONE; YELLOWISH GRAY
POROSITY: INTERGRANULAR, PIN POINT VUGS, MOLDIC
GRAIN TYPE: SKELETAL, CALCILUTITE, CRYSTALS
40% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: MEDIUM; RANGE: FINE TO GRAVEL
CEMENT TYPE(S): CALCILUTITE MATRIX
ACCESSORY MINERALS: CLAY-02%
OTHER FEATURES: MUDDY, HIGH RECRYSTALLIZATION
FOSSILS: BENTHIC FORAMINIFERA, ECHINOID

INDURATION IS MOSTLY POOR BUT RANGES FROM POOR TO MODERATE.

995 - 1000 PACKSTONE; YELLOWISH GRAY
POROSITY: INTERGRANULAR, PIN POINT VUGS, MOLDIC
GRAIN TYPE: SKELETAL, CALCILUTITE, INTRACLASTS
60% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: MEDIUM; RANGE: FINE TO MEDIUM
CEMENT TYPE(S): CALCILUTITE MATRIX
ACCESSORY MINERALS: CLAY-02%
OTHER FEATURES: MUDDY, HIGH RECRYSTALLIZATION
FOSSILS: BENTHIC FORAMINIFERA
INDURATION RANGES FROM POOR TO MODERATE.

1000 - 1005 WACKESTONE; YELLOWISH GRAY
POROSITY: INTERGRANULAR, PIN POINT VUGS, MOLDIC
GRAIN TYPE: CALCILUTITE, INTRACLASTS, SKELETAL
40% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: MEDIUM; RANGE: FINE TO MEDIUM; POOR INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
ACCESSORY MINERALS: CLAY-03%
OTHER FEATURES: MUDDY, HIGH RECRYSTALLIZATION
FOSSILS: BENTHIC FORAMINIFERA

1005 - 1010 AS ABOVE

1010 - 1015 WACKESTONE; YELLOWISH GRAY
POROSITY: INTERGRANULAR, PIN POINT VUGS, MOLDIC
GRAIN TYPE: CALCILUTITE, SKELETAL, CRYSTALS
40% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: MEDIUM; RANGE: FINE TO MEDIUM
CEMENT TYPE(S): CALCILUTITE MATRIX
ACCESSORY MINERALS: CLAY-01%
OTHER FEATURES: MUDDY, HIGH RECRYSTALLIZATION
FOSSILS: BENTHIC FORAMINIFERA
INDURATION RANGES FROM POOR TO GOOD.

1015 - 1020 WACKESTONE; YELLOWISH GRAY
POROSITY: INTERGRANULAR, MOLDIC, PIN POINT VUGS
GRAIN TYPE: CALCILUTITE, SKELETAL, CRYSTALS
40% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: MEDIUM; RANGE: FINE TO GRAVEL
CEMENT TYPE(S): CALCILUTITE MATRIX
ACCESSORY MINERALS: CLAY-01%
OTHER FEATURES: MUDDY, HIGH RECRYSTALLIZATION
FOSSILS: BENTHIC FORAMINIFERA, MOLLUSKS
INDURATION VARIES FROM POOR TO MODERATE.

1020 - 1025 PACKSTONE; YELLOWISH GRAY
POROSITY: INTERGRANULAR, MOLDIC, PIN POINT VUGS
GRAIN TYPE: SKELETAL, CALCILUTITE, CRYSTALS
85% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: MEDIUM; RANGE: FINE TO GRAVEL; POOR INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
ACCESSORY MINERALS: CLAY-01%
OTHER FEATURES: CHALKY, HIGH RECRYSTALLIZATION

FOSSILS: BENTHIC FORAMINIFERA, ECHINOID

1025 - 1030 PACKSTONE; YELLOWISH GRAY
POROSITY: INTERGRANULAR, MOLDIC, PIN POINT VUGS
GRAIN TYPE: SKELETAL, CRYSTALS, CALCILUTITE
85% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: MEDIUM; RANGE: FINE TO MEDIUM
MODERATE INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
ACCESSORY MINERALS: CLAY-02%
OTHER FEATURES: CHALKY, HIGH RECRYSTALLIZATION, DOLOMITIC
FOSSILS: BENTHIC FORAMINIFERA

1030 - 1035 PACKSTONE; YELLOWISH GRAY
POROSITY: INTERGRANULAR, MOLDIC, PIN POINT VUGS
GRAIN TYPE: SKELETAL, CALCILUTITE, CRYSTALS
80% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: MEDIUM; RANGE: FINE TO GRAVEL; POOR INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
ACCESSORY MINERALS: CLAY-01%
OTHER FEATURES: MUDDY, HIGH RECRYSTALLIZATION
FOSSILS: BENTHIC FORAMINIFERA, ECHINOID

1035 - 1040 PACKSTONE; YELLOWISH GRAY
POROSITY: INTERGRANULAR, MOLDIC, PIN POINT VUGS
GRAIN TYPE: SKELETAL, CALCILUTITE, CRYSTALS
80% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: MEDIUM; RANGE: FINE TO GRAVEL
CEMENT TYPE(S): CALCILUTITE MATRIX
ACCESSORY MINERALS: CLAY-02%
OTHER FEATURES: CHALKY, HIGH RECRYSTALLIZATION
FOSSILS: BENTHIC FORAMINIFERA, ECHINOID
INDURATION RANGES FROM POOR TO GOOD. DICTYOCONUS IS PRESENT.

1040 - 1045 PACKSTONE; YELLOWISH GRAY
POROSITY: INTERGRANULAR, MOLDIC, PIN POINT VUGS
GRAIN TYPE: SKELETAL, CALCILUTITE, CRYSTALS
90% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: MEDIUM; RANGE: FINE TO GRAVEL
CEMENT TYPE(S): CALCILUTITE MATRIX
OTHER FEATURES: CHALKY, HIGH RECRYSTALLIZATION
FOSSILS: BENTHIC FORAMINIFERA, ECHINOID
INDURATION RANGES FROM POOR TO MEDIUM.

1045 - 1050 PACKSTONE; YELLOWISH GRAY
POROSITY: INTERGRANULAR, MOLDIC, PIN POINT VUGS
GRAIN TYPE: SKELETAL, CALCILUTITE, CRYSTALS
90% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: MEDIUM; RANGE: FINE TO GRAVEL
CEMENT TYPE(S): CALCILUTITE MATRIX
OTHER FEATURES: CHALKY, HIGH RECRYSTALLIZATION, DOLOMITIC
FOSSILS: BENTHIC FORAMINIFERA, ECHINOID
INDURATION VARIES FROM POOR TO GOOD IN DOLOMITIZED FRAGMENTS.

1050 - 1055 PACKSTONE; YELLOWISH GRAY

POROSITY: INTERGRANULAR, MOLDIC, PIN POINT VUGS
GRAIN TYPE: SKELETAL, CALCILUTITE, CRYSTALS
85% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: MEDIUM; RANGE: FINE TO GRAVEL
CEMENT TYPE(S): CALCILUTITE MATRIX
OTHER FEATURES: CHALKY, HIGH RECRYSTALLIZATION, DOLOMITIC
FOSSILS: BENTHIC FORAMINIFERA, ECHINOID
INDURATION VARIES FROM POOR TO GOOD. CONE FORAM PRESENT.

1055 - 1060 PACKSTONE; YELLOWISH GRAY
POROSITY: INTERGRANULAR, MOLDIC, PIN POINT VUGS
GRAIN TYPE: SKELETAL, CRYSTALS, CALCILUTITE
80% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: MEDIUM; RANGE: FINE TO GRAVEL
CEMENT TYPE(S): CALCILUTITE MATRIX
ACCESSORY MINERALS: CLAY-01%
OTHER FEATURES: CHALKY, HIGH RECRYSTALLIZATION
FOSSILS: BENTHIC FORAMINIFERA, ECHINOID
INDURATION VARIES FROM POOR TO GOOD.

1060 - 1065 PACKSTONE; YELLOWISH GRAY
POROSITY: INTERGRANULAR, MOLDIC, PIN POINT VUGS
GRAIN TYPE: SKELETAL, CRYSTALS, CALCILUTITE
75% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: MEDIUM; RANGE: FINE TO GRAVEL
CEMENT TYPE(S): CALCILUTITE MATRIX
ACCESSORY MINERALS: CLAY-01%
OTHER FEATURES: CHALKY, HIGH RECRYSTALLIZATION
FOSSILS: BENTHIC FORAMINIFERA, ECHINOID
DICTYOCONUS PRESENT, POSSIBLY AMERICANUS. INDURATION VARIES FROM POOR TO GOOD.

1065 - 1070 PACKSTONE; YELLOWISH GRAY
POROSITY: INTERGRANULAR, MOLDIC, PIN POINT VUGS
GRAIN TYPE: SKELETAL, CRYSTALS, CALCILUTITE
80% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: MEDIUM; RANGE: FINE TO GRAVEL
CEMENT TYPE(S): CALCILUTITE MATRIX
ACCESSORY MINERALS: CLAY-01%, DOLOMITE-03%
OTHER FEATURES: CHALKY, HIGH RECRYSTALLIZATION
FOSSILS: BENTHIC FORAMINIFERA, ECHINOID
DICTYOCONUS PRESENT.

1070 - 1075 AS ABOVE

1075 - 1080 PACKSTONE; YELLOWISH GRAY
POROSITY: INTERGRANULAR, MOLDIC, PIN POINT VUGS
GRAIN TYPE: SKELETAL, CRYSTALS, CALCILUTITE
75% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: MEDIUM; RANGE: FINE TO GRAVEL
CEMENT TYPE(S): CALCILUTITE MATRIX
ACCESSORY MINERALS: CLAY-02%, DOLOMITE-01%
OTHER FEATURES: DOLOMITIC, CHALKY, HIGH RECRYSTALLIZATION
FOSSILS: BENTHIC FORAMINIFERA, ECHINOID
INDURATION RANGES FROM POOR TO GOOD.

1080 - 1085 PACKSTONE; YELLOWISH GRAY
POROSITY: INTERGRANULAR, PIN POINT VUGS

GRAIN TYPE: SKELETAL, CRYSTALS, CALCILUTITE
85% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: MEDIUM; RANGE: FINE TO GRAVEL
CEMENT TYPE(S): CALCILUTITE MATRIX
ACCESSORY MINERALS: CLAY-02%, DOLOMITE-01%
OTHER FEATURES: CHALKY, HIGH RECRYSTALLIZATION
FOSSILS: BENTHIC FORAMINIFERA
INDURATION RANGES FROM POOR TO MODERATE.

1085 - 1090 PACKSTONE; YELLOWISH GRAY
POROSITY: INTERGRANULAR, PIN POINT VUGS
GRAIN TYPE: SKELETAL, CRYSTALS, CALCILUTITE
85% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: MEDIUM; RANGE: FINE TO GRAVEL
CEMENT TYPE(S): CALCILUTITE MATRIX
ACCESSORY MINERALS: DOLOMITE-01%
OTHER FEATURES: CHALKY, HIGH RECRYSTALLIZATION
FOSSILS: BENTHIC FORAMINIFERA
DICTYOCONUS IS PRESENT. INDURATION RANGES FROM POOR TO MODERATE.

1090 - 1095 PACKSTONE; YELLOWISH GRAY
POROSITY: INTERGRANULAR, INTERCRYSTALLINE, PIN POINT VUGS
GRAIN TYPE: SKELETAL, CRYSTALS, CALCILUTITE
70% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: MEDIUM; RANGE: FINE TO GRAVEL
CEMENT TYPE(S): CALCILUTITE MATRIX
ACCESSORY MINERALS: DOLOMITE-02%
OTHER FEATURES: CHALKY, HIGH RECRYSTALLIZATION
FOSSILS: BENTHIC FORAMINIFERA
INDURATION RANGES FROM POOR TO MODERATE.

1095 - 1100 AS ABOVE

1100 - 1105 PACKSTONE; YELLOWISH GRAY
POROSITY: INTERGRANULAR, INTERCRYSTALLINE, PIN POINT VUGS
GRAIN TYPE: SKELETAL, CRYSTALS, CALCILUTITE
75% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: MEDIUM; RANGE: FINE TO GRAVEL
CEMENT TYPE(S): CALCILUTITE MATRIX
ACCESSORY MINERALS: DOLOMITE-02%, CLAY-01%
OTHER FEATURES: CHALKY, HIGH RECRYSTALLIZATION
FOSSILS: BENTHIC FORAMINIFERA
INDURATION RANGES FROM POOR TO GOOD.

1105 - 1110 AS ABOVE

1110 - 1115 PACKSTONE; YELLOWISH GRAY
POROSITY: INTERGRANULAR, INTERCRYSTALLINE
GRAIN TYPE: CALCILUTITE, SKELETAL, INTRACLASTS
70% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: MEDIUM; RANGE: FINE TO GRAVEL
CEMENT TYPE(S): CALCILUTITE MATRIX
ACCESSORY MINERALS: DOLOMITE-01%
OTHER FEATURES: MUDDY, MEDIUM RECRYSTALLIZATION
FOSSILS: BENTHIC FORAMINIFERA
INDURATION RANGES FROM POOR TO MODERATE. LIMESTONE FRAGMENTS APPEAR TO BE COATED WITH MICRITE.

1115 - 1120 PACKSTONE; YELLOWISH GRAY
POROSITY: INTERGRANULAR, PIN POINT VUGS, MOLDIC
GRAIN TYPE: SKELETAL, CALCILUTITE, CRYSTALS
85% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: MEDIUM; RANGE: FINE TO GRAVEL
CEMENT TYPE(S): CALCILUTITE MATRIX
OTHER FEATURES: CHALKY, DOLOMITIC, GREASY
FOSSILS: BENTHIC FORAMINIFERA, ECHINOID

1120 - 1125 PACKSTONE; YELLOWISH GRAY
POROSITY: INTERGRANULAR, INTERCRYSTALLINE, MOLDIC
GRAIN TYPE: SKELETAL, CALCILUTITE, INTRACLASTS
75% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: MEDIUM; RANGE: FINE TO GRAVEL
CEMENT TYPE(S): CALCILUTITE MATRIX
ACCESSORY MINERALS: DOLOMITE-02%, CLAY-01%
OTHER FEATURES: MUDDY, HIGH RECRYSTALLIZATION
FOSSILS: BENTHIC FORAMINIFERA, MOLLUSKS
INDURATION RANGES FROM POOR TO GOOD.

1125 - 1130 AS ABOVE

1130 - 1135 PACKSTONE; YELLOWISH GRAY
POROSITY: INTERGRANULAR, INTERCRYSTALLINE, PIN POINT VUGS
GRAIN TYPE: SKELETAL, CALCILUTITE, CRYSTALS
85% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: MEDIUM; RANGE: FINE TO COARSE
MODERATE INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
ACCESSORY MINERALS: DOLOMITE-02%, CLAY-01%
OTHER FEATURES: CHALKY, HIGH RECRYSTALLIZATION, DOLOMITIC
FOSSILS: BENTHIC FORAMINIFERA

1135 - 1140 AS ABOVE

1140 - 1145 PACKSTONE; BROWNISH GRAY
POROSITY: INTERGRANULAR, INTERCRYSTALLINE, PIN POINT VUGS
GRAIN TYPE: SKELETAL, CALCILUTITE, INTRACLASTS
80% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: MEDIUM; RANGE: FINE TO COARSE
CEMENT TYPE(S): CALCILUTITE MATRIX
ACCESSORY MINERALS: DOLOMITE-01%, CLAY-01%
OTHER FEATURES: CHALKY, HIGH RECRYSTALLIZATION
FOSSILS: BENTHIC FORAMINIFERA
INDURATION RANGES FROM POOR TO MODERATE.

1145 - 1150 PACKSTONE; YELLOWISH GRAY
POROSITY: INTERGRANULAR, INTERCRYSTALLINE, PIN POINT VUGS
GRAIN TYPE: SKELETAL, CALCILUTITE, CRYSTALS
80% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: MEDIUM; RANGE: FINE TO COARSE
CEMENT TYPE(S): CALCILUTITE MATRIX
ACCESSORY MINERALS: CLAY-02%, DOLOMITE-02%
OTHER FEATURES: CHALKY, HIGH RECRYSTALLIZATION, DOLOMITIC
FOSSILS: BENTHIC FORAMINIFERA
INDURATION RANGES FROM POOR TO MODERATE.

1150 - 1155 PACKSTONE; YELLOWISH GRAY
POROSITY: INTERGRANULAR, INTERCRYSTALLINE, MOLDIC
GRAIN TYPE: SKELETAL, CALCILUTITE, CRYSTALS
85% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: MEDIUM; RANGE: FINE TO GRAVEL
CEMENT TYPE(S): CALCILUTITE MATRIX
ACCESSORY MINERALS: DOLOMITE-01%
OTHER FEATURES: HIGH RECRYSTALLIZATION, CHALKY
FOSSILS: BENTHIC FORAMINIFERA
CONE FOSSIL FOUND, POSSIBLY DICTYOCONUS OR CUSHMANIA AMERICANAS. INDURATION RANGES FROM POOR TO MODERATE.

1155 - 1160 PACKSTONE; YELLOWISH GRAY
POROSITY: INTERGRANULAR, INTERCRYSTALLINE, MOLDIC
GRAIN TYPE: SKELETAL, CALCILUTITE, CRYSTALS
85% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: MEDIUM; RANGE: FINE TO COARSE
CEMENT TYPE(S): CALCILUTITE MATRIX
ACCESSORY MINERALS: DOLOMITE-01%
OTHER FEATURES: HIGH RECRYSTALLIZATION, CHALKY
FOSSILS: BENTHIC FORAMINIFERA
INDURATION RANGES FROM POOR TO MODERATE.

1160 - 1165 AS ABOVE

1165 - 1170 PACKSTONE; YELLOWISH GRAY TO GRAYISH BROWN
POROSITY: INTERGRANULAR, INTERCRYSTALLINE
GRAIN TYPE: SKELETAL, CALCILUTITE, INTRACLASTS
80% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: MEDIUM; RANGE: FINE TO GRANULE
CEMENT TYPE(S): CALCILUTITE MATRIX
ACCESSORY MINERALS: DOLOMITE-30%
OTHER FEATURES: HIGH RECRYSTALLIZATION, CHALKY
FOSSILS: BENTHIC FORAMINIFERA
TRACE DOLOMITE DESCRIBED AS FOLLOWS: 90-100% ALTERED EUHEDRAL CRYSTALLINITY, SIZE MODE IS VERY FINE AND RANGES FROM MICROCRYSTALLINE TO MEDIUM. DICTYOCONUS IS PRESENT. INDURATION RANGES FROM POOR TO GOOD. POSSIBLE SILT SIZED EVAPORITES FOUND WITHIN SOME PORES SPACES IN THE DOLOMITE.

1170 - 1175 AS ABOVE

1175 - 1180 PACKSTONE; YELLOWISH GRAY TO GRAYISH BROWN
POROSITY: INTERGRANULAR, INTERCRYSTALLINE
GRAIN TYPE: SKELETAL, CALCILUTITE, INTRACLASTS
80% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: MEDIUM; RANGE: FINE TO GRANULE
CEMENT TYPE(S): CALCILUTITE MATRIX
ACCESSORY MINERALS: DOLOMITE-40%
OTHER FEATURES: HIGH RECRYSTALLIZATION, CHALKY
FOSSILS: BENTHIC FORAMINIFERA
DICTYOCONUS PRESENT. IDURATION RANGES FROM POOR TO GOOD. TRACE DOLOMITE DESCRIBED AS FOLLOWS: 90-100% ALTERED EUHEDRAL CRYSTALLINITY, SIZE MODE IS VERY FINE AND RANGES FROM MICROCRYSTALLINE TO MEDIUM.

1180 - 1185 DOLOSTONE; VERY LIGHT ORANGE TO GRAYISH BROWN

POROSITY: INTERGRANULAR, INTERCRYSTALLINE; 90-100% ALTERED EUHEDRAL
GRAIN SIZE: VERY FINE; RANGE: MICROCRYSTALLINE TO MEDIUM
POOR INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
ACCESSORY MINERALS: CALCILUTITE-20%
FOSSILS: BENTHIC FORAMINIFERA
SAMPLE APPEARS TO BE INDIVIDUAL OR SMALL CLUSTERS OF DOLOMITE. CRYSTALS ARE CEMENTED BY MICRITE.

1185 - 1190 AS ABOVE

1190 - 1195 DOLOSTONE; VERY LIGHT ORANGE TO GRAYISH BROWN
POROSITY: INTERGRANULAR, INTERCRYSTALLINE; 90-100% ALTERED EUHEDRAL
GRAIN SIZE: VERY FINE; RANGE: MICROCRYSTALLINE TO MEDIUM
CEMENT TYPE(S): CALCILUTITE MATRIX
IDURATION RANGES FROM POOR TO MODERATE. CONE FORAMS PRESENT.

1195 - 1200 DOLOSTONE; MODERATE YELLOWISH BROWN TO GRAYISH BROWN
POROSITY: INTERCRYSTALLINE, PIN POINT VUGS
90-100% ALTERED; EUHEDRAL
GRAIN SIZE: VERY FINE; RANGE: MICROCRYSTALLINE TO FINE
GOOD INDURATION
CEMENT TYPE(S): DOLOMITE CEMENT
ACCESSORY MINERALS: CALCILUTITE-01%

1200 - 1205 DOLOSTONE; MODERATE YELLOWISH BROWN TO GRAYISH BROWN
POROSITY: INTERCRYSTALLINE, PIN POINT VUGS
90-100% ALTERED; EUHEDRAL
GRAIN SIZE: VERY FINE; RANGE: MICROCRYSTALLINE TO FINE
GOOD INDURATION
CEMENT TYPE(S): DOLOMITE CEMENT
CONTAINS TRACE CALCITE.

1205 - 1210 AS ABOVE

1210 - 1215 AS ABOVE

1215 - 1220 DOLOSTONE; MODERATE YELLOWISH BROWN TO GRAYISH BROWN
POROSITY: INTERCRYSTALLINE, PIN POINT VUGS
90-100% ALTERED; EUHEDRAL
GRAIN SIZE: VERY FINE; RANGE: MICROCRYSTALLINE TO FINE
CEMENT TYPE(S): DOLOMITE CEMENT
FOSSILS: ECHINOID
ECHINOID PRESENCE POSSIBLY DUE TO CAVINGS. INDURATION RANGES FROM MODERATE TO GOOD. CONTAINS TRACE CALCITE AND MICRITE.

1220 - 1225 DOLOSTONE; MODERATE YELLOWISH BROWN TO GRAYISH BROWN
POROSITY: INTERCRYSTALLINE, PIN POINT VUGS
90-100% ALTERED; EUHEDRAL
GRAIN SIZE: VERY FINE; RANGE: MICROCRYSTALLINE TO FINE
CEMENT TYPE(S): DOLOMITE CEMENT
CONTAINS TRACE CALCITE AND MICRITE. INDURATION RANGES FROM MODERATE TO GOOD.

1225 - 1230 AS ABOVE

1230 - 1235 AS ABOVE

1235 - 1240 AS ABOVE
PRESENCE OF LEPIDOCYCLINA AND CONES POSSIBLY DUE TO CAVINGS AND REPRESENT ~1% OF SAMPLE INTERVAL

1240 - 1245 DOLOSTONE; NO COLOR GIVEN
90-100% ALTERED; EUHEDRAL
GRAIN SIZE: FINE; RANGE: MICROCRYSTALLINE TO MEDIUM
GOOD INDURATION
CEMENT TYPE(S): DOLOMITE CEMENT
CONTAINS TRACE MICRITE AND CALCITE.

1245 - 1250 AS ABOVE

1250 - 1255 AS ABOVE

1255 - 1260 AS ABOVE

1260 - 1265 DOLOSTONE; GRAYISH ORANGE TO DARK YELLOWISH BROWN
POROSITY: INTERCRYSTALLINE, PIN POINT VUGS
90-100% ALTERED; EUHEDRAL
GRAIN SIZE: FINE; RANGE: MICROCRYSTALLINE TO MEDIUM
GOOD INDURATION
CEMENT TYPE(S): DOLOMITE CEMENT
ACCESSORY MINERALS: CALCILUTITE-01%

1265 - 1270 AS ABOVE

1270 - 1275 AS ABOVE

1275 - 1280 DOLOSTONE; GRAYISH ORANGE TO DARK YELLOWISH BROWN
POROSITY: INTERCRYSTALLINE, PIN POINT VUGS
90-100% ALTERED; EUHEDRAL
GRAIN SIZE: FINE; RANGE: MICROCRYSTALLINE TO MEDIUM
GOOD INDURATION
CEMENT TYPE(S): DOLOMITE CEMENT
ACCESSORY MINERALS: CALCILUTITE-01%
ORGANIC LAMINATIONS PRESENT ON A FEW FRAGMENTS.

1280 - 1285 AS ABOVE

1285 - 1290 DOLOSTONE; GRAYISH ORANGE TO DARK YELLOWISH BROWN
POROSITY: INTERCRYSTALLINE, PIN POINT VUGS
90-100% ALTERED; EUHEDRAL
GRAIN SIZE: FINE; RANGE: MICROCRYSTALLINE TO MEDIUM
GOOD INDURATION
CEMENT TYPE(S): DOLOMITE CEMENT
ACCESSORY MINERALS: CALCILUTITE-01%

1290 - 1295 DOLOSTONE; GRAYISH ORANGE TO DARK YELLOWISH BROWN
POROSITY: INTERCRYSTALLINE, PIN POINT VUGS
90-100% ALTERED; EUHEDRAL
GRAIN SIZE: FINE; RANGE: MICROCRYSTALLINE TO MEDIUM
GOOD INDURATION
CEMENT TYPE(S): DOLOMITE CEMENT

ACCESSORY MINERALS: CALCILUTITE-03%
FOSSILS: BENTHIC FORAMINIFERA
A COUPLE FOSSILS FOUND, INCLUDING DICTYOCONUS AND LEPIDACYCLINA, ARE PROBABLY CAVINGS. CONTAINS TRACE CALCITE.

1295 - 1300 DOLOSTONE; GRAYISH ORANGE TO DARK YELLOWISH BROWN
POROSITY: INTERCRYSTALLINE, PIN POINT VUGS, INTERGRANULAR
90-100% ALTERED; EUHEDRAL
GRAIN SIZE: FINE; RANGE: MICROCRYSTALLINE TO MEDIUM
GOOD INDURATION
CEMENT TYPE(S): DOLOMITE CEMENT
ACCESSORY MINERALS: CALCILUTITE-05%
FOSSILS: BENTHIC FORAMINIFERA
INCREASED DICTYOCONUS PRESENCE.

1300 - 1305 DOLOSTONE; GRAYISH ORANGE TO DARK YELLOWISH BROWN
POROSITY: INTERCRYSTALLINE, PIN POINT VUGS, INTERGRANULAR
90-100% ALTERED; EUHEDRAL
GRAIN SIZE: FINE; RANGE: MICROCRYSTALLINE TO MEDIUM
GOOD INDURATION
CEMENT TYPE(S): DOLOMITE CEMENT
ACCESSORY MINERALS: CALCILUTITE-07%
FOSSILS: BENTHIC FORAMINIFERA
SOME ORGANIC LAMINATIONS PRESENT.

1305 - 1310 AS ABOVE

1310 - 1315 DOLOSTONE; GRAYISH ORANGE TO DARK YELLOWISH BROWN
POROSITY: INTERCRYSTALLINE, PIN POINT VUGS, INTERGRANULAR
90-100% ALTERED; EUHEDRAL
GRAIN SIZE: FINE; RANGE: MICROCRYSTALLINE TO MEDIUM
GOOD INDURATION
CEMENT TYPE(S): DOLOMITE CEMENT
ACCESSORY MINERALS: CALCILUTITE-10%
FOSSILS: BENTHIC FORAMINIFERA
DICTYOCONUS PRESENT. SOME ORGANIC LAMINATIONS PRESENT.

1315 - 1320 DOLOSTONE; GRAYISH ORANGE TO DARK YELLOWISH BROWN
POROSITY: INTERCRYSTALLINE, PIN POINT VUGS, INTERGRANULAR
90-100% ALTERED; EUHEDRAL
GRAIN SIZE: FINE; RANGE: MICROCRYSTALLINE TO MEDIUM
CEMENT TYPE(S): DOLOMITE CEMENT
ACCESSORY MINERALS: CALCILUTITE-10%
FOSSILS: BENTHIC FORAMINIFERA
INDURATION RANGES FROM POOR TO GOOD BUT IS MOSTLY MODERATE. DICTYOCONUS IS PRESENT.

1320 - 1325 AS ABOVE

1325 - 1330 AS ABOVE
SOME ORGANIC LAMINATIONS PRESENT.

1330 - 1335 DOLOSTONE; DARK YELLOWISH BROWN TO GRAYISH ORANGE
POROSITY: INTERCRYSTALLINE, PIN POINT VUGS, INTERGRANULAR
90-100% ALTERED; EUHEDRAL
GRAIN SIZE: FINE; RANGE: MICROCRYSTALLINE TO MEDIUM
GOOD INDURATION

CEMENT TYPE(S): DOLOMITE CEMENT
ACCESSORY MINERALS: CALCILUTITE-05%
FOSSILS: BENTHIC FORAMINIFERA
DICTYOCONUS IS PRESENT. THE SAMPLE CONTAINS TRACE ORGANICS.

1335 - 1340 AS ABOVE

1340 - 1345 AS ABOVE

1345 - 1350 DOLOSTONE; GRAYISH ORANGE TO DARK YELLOWISH BROWN
POROSITY: INTERCRYSTALLINE, PIN POINT VUGS, INTERGRANULAR
90-100% ALTERED; EUHEDRAL
GRAIN SIZE: FINE; RANGE: MICROCRYSTALLINE TO MEDIUM
CEMENT TYPE(S): DOLOMITE CEMENT, CALCILUTITE MATRIX
ACCESSORY MINERALS: CALCILUTITE-07%
FOSSILS: BENTHIC FORAMINIFERA
DICTYOCONUS COOKEI IS PRESENT. INDURATION RANGES FROM POOR TO GOOD.

1350 - 1355 AS ABOVE

1355 - 1360 DOLOSTONE; GRAYISH ORANGE TO DARK YELLOWISH BROWN
POROSITY: INTERCRYSTALLINE, PIN POINT VUGS, INTERGRANULAR
90-100% ALTERED; EUHEDRAL
GRAIN SIZE: FINE; RANGE: MICROCRYSTALLINE TO MEDIUM
CEMENT TYPE(S): DOLOMITE CEMENT, CALCILUTITE MATRIX
ACCESSORY MINERALS: CALCILUTITE-10%
FOSSILS: BENTHIC FORAMINIFERA
INDURATION RANGES FROM POOR TO GOOD. CONTAINS TRACE ORGANICS. DICTYOCONUS IS PRESENT.

1360 - 1365 DOLOSTONE; GRAYISH ORANGE TO DARK YELLOWISH BROWN
POROSITY: INTERCRYSTALLINE, PIN POINT VUGS, INTERGRANULAR
90-100% ALTERED; EUHEDRAL
GRAIN SIZE: FINE; RANGE: MICROCRYSTALLINE TO MEDIUM
MODERATE INDURATION
CEMENT TYPE(S): DOLOMITE CEMENT, CALCILUTITE MATRIX
ACCESSORY MINERALS: CALCILUTITE-07%
FOSSILS: BENTHIC FORAMINIFERA, ALGAE
FOSSIL FOUND MAY BE LITUONELLA.

1365 - 1370 DOLOSTONE; GRAYISH ORANGE TO DARK YELLOWISH BROWN
POROSITY: INTERCRYSTALLINE, PIN POINT VUGS, INTERGRANULAR
90-100% ALTERED; EUHEDRAL
GRAIN SIZE: FINE; RANGE: MICROCRYSTALLINE TO MEDIUM
CEMENT TYPE(S): DOLOMITE CEMENT, CALCILUTITE MATRIX
ACCESSORY MINERALS: CALCILUTITE-10%
FOSSILS: BENTHIC FORAMINIFERA
DICTYOCONUS IS PRESENT. SAMPLE INTERVAL CONTAINS TRACE ORGANICS. INDURATION RANGES FROM POOR TO GOOD.

1370 - 1375 DOLOSTONE; DARK YELLOWISH BROWN TO VERY LIGHT ORANGE
POROSITY: INTERCRYSTALLINE, PIN POINT VUGS, INTERGRANULAR
90-100% ALTERED; EUHEDRAL
GRAIN SIZE: FINE; RANGE: MICROCRYSTALLINE TO MEDIUM
CEMENT TYPE(S): DOLOMITE CEMENT, CALCILUTITE MATRIX
ACCESSORY MINERALS: CALCILUTITE-15%

FOSSILS: BENTHIC FORAMINIFERA
DICTYOCONUS IS PRESENT. INDURATION RANGES FROM POOR TO GOOD. MICRITE CEMENTED SECTIONS HAVE POORER INDURATION.

1375 - 1380 DOLOSTONE; GRAYISH ORANGE TO DARK YELLOWISH BROWN
POROSITY: INTERCRYSTALLINE, PIN POINT VUGS, INTERGRANULAR
90-100% ALTERED; EUHEDRAL
GRAIN SIZE: FINE; RANGE: MICROCRYSTALLINE TO MEDIUM
GOOD INDURATION
CEMENT TYPE(S): DOLOMITE CEMENT, CALCILUTITE MATRIX
ACCESSORY MINERALS: CALCILUTITE-07%
FOSSILS: BENTHIC FORAMINIFERA
DICTYOCONUS IS PRESENT.

1380 - 1385 AS ABOVE

1385 - 1390 AS ABOVE
POOR INDURATION IN MICRITE CEMEMENTED DOLOMITE GRAINS

1390 - 1395 DOLOSTONE; GRAYISH ORANGE TO DARK YELLOWISH BROWN
POROSITY: INTERCRYSTALLINE, PIN POINT VUGS, INTERGRANULAR
90-100% ALTERED; EUHEDRAL
GRAIN SIZE: FINE; RANGE: MICROCRYSTALLINE TO MEDIUM
CEMENT TYPE(S): DOLOMITE CEMENT, CALCILUTITE MATRIX
ACCESSORY MINERALS: CALCILUTITE-05%
FOSSILS: BENTHIC FORAMINIFERA
DICTYOCONUS IS PRESENT. MOST OF SAMPLE HAS GOOD INDURATION HOWEVER INDURATION RANGES FROM MODERATE TO GOOD.

1395 - 1398 AS ABOVE

1398 TOTAL DEPTH

OKF-105 Lithologic Description
1,400 to 2,500 feet below land surface

From	To	Description
0	1,400	See Florida Geological Survey description.
1,400	1,430	Dolostone, brown, sucrosic, intergranular porosity and pinpoint vugs, well indurated.
1,430	1,450	Dolostone, brown to black, crystalline, intercrystalline and pinpoint vugs, well indurated.
1,450	1,460	Dolostone, brown, sucrosic and crystalline, intergranular porosity and pinpoint vugs, well indurated, dolomite cement.
1,460	1,470	70% dolostone, brown, sucrosic and crystalline, intergranular porosity and pinpoint vugs, well indurated, dolomite cement and 30% limestone, mudstone, tan, intergranular to vuggy, calcite cement.
1,470	1,480	Limestone, mudstone, tan to white, intergranular porosity and pinpoint vugs, well indurated, calcite cement, *Dictyconus americanus*, some dark to light layering.
1,480	1,500	Limestone, packstone, tan to white, intergranular porosity to pinpoint vugs, well indurated, calcite cement.
1,500	1,520	Limestone, packstone, tan to white, intergranular porosity and pinpoint vugs, well indurated, calcite cement, 3% tan dolomite.
1,520	1,550	Limestone, mudstone, white, intergranular porosity and pinpoint vugs, friable, calcite cement.
1,550	1,560	Limestone, mudstone, tan, intergranular porosity and pin point vugs, well indurated, calcite cement.
1,560	1,570	Limestone, mudstone, tan, intergranular porosity and pin point vugs, well indurated, calcite cement.
1,570	1,610	75% limestone, mudstone, white, intergranular porosity and pinpoint vugs, friable, calcite cement, 25% dark brown crystalline dolomite.
1,610	1,620	Dolostone, grey to tan, pinpoint vugs, well indurated.
1,620	1,630	Limestone, mudstone, tan to light brown, pinpoint vugs, intergranular, and interclast porosity, well indurated, calcite cement, some mollusk clasts.
1,630	1,670	Dolostone, tan to dark brown, crystalline, pinpoint vugs, well indurated.
1,670	1,680	Dolostone, tan to dark brown, crystalline, pinpoint vugs, well indurated, 10% white limestone (packstone).
1,680	1,690	Dolostone, tan to dark brown, crystalline, pinpoint vugs, well indurated.
1,690	1,710	Dolostone, tan to dark brown, crystalline, pinpoint vugs, well indurated, 10% white limestone (packstone).
1,710	1,730	Dolostone, tan to dark brown, crystalline, pinpoint vugs, well indurated.
1,730	1,740	Dolostone, tan to dark brown, crystalline, pinpoint vugs, well indurated, 50% white limestone (packstone), friable.
1,740	1,750	Limestone, packstone, white, pinpoint vugs, calcite cement, friable.

1,750	1,760	Dolostone, brown, crystalline, pin point vugs, well indurated, some fossil clasts.
1,760	1,770	Limestone, packstone, white, pinpoint vugs, friable, calcite cement.
1,770	1,800	Dolostone, brown, crystalline, pin point vugs, well indurated, some anhydrite.
1,800	1,820	Dolostone, tan to brown, crystalline, pinpoint vugs, well indurated, 40% white limestone (packstone), friable, 5 to 10% anhydrite.
1,820	1,840	Limestone, packstone, white, intergranular porosity, friable, calcite cement, 10% brown crystalline dolostone.
1,840	1,865	Dolostone, tan to brown, crystalline, pinpoint vugs, well indurated, 10% anhydrite.
1,865	1,870	Dolostone, tan to brown, crystalline, pinpoint vugs, well indurated, 25% white limestone (packstone), friable.
1,870	1,890	Limestone, packstone, white, pinpoint vugs, friable, calcite cement, 5% brown dolostone and anhydrite.
1,890	1,895	Dolostone, tan to white, intergranular porosity, well indurated, 5% white limestone (packstone).
1,895	1,910	Dolostone, tan to white, some crystalline, intergranular porosity to pinpoint vugs, well indurated, 15% white limestone (grainstone).
1,910	1,920	Dolostone, tan to brown, crystalline, pinpoint vugs, well indurated, 1 to 2% anhydrite.
1,920	1,960	Dolostone, tan, crystalline, pinpoint vugs, well indurated, 1 to 2% anhydrite.
1,960	2,015	Dolostone, tan, crystalline, pinpoint vugs, well indurated, 10% anhydrite.
2,015	2,025	Dolostone, tan, crystalline, pinpoint vugs, well indurated, 10% anhydrite, minor gypsum.
2,025	2,040	Dolostone, tan, crystalline, pinpoint vugs, well indurated, 1% anhydrite and gypsum.
2,040	2,060	Dolostone, tan, crystalline, pinpoint vugs, well indurated, 15 to 20% anhydrite and gypsum.
2,060	2,070	Limestone, white to tan, packstone, intergranular porosity to pinpoint vugs, calcite cement, friable, 1 to 5% tan crystalline dolostone.
2,070	2,110	Limestone, white to tan, packstone, intergranular and moldic porosity, some pinpoint vugs, calcite cement, friable, mollusk fragments.
2,110	2,120	Limestone, white to tan, packstone, intergranular and moldic porosity, some pinpoint vugs, calcite cement, friable, mollusk fragments.
2,120	2,132	Limestone, white to tan, packstone, intergranular and moldic porosity, some pinpoint vugs, calcite cement, friable, 40% brown sucrosic dolostone.
2,132	2,140	Dolostone, tan, crystalline, intercrystalline porosity, well indurated, 1% anhydrite.
2,140	2,150	50% dolostone and 50% limestone (mudstone), dolostone is tan, limetsone is white, both exhibit intergranular porosity.
2,150	2,165	Dolostone, tan, crystalline, pinpoint vugs, well indurated, 15% white limestone(mudstone to packstone), friable.

2,165	2,175	Dolostone, tan, intergranular porosity, 10 to 15 % white limestone (mudstone).
2,175	2,190	Dolostone, tan, crystalline, pinpoint vugs, well indurated, 30% white limestone (wakestone), friable, 1% anhydrite, some benthic forams (possible *Helicostagina gyralis*).
2,190	2,200	Dolostone, tan to white, intergranular porosity, well indurated, 15% anhydrite.
2,200	2,220	Limestone, white, wackestone, intergranular porosity to pinpoint vugs, calcite cement, friable, some glauconite.
2,220	2,230	Limestone, white to tan, packstone, intergranular porosity, calcite cement, friable.
2,230	2,240	Limestone, tan, packstone, intergranular and moldic porosity, calcite cement, friable, 10% tan crystalline dolostone.
2,240	2,250	Limestone, white, packstone, intergranular and moldic porosity, calcite cement, friable, 10% tan crystalline dolostone, 1% anhydrite.
2,250	2,260	Dolostone, tan to brown, sucrosic to crystalline, intercrystalline porosity, well indurated.
2,260	2,280	Dolostone, white to tan, crystalline, intercrystalline porosity, well indurated, 10% white limestone (mudstone).
2,280	2,290	Dolostone, grey, crystalline, intercrystalline porosity, well indurtaed, 40% grey limestone (packstone).
2,290	2,295	Limestone, white, mudstone, intergranular porosity, friable, 20% tan to brown dolostone with pin point vugs.
2,295	2,300	Limestone, white, mudstone to wackestone, intergranular porosity, friable.
2,300	2,310	Limestone, white, mudstone to packstone, intergranular porosity and pinpoint vugs, calcite cement, friable, 10% tan crystalline dolostone.
2,310	2,320	Dolostone, tan, crystalline, intercrystalline porosity, well indurated, 10 to 20% whit elimestone (mudstone).
2,320	2,325	Dolostone, grey sucrosic, intergranular porosity, well indurated, 10 to 20% light grey limestone (mudstone).
2,325	2,340	Dolostone, tan to brown, crystalline, intergrystalline porosity, well indurated, 1% anhydrite and white limestone (mudstone).
2,340	2,360	Dolostone, tan, crystalline, intercyrstalline porosity, well indurated.
2,360	2,370	Dolostone, tan, 20% grey, crystalline, intercyrstalline porosity, well indurated.
2,370	2,380	Dolostone, tan, crystalline, intercyrstalline porosity, well indurated.
2,380	2,390	Dolostone, tan to grey, crystalline, intercyrstalline porosity, well indurated.
2,390	2,395	Dolostone, tan, crystalline, intercyrstalline porosity, well indurated, 30% white to gey limstone (packstone).
2,395	2,410	Limestone, white, packstone, intergranular porosity and pinpoint vugs, calcite cement, friable.
2,410	2,420	Dolostone, light grey to tan, intercrystalline porosity, well indurated.

2,420	2,425	Dolostone, light grey to tan, crystalline,intercrystalline porosity, well indurated.
2,425	2,455	Limestone, white, mudstone, intergranular porosity and pinpoint vugs, friable, 10% grey crystalline dolostone.
2,455	2,470	Limestone, white, wackestone, intergranular porosity and pinpoint vugs, friable, 10% tan crystalline dolostone, some echinoids.
2,470	2,475	Limestone, white, wackestone, intergranular porosity and pinpoint vugs, friable, 30% tan crystalline dolostone.
2,475	2,480	Dolostone, tan, crystalline, intercrystalline porosity and pinpoint vugs, well indurated, 40% white limestone (wackestone).
2,480	2,490	Dolostone, tan, crystalline, intercrytsalline porosity and pinpoint vugs, well indurated.
2,490	2,500	Dolostone, tan to dark grey, crystalline, intercrytalline porosity and pin point vugs, well indurated.

OKF-105 Lithologic Description
0 to 1,398 feet below land surface

LITHOLOGIC WELL LOG PRINTOUT

SOURCE - FGS

WELL NUMBER: W-18777
TOTAL DEPTH: 1398 FT.
271 SAMPLES FROM 40 TO 1398 FT.

COUNTY - OKEECHOBEE
LOCATION: T.35S R.32E S.27 BC
LAT = 27D 24M 07S
LON = 81D 06M 51S

COMPLETION DATE: N/A
ELEVATION: 35 FT
OTHER TYPES OF LOGS AVAILABLE - NONE

OWNER/DRILLER:SFWMD

WORKED BY:DAVID WAGNER
ALSO KNOWN AS 565-C SFWMD FLORIDAN AQUIFER TEST WELL AT 565-C
OTHER WELL NAME IS OKF-105
ELEVATION OBTAINED FROM ARCGIS MAP WGS84 USING LAT/LON GIVEN
TOWNSHIP AND RANGE OBTAINED FROM ARCGIS MAP NAD83 USING LAT/LON GIVEN LOCATION ON GIS MAP APPEARS TO BE ALONG THE KISSIMEE RIVER JUST OFF CHANDLER RANCH RD. ON THE NORTH SIDE OF THE RIVER.
DEFINITE ARCADIA AT DEPTH 350'. TOP COULD BE HIGHER BUT IS DIFFICULT TO DETERMINE BECAUSE THERE IS MUCH HIGHER SAND CONTENT THAN CHARACTERISTICALLY PRESENT IN ARCADIA ABOVE THE 350'-355'. SAMPLE.
TOP OF AVON PARK CHOSEN AT 805 FT. BUT COULD BE HIGHER. MILLER PLACES TOP OF AVON PARK AT 600'-700' BELOW MSL. DICTYOCONUS FORAMS FOUN IN SAMPLE 725'-730', BUT 725'-730' CONSISTS MOSTLY OF LEPIDOCYCLINA AND NUMMULITES FROM 765'-805', SAMPLES SHOW LARGE DECREASE IN LEPIDOCYCLINA AND NUMMULITES, HOWEVER, THIS IS DIFFICULT TO TELL BECAUSE SAMPLES WERE POORLY PROCESSED.

0.	-	40.	000NOSM	NO SAMPLES
40.	-	350.	122PCRV	PEACE RIVER FM.
350.	-	485.	122ARCA	ARCADIA FM.
485.	-	805.	124OCAL	OCALA GROUP
805.	-	.	124AVPK	AVON PARK FM.

0	-	40	NO SAMPLES

40	-	45	SAND; LIGHT OLIVE GRAY TO YELLOWISH GRAY POROSITY: INTERGRANULAR GRAIN SIZE: FINE; RANGE: VERY FINE TO MEDIUM ROUNDNESS: ANGULAR TO SUB-ANGULAR; MEDIUM SPHERICITY UNCONSOLIDATED ACCESSORY MINERALS: CALCILUTITE-15%, SHELL-05% PHOSPHATIC SAND-03%, LIMESTONE-03% FOSSILS: MOLLUSKS, BARNACLES, ECHINOID GOOD PRESERVATION OF BARNICLES-COUPLE GRAVEL SIZED PHOSPHATES. ECHINOID FRAGMENTS FOUND INCLUDE ONLY SPINES. INDURATION RANGES FROM UNCONSOLIDATED TO POORLY CONSOLIDATED DUE TO THE COHESIVE CLAY CONTENT AND MICRITE MOSTLY UNCONSOLIDATED. ~1% SILT CONTENT. MOST PHOSPHATE GRAIN SIZES RANGE FROM VERY FINE TO FINE. ~2% CLAY CONTENT AND 1% ORGANICS. SOME SHELLS STILL RETAIN RED/NATURAL COLORS AND ARE NOT COMPLETLEY FOSSILIZED.
45	-	50	CALCILUTITE; YELLOWISH GRAY TO LIGHT OLIVE GRAY POROSITY: INTERGRANULAR MODERATE INDURATION

ACCESSORY MINERALS: QUARTZ SAND-15%, PHOSPHATIC SAND-03%
CLAY-02%, SHELL-05%
FOSSILS: MOLLUSKS, BARNACLES, ECHINOID
SAND CONTENT DESCRIBED AS FOLLOWS: SIZE MODE IS FINE, SIZE RANGES FROM VERY FINE TO MEDIUM, ROUNDESS RANGES FROM ANGULAR TO SUBANGULAR, SPERICITY IS MEDIUM. SHELLS AND FOSSILS APPEAR TO BE A COMPONENT OF THE SAND AND NOT OF THE LIMESTONE. GRAVEL PHOSPHATE PRESENT (~2% OF SAMPLEINTERVAL). LIMESTONE IS VARIABLY SANDY, RANGING FROM ~0-5% QUARTZ SAND. VERY FINE PHOSPHATES ARE PRESENT THROUGHOUT THE LIMESTONE. SOME SHELLS STILL RETAIN RED/NATURAL COLORS AND ARE NOT COMPLETLEY FOSSILIZED.

50 - 55 SHELL BED; YELLOWISH GRAY TO LIGHT OLIVE GRAY
POROSITY: INTERGRANULAR; UNCONSOLIDATED
ACCESSORY MINERALS: QUARTZ SAND-15%, PHOSPHATIC SAND-02%
CLAY-01%, CALCILUTITE-07%
FOSSILS: MOLLUSKS, BARNACLES, CORAL, ECHINOID
ON AVERAGE, SHELLS ARE WELL PRESERVED. ~10% OF SHELLS ARE RECRYSTALLIZED. ~3% OF SHELLS RETAIN ORIGINAL COLOR. SAND CONTENT DESCRIBED AS FOLLOWS: SIZE MODE IS FINE, SIZE RANGES FROM VERY FINE TO MEDIUM, ROUNDESS RANGES FROM ANGULAR TO SUBANGULAR, SPERICITY IS MEDIUM. CALCILUTITE COMPRISES 2% OF INTERVAL.

55 - 60 SAND; LIGHT OLIVE GRAY TO LIGHT OLIVE GRAY
POROSITY: INTERGRANULAR
GRAIN SIZE: FINE; RANGE: VERY FINE TO VERY COARSE
ROUNDNESS: ANGULAR TO SUB-ROUNDED; MEDIUM SPHERICITY
UNCONSOLIDATED
ACCESSORY MINERALS: CALCILUTITE-03%, SHELL-15%
PHOSPHATIC SAND-03%, CLAY-03%
FOSSILS: MOLLUSKS, BARNACLES, ECHINOID
A FEW SHELLS ARE PURE WHITE. TRACE CALCILUTITE CONTAINING ~1% SILT.

60 - 65 AS ABOVE
HIGHER CONTENT OF PURE WHITE SHELLS.

65 - 70 SAND; LIGHT OLIVE GRAY TO YELLOWISH GRAY
GRAIN SIZE: MEDIUM; RANGE: VERY FINE TO VERY COARSE
ROUNDNESS: ANGULAR TO SUB-ROUNDED; MEDIUM SPHERICITY
UNCONSOLIDATED
ACCESSORY MINERALS: ORGANICS-1O%, PHOSPHATIC SAND-03%
CLAY-05%, CALCILUTITE-02%
FOSSILS: MOLLUSKS, BARNACLES, ECHINOID
ECHINOIDS STIL ONLY PRESENT BY SPINES. DECREASING ECHINOID SPINE CONTENT MAY BE EXPLAINED BY CAVINGS INTO THIS DEPTH INTERVAL. COLOR IS VARIABLE. ~20% OF SHELLS ARE PURE WHITE AND ARE LOCALLY POORLY CONSOLIDATED FROM COHESIVE CLAY AND MICRITE.

70 - 75 AS ABOVE

75 - 80 SAND; LIGHT OLIVE GRAY TO YELLOWISH GRAY
POROSITY: INTERGRANULAR, MOLDIC
GRAIN SIZE: MEDIUM; RANGE: VERY FINE TO COARSE
ROUNDNESS: ANGULAR TO SUB-ROUNDED; MEDIUM SPHERICITY
POOR INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX, SPARRY CALCITE CEMENT

ACCESSORY MINERALS: SHELL-07%, PHOSPHATIC SAND-02%
CALCILUTITE-07%, CLAY-02%
OTHER FEATURES: CALCAREOUS
FOSSILS: MOLLUSKS, FOSSIL MOLDS
SHELLS LESS ABUNDANT AND NOT AS WELL PRESERVED AND MEDIAN
RECRYSTALLIZED SAMPLE CONTAINS ~1% SILT. GRAVEL SIZED
PHOSPHATES PRESENT.

80 - 85 SAND; LIGHT OLIVE GRAY TO YELLOWISH GRAY
POROSITY: INTERGRANULAR, MOLDIC
GRAIN SIZE: FINE; RANGE: VERY FINE TO COARSE
ROUNDNESS: ANGULAR TO SUB-ROUNDED; MEDIUM SPHERICITY
MODERATE INDURATION
CEMENT TYPE(S): CLAY MATRIX, CALCILUTITE MATRIX
SPARRY CALCITE CEMENT
ACCESSORY MINERALS: CLAY-15%, PHOSPHATIC SAND-02%
SHELL-03%, CALCILUTITE-05%
OTHER FEATURES: CALCAREOUS
FOSSILS: MOLLUSKS, BARNACLES, SHARKS TEETH, FOSSIL MOLDS
BENTHIC FORAMINIFERA
1% SILT CONTENT. ECHINOID SPINES PRESENT. THERE MAY BE SOME
CORALS.TRACE AMOUNTS OF GRAVEL SIZE, ROUNDED QUARTZ
GRAINS. THERE ARE PREDOMINANT LITHOLOGIES PRESENT.
ONE IS A POORLYY INDURATED/CONSOLOIDATED, SANDY,
SILTY, CALCAREOUS CLAY, AND THE SECOND IS A MEDIUM
INDURATED, CALCAREOUS SAND WITH LOW CLAY CONTENT.
A COUPLE GRAVEL SIZED PHOSPHATES ARE PRESENT.

85 - 90 CLAY; LIGHT OLIVE GRAY
POROSITY: INTERGRANULAR, LOW PERMEABILITY; POOR INDURATION
CEMENT TYPE(S): CLAY MATRIX, CALCILUTITE MATRIX
ACCESSORY MINERALS: PHOSPHATIC SAND-01%, SHELL-02%
CALCILUTITE-03%, QUARTZ SAND-30%
OTHER FEATURES: CALCAREOUS
FOSSILS: BARNACLES, MOLLUSKS, BENTHIC FORAMINIFERA
ECHINOID, CRUSTACEA
TRACE ORGANICS AND MICAS PRESENT. SAND CONTENT DESCRIBED
AS FOLLOWS: SIZE MODE IS VERY FINE, SIZE RANGES FROM VERY
FINE TO COARSE, ROUNDESS RANGES FROM ANGULAR TO SUBROUNDED
SPERICITY IS MEDIUM. SILT COMPRISES 1% OF SAMPLE. 2% OF
INTERVAL IS A MEDIUM INDURATED, CALCAREOUS SAND WITH
LOW CLAY CONTENT.

90 - 95 AS ABOVE
LOWER BARNACLE CONTENT.

95 - 100 CLAY; LIGHT OLIVE GRAY TO YELLOWISH GRAY
POROSITY: INTERGRANULAR, LOW PERMEABILITY; POOR INDURATION
CEMENT TYPE(S): CLAY MATRIX, CALCILUTITE MATRIX
ACCESSORY MINERALS: PHOSPHATIC SAND-01%, SHELL-03%
CALCILUTITE-03%, QUARTZ SAND-03%
OTHER FEATURES: CALCAREOUS
FOSSILS: MOLLUSKS, BARNACLES, FOSSIL MOLDS
BENTHIC FORAMINIFERA, ECHINOID
COLOR #86 IN INTERVAL DESCRIPTION IS FOUND ONLY IN SHELLS.
SAND CONTENT IS DESCRIBED AS FOLLOWS: SIZE MODE IS FINE
SIZE RANGES FROM VERY FINE TO COARSE, ROUNDNESS RANGES FROM
ANGULAR TO SUBROUNDED, SPERICITY IS MEDIUM. 3% OF INTERVAL
IS COMPRISED OF FRAGMENTS OF A CALCAREOUS SAND STONE

DESCRIBED AS FOLLOWS: SIZE MODE IS MEDIUM, SIZE RANGES FROM VERY FINE TO COARSE, ROUNDNESS RANGES FROM ANGULAR TO SUBROUNDED SPERICITY IS MEDIUM (APPEARS TO BE SAME SAND STONE AS DESCRIBED AS THE PRIMARY LITHOLOGY FOR THE 80' INTERVAL). 1% OF INTERVAL IS COMPRISED OF SILT. TRACE MICAS PRESENT.

100 - 105 CLAY; LIGHT OLIVE GRAY TO YELLOWISH GRAY
POROSITY: INTERGRANULAR, LOW PERMEABILITY; POOR INDURATION
CEMENT TYPE(S): CLAY MATRIX, CALCILUTITE MATRIX
ACCESSORY MINERALS: PHOSPHATIC SAND-01%, ORGANICS-02%
CALCILUTITE-03%, QUARTZ SAND-30%
OTHER FEATURES: CALCAREOUS
FOSSILS: MOLLUSKS, BARNACLES, BENTHIC FORAMINIFERA
ECHINOID
COLOR #86 IN INTERVAL DESCRIPTION IS FOUND ONLY IN SHELLS. 1% SILT CONTENT FOR INTERVAL. 1-2% OF INTERVAL IS COMPRISED OF FRAGMENTS OF A CALCAREOUS SAND STONE DESCRIBED AS FOLLOWS: SIZE MODE IS MEDIUM, SIZE RANGES FROM VERY FINE TO COARSE, ROUNDNESS RANGES FROM ANGULAR TO SUBROUNDED SPERICITY IS MEDIUM (APPEARS TO BE SAME SAND STONE AS DESCRIBED AS THE PRIMARY LITHOLOGY FOR THE 80' INTERVAL). SAND CONTENT IS DESCRIBED AS FOLLOWS: SIZE MODE IS FINE SIZE RANGES FROM VERY FINE TO COARSE, ROUNDNESS RANGES FROM ANGULAR TO SUBROUNDED, SPERICITY IS MEDIUM.

105 - 110 SAND; LIGHT OLIVE GRAY TO YELLOWISH GRAY
POROSITY: INTERGRANULAR
GRAIN SIZE: FINE; RANGE: VERY FINE TO VERY COARSE
ROUNDNESS: ANGULAR TO SUB-ROUNDED; MEDIUM SPHERICITY
UNCONSOLIDATED
ACCESSORY MINERALS: SHELL-30%, PHOSPHATIC SAND-02%
CALCILUTITE-02%, CLAY-01%
OTHER FEATURES: CALCAREOUS
FOSSILS: MOLLUSKS, BARNACLES, ECHINOID
BENTHIC FORAMINIFERA
1% SILT CONTENT FOR INTERVAL. IN THE CEMENTED SANDS, THERE IS A MOLDIC POROSITY FROM WEATHERED SHELLS. THE INDURATION IS POOR WITH SPARRY CALCITE AND MICRITE MATRIX.

110 - 115 SAND; LIGHT OLIVE GRAY TO YELLOWISH GRAY
POROSITY: INTERGRANULAR
GRAIN SIZE: FINE; RANGE: VERY FINE TO VERY COARSE
ROUNDNESS: ANGULAR TO SUB-ROUNDED; MEDIUM SPHERICITY
UNCONSOLIDATED
ACCESSORY MINERALS: SHELL-25%, PHOSPHATIC SAND-02%
CALCILUTITE-02%, CLAY-02%
OTHER FEATURES: CALCAREOUS
FOSSILS: MOLLUSKS, BARNACLES, ECHINOID
BENTHIC FORAMINIFERA
1% SILT CONTENT FOR INTERVAL. THE CEMENTED SANDS/SANDY LIMESTONE HAS MOLDIC POROSITY FROM WEATHERED SHELLS. THESE FRAGMENTS MAY BE SAME LITHOLOGY, HOWEVER, IS POORLY CEMENTED AND CONTAINS SPARRY CALCITE AND MICRITE. ALTHOUGH THE MODAL GRAINSIZE IN THE CEMENTED SANDS ARE LARGER WHICH COULD INDICATE DIFFERENT LITHOLOGIES.

115 - 120 SAND; LIGHT OLIVE GRAY TO YELLOWISH GRAY
POROSITY: INTERGRANULAR

GRAIN SIZE: FINE; RANGE: VERY FINE TO VERY COARSE
ROUNDNESS: ANGULAR TO SUB-ROUNDED; MEDIUM SPHERICITY
ACCESSORY MINERALS: SHELL-20%, PHOSPHATIC SAND-03%
CALCILUTITE-02%, CLAY-02%
OTHER FEATURES: CALCAREOUS
FOSSILS: MOLLUSKS, BARNACLES, ECHINOID
BENTHIC FORAMINIFERA
1% SILT CONTENT FOR INTERVAL. HIGHER PHOSPHATE CONTENT IN THE CEMENTED SANDS AND SANDY LIMESTONE. POSSIBLE GRADATIONAL PEACE RIVER CONTACT. HIGH CONTENT OF MICRITE AND MOLDIC SECONDARY POROSITY IS BECOMING MORE PRONOUNCED AND REPRESENTS ~20% OF SAMPLE INTERVAL. SAND AND SHELLS AND CALCILUTITE COULD BE FROM CAVINGS. 1% GRAVEL AND GRANULE SIZE PHOSPHATE CONTENT.

120 - 125 AS ABOVE

125 - 130 SAND; LIGHT OLIVE GRAY TO YELLOWISH GRAY
POROSITY: INTERGRANULAR
GRAIN SIZE: FINE; RANGE: VERY FINE TO VERY COARSE
ROUNDNESS: ANGULAR TO SUB-ROUNDED; MEDIUM SPHERICITY
UNCONSOLIDATED
ACCESSORY MINERALS: ORGANICS-15%, PHOSPHATIC SAND-03%
CALCILUTITE-02%, CLAY-03%
OTHER FEATURES: CALCAREOUS
FOSSILS: MOLLUSKS, BARNACLES, ECHINOID
BENTHIC FORAMINIFERA, PLANKTONIC FORAMINIFERA
SILT 1% GRANULE AND GRAVEL SIZE PHOSPHATE CONTENT. THE CEMENTED SANDS CONTENT HAS INCREASED TO ~30%.

130 - 135 AS ABOVE

135 - 140 SAND; LIGHT OLIVE GRAY TO YELLOWISH GRAY
POROSITY: INTERGRANULAR, MOLDIC; MODERATE INDURATION
CEMENT TYPE(S): SPARRY CALCITE CEMENT
ACCESSORY MINERALS: SHELL-10%, PHOSPHATIC SAND-03%
CALCILUTITE-03%, CLAY-03%
OTHER FEATURES: CALCAREOUS
FOSSILS: MOLLUSKS, BARNACLES, ECHINOID
BENTHIC FORAMINIFERA, PLANKTONIC FORAMINIFERA
INDURATION IS MOSTLY POOR BUT RANGES FROM POOR TO MODERATE. SOME SILT PRESENT. 1% GRAVEL AND GRANULE SIZE PHOSPHATE CONTENT. CARBONATE CEMENTED SANDS HAVE BECOME DOMINANT LITHOLOGY. LOOSE SANDS ARE ANGULAR AND MODAL SIZE IS FINE. SOME CAST FOSSILS PRESENT REPRESENTING LESS THAN 1% OF INTERVAL.

140 - 145 SAND; LIGHT OLIVE GRAY TO VERY LIGHT GRAY
POROSITY: INTERGRANULAR, MOLDIC
GRAIN SIZE: COARSE; RANGE: MEDIUM TO VERY COARSE
ROUNDNESS: ANGULAR TO SUB-ROUNDED; MEDIUM SPHERICITY
POOR INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX, SPARRY CALCITE CEMENT
ACCESSORY MINERALS: SHELL-10%, CLAY-05%
PHOSPHATIC SAND-05%, CALCILUTITE-03%
OTHER FEATURES: CALCAREOUS
FOSSILS: MOLLUSKS, BARNACLES
DECREASING MODAL GRAIN SIZE FOR LOOSE SANDS (POSSIBLY CAVINGS) AND WEATHERED AND CRUSHED CEMENTED SAND HAS A

SMALLER MODAL GRAIN SIZE. LESS THAN 1% GRANUAL AND GRAVEL PHOSPHATE CONTENT.

145 - 150 SAND; LIGHT OLIVE GRAY TO VERY LIGHT GRAY
POROSITY: INTERGRANULAR, MOLDIC; POOR INDURATION
CEMENT TYPE(S): SPARRY CALCITE CEMENT, CALCILUTITE MATRIX
ACCESSORY MINERALS: SHELL-15%, CLAY-03%
PHOSPHATIC SAND-05%, CALCILUTITE-03%
OTHER FEATURES: CALCAREOUS
FOSSILS: MOLLUSKS, BARNACLES
LITHOLOGY VARIES RANGING FROM QUARTZ AND PHOSPHATE SAND CEMENTED WITH CARBONATE MATRIX TO A WEATHERED AND RECRYSTALIZED, SANDY COQUINA IN SOME FRAGMENTS. QUARTZ SAND STILL APPEARS TO BE THE DOMINANT COMPOSITION. LOOSE SAND HAS SMALLER MODAL GRAIN SIZE, SOME OF WHICH IS PROBABLY CAVINGS. SILTY AND VERY FINE SANDY CLAY NODULES WITH SIMULARITY TO COMPONENTS OF LAST 15-20'. 1-2% WEATHERED CALCITE CONTENT. 1% GRAVEL PHOSPHATE CONTENT.

150 - 155 SHELL BED; LIGHT OLIVE GRAY TO YELLOWISH GRAY
POROSITY: INTERGRANULAR, MOLDIC; POOR INDURATION
CEMENT TYPE(S): SPARRY CALCITE CEMENT, CALCILUTITE MATRIX
ACCESSORY MINERALS: PHOSPHATIC SAND-05%, CLAY-01%
QUARTZ SAND-30%
FOSSILS: BARNACLES, MOLLUSKS
DECREASING SAND CONTENT. MAIN LITHOLOGY APPEARS TO BE A SANDY WEATHERED COQUINA. SAMPLE IS WELL COMPACTED. SOME FRAGMENTS ARE PURE SAND WITH CALCAREOUS CEMENT. 1% GRAVEL/GRANULE PHOSPHATE CONTENT.

155 - 160 GRAINSTONE; LIGHT OLIVE GRAY TO YELLOWISH GRAY
POROSITY: INTERGRANULAR, MOLDIC
GRAIN TYPE: SKELETAL, CRYSTALS, CALCILUTITE
90% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: VERY COARSE; RANGE: COARSE TO GRAVEL
MODERATE INDURATION
CEMENT TYPE(S): SPARRY CALCITE CEMENT, CALCILUTITE MATRIX
ACCESSORY MINERALS: PHOSPHATIC SAND-03%, SHELL-40%
CLAY-03%, QUARTZ SAND-25%
OTHER FEATURES: HIGH RECRYSTALLIZATION
FOSSILS: MOLLUSKS, ECHINOID, BARNACLES, FOSSIL MOLDS
CORAL
VARIABLY SANDY, FRAGMENTS RANGING FROM NEARLY NO SAND TO COMPLETELY COMPRISED OF SAND. INDURATION VARIES ~50/50 POOR TO MODERATE. 1% CALCITE CONTENT. ~2% GRAVEL PHOSPHATE CONTENT. SAND CONTENT IS DESCRIBED AS FOLLOWS: IS COARSE SIZE RANGES FROM FINE TO COARSE, ROUNDNESS RANGES FROM SUBANGULAR TO SUBROUNDED, SPERICITY IS MEDIUM.

160 - 165 GRAINSTONE; LIGHT OLIVE GRAY TO YELLOWISH GRAY
POROSITY: INTERGRANULAR, MOLDIC
GRAIN TYPE: SKELETAL, CRYSTALS, CALCILUTITE
90% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: VERY COARSE; RANGE: COARSE TO GRAVEL
POOR INDURATION
CEMENT TYPE(S): SPARRY CALCITE CEMENT, CALCILUTITE MATRIX
ACCESSORY MINERALS: PHOSPHATIC SAND-03%, SHELL-40%
CLAY-02%, QUARTZ SAND-30%
OTHER FEATURES: HIGH RECRYSTALLIZATION

FOSSILS: MOLLUSKS, ECHINOID, BARNACLES, FOSSIL MOLDS
CORAL
VARIABLY SANDY. ~20-30% OF INTERVAL IS MODERATELY INDURATED BUT INDURATION RANGES FROM POOR TO MODERATE OVERALL. SAND CONTENT IS DESCRIBED AS FOLLOWS: SIZE MODE IS MEDIUM, SIZE RANGES FROM FINE TO COARSE, ROUNDNESS RANGES FROM SUBANGULAR TO SUBROUNDED, SPERICITY IS MEDIUM. 2% GRAVEL AND GRANULE PHOSPHATE CONTENT. 1% CALCITE CONTENT. SHARK'S TOOTH FOUND.

165 - 170 SAND; LIGHT OLIVE GRAY TO YELLOWISH GRAY
POROSITY: INTERGRANULAR, MOLDIC
GRAIN SIZE: MEDIUM; RANGE: VERY FINE TO VERY COARSE
ROUNDNESS: SUB-ANGULAR TO SUB-ROUNDED; MEDIUM SPHERICITY
UNCONSOLIDATED
ACCESSORY MINERALS: PHOSPHATIC SAND-03%, SHELL-30%
CLAY-02%, CALCILUTITE-05%
OTHER FEATURES: HIGH RECRYSTALLIZATION
FOSSILS: MOLLUSKS, BARNACLES, ECHINOID, FOSSIL MOLDS
SHELLS ARE MOSTLY HIGHLY RECRYSTALLIZED. 1% OR LESS GRAVEL PHOSPHATE CONTENT. THERE ARE THREE LITHOLOGIES PRESENT: THE SAND DESCRIBED ABOVE WHICH MAY WHICH MAY BE POORLY CEMENTED BY SPARRY CALCITE AND MUD; FRAGEMENTS OF THE GRAINSTONE DESCRIBED ABOVE; FRAGMENTS OF A WELL INDURATED, MEDIUM TO LIGHT GRAY, VERY FINE GRAINED DOLOMITE WHICH REPRESENTS ~2-3% OF SAMPLE INTERVAL. TRACE SILT PRESENT.

170 - 180 SAND; LIGHT OLIVE GRAY TO YELLOWISH GRAY
POROSITY: INTERGRANULAR, MOLDIC
GRAIN SIZE: FINE; RANGE: VERY FINE TO VERY COARSE
ROUNDNESS: ANGULAR TO SUB-ROUNDED; MEDIUM SPHERICITY
UNCONSOLIDATED
ACCESSORY MINERALS: CALCILUTITE-05%, CLAY-03%
PHOSPHATIC SAND-02%, SHELL-15%
OTHER FEATURES: CALCAREOUS
FOSSILS: MOLLUSKS, ECHINOID, FOSSIL MOLDS
BENTHIC FORAMINIFERA
1% GRAVEL PHOSPHATE CONTENT.

180 - 190 SAND; LIGHT OLIVE GRAY
POROSITY: INTERGRANULAR, MOLDIC
GRAIN SIZE: MEDIUM; RANGE: VERY FINE TO VERY COARSE
ROUNDNESS: ANGULAR TO SUB-ROUNDED; MEDIUM SPHERICITY
UNCONSOLIDATED
ACCESSORY MINERALS: SHELL-01%, PHOSPHATIC SAND-02%
FOSSILS: ECHINOID, BENTHIC FORAMINIFERA, FOSSIL FRAGMENTS
TRACE SILT AND MICA PRESENT.

190 - 195 AS ABOVE

195 - 200 AS ABOVE

200 - 205 SAND; LIGHT OLIVE GRAY
POROSITY: INTERGRANULAR, MOLDIC
GRAIN SIZE: MEDIUM; RANGE: VERY FINE TO VERY COARSE
ROUNDNESS: ANGULAR TO SUB-ANGULAR; MEDIUM SPHERICITY
UNCONSOLIDATED
ACCESSORY MINERALS: SHELL-01%, PHOSPHATIC SAND-02%
FOSSILS: ECHINOID, FOSSIL FRAGMENTS, BENTHIC FORAMINIFERA

OSTRACODS
TRACE SILT PRESENT.

205 - 210 SAND; LIGHT OLIVE GRAY
POROSITY: INTERGRANULAR, MOLDIC
GRAIN SIZE: MEDIUM; RANGE: VERY FINE TO VERY COARSE
ROUNDNESS: ANGULAR TO SUB-ANGULAR; MEDIUM SPHERICITY
UNCONSOLIDATED
ACCESSORY MINERALS: SHELL-01%, PHOSPHATIC SAND-02%
FOSSILS: ECHINOID, FOSSIL FRAGMENTS, BENTHIC FORAMINIFERA
TRACE SILT AND CLAY PRESENT.

210 - 215 AS ABOVE

215 - 220 SAND; LIGHT OLIVE GRAY
POROSITY: INTERGRANULAR, MOLDIC
GRAIN SIZE: MEDIUM; RANGE: VERY FINE TO VERY COARSE
ROUNDNESS: ANGULAR TO SUB-ROUNDED; MEDIUM SPHERICITY
UNCONSOLIDATED
ACCESSORY MINERALS: SHELL-02%, PHOSPHATIC SAND-02%
CLAY-01%
FOSSILS: ECHINOID, FOSSIL FRAGMENTS, BENTHIC FORAMINIFERA
FEW CAVINGS OF THE PREVIOUS LIMESTONE AND DOLOMITE.

220 - 225 SAND; LIGHT OLIVE GRAY
POROSITY: INTERGRANULAR, MOLDIC
GRAIN SIZE: MEDIUM; RANGE: VERY FINE TO VERY COARSE
ROUNDNESS: ANGULAR TO SUB-ANGULAR; MEDIUM SPHERICITY
UNCONSOLIDATED
ACCESSORY MINERALS: SHELL-03%, PHOSPHATIC SAND-02%
CLAY-01%
FOSSILS: ECHINOID, FOSSIL FRAGMENTS, BENTHIC FORAMINIFERA
MOLLUSKS, BARNACLES
TRACE SILT CONTENT.

225 - 230 AS ABOVE

230 - 235 SAND; LIGHT OLIVE GRAY
POROSITY: INTERGRANULAR, MOLDIC
GRAIN SIZE: MEDIUM; RANGE: VERY FINE TO VERY COARSE
ROUNDNESS: ANGULAR TO SUB-ANGULAR; MEDIUM SPHERICITY
UNCONSOLIDATED
ACCESSORY MINERALS: SHELL-03%, PHOSPHATIC SAND-02%
CLAY-01%
OTHER FEATURES: FOSSILIFEROUS
FOSSILS: ECHINOID, MOLLUSKS, BENTHIC FORAMINIFERA, CORAL
BARNACLES
HIGHER FOSSIL CONTENT.

235 - 240 SAND; LIGHT OLIVE GRAY
POROSITY: INTERGRANULAR, MOLDIC
GRAIN SIZE: MEDIUM; RANGE: VERY FINE TO VERY COARSE
ROUNDNESS: ANGULAR TO SUB-ANGULAR; MEDIUM SPHERICITY
UNCONSOLIDATED
ACCESSORY MINERALS: SHELL-02%, CLAY-01%
PHOSPHATIC SAND-02%
FOSSILS: ECHINOID, FOSSIL FRAGMENTS, BENTHIC FORAMINIFERA
TRACE SILT AND MICA CONTENT. FOSSIL CONTENT DECREASED
FROM LAST INTERVAL.

240 - 245 AS ABOVE

245 - 250 AS ABOVE

250 - 255 SAND; LIGHT OLIVE GRAY TO MODERATE LIGHT GRAY
POROSITY: INTERGRANULAR, MOLDIC
GRAIN SIZE: MEDIUM; RANGE: VERY FINE TO VERY COARSE
ROUNDNESS: ANGULAR TO SUB-ROUNDED; MEDIUM SPHERICITY
UNCONSOLIDATED
ACCESSORY MINERALS: SHELL-02%, CLAY-01%
PHOSPHATIC SAND-03%
OTHER FEATURES: FOSSILIFEROUS
FOSSILS: ECHINOID, BARNACLES, BENTHIC FORAMINIFERA
FOSSIL FRAGMENTS
INCREASED FOSSIL CONTENT. TRACE SILT PRESENT

255 - 260 SAND; LIGHT OLIVE GRAY
POROSITY: INTERGRANULAR, MOLDIC
GRAIN SIZE: MEDIUM; RANGE: VERY FINE TO VERY COARSE
ROUNDNESS: ANGULAR TO SUB-ROUNDED; MEDIUM SPHERICITY
UNCONSOLIDATED
ACCESSORY MINERALS: SHELL-03%, CLAY-01%
PHOSPHATIC SAND-03%
OTHER FEATURES: FOSSILIFEROUS
FOSSILS: ECHINOID, BARNACLES, BENTHIC FORAMINIFERA
FOSSIL FRAGMENTS
TRACE SILT AND CALCITE PRESENT. THERE IS A
MICROCRYSTALLINE CALCITE COATING ON SOME OF THE QUARTZ
SAND GRAINS.

260 - 265 SAND; LIGHT OLIVE GRAY
POROSITY: INTERGRANULAR, MOLDIC
GRAIN SIZE: MEDIUM; RANGE: VERY FINE TO VERY COARSE
ROUNDNESS: ANGULAR TO SUB-ROUNDED; MEDIUM SPHERICITY
UNCONSOLIDATED
ACCESSORY MINERALS: SHELL-02%, CLAY-01%
PHOSPHATIC SAND-03%
FOSSILS: ECHINOID, BARNACLES, FOSSIL FRAGMENTS
BENTHIC FORAMINIFERA
TRACE SILT AND CALCITE PRESENT. THERE IS A MICROCRYSTALLINE
CALCITE COATING ON SOME OF THE QUARTZ SAND GRAINS.

265 - 270 SAND; LIGHT OLIVE GRAY TO DARK GRAY
POROSITY: INTERGRANULAR, MOLDIC
GRAIN SIZE: FINE; RANGE: VERY FINE TO VERY COARSE
ROUNDNESS: ANGULAR TO SUB-ROUNDED; MEDIUM SPHERICITY
UNCONSOLIDATED
ACCESSORY MINERALS: SHELL-03%, PHOSPHATIC SAND-15%
FOSSILS: ECHINOID, BARNACLES, MOLLUSKS
BENTHIC FORAMINIFERA, OSTRACODS
TRACE SILT AND CLAY PRESENT. SHARK'S TOOTH FOUND.
PHOSPHATE GRAIN SIZE RANGES FROM VERY FINE TO VERY COARSE
BUT THE VAST MAJORITY IS IN THE FINE TO MEDIUM RANGE.

270 - 275 AS ABOVE

275 - 280 AS ABOVE

280 - 285 SAND; LIGHT OLIVE GRAY TO DARK GRAY
POROSITY: INTERGRANULAR, MOLDIC
GRAIN SIZE: FINE; RANGE: VERY FINE TO VERY COARSE
ROUNDNESS: ANGULAR TO SUB-ROUNDED; MEDIUM SPHERICITY
UNCONSOLIDATED
ACCESSORY MINERALS: SHELL-05%, PHOSPHATIC SAND-15%
OTHER FEATURES: FOSSILIFEROUS
FOSSILS: ECHINOID, BENTHIC FORAMINIFERA, BARNACLES
SHARKS TEETH
TRACE SILT, CALCITE, CLAY, AND DOLOMITE.

285 - 290 SAND; LIGHT OLIVE GRAY TO DARK GRAY
POROSITY: INTERGRANULAR, MOLDIC
GRAIN SIZE: FINE; RANGE: VERY FINE TO VERY COARSE
ROUNDNESS: ANGULAR TO SUB-ROUNDED; MEDIUM SPHERICITY
UNCONSOLIDATED
ACCESSORY MINERALS: SHELL-03%, PHOSPHATIC SAND-15%
FOSSILS: ECHINOID, BENTHIC FORAMINIFERA, SHARKS TEETH
BARNACLES, OSTRACODS
TRACE SILT AND CLAY CONTENT. PHOSPHATE MODAL GRAIN SIZE
IS MEDIUM, BUT RANGES FROM VERY FINE TO VERY COARSE.

290 - 295 AS ABOVE

295 - 300 SAND; LIGHT OLIVE GRAY TO DARK GRAY
POROSITY: INTERGRANULAR, MOLDIC
GRAIN SIZE: FINE; RANGE: VERY FINE TO VERY COARSE
ROUNDNESS: ANGULAR TO SUB-ROUNDED; MEDIUM SPHERICITY
UNCONSOLIDATED
ACCESSORY MINERALS: SHELL-02%, PHOSPHATIC SAND-15%
FOSSILS: ECHINOID, BENTHIC FORAMINIFERA, SHARKS TEETH
BARNACLES, OSTRACODS
TRACE SILT AND CLAY PRESENT. PHOSPHATE MODAL GRAIN
SIZE IS MEDIUM.

300 - 305 AS ABOVE

305 - 310 AS ABOVE

310 - 315 SAND; LIGHT OLIVE GRAY TO DARK GRAY
POROSITY: INTERGRANULAR, MOLDIC
GRAIN SIZE: FINE; RANGE: VERY FINE TO VERY COARSE
ROUNDNESS: ANGULAR TO SUB-ROUNDED; MEDIUM SPHERICITY
UNCONSOLIDATED
ACCESSORY MINERALS: SHELL-03%, PHOSPHATIC SAND-15%
FOSSILS: ECHINOID, BENTHIC FORAMINIFERA, OSTRACODS
BARNACLES, FOSSIL FRAGMENTS
TRACE SILT AND GRAVEL SIZE PHOSPHATE. PHOSPHATE MODAL
SIZE IS MEDIUM.

315 - 320 AS ABOVE

320 - 325 SAND; LIGHT OLIVE GRAY TO DARK GRAY
POROSITY: INTERGRANULAR, MOLDIC
GRAIN SIZE: FINE; RANGE: VERY FINE TO VERY COARSE
ROUNDNESS: ANGULAR TO SUB-ROUNDED; MEDIUM SPHERICITY
UNCONSOLIDATED
ACCESSORY MINERALS: SHELL-02%, PHOSPHATIC SAND-20%
DOLOMITE-01%

OTHER FEATURES: FOSSILIFEROUS
FOSSILS: FOSSIL FRAGMENTS, ECHINOID, SHARKS TEETH
TRACE SILT CONTENT. PHOSPHATE MODAL GRAIN SIZE IS MEDIUM.

325 - 330 SAND; LIGHT OLIVE GRAY TO DARK GRAY
POROSITY: INTERGRANULAR, MOLDIC
GRAIN SIZE: FINE; RANGE: VERY FINE TO VERY COARSE
ROUNDNESS: ANGULAR TO SUB-ROUNDED; MEDIUM SPHERICITY
UNCONSOLIDATED
ACCESSORY MINERALS: SHELL-03%, PHOSPHATIC SAND-20%
DOLOMITE-01%
FOSSILS: MOLLUSKS, ECHINOID, SHARKS TEETH, BARNACLES
BENTHIC FORAMINIFERA
TRACE SILT CONTENT. PHOSPHATE MODAL GRAIN SIZE IS MEDIUM.

330 - 335 AS ABOVE

335 - 340 AS ABOVE
SMALL OSTRACODS PRESENT.

340 - 345 AS ABOVE
PLANKTIC FORAM PRESENT.

345 - 350 AS ABOVE
NO PLANKTIC FORAMS OR OSTRACODS SEEN IN THE INTERVAL.

350 - 355 SILT-SIZE DOLOMITE; YELLOWISH GRAY TO LIGHT OLIVE GRAY
POROSITY: INTERGRANULAR, MOLDIC; MODERATE INDURATION
CEMENT TYPE(S): DOLOMITE CEMENT, CLAY MATRIX
ACCESSORY MINERALS: CLAY-07%, PHOSPHATIC SAND-10%
SILT-01%, PHOSPHATIC GRAVEL-01%
OTHER FEATURES: SUCROSIC, MUDDY
FOSSILS: FOSSIL MOLDS, FOSSIL FRAGMENTS

355 - 360 AS ABOVE

360 - 365 SILT-SIZE DOLOMITE; YELLOWISH GRAY TO WHITE
POROSITY: INTERGRANULAR, MOLDIC; POOR INDURATION
CEMENT TYPE(S): CLAY MATRIX, CALCILUTITE MATRIX
DOLOMITE CEMENT
ACCESSORY MINERALS: PHOSPHATIC SAND-07%, CLAY-10%
LIMESTONE-03%, CALCILUTITE-05%
OTHER FEATURES: SUCROSIC, MUDDY
FOSSILS: BARNACLES, FOSSIL FRAGMENTS, FOSSIL MOLDS
ECHINOID
1% SILT AND PHOSPHATE GRAVEL CONTENT.

365 - 370 DOLOSTONE; YELLOWISH GRAY
POROSITY: INTERGRANULAR, INTERCRYSTALLINE, MOLDIC
10-50% ALTERED; SUBHEDRAL
GRAIN SIZE: MICROCRYSTALLINE
RANGE: MICROCRYSTALLINE TO VERY FINE; GOOD INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX, DOLOMITE CEMENT
CLAY MATRIX
ACCESSORY MINERALS: CLAY-03%, PHOSPHATIC SAND-07%
QUARTZ SAND-02%, CALCILUTITE-20%
OTHER FEATURES: VARIEGATED
FOSSILS: ECHINOID, CORAL, FOSSIL MOLDS
ALTERATION RANGES FROM LOW TO HIGH. PERCENTAGES OF

ALTERATION ARE DIFFICULT TO ESTIMATE BECAUSE OF MICRITE AND DOLOSILT COATING THE SAMPLE. CRYSTALLINITY RANGES FROM ANHEDRAL TO EUHEDRAL IN THE MORE HIGHLY ALTERED DOLOMITES.

370 - 375 DOLOSTONE; LIGHT OLIVE GRAY TO YELLOWISH GRAY
POROSITY: INTERCRYSTALLINE, MOLDIC, INTERGRANULAR
10-50% ALTERED; SUBHEDRAL
GRAIN SIZE: MICROCRYSTALLINE
RANGE: MICROCRYSTALLINE TO VERY FINE; GOOD INDURATION
CEMENT TYPE(S): DOLOMITE CEMENT, CALCILUTITE MATRIX
ACCESSORY MINERALS: PHOSPHATIC SAND-03%, CLAY-02%
QUARTZ SAND-02%, CALCILUTITE-15%
OTHER FEATURES: MUDDY
FOSSILS: FOSSIL MOLDS, FOSSIL FRAGMENTS
INDURATION RANGES FROM MEDIUM TO GOOD WITH ~10% OF SAMPLE SHOWING MEDIUM INDURATION. TRACE CALCITE CONTENT. ALTERATION RANGES FROM MEDIUM TO HIGH. CRYSTALLINITY RANGES FROM ANHEDRAL TO EUHEDRAL. ONE FOSSIL FRAGMENT FOUND APPEARING TO BE OF A VERTEBRATE. 1% GRAVEL PHOSPHATE AND DOLOSILT CONTENT.

375 - 380 AS ABOVE

380 - 385 DOLOSTONE; LIGHT OLIVE GRAY TO YELLOWISH GRAY
POROSITY: INTERCRYSTALLINE, MOLDIC, INTERGRANULAR
10-50% ALTERED; SUBHEDRAL
GRAIN SIZE: MICROCRYSTALLINE
RANGE: MICROCRYSTALLINE TO VERY FINE; GOOD INDURATION
CEMENT TYPE(S): DOLOMITE CEMENT, CALCILUTITE MATRIX
ACCESSORY MINERALS: PHOSPHATIC SAND-03%
PHOSPHATIC GRAVEL-02%, CALCILUTITE-15%, LIMESTONE-05%
OTHER FEATURES: MUDDY
FOSSILS: FOSSIL MOLDS, FOSSIL FRAGMENTS
ALTERATION VARIES FROM MEDIUM IN DOLOMITIC LIMESTONE TO HIGH ALTERATION. CRYSTALLINITY VARIES FROM ANHEDRAL TO EUHEDRAL IN THE MORE HIGHLY ALTERED DOLOMITE. 2% CLAY CONTENT. 1-2% QUARTZ SAND CONTENT.

385 - 390 AS ABOVE

390 - 395 DOLOSTONE; YELLOWISH GRAY TO LIGHT OLIVE GRAY
POROSITY: INTERGRANULAR, INTERCRYSTALLINE, MOLDIC
10-50% ALTERED; ANHEDRAL
GRAIN SIZE: MICROCRYSTALLINE
RANGE: MICROCRYSTALLINE TO VERY FINE; MODERATE INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX, DOLOMITE CEMENT
ACCESSORY MINERALS: PHOSPHATIC SAND-02%
PHOSPHATIC GRAVEL-01%, LIMESTONE-20%, QUARTZ SAND-01%
OTHER FEATURES: VARIEGATED
FOSSILS: FOSSIL MOLDS, FOSSIL FRAGMENTS
2% CLAY CONTENT. LIMESTONE PRESENT HAS GRAIN TYPE RANGING FROM MICROCRYSTALLINE TO GRAVEL AND CONTAINING 15% SILT CONTENT. MODAL GRAINSIZE IN LIMESTONE IS MICROCRYSTALLINE AND RANGES FROM MICROCRYSTALLINE TO GRAVEL SIZE. DOLOMITIC MUDSTONE AND WACKESTONE ALSO PRESENT. ALTERATION AND CRYSTALLINITY VARIES FROM MOSTLY LOW AND ANHEDRAL TO HIGH AND EUHEDRAL.

395 - 400 DOLOSTONE; LIGHT OLIVE GRAY
POROSITY: INTERCRYSTALLINE, INTERGRANULAR, MOLDIC
50-90% ALTERED; SUBHEDRAL
GRAIN SIZE: MICROCRYSTALLINE
RANGE: MICROCRYSTALLINE TO VERY FINE; GOOD INDURATION
CEMENT TYPE(S): DOLOMITE CEMENT, CALCILUTITE MATRIX
ACCESSORY MINERALS: PHOSPHATIC SAND-03%
PHOSPHATIC GRAVEL-01%, LIMESTONE-03%, QUARTZ SAND-02%
FOSSILS: FOSSIL MOLDS
1% DOLOSILT CONTENT.

400 - 405 WACKESTONE; YELLOWISH GRAY
POROSITY: INTERGRANULAR
GRAIN TYPE: SKELETAL, CALCILUTITE
50% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: MEDIUM; RANGE: VERY FINE TO GRANULE
POOR INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX, CLAY MATRIX
ACCESSORY MINERALS: PHOSPHATIC SAND-01%, QUARTZ SAND-02%
CLAY-05%
OTHER FEATURES: CHALKY
FOSSILS: BENTHIC FORAMINIFERA, FOSSIL FRAGMENTS, ECHINOID
TRACE SILT AND DOLOSILT PRESENT. LEPIDOCYLINA AND
POSSIBLY SOME PLANKTONIC FORAMS PRESENT. ECHINOID SPINES
PRESENT. FOSSILS ARE NOT WELL PRESERVED. PHOSPHATE IS
MOSTLY FINE BUT SIZE RANGES FROM SILT TO FINE.

405 - 410 AS ABOVE

410 - 415 PACKSTONE; YELLOWISH GRAY
POROSITY: INTERGRANULAR
GRAIN TYPE: SKELETAL, CALCILUTITE
75% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: MEDIUM; RANGE: VERY FINE TO GRANULE
POOR INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX, CLAY MATRIX
ACCESSORY MINERALS: PHOSPHATIC SAND-01%, QUARTZ SAND-02%
CLAY-05%
OTHER FEATURES: CHALKY
FOSSILS: BENTHIC FORAMINIFERA, FOSSIL FRAGMENTS, ECHINOID
CORAL
LEPIDOCYCLINA PRESENT. PHOPHATE GRAIN SIZE IS GENERALLY
FINE TO VERY FINE.

415 - 420 AS ABOVE

420 - 425 PACKSTONE; YELLOWISH GRAY
POROSITY: INTERGRANULAR
GRAIN TYPE: SKELETAL, CALCILUTITE
75% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: MEDIUM; RANGE: VERY FINE TO GRANULE
POOR INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX, CLAY MATRIX
ACCESSORY MINERALS: PHOSPHATIC SAND-01%, QUARTZ SAND-02%
CLAY-05%
OTHER FEATURES: CHALKY
FOSSILS: BENTHIC FORAMINIFERA, ECHINOID, CORAL
FOSSIL FRAGMENTS
LEPIDOCYCLINA PRESENT. TRACE DOLOSILT CONTENT.

425 - 430 AS ABOVE

430 - 435 PACKSTONE; YELLOWISH GRAY
POROSITY: INTERGRANULAR
GRAIN TYPE: SKELETAL, CALCILUTITE
75% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: MEDIUM; RANGE: VERY FINE TO GRANULE
POOR INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX, CLAY MATRIX
ACCESSORY MINERALS: PHOSPHATIC SAND-01%, QUARTZ SAND-02%
CLAY-05%
OTHER FEATURES: CHALKY
FOSSILS: BENTHIC FORAMINIFERA, ECHINOID, MOLLUSKS
FOSSIL FRAGMENTS, OSTRACODS
LEPIDOCYCLINA PRESENT. TRACE DOLOSILT CONTENT.

435 - 440 AS ABOVE

440 - 445 AS ABOVE

445 - 450 PACKSTONE; YELLOWISH GRAY
POROSITY: INTERGRANULAR
GRAIN TYPE: SKELETAL, CALCILUTITE
75% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: MEDIUM; RANGE: VERY FINE TO GRANULE
POOR INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX, CLAY MATRIX
ACCESSORY MINERALS: PHOSPHATIC SAND-01%, QUARTZ SAND-03%
CLAY-05%
OTHER FEATURES: CHALKY
FOSSILS: BENTHIC FORAMINIFERA, ECHINOID, FOSSIL FRAGMENTS
LEPIDOCYCLINA PRESENT. TRACE DOLOSILT CONTENT. QUARTZ
SAND AND PHOSPHATE MAY BE CAVINGS AND CEMENTED DURING
OVEN DRYING.

450 - 455 AS ABOVE

455 - 460 PACKSTONE; YELLOWISH GRAY
POROSITY: INTERGRANULAR
GRAIN TYPE: SKELETAL, CALCILUTITE
75% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: FINE; RANGE: VERY FINE TO GRANULE
POOR INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX, CLAY MATRIX
ACCESSORY MINERALS: PHOSPHATIC SAND-01%, QUARTZ SAND-05%
CLAY-05%
OTHER FEATURES: CHALKY
FOSSILS: BENTHIC FORAMINIFERA, CORAL, MOLLUSKS
FOSSIL FRAGMENTS, ECHINOID
LEPIDOCYCLINA AND NUMMULITIES PRESENT. TRACE DOLOSILT
CONTENT.

460 - 465 AS ABOVE

465 - 470 PACKSTONE; YELLOWISH GRAY
POROSITY: INTERGRANULAR
GRAIN TYPE: SKELETAL, CALCILUTITE
75% ALLOCHEMICAL CONSTITUENTS

GRAIN SIZE: FINE; RANGE: VERY FINE TO GRANULE
POOR INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX, CLAY MATRIX
ACCESSORY MINERALS: PHOSPHATIC SAND-01%, QUARTZ SAND-05%
CLAY-05%
OTHER FEATURES: CHALKY
FOSSILS: BENTHIC FORAMINIFERA, ECHINOID, FOSSIL FRAGMENTS
OSTRACODS, CORAL
TRACE DOLOSILT CONTENT. LEPIDOCYCLINA AND NUMMULITIES
PRESENT.

470 - 475 AS ABOVE

475 - 480 AS ABOVE

480 - 485 PACKSTONE; YELLOWISH GRAY
POROSITY: INTERGRANULAR
GRAIN TYPE: SKELETAL, CALCILUTITE
75% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: FINE; RANGE: VERY FINE TO GRANULE
POOR INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX, CLAY MATRIX
ACCESSORY MINERALS: PHOSPHATIC SAND-01%, QUARTZ SAND-05%
CLAY-05%
OTHER FEATURES: CHALKY
FOSSILS: BENTHIC FORAMINIFERA, ECHINOID, MOLLUSKS, CORAL
LEPIDOCYCLINA AND NUMMULITIES PRESENT. TRACE DOLOSILT
CONTENT.

485 - 490 PACKSTONE; YELLOWISH GRAY
POROSITY: INTERGRANULAR
GRAIN TYPE: SKELETAL, CALCILUTITE
85% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: GRAVEL; RANGE: COARSE TO GRAVEL
POOR INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX, CLAY MATRIX
ACCESSORY MINERALS: CLAY-03%, ORGANICS-01%
OTHER FEATURES: MEDIUM RECRYSTALLIZATION
FOSSILS: BENTHIC FORAMINIFERA, MOLLUSKS, CRUSTACEA, CORAL
LEPIDOCYCLINA AND NUMMULITIES PRESENT. TRACE QUARTZ SAND
CONTENT. DOLOMITE CONTENT REPRESENTING 203% OF SAMPLE
INTERVAL, APPEARS TO BE ARCADIA CAVINGS.

490 - 495 PACKSTONE; YELLOWISH GRAY
POROSITY: INTERGRANULAR
GRAIN TYPE: SKELETAL, CALCILUTITE
85% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: GRAVEL; RANGE: COARSE TO GRAVEL
POOR INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX, CLAY MATRIX
ACCESSORY MINERALS: CLAY-O3%, SHELL-01%
OTHER FEATURES: MEDIUM RECRYSTALLIZATION
FOSSILS: BENTHIC FORAMINIFERA, MOLLUSKS, CORAL
NO DOLOMITE IN INTERVAL. TRACE SAND, SILT, AND DOLOSILT
CONTENT.

495 - 500 AS ABOVE

500 - 505 PACKSTONE; YELLOWISH GRAY

POROSITY: INTERGRANULAR
GRAIN TYPE: SKELETAL, CALCILUTITE
85% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: GRAVEL; RANGE: COARSE TO GRAVEL
POOR INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX, CLAY MATRIX
ACCESSORY MINERALS: CLAY-03%, SHELL-01%
OTHER FEATURES: MEDIUM RECRYSTALLIZATION
FOSSILS: BENTHIC FORAMINIFERA, MOLLUSKS, ECHINOID
2% ARCADIA CAVINGS .

505 - 510 PACKSTONE; YELLOWISH GRAY
POROSITY: INTERGRANULAR
GRAIN TYPE: SKELETAL, CALCILUTITE
85% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: GRAVEL; RANGE: COARSE TO GRAVEL
POOR INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX, CLAY MATRIX
ACCESSORY MINERALS: CLAY-03%, SHELL-01%
OTHER FEATURES: MEDIUM RECRYSTALLIZATION
FOSSILS: BENTHIC FORAMINIFERA, MOLLUSKS, CORAL
1-2% DOLOMITE ARCADIA CAVINGS.

510 - 515 AS ABOVE

515 - 520 AS ABOVE

520 - 525 AS ABOVE
TRACE SAND SIZE PHOSPHATE CONTENT.

525 - 530 PACKSTONE; YELLOWISH GRAY
POROSITY: INTERGRANULAR
GRAIN TYPE: SKELETAL, CALCILUTITE
85% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: GRAVEL; RANGE: COARSE TO GRAVEL
POOR INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX, CLAY MATRIX
ACCESSORY MINERALS: SHELL-01%, CLAY-03%
OTHER FEATURES: MEDIUM RECRYSTALLIZATION
FOSSILS: BENTHIC FORAMINIFERA, MOLLUSKS
PROBABLE CAVINGS OF TRACE SAND SIZED PHOSPHATES AND SILT.
1% ARCADIA CAVINGS CONTENT.

530 - 535 PACKSTONE; YELLOWISH GRAY
POROSITY: INTERGRANULAR
GRAIN TYPE: SKELETAL, CALCILUTITE
85% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: GRAVEL; RANGE: COARSE TO GRAVEL
POOR INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX, CLAY MATRIX
ACCESSORY MINERALS: SHELL-01%, CLAY-03%
OTHER FEATURES: MEDIUM RECRYSTALLIZATION
FOSSILS: BENTHIC FORAMINIFERA, MOLLUSKS, CORAL
TRACE DOLOSILT CONTENT.

535 - 540 AS ABOVE

540 - 545 PACKSTONE; YELLOWISH GRAY
POROSITY: INTERGRANULAR

GRAIN TYPE: SKELETAL, CALCILUTITE
85% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: GRAVEL; RANGE: COARSE TO GRAVEL
POOR INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX, CLAY MATRIX
ACCESSORY MINERALS: SHELL-01%, CLAY-03%
OTHER FEATURES: MEDIUM RECRYSTALLIZATION
FOSSILS: BENTHIC FORAMINIFERA, MOLLUSKS, BRYOZOA, CORAL
TRACE DOLOSILT.

545 - 550 PACKSTONE; YELLOWISH GRAY
POROSITY: INTERGRANULAR
GRAIN TYPE: SKELETAL, CALCILUTITE
85% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: GRAVEL; RANGE: COARSE TO GRAVEL
POOR INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX, CLAY MATRIX
ACCESSORY MINERALS: SHELL-01%, CLAY-03%
OTHER FEATURES: MEDIUM RECRYSTALLIZATION
FOSSILS: BENTHIC FORAMINIFERA, MOLLUSKS, CORAL
TRACE DOLOSILT.

550 - 555 AS ABOVE

555 - 560 PACKSTONE; YELLOWISH GRAY
POROSITY: INTERGRANULAR
GRAIN TYPE: SKELETAL, CALCILUTITE
85% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: GRAVEL; RANGE: COARSE TO GRAVEL
POOR INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX, CLAY MATRIX
ACCESSORY MINERALS: SHELL-01%, CLAY-03%
OTHER FEATURES: MEDIUM RECRYSTALLIZATION
FOSSILS: BENTHIC FORAMINIFERA, MOLLUSKS
SOME ARCADIA CAVING PRESENT. TRACE DOLOSILT.

560 - 565 AS ABOVE

565 - 570 GRAINSTONE; YELLOWISH GRAY
POROSITY: INTERGRANULAR
GRAIN TYPE: SKELETAL, CALCILUTITE
93% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: GRAVEL; RANGE: COARSE TO GRAVEL
POOR INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX, CLAY MATRIX
ACCESSORY MINERALS: CLAY-03%, CALCILUTITE-05%
OTHER FEATURES: MEDIUM RECRYSTALLIZATION
FOSSILS: BENTHIC FORAMINIFERA, CORAL
SLIGHT COLOR CHANGE IN FOSSILS, BECOMING LIGHTER AND MORE
WHITE.

570 - 575 GRAINSTONE; YELLOWISH GRAY
POROSITY: INTERGRANULAR
GRAIN TYPE: SKELETAL, CALCILUTITE
93% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: GRAVEL; RANGE: COARSE TO GRAVEL
POOR INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX, CLAY MATRIX
ACCESSORY MINERALS: CLAY-03%, CALCILUTITE-05%

OTHER FEATURES: MEDIUM RECRYSTALLIZATION
FOSSILS: BENTHIC FORAMINIFERA, ECHINOID, BRYOZOA

575 - 580 GRAINSTONE; YELLOWISH GRAY
POROSITY: INTERGRANULAR
GRAIN TYPE: SKELETAL, CALCILUTITE
GRAIN SIZE: GRAVEL; RANGE: COARSE TO GRAVEL
POOR INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX, CLAY MATRIX
ACCESSORY MINERALS: CLAY-01%
OTHER FEATURES: MEDIUM RECRYSTALLIZATION
FOSSILS: BENTHIC FORAMINIFERA

580 - 585 GRAINSTONE; YELLOWISH GRAY
POROSITY: INTERGRANULAR
GRAIN TYPE: SKELETAL, CALCILUTITE
93% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: GRAVEL; RANGE: COARSE TO GRAVEL
POOR INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX, CLAY MATRIX
ACCESSORY MINERALS: CLAY-02%
OTHER FEATURES: MEDIUM RECRYSTALLIZATION
FOSSILS: BENTHIC FORAMINIFERA, CORAL

585 - 590 AS ABOVE

590 - 595 GRAINSTONE; YELLOWISH GRAY
POROSITY: INTERGRANULAR
GRAIN TYPE: SKELETAL, CALCILUTITE
95% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: GRAVEL; RANGE: COARSE TO GRAVEL
POOR INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX, CLAY MATRIX
ACCESSORY MINERALS: CLAY-02%
OTHER FEATURES: HIGH RECRYSTALLIZATION
FOSSILS: BENTHIC FORAMINIFERA, MOLLUSKS, CORAL

595 - 600 AS ABOVE

600 - 605 GRAINSTONE; YELLOWISH GRAY
POROSITY: INTERGRANULAR
GRAIN TYPE: SKELETAL, CALCILUTITE
90% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: GRAVEL; RANGE: COARSE TO GRAVEL
POOR INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX, CLAY MATRIX
ACCESSORY MINERALS: CLAY-03%
OTHER FEATURES: HIGH RECRYSTALLIZATION
FOSSILS: BENTHIC FORAMINIFERA, CORAL

605 - 610 PACKSTONE; YELLOWISH GRAY
POROSITY: INTERGRANULAR
GRAIN TYPE: SKELETAL, CALCILUTITE
90% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: GRAVEL; RANGE: COARSE TO GRAVEL
POOR INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX, CLAY MATRIX
ACCESSORY MINERALS: CLAY-03%
OTHER FEATURES: HIGH RECRYSTALLIZATION

FOSSILS: BENTHIC FORAMINIFERA, MOLLUSKS, ECHINOID, CORAL

610 - 615 PACKSTONE; YELLOWISH GRAY
POROSITY: INTERGRANULAR
GRAIN TYPE: SKELETAL, CALCILUTITE
85% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: GRAVEL; RANGE: COARSE TO GRAVEL
POOR INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX, CLAY MATRIX
ACCESSORY MINERALS: CLAY-05%
OTHER FEATURES: HIGH RECRYSTALLIZATION
FOSSILS: BENTHIC FORAMINIFERA, MOLLUSKS, CORAL

615 - 620 PACKSTONE; YELLOWISH GRAY
POROSITY: INTERGRANULAR
GRAIN TYPE: SKELETAL, CALCILUTITE
80% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: GRAVEL; RANGE: COARSE TO GRAVEL
POOR INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX, CLAY MATRIX
ACCESSORY MINERALS: CLAY-03%
OTHER FEATURES: HIGH RECRYSTALLIZATION
FOSSILS: BENTHIC FORAMINIFERA, CORAL

620 - 625 PACKSTONE; YELLOWISH GRAY
POROSITY: INTERGRANULAR
GRAIN TYPE: SKELETAL, CALCILUTITE
85% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: GRAVEL; RANGE: COARSE TO GRAVEL
POOR INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX, CLAY MATRIX
ACCESSORY MINERALS: CLAY-03%
OTHER FEATURES: HIGH RECRYSTALLIZATION
FOSSILS: BENTHIC FORAMINIFERA, CORAL

625 - 630 GRAINSTONE; YELLOWISH GRAY
POROSITY: INTERGRANULAR
GRAIN TYPE: SKELETAL, CALCILUTITE
90% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: GRAVEL; RANGE: COARSE TO GRAVEL
POOR INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX, CLAY MATRIX
ACCESSORY MINERALS: CLAY-03%
OTHER FEATURES: HIGH RECRYSTALLIZATION
FOSSILS: BENTHIC FORAMINIFERA, CORAL

630 - 635 GRAINSTONE; YELLOWISH GRAY
POROSITY: INTERGRANULAR
GRAIN TYPE: SKELETAL, CALCILUTITE
90% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: GRAVEL; RANGE: COARSE TO GRAVEL
POOR INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX, CLAY MATRIX
ACCESSORY MINERALS: CLAY-01%
OTHER FEATURES: HIGH RECRYSTALLIZATION
FOSSILS: BENTHIC FORAMINIFERA, CORAL

635 - 640 AS ABOVE

640 - 645 PACKSTONE; YELLOWISH GRAY
POROSITY: INTERGRANULAR
GRAIN TYPE: SKELETAL, CALCILUTITE
85% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: GRAVEL; RANGE: COARSE TO GRAVEL
POOR INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX, CLAY MATRIX
ACCESSORY MINERALS: CLAY-01%
OTHER FEATURES: HIGH RECRYSTALLIZATION
FOSSILS: BENTHIC FORAMINIFERA, MOLLUSKS, CORAL

645 - 650 PACKSTONE; YELLOWISH GRAY
POROSITY: INTERGRANULAR
GRAIN TYPE: SKELETAL, CALCILUTITE
85% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: GRAVEL; RANGE: COARSE TO GRAVEL
POOR INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX, CLAY MATRIX
ACCESSORY MINERALS: CLAY-01%
OTHER FEATURES: HIGH RECRYSTALLIZATION
FOSSILS: BENTHIC FORAMINIFERA, CORAL, ECHINOID

650 - 655 PACKSTONE; YELLOWISH GRAY
POROSITY: INTERGRANULAR
GRAIN TYPE: SKELETAL, CALCILUTITE
85% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: GRAVEL; RANGE: COARSE TO GRAVEL
POOR INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX, CLAY MATRIX
ACCESSORY MINERALS: CLAY-02%
OTHER FEATURES: HIGH RECRYSTALLIZATION
FOSSILS: BENTHIC FORAMINIFERA

655 - 660 PACKSTONE; YELLOWISH GRAY
POROSITY: INTERGRANULAR
GRAIN TYPE: SKELETAL, CALCILUTITE
85% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: GRAVEL; RANGE: COARSE TO GRAVEL
POOR INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX, CLAY MATRIX
ACCESSORY MINERALS: CLAY-02%
OTHER FEATURES: HIGH RECRYSTALLIZATION
FOSSILS: BENTHIC FORAMINIFERA

660 - 665 PACKSTONE; YELLOWISH GRAY
POROSITY: INTERGRANULAR
GRAIN TYPE: SKELETAL, CALCILUTITE
80% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: GRAVEL; RANGE: COARSE TO GRAVEL
POOR INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX, CLAY MATRIX
ACCESSORY MINERALS: CLAY-02%
OTHER FEATURES: HIGH RECRYSTALLIZATION
FOSSILS: BENTHIC FORAMINIFERA

665 - 670 GRAINSTONE; YELLOWISH GRAY
POROSITY: INTERGRANULAR
GRAIN TYPE: SKELETAL, CALCILUTITE
90% ALLOCHEMICAL CONSTITUENTS

GRAIN SIZE: GRAVEL; RANGE: FINE TO GRAVEL; POOR INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX, CLAY MATRIX
ACCESSORY MINERALS: CLAY-02%
OTHER FEATURES: HIGH RECRYSTALLIZATION
FOSSILS: BENTHIC FORAMINIFERA

670 - 675 GRAINSTONE; YELLOWISH GRAY
POROSITY: INTERGRANULAR
GRAIN TYPE: SKELETAL, CALCILUTITE
90% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: GRAVEL; RANGE: COARSE TO GRAVEL
POOR INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX, CLAY MATRIX
ACCESSORY MINERALS: CLAY-01%
OTHER FEATURES: HIGH RECRYSTALLIZATION
FOSSILS: BENTHIC FORAMINIFERA, BRYOZOA

675 - 680 GRAINSTONE; YELLOWISH GRAY
POROSITY: INTERGRANULAR
GRAIN TYPE: SKELETAL, CALCILUTITE
90% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: GRAVEL; RANGE: MEDIUM TO GRAVEL
POOR INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX, CLAY MATRIX
ACCESSORY MINERALS: CLAY-01%
OTHER FEATURES: HIGH RECRYSTALLIZATION
FOSSILS: BENTHIC FORAMINIFERA

680 - 685 PACKSTONE; YELLOWISH GRAY
POROSITY: INTERGRANULAR
GRAIN TYPE: SKELETAL, CALCILUTITE
87% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: GRAVEL; RANGE: COARSE TO GRAVEL
POOR INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX, CLAY MATRIX
ACCESSORY MINERALS: CLAY-02%
OTHER FEATURES: HIGH RECRYSTALLIZATION
FOSSILS: BENTHIC FORAMINIFERA, CORAL

685 - 690 AS ABOVE

690 - 695 AS ABOVE

695 - 700 PACKSTONE; YELLOWISH GRAY
POROSITY: INTERGRANULAR
GRAIN TYPE: SKELETAL, CALCILUTITE
85% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: GRAVEL; RANGE: COARSE TO GRAVEL
POOR INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX, CLAY MATRIX
ACCESSORY MINERALS: CLAY-03%
OTHER FEATURES: HIGH RECRYSTALLIZATION
FOSSILS: BENTHIC FORAMINIFERA, CORAL

700 - 705 PACKSTONE; YELLOWISH GRAY
POROSITY: INTERGRANULAR
GRAIN TYPE: SKELETAL, CALCILUTITE
93% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: GRAVEL; RANGE: COARSE TO GRAVEL

POOR INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX, CLAY MATRIX
ACCESSORY MINERALS: CLAY-01%
OTHER FEATURES: HIGH RECRYSTALLIZATION
FOSSILS: BENTHIC FORAMINIFERA

705 - 710 GRAINSTONE; YELLOWISH GRAY
POROSITY: INTERGRANULAR
GRAIN TYPE: SKELETAL, CALCILUTITE
90% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: GRAVEL; RANGE: COARSE TO GRAVEL
POOR INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX, CLAY MATRIX
ACCESSORY MINERALS: CLAY-02%
OTHER FEATURES: HIGH RECRYSTALLIZATION
FOSSILS: BENTHIC FORAMINIFERA, ECHINOID

710 - 715 GRAINSTONE; YELLOWISH GRAY
POROSITY: INTERGRANULAR
GRAIN TYPE: SKELETAL, CALCILUTITE
93% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: GRAVEL; RANGE: COARSE TO GRAVEL
POOR INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX, CLAY MATRIX
ACCESSORY MINERALS: CLAY-01%
OTHER FEATURES: HIGH RECRYSTALLIZATION
FOSSILS: BENTHIC FORAMINIFERA, CORAL

715 - 720 AS ABOVE

720 - 725 WACKESTONE; YELLOWISH GRAY
POROSITY: INTERGRANULAR, PIN POINT VUGS
GRAIN TYPE: CALCILUTITE, SKELETAL
25% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: VERY COARSE; RANGE: MEDIUM TO GRAVEL
CEMENT TYPE(S): CALCILUTITE MATRIX, CLAY MATRIX
ACCESSORY MINERALS: CLAY-01%
OTHER FEATURES: HIGH RECRYSTALLIZATION, MUDDY, DOLOMITIC
FOSSILS: BENTHIC FORAMINIFERA, ECHINOID
INDURATION RANGES FROM POOR TO MODERATE. LESS THAN 1%
CALCITE CONTENT.

725 - 730 WACKESTONE; YELLOWISH GRAY
POROSITY: INTERGRANULAR, PIN POINT VUGS
GRAIN TYPE: CALCILUTITE, SKELETAL
20% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: VERY COARSE; RANGE: MEDIUM TO GRAVEL
POOR INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX, CLAY MATRIX
ACCESSORY MINERALS: CLAY-03%
OTHER FEATURES: MUDDY, DOLOMITIC
FOSSILS: BENTHIC FORAMINIFERA, FOSSIL MOLDS
DICTYOCONUS COOKEI PRESENT. SAMPLES DON'T LOOK LIKE THEY
WERE WELL WASHED. HIGHER CLAY CONTENT IN THIS SAMPLE;
SOME OF THE CLAY MAY BE DRILL MUD.

730 - 735 PACKSTONE; YELLOWISH GRAY TO VERY LIGHT ORANGE
POROSITY: INTERGRANULAR
GRAIN TYPE: SKELETAL, CALCILUTITE

60% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: GRAVEL; RANGE: MEDIUM TO GRAVEL
POOR INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX, CLAY MATRIX
ACCESSORY MINERALS: CLAY-05%
OTHER FEATURES: HIGH RECRYSTALLIZATION, MUDDY
FOSSILS: BENTHIC FORAMINIFERA, MOLLUSKS, BRYOZOA
SAMPLE LOOKS LIKE A MUDDY LEP BED FROM TABLE VIEW. SAMPLE IS MOSTLY A WACKESTONE CONTAINING 1-2% GRAINSTONE FRAGMENTS. SAMPLE APPEARS POORLY WASHED. FOSSILS ARE MAINLY LEPIDOCYCLINA AND NUMMULITIES.

735 - 740 PACKSTONE; YELLOWISH GRAY TO VERY LIGHT ORANGE
POROSITY: INTERGRANULAR
GRAIN TYPE: SKELETAL, CALCILUTITE
60% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: GRAVEL; RANGE: MEDIUM TO GRAVEL
POOR INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX, CLAY MATRIX
ACCESSORY MINERALS: CLAY-05%
OTHER FEATURES: HIGH RECRYSTALLIZATION, MUDDY
FOSSILS: BENTHIC FORAMINIFERA, MOLLUSKS, ECHINOID
POSSIBLE ECHINOID FRAGMENTS OF EUPATAGUS ANTILLARUM. DARKER CLAY MAY BE DRILL MUD. FOSSILS PRESENT ARE MAINLY LEPIDOCYCLINA AND NUMMULITIES.

740 - 745 PACKSTONE; YELLOWISH GRAY TO VERY LIGHT ORANGE
POROSITY: INTERGRANULAR
GRAIN TYPE: SKELETAL, CALCILUTITE
60% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: GRAVEL; RANGE: MEDIUM TO GRAVEL
POOR INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX, CLAY MATRIX
ACCESSORY MINERALS: CLAY-05%
OTHER FEATURES: MUDDY, HIGH RECRYSTALLIZATION
FOSSILS: BENTHIC FORAMINIFERA, MOLLUSKS, BRYOZOA
FOSSIL CONTENT IS MAINLY LEPIDOCYCLINA AND NUMMULITIES. SAMPLE IS POORLY WASHED.

745 - 750 AS ABOVE

750 - 755 PACKSTONE; YELLOWISH GRAY TO VERY LIGHT ORANGE
POROSITY: INTERGRANULAR
GRAIN TYPE: SKELETAL, CALCILUTITE
60% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: GRAVEL; RANGE: MEDIUM TO GRAVEL
POOR INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX, CLAY MATRIX
ACCESSORY MINERALS: CLAY-05%
OTHER FEATURES: MUDDY, HIGH RECRYSTALLIZATION
FOSSILS: BENTHIC FORAMINIFERA, ECHINOID, MOLLUSKS
ECHINOID FRAGMENTS, POSSIBLY OF NEOLAGANUM DALLI ARE PRESENT. SAMPLE IS POORLY WASHED.

755 - 760 AS ABOVE

760 - 765 WACKESTONE; YELLOWISH GRAY TO VERY LIGHT ORANGE
POROSITY: INTERGRANULAR, PIN POINT VUGS
GRAIN TYPE: CALCILUTITE, SKELETAL

20% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: GRAVEL; RANGE: MEDIUM TO GRAVEL
POOR INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX, CLAY MATRIX
ACCESSORY MINERALS: CLAY-05%
OTHER FEATURES: MUDDY, HIGH RECRYSTALLIZATION
FOSSILS: BENTHIC FORAMINIFERA, MOLLUSKS
DECREASED LEPIDACYCLINA AND NUMMULITIES CONTENT.
APPLICATION OF ALIZARIN RED MAY INDICATE TRACE DOLOSILT.
SAMPLE INTERVAL MAY BE DOLOMITIC. VUGS ARE COVERED BY MUD.
SAMPLE MAY NOT HAVE BEEN WASHED, OR IS POORLY WASHED.

765 - 770 AS ABOVE

770 - 775 PACKSTONE; YELLOWISH GRAY TO VERY LIGHT ORANGE
POROSITY: INTERGRANULAR, MOLDIC, PIN POINT VUGS
GRAIN TYPE: CALCILUTITE, SKELETAL
20% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: MEDIUM; RANGE: MEDIUM TO GRAVEL
POOR INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
ACCESSORY MINERALS: CLAY-05%
FOSSILS: BENTHIC FORAMINIFERA, ECHINOID, FOSSIL MOLDS
SAMPLE IS POORLY WASHED. FOSSIL PRESERVATION IS POOR, BUT
THERE MAY BE SOME PLANKTONIC FORAMS PRESENT. SOME CAVINGS
OF SAND AND PHOSPHATES.

775 - 780 WACKESTONE; YELLOWISH GRAY
POROSITY: INTERGRANULAR, PIN POINT VUGS, MOLDIC
GRAIN TYPE: CALCILUTITE, SKELETAL
15% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: MEDIUM; RANGE: FINE TO GRAVEL
CEMENT TYPE(S): CALCILUTITE MATRIX
ACCESSORY MINERALS: CLAY-01%
FOSSILS: BENTHIC FORAMINIFERA, ECHINOID
INDURATION IS POOR TO MODERATE. FOSSIL PRESERVATION IS
POOR, BUT SOME FOSSILS RESEMBLE PLANKTONIC FORAMS.
PRESENCE OF LEPIDACYCLINA AND NUMMULITIES MAY BE FROM
CAVINGS OUT OF OCALA.

780 - 785 AS ABOVE

785 - 790 AS ABOVE

790 - 795 WACKESTONE; PINKISH GRAY
POROSITY: INTERGRANULAR, PIN POINT VUGS
GRAIN TYPE: CALCILUTITE, SKELETAL
25% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: MEDIUM; RANGE: FINE TO GRAVEL; POOR INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
ACCESSORY MINERALS: CLAY-02%
OTHER FEATURES: MUDDY
FOSSILS: BENTHIC FORAMINIFERA, ECHINOID
SAMPLE APPEARS TO BE POORLY WASHED. TRACE CALCITE CONTENT.

795 - 800 WACKESTONE; YELLOWISH GRAY TO LIGHT OLIVE GRAY
POROSITY: INTERGRANULAR, PIN POINT VUGS
GRAIN TYPE: CALCILUTITE, SKELETAL
30% ALLOCHEMICAL CONSTITUENTS

GRAIN SIZE: MEDIUM; RANGE: FINE TO GRAVEL; POOR INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
ACCESSORY MINERALS: CLAY-03%
OTHER FEATURES: MUDDY
FOSSILS: BENTHIC FORAMINIFERA, ECHINOID, FOSSIL MOLDS
CORAL
SAMPLE APPEARS TO BE POORLY WASHED. TRACE CALCITE CONTENT.

800 - 805 WACKESTONE; YELLOWISH GRAY
POROSITY: INTERGRANULAR, PIN POINT VUGS, MOLDIC
GRAIN TYPE: CALCILUTITE, SKELETAL
30% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: MEDIUM; RANGE: FINE TO GRAVEL; POOR INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
ACCESSORY MINERALS: CLAY-01%
FOSSILS: BENTHIC FORAMINIFERA, FOSSIL MOLDS, ECHINOID
OSTRACODS
TRACE CALCITE. 2% FINE GRAIN GRAINSTONE FRAGMENT CONTENT.

805 - 810 WACKESTONE; YELLOWISH GRAY
POROSITY: INTERGRANULAR, PIN POINT VUGS, MOLDIC
GRAIN TYPE: CALCILUTITE, SKELETAL
40% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: MEDIUM; RANGE: FINE TO GRAVEL; POOR INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
ACCESSORY MINERALS: CLAY-02%
OTHER FEATURES: MUDDY, MEDIUM RECRYSTALLIZATION
FOSSILS: BENTHIC FORAMINIFERA, ECHINOID
SPIROLINA PRESENT. DICTYOCONUS, POSSIBLY AMERICANUS IS
PRESENT. ECHINOIDS ARE HIGHLY RECRYSTALLIZED. TRACE CALCITE
CONTENT. 3-5% FINE GRAIN GRAINSTONE FRAGMENT CONTENT.

810 - 815 AS ABOVE

815 - 820 WACKESTONE; YELLOWISH GRAY
POROSITY: INTERGRANULAR, PIN POINT VUGS, MOLDIC
GRAIN TYPE: CALCILUTITE, SKELETAL
30% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: MEDIUM; RANGE: FINE TO GRAVEL; POOR INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
ACCESSORY MINERALS: CLAY-02%
OTHER FEATURES: MUDDY, MEDIUM RECRYSTALLIZATION
FOSSILS: ECHINOID, BENTHIC FORAMINIFERA, FOSSIL MOLDS
MOLLUSKS
ECHINOIDS ARE HIGHLY RECRYSTALLIZED. TRACE CALCITE CONTENT.
ALTHOUGH DIFFICULT TO ESTIMATE PERCENTAGE, ~2% FINE GRAIN
GRAINSTONE FRAGMENT CONTENT.

820 - 825 PACKSTONE; YELLOWISH GRAY
POROSITY: INTERGRANULAR, PIN POINT VUGS, MOLDIC
GRAIN TYPE: SKELETAL, CALCILUTITE, INTRACLASTS
75% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: MEDIUM; RANGE: FINE TO GRAVEL; POOR INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
ACCESSORY MINERALS: CLAY-02%
OTHER FEATURES: MUDDY, MEDIUM RECRYSTALLIZATION
FOSSILS: ECHINOID, BENTHIC FORAMINIFERA, FOSSIL MOLDS
MOLLUSKS
MAJORITY OF SAMPLE APPEARS TO BE A FINE GRAINED PACKSTONE

OR GRAINSTONE WITH MICRITE AND POSSILBY MUD COATING.

825 - 830 AS ABOVE

830 - 835 PACKSTONE; YELLOWISH GRAY
POROSITY: INTERGRANULAR, PIN POINT VUGS, MOLDIC
GRAIN TYPE: SKELETAL, CALCILUTITE, INTRACLASTS
80% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: MEDIUM; RANGE: FINE TO GRAVEL; POOR INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
ACCESSORY MINERALS: CLAY-01%
OTHER FEATURES: MEDIUM RECRYSTALLIZATION
FOSSILS: BENTHIC FORAMINIFERA, ECHINOID, MOLLUSKS
ECHINOIDS ARE HIGHLY RECRYSTALLIZED. THE DEGREE OF
RECRYSTALLIZATION IS CONSIDERABLY HIGH RELATIVE TO REST OF SAMPLE.

835 - 840 PACKSTONE; YELLOWISH GRAY
POROSITY: INTERGRANULAR, PIN POINT VUGS, MOLDIC
GRAIN TYPE: SKELETAL, CALCILUTITE, INTRACLASTS
75% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: MEDIUM; RANGE: FINE TO GRAVEL; POOR INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
ACCESSORY MINERALS: CLAY-02%
OTHER FEATURES: MUDDY, MEDIUM RECRYSTALLIZATION
FOSSILS: BENTHIC FORAMINIFERA, ECHINOID
SAMPLE APPEARS POORLY WASHED. ECHINOIDS ARE HIGHLY
RECRYSTALLIZED.

840 - 845 AS ABOVE

845 - 850 AS ABOVE

850 - 855 AS ABOVE

855 - 860 PACKSTONE; YELLOWISH GRAY
POROSITY: INTERGRANULAR, PIN POINT VUGS, MOLDIC
GRAIN TYPE: SKELETAL, CALCILUTITE, INTRACLASTS
85% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: MEDIUM; RANGE: FINE TO GRAVEL; POOR INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
ACCESSORY MINERALS: CLAY-01%
OTHER FEATURES: MUDDY, MEDIUM RECRYSTALLIZATION
FOSSILS: BENTHIC FORAMINIFERA, ECHINOID
ECHINOIDS ARE HIGHLY RECRYSTALLIZED.

860 - 865 PACKSTONE; YELLOWISH GRAY
POROSITY: INTERGRANULAR, PIN POINT VUGS, MOLDIC
GRAIN TYPE: SKELETAL, CALCILUTITE, INTRACLASTS
80% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: GRAVEL; RANGE: FINE TO GRAVEL; POOR INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
ACCESSORY MINERALS: CLAY-01%
OTHER FEATURES: MUDDY, MEDIUM RECRYSTALLIZATION
FOSSILS: BENTHIC FORAMINIFERA, ECHINOID, CORAL
FOSSIL MOLDS, ALGAE

865 - 870 PACKSTONE; YELLOWISH GRAY
POROSITY: INTERGRANULAR, PIN POINT VUGS
GRAIN TYPE: SKELETAL, CALCILUTITE, INTRACLASTS

80% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: GRAVEL; RANGE: FINE TO GRAVEL; POOR INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
ACCESSORY MINERALS: CLAY-01%
OTHER FEATURES: MUDDY, MEDIUM RECRYSTALLIZATION
FOSSILS: BENTHIC FORAMINIFERA, ECHINOID, CORAL

870 - 875 PACKSTONE; YELLOWISH GRAY
POROSITY: INTERGRANULAR, MOLDIC, PIN POINT VUGS
GRAIN TYPE: SKELETAL, CALCILUTITE, INTRACLASTS
80% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: GRAVEL; RANGE: FINE TO GRAVEL; POOR INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
ACCESSORY MINERALS: CLAY-02%
OTHER FEATURES: MUDDY, MEDIUM RECRYSTALLIZATION
FOSSILS: BENTHIC FORAMINIFERA, ECHINOID, CORAL

875 - 880 PACKSTONE; YELLOWISH GRAY
POROSITY: INTERGRANULAR, MOLDIC, PIN POINT VUGS
GRAIN TYPE: SKELETAL, CALCILUTITE, INTRACLASTS
85% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: GRAVEL; RANGE: FINE TO GRAVEL; POOR INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
ACCESSORY MINERALS: CLAY-02%
OTHER FEATURES: MUDDY, MEDIUM RECRYSTALLIZATION
FOSSILS: BENTHIC FORAMINIFERA, ECHINOID
NEOLAGANUM DALLI IS PRESENT. VARIABLE PACKSTONE AND
GRAINSTONE

880 - 885 AS ABOVE

885 - 890 AS ABOVE

890 - 895 PACKSTONE; YELLOWISH GRAY
POROSITY: INTERGRANULAR, PIN POINT VUGS, MOLDIC
GRAIN TYPE: SKELETAL, CALCILUTITE, INTRACLASTS
85% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: GRAVEL; RANGE: FINE TO GRAVEL; POOR INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
ACCESSORY MINERALS: CLAY-01%
OTHER FEATURES: MEDIUM RECRYSTALLIZATION
FOSSILS: BENTHIC FORAMINIFERA, ECHINOID
NEOLAGANUM DALLI PRESENT. TRACE DOLOMITE CONTENT. ECHINOIDS
ARE HIGHLY RECRYSTALLIZED. VARIABLE PACKSTONE AND
GRAINSTONE.

895 - 900 AS ABOVE

900 - 905 PACKSTONE; YELLOWISH GRAY
POROSITY: INTERGRANULAR, PIN POINT VUGS, MOLDIC
GRAIN TYPE: SKELETAL, CALCILUTITE, INTRACLASTS
75% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: GRAVEL; RANGE: FINE TO GRAVEL; POOR INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
ACCESSORY MINERALS: CLAY-02%
OTHER FEATURES: MUDDY, MEDIUM RECRYSTALLIZATION
FOSSILS: BENTHIC FORAMINIFERA, ECHINOID
ECHINOIDS ARE HIGHLY RECRYSTALLIZED.

905 - 910 PACKSTONE; YELLOWISH GRAY
POROSITY: INTERGRANULAR, MOLDIC, PIN POINT VUGS
GRAIN TYPE: SKELETAL, CALCILUTITE, INTRACLASTS
70% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: MEDIUM; RANGE: FINE TO GRAVEL; POOR INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
ACCESSORY MINERALS: CLAY-03%
OTHER FEATURES: MUDDY, MEDIUM RECRYSTALLIZATION
FOSSILS: BENTHIC FORAMINIFERA, ECHINOID
ECHINOIDS ARE HIGHLY RECRYSTALLIZED.

910 - 915 PACKSTONE; YELLOWISH GRAY
POROSITY: INTERGRANULAR, MOLDIC, PIN POINT VUGS
GRAIN TYPE: SKELETAL, CALCILUTITE, INTRACLASTS
80% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: MEDIUM; RANGE: FINE TO GRAVEL; POOR INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
ACCESSORY MINERALS: CLAY-02%
OTHER FEATURES: MUDDY, MEDIUM RECRYSTALLIZATION
FOSSILS: BENTHIC FORAMINIFERA, ECHINOID, FOSSIL MOLDS
ECHINOIDS ARE HIGHLY RECRYSTALLIZED.

915 - 920 PACKSTONE; YELLOWISH GRAY
POROSITY: INTERGRANULAR, MOLDIC, PIN POINT VUGS
GRAIN TYPE: SKELETAL, CALCILUTITE
85% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: FINE; RANGE: GRAVEL TO FINE; POOR INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
ACCESSORY MINERALS: CLAY-02%
OTHER FEATURES: MEDIUM RECRYSTALLIZATION, CHALKY
FOSSILS: BENTHIC FORAMINIFERA, ECHINOID, ALGAE
INCREASED ECHINOID CONTENT. ECHINOIDS ARE HIGHLY
RECRYSTALLIZED. NEOLAGANUM DALLI PRESENT.

920 - 925 PACKSTONE; YELLOWISH GRAY
POROSITY: INTERGRANULAR, PIN POINT VUGS, MOLDIC
GRAIN TYPE: SKELETAL, CALCILUTITE, INTRACLASTS
70% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: GRAVEL; RANGE: FINE TO GRAVEL
CEMENT TYPE(S): CALCILUTITE MATRIX
ACCESSORY MINERALS: CLAY-02%
OTHER FEATURES: MEDIUM RECRYSTALLIZATION, CHALKY
FOSSILS: BENTHIC FORAMINIFERA, ECHINOID
ECHINOIDS ARE HIGHLY RECRYSTALLIZED. INDURATION VARIES
BETWEEN POOR AND MODERATE.

925 - 930 PACKSTONE; YELLOWISH GRAY
POROSITY: INTERGRANULAR, MOLDIC
GRAIN TYPE: SKELETAL, CALCILUTITE, INTRACLASTS
65% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: MEDIUM; RANGE: FINE TO GRAVEL; POOR INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
ACCESSORY MINERALS: CLAY-02%
OTHER FEATURES: MUDDY, HIGH RECRYSTALLIZATION
FOSSILS: BENTHIC FORAMINIFERA, ECHINOID
INDURATION RANGES FROM POOR TO MODERATE. ECHINOIDS AND
ALL OTHER FOSSILS APPEAR HIGHLY RECRYSTALLIZED. PLANKTONIC
FORAMS MABY BE PRESENT.

930 - 935 PACKSTONE; YELLOWISH GRAY
POROSITY: INTERGRANULAR, PIN POINT VUGS, MOLDIC
GRAIN TYPE: SKELETAL, CALCILUTITE, INTRACLASTS
75% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: MEDIUM; RANGE: FINE TO GRAVEL; POOR INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
ACCESSORY MINERALS: CLAY-01%
OTHER FEATURES: CHALKY, HIGH RECRYSTALLIZATION
FOSSILS: BENTHIC FORAMINIFERA, ECHINOID
LEPIDOCYCLINA IS NOT SEEN IN SAMPLE.

935 - 940 AS ABOVE

940 - 945 AS ABOVE

945 - 950 PACKSTONE; YELLOWISH GRAY
POROSITY: INTERGRANULAR, PIN POINT VUGS, MOLDIC
GRAIN TYPE: SKELETAL, CALCILUTITE, INTRACLASTS
75% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: MEDIUM; RANGE: FINE TO GRAVEL; POOR INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
ACCESSORY MINERALS: CLAY-01%
OTHER FEATURES: CHALKY, HIGH RECRYSTALLIZATION
FOSSILS: BENTHIC FORAMINIFERA, ECHINOID
SAMPLE APPEARS TO BE A GRAINSTONE WITH A THICK MICRITE
COATING. A FEW GRAVEL SIZED MOLLUSK CASTS PRESENT. NO
SHELLS FOUND, ONLY CASTS.

950 - 955 PACKSTONE; YELLOWISH GRAY
POROSITY: INTERGRANULAR, PIN POINT VUGS, MOLDIC
GRAIN TYPE: SKELETAL, CALCILUTITE, INTRACLASTS
80% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: MEDIUM; RANGE: FINE TO GRAVEL; POOR INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
ACCESSORY MINERALS: CLAY-01%
OTHER FEATURES: CHALKY, HIGH RECRYSTALLIZATION
FOSSILS: BENTHIC FORAMINIFERA, ECHINOID, CORAL

955 - 960 PACKSTONE; YELLOWISH GRAY
POROSITY: INTERGRANULAR, PIN POINT VUGS, MOLDIC
GRAIN TYPE: SKELETAL, CALCILUTITE, INTRACLASTS
80% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: MEDIUM; RANGE: FINE TO GRAVEL; POOR INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
ACCESSORY MINERALS: CLAY-01%
OTHER FEATURES: CHALKY, HIGH RECRYSTALLIZATION
FOSSILS: BENTHIC FORAMINIFERA, ECHINOID

960 - 965 AS ABOVE

965 - 970 AS ABOVE

970 - 975 PACKSTONE; YELLOWISH GRAY
POROSITY: INTERGRANULAR, PIN POINT VUGS, MOLDIC
GRAIN TYPE: SKELETAL, CALCILUTITE, INTRACLASTS
75% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: MEDIUM; RANGE: FINE TO GRAVEL; POOR INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
ACCESSORY MINERALS: CLAY-03%

OTHER FEATURES: MUDDY, HIGH RECRYSTALLIZATION
FOSSILS: BENTHIC FORAMINIFERA

975 - 980 AS ABOVE

980 - 985 PACKSTONE; YELLOWISH GRAY
POROSITY: INTERGRANULAR, PIN POINT VUGS, MOLDIC
GRAIN TYPE: SKELETAL, CALCILUTITE, INTRACLASTS
80% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: MEDIUM; RANGE: FINE TO GRAVEL; POOR INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
ACCESSORY MINERALS: CLAY-02%
OTHER FEATURES: MUDDY, HIGH RECRYSTALLIZATION
FOSSILS: BENTHIC FORAMINIFERA

985 - 990 PACKSTONE; YELLOWISH GRAY
POROSITY: INTERGRANULAR, PIN POINT VUGS, MOLDIC
GRAIN TYPE: SKELETAL, CALCILUTITE, INTRACLASTS
70% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: MEDIUM; RANGE: FINE TO GRAVEL; POOR INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
ACCESSORY MINERALS: CLAY-02%
OTHER FEATURES: MUDDY, HIGH RECRYSTALLIZATION
FOSSILS: BENTHIC FORAMINIFERA, ECHINOID
INDURATION IS MOSTLY POOR BUT RANGES FROM POOR TO MODERATE.

990 - 995 WACKESTONE; YELLOWISH GRAY
POROSITY: INTERGRANULAR, PIN POINT VUGS, MOLDIC
GRAIN TYPE: SKELETAL, CALCILUTITE, CRYSTALS
40% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: MEDIUM; RANGE: FINE TO GRAVEL
CEMENT TYPE(S): CALCILUTITE MATRIX
ACCESSORY MINERALS: CLAY-02%
OTHER FEATURES: MUDDY, HIGH RECRYSTALLIZATION
FOSSILS: BENTHIC FORAMINIFERA, ECHINOID
INDURATION IS MOSTLY POOR BUT RANGES FROM POOR TO MODERATE.

995 - 1000 PACKSTONE; YELLOWISH GRAY
POROSITY: INTERGRANULAR, PIN POINT VUGS, MOLDIC
GRAIN TYPE: SKELETAL, CALCILUTITE, INTRACLASTS
60% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: MEDIUM; RANGE: FINE TO MEDIUM
CEMENT TYPE(S): CALCILUTITE MATRIX
ACCESSORY MINERALS: CLAY-02%
OTHER FEATURES: MUDDY, HIGH RECRYSTALLIZATION
FOSSILS: BENTHIC FORAMINIFERA
INDURATION RANGES FROM POOR TO MODERATE.

1000 - 1005 WACKESTONE; YELLOWISH GRAY
POROSITY: INTERGRANULAR, PIN POINT VUGS, MOLDIC
GRAIN TYPE: CALCILUTITE, INTRACLASTS, SKELETAL
40% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: MEDIUM; RANGE: FINE TO MEDIUM; POOR INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
ACCESSORY MINERALS: CLAY-03%
OTHER FEATURES: MUDDY, HIGH RECRYSTALLIZATION
FOSSILS: BENTHIC FORAMINIFERA

1005 - 1010 AS ABOVE

1010 - 1015 WACKESTONE; YELLOWISH GRAY
POROSITY: INTERGRANULAR, PIN POINT VUGS, MOLDIC
GRAIN TYPE: CALCILUTITE, SKELETAL, CRYSTALS
40% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: MEDIUM; RANGE: FINE TO MEDIUM
CEMENT TYPE(S): CALCILUTITE MATRIX
ACCESSORY MINERALS: CLAY-01%
OTHER FEATURES: MUDDY, HIGH RECRYSTALLIZATION
FOSSILS: BENTHIC FORAMINIFERA
INDURATION RANGES FROM POOR TO GOOD.

1015 - 1020 WACKESTONE; YELLOWISH GRAY
POROSITY: INTERGRANULAR, MOLDIC, PIN POINT VUGS
GRAIN TYPE: CALCILUTITE, SKELETAL, CRYSTALS
40% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: MEDIUM; RANGE: FINE TO GRAVEL
CEMENT TYPE(S): CALCILUTITE MATRIX
ACCESSORY MINERALS: CLAY-01%
OTHER FEATURES: MUDDY, HIGH RECRYSTALLIZATION
FOSSILS: BENTHIC FORAMINIFERA, MOLLUSKS
INDURATION VARIES FROM POOR TO MODERATE.

1020 - 1025 PACKSTONE; YELLOWISH GRAY
POROSITY: INTERGRANULAR, MOLDIC, PIN POINT VUGS
GRAIN TYPE: SKELETAL, CALCILUTITE, CRYSTALS
85% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: MEDIUM; RANGE: FINE TO GRAVEL; POOR INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
ACCESSORY MINERALS: CLAY-01%
OTHER FEATURES: CHALKY, HIGH RECRYSTALLIZATION
FOSSILS: BENTHIC FORAMINIFERA, ECHINOID

1025 - 1030 PACKSTONE; YELLOWISH GRAY
POROSITY: INTERGRANULAR, MOLDIC, PIN POINT VUGS
GRAIN TYPE: SKELETAL, CRYSTALS, CALCILUTITE
85% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: MEDIUM; RANGE: FINE TO MEDIUM
MODERATE INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
ACCESSORY MINERALS: CLAY-02%
OTHER FEATURES: CHALKY, HIGH RECRYSTALLIZATION, DOLOMITIC
FOSSILS: BENTHIC FORAMINIFERA

1030 - 1035 PACKSTONE; YELLOWISH GRAY
POROSITY: INTERGRANULAR, MOLDIC, PIN POINT VUGS
GRAIN TYPE: SKELETAL, CALCILUTITE, CRYSTALS
80% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: MEDIUM; RANGE: FINE TO GRAVEL; POOR INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
ACCESSORY MINERALS: CLAY-01%
OTHER FEATURES: MUDDY, HIGH RECRYSTALLIZATION
FOSSILS: BENTHIC FORAMINIFERA, ECHINOID

1035 - 1040 PACKSTONE; YELLOWISH GRAY
POROSITY: INTERGRANULAR, MOLDIC, PIN POINT VUGS
GRAIN TYPE: SKELETAL, CALCILUTITE, CRYSTALS
80% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: MEDIUM; RANGE: FINE TO GRAVEL

CEMENT TYPE(S): CALCILUTITE MATRIX
ACCESSORY MINERALS: CLAY-02%
OTHER FEATURES: CHALKY, HIGH RECRYSTALLIZATION
FOSSILS: BENTHIC FORAMINIFERA, ECHINOID
INDURATION RANGES FROM POOR TO GOOD. DICTYOCONUS IS PRESENT.

1040 - 1045 PACKSTONE; YELLOWISH GRAY
POROSITY: INTERGRANULAR, MOLDIC, PIN POINT VUGS
GRAIN TYPE: SKELETAL, CALCILUTITE, CRYSTALS
90% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: MEDIUM; RANGE: FINE TO GRAVEL
CEMENT TYPE(S): CALCILUTITE MATRIX
OTHER FEATURES: CHALKY, HIGH RECRYSTALLIZATION
FOSSILS: BENTHIC FORAMINIFERA, ECHINOID
INDURATION RANGES FROM POOR TO MEDIUM.

1045 - 1050 PACKSTONE; YELLOWISH GRAY
POROSITY: INTERGRANULAR, MOLDIC, PIN POINT VUGS
GRAIN TYPE: SKELETAL, CALCILUTITE, CRYSTALS
90% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: MEDIUM; RANGE: FINE TO GRAVEL
CEMENT TYPE(S): CALCILUTITE MATRIX
OTHER FEATURES: CHALKY, HIGH RECRYSTALLIZATION, DOLOMITIC
FOSSILS: BENTHIC FORAMINIFERA, ECHINOID
INDURATION VARIES FROM POOR TO GOOD IN DOLOMITIZED FRAGMENTS.

1050 - 1055 PACKSTONE; YELLOWISH GRAY
POROSITY: INTERGRANULAR, MOLDIC, PIN POINT VUGS
GRAIN TYPE: SKELETAL, CALCILUTITE, CRYSTALS
85% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: MEDIUM; RANGE: FINE TO GRAVEL
CEMENT TYPE(S): CALCILUTITE MATRIX
OTHER FEATURES: CHALKY, HIGH RECRYSTALLIZATION, DOLOMITIC
FOSSILS: BENTHIC FORAMINIFERA, ECHINOID
INDURATION VARIES FROM POOR TO GOOD. CONE FORAM PRESENT.

1055 - 1060 PACKSTONE; YELLOWISH GRAY
POROSITY: INTERGRANULAR, MOLDIC, PIN POINT VUGS
GRAIN TYPE: SKELETAL, CRYSTALS, CALCILUTITE
80% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: MEDIUM; RANGE: FINE TO GRAVEL
CEMENT TYPE(S): CALCILUTITE MATRIX
ACCESSORY MINERALS: CLAY-01%
OTHER FEATURES: CHALKY, HIGH RECRYSTALLIZATION
FOSSILS: BENTHIC FORAMINIFERA, ECHINOID
INDURATION VARIES FROM POOR TO GOOD.

1060 - 1065 PACKSTONE; YELLOWISH GRAY
POROSITY: INTERGRANULAR, MOLDIC, PIN POINT VUGS
GRAIN TYPE: SKELETAL, CRYSTALS, CALCILUTITE
75% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: MEDIUM; RANGE: FINE TO GRAVEL
CEMENT TYPE(S): CALCILUTITE MATRIX
ACCESSORY MINERALS: CLAY-01%
OTHER FEATURES: CHALKY, HIGH RECRYSTALLIZATION
FOSSILS: BENTHIC FORAMINIFERA, ECHINOID
DICTYOCONUS PRESENT, POSSIBLY AMERICANUS. INDURATION

VARIES FROM POOR TO GOOD.

1065 - 1070 PACKSTONE; YELLOWISH GRAY
POROSITY: INTERGRANULAR, MOLDIC, PIN POINT VUGS
GRAIN TYPE: SKELETAL, CRYSTALS, CALCILUTITE
80% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: MEDIUM; RANGE: FINE TO GRAVEL
CEMENT TYPE(S): CALCILUTITE MATRIX
ACCESSORY MINERALS: CLAY-01%, DOLOMITE-03%
OTHER FEATURES: CHALKY, HIGH RECRYSTALLIZATION
FOSSILS: BENTHIC FORAMINIFERA, ECHINOID
DICTYOCONUS PRESENT.

1070 - 1075 AS ABOVE

1075 - 1080 PACKSTONE; YELLOWISH GRAY
POROSITY: INTERGRANULAR, MOLDIC, PIN POINT VUGS
GRAIN TYPE: SKELETAL, CRYSTALS, CALCILUTITE
75% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: MEDIUM; RANGE: FINE TO GRAVEL
CEMENT TYPE(S): CALCILUTITE MATRIX
ACCESSORY MINERALS: CLAY-02%, DOLOMITE-01%
OTHER FEATURES: DOLOMITIC, CHALKY, HIGH RECRYSTALLIZATION
FOSSILS: BENTHIC FORAMINIFERA, ECHINOID
INDURATION RANGES FROM POOR TO GOOD.

1080 - 1085 PACKSTONE; YELLOWISH GRAY
POROSITY: INTERGRANULAR, PIN POINT VUGS
GRAIN TYPE: SKELETAL, CRYSTALS, CALCILUTITE
85% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: MEDIUM; RANGE: FINE TO GRAVEL
CEMENT TYPE(S): CALCILUTITE MATRIX
ACCESSORY MINERALS: CLAY-02%, DOLOMITE-01%
OTHER FEATURES: CHALKY, HIGH RECRYSTALLIZATION
FOSSILS: BENTHIC FORAMINIFERA
INDURATION RANGES FROM POOR TO MODERATE.

1085 - 1090 PACKSTONE; YELLOWISH GRAY
POROSITY: INTERGRANULAR, PIN POINT VUGS
GRAIN TYPE: SKELETAL, CRYSTALS, CALCILUTITE
85% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: MEDIUM; RANGE: FINE TO GRAVEL
CEMENT TYPE(S): CALCILUTITE MATRIX
ACCESSORY MINERALS: DOLOMITE-01%
OTHER FEATURES: CHALKY, HIGH RECRYSTALLIZATION
FOSSILS: BENTHIC FORAMINIFERA
DICTYOCONUS IS PRESENT. INDURATION RANGES FROM POOR TO MODERATE.

1090 - 1095 PACKSTONE; YELLOWISH GRAY
POROSITY: INTERGRANULAR, INTERCRYSTALLINE, PIN POINT VUGS
GRAIN TYPE: SKELETAL, CRYSTALS, CALCILUTITE
70% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: MEDIUM; RANGE: FINE TO GRAVEL
CEMENT TYPE(S): CALCILUTITE MATRIX
ACCESSORY MINERALS: DOLOMITE-02%
OTHER FEATURES: CHALKY, HIGH RECRYSTALLIZATION
FOSSILS: BENTHIC FORAMINIFERA
INDURATION RANGES FROM POOR TO MODERATE.

1095 - 1100 AS ABOVE

1100 - 1105 PACKSTONE; YELLOWISH GRAY
POROSITY: INTERGRANULAR, INTERCRYSTALLINE, PIN POINT VUGS
GRAIN TYPE: SKELETAL, CRYSTALS, CALCILUTITE
75% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: MEDIUM; RANGE: FINE TO GRAVEL
CEMENT TYPE(S): CALCILUTITE MATRIX
ACCESSORY MINERALS: DOLOMITE-02%, CLAY-01%
OTHER FEATURES: CHALKY, HIGH RECRYSTALLIZATION
FOSSILS: BENTHIC FORAMINIFERA
INDURATION RANGES FROM POOR TO GOOD.

1105 - 1110 AS ABOVE

1110 - 1115 PACKSTONE; YELLOWISH GRAY
POROSITY: INTERGRANULAR, INTERCRYSTALLINE
GRAIN TYPE: CALCILUTITE, SKELETAL, INTRACLASTS
70% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: MEDIUM; RANGE: FINE TO GRAVEL
CEMENT TYPE(S): CALCILUTITE MATRIX
ACCESSORY MINERALS: DOLOMITE-01%
OTHER FEATURES: MUDDY, MEDIUM RECRYSTALLIZATION
FOSSILS: BENTHIC FORAMINIFERA
INDURATION RANGES FROM POOR TO MODERATE. LIMESTONE
FRAGMENTS APPEAR TO BE COATED WITH MICRITE.

1115 - 1120 PACKSTONE; YELLOWISH GRAY
POROSITY: INTERGRANULAR, PIN POINT VUGS, MOLDIC
GRAIN TYPE: SKELETAL, CALCILUTITE, CRYSTALS
85% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: MEDIUM; RANGE: FINE TO GRAVEL
CEMENT TYPE(S): CALCILUTITE MATRIX
OTHER FEATURES: CHALKY, DOLOMITIC, GREASY
FOSSILS: BENTHIC FORAMINIFERA, ECHINOID

1120 - 1125 PACKSTONE; YELLOWISH GRAY
POROSITY: INTERGRANULAR, INTERCRYSTALLINE, MOLDIC
GRAIN TYPE: SKELETAL, CALCILUTITE, INTRACLASTS
75% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: MEDIUM; RANGE: FINE TO GRAVEL
CEMENT TYPE(S): CALCILUTITE MATRIX
ACCESSORY MINERALS: DOLOMITE-02%, CLAY-01%
OTHER FEATURES: MUDDY, HIGH RECRYSTALLIZATION
FOSSILS: BENTHIC FORAMINIFERA, MOLLUSKS
INDURATION RANGES FROM POOR TO GOOD.

1125 - 1130 AS ABOVE

1130 - 1135 PACKSTONE; YELLOWISH GRAY
POROSITY: INTERGRANULAR, INTERCRYSTALLINE, PIN POINT VUGS
GRAIN TYPE: SKELETAL, CALCILUTITE, CRYSTALS
85% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: MEDIUM; RANGE: FINE TO COARSE
MODERATE INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
ACCESSORY MINERALS: DOLOMITE-02%, CLAY-01%
OTHER FEATURES: CHALKY, HIGH RECRYSTALLIZATION, DOLOMITIC

FOSSILS: BENTHIC FORAMINIFERA

1135 - 1140 AS ABOVE

1140 - 1145 PACKSTONE; BROWNISH GRAY
POROSITY: INTERGRANULAR, INTERCRYSTALLINE, PIN POINT VUGS
GRAIN TYPE: SKELETAL, CALCILUTITE, INTRACLASTS
80% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: MEDIUM; RANGE: FINE TO COARSE
CEMENT TYPE(S): CALCILUTITE MATRIX
ACCESSORY MINERALS: DOLOMITE-01%, CLAY-01%
OTHER FEATURES: CHALKY, HIGH RECRYSTALLIZATION
FOSSILS: BENTHIC FORAMINIFERA
INDURATION RANGES FROM POOR TO MODERATE.

1145 - 1150 PACKSTONE; YELLOWISH GRAY
POROSITY: INTERGRANULAR, INTERCRYSTALLINE, PIN POINT VUGS
GRAIN TYPE: SKELETAL, CALCILUTITE, CRYSTALS
80% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: MEDIUM; RANGE: FINE TO COARSE
CEMENT TYPE(S): CALCILUTITE MATRIX
ACCESSORY MINERALS: CLAY-02%, DOLOMITE-02%
OTHER FEATURES: CHALKY, HIGH RECRYSTALLIZATION, DOLOMITIC
FOSSILS: BENTHIC FORAMINIFERA
INDURATION RANGES FROM POOR TO MODERATE.

1150 - 1155 PACKSTONE; YELLOWISH GRAY
POROSITY: INTERGRANULAR, INTERCRYSTALLINE, MOLDIC
GRAIN TYPE: SKELETAL, CALCILUTITE, CRYSTALS
85% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: MEDIUM; RANGE: FINE TO GRAVEL
CEMENT TYPE(S): CALCILUTITE MATRIX
ACCESSORY MINERALS: DOLOMITE-01%
OTHER FEATURES: HIGH RECRYSTALLIZATION, CHALKY
FOSSILS: BENTHIC FORAMINIFERA
CONE FOSSIL FOUND, POSSIBLY DICTYOCONUS OR CUSHMANIA
AMERICANAS. INDURATION RANGES FROM POOR TO MODERATE.

1155 - 1160 PACKSTONE; YELLOWISH GRAY
POROSITY: INTERGRANULAR, INTERCRYSTALLINE, MOLDIC
GRAIN TYPE: SKELETAL, CALCILUTITE, CRYSTALS
85% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: MEDIUM; RANGE: FINE TO COARSE
CEMENT TYPE(S): CALCILUTITE MATRIX
ACCESSORY MINERALS: DOLOMITE-01%
OTHER FEATURES: HIGH RECRYSTALLIZATION, CHALKY
FOSSILS: BENTHIC FORAMINIFERA
INDURATION RANGES FROM POOR TO MODERATE.

1160 - 1165 AS ABOVE

1165 - 1170 PACKSTONE; YELLOWISH GRAY TO GRAYISH BROWN
POROSITY: INTERGRANULAR, INTERCRYSTALLINE
GRAIN TYPE: SKELETAL, CALCILUTITE, INTRACLASTS
80% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: MEDIUM; RANGE: FINE TO GRANULE
CEMENT TYPE(S): CALCILUTITE MATRIX
ACCESSORY MINERALS: DOLOMITE-30%
OTHER FEATURES: HIGH RECRYSTALLIZATION, CHALKY

FOSSILS: BENTHIC FORAMINIFERA
TRACE DOLOMITE DESCRIBED AS FOLLOWS: 90-100% ALTERED
EUHEDRAL CRYSTALLINITY, SIZE MODE IS VERY FINE AND RANGES
FROM MICROCRYSTALLINE TO MEDIUM. DICTYOCONUS IS PRESENT.
INDURATION RANGES FROM POOR TO GOOD. POSSIBLE SILT SIZED
EVAPORITES FOUND WITHIN SOME PORES SPACES IN THE DOLOMITE.

1170 - 1175 AS ABOVE

1175 - 1180 PACKSTONE; YELLOWISH GRAY TO GRAYISH BROWN
POROSITY: INTERGRANULAR, INTERCRYSTALLINE
GRAIN TYPE: SKELETAL, CALCILUTITE, INTRACLASTS
80% ALLOCHEMICAL CONSTITUENTS
GRAIN SIZE: MEDIUM; RANGE: FINE TO GRANULE
CEMENT TYPE(S): CALCILUTITE MATRIX
ACCESSORY MINERALS: DOLOMITE-40%
OTHER FEATURES: HIGH RECRYSTALLIZATION, CHALKY
FOSSILS: BENTHIC FORAMINIFERA
DICTYOCONUS PRESENT. IDURATION RANGES FROM POOR TO GOOD.
TRACE DOLOMITE DESCRIBED AS FOLLOWS: 90-100% ALTERED
EUHEDRAL CRYSTALLINITY, SIZE MODE IS VERY FINE AND RANGES
FROM MICROCRYSTALLINE TO MEDIUM.

1180 - 1185 DOLOSTONE; VERY LIGHT ORANGE TO GRAYISH BROWN
POROSITY: INTERGRANULAR, INTERCRYSTALLINE; 90-100% ALTERED EUHEDRAL
GRAIN SIZE: VERY FINE; RANGE: MICROCRYSTALLINE TO MEDIUM
POOR INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
ACCESSORY MINERALS: CALCILUTITE-20%
FOSSILS: BENTHIC FORAMINIFERA
SAMPLE APPEARS TO BE INDIVIDUAL OR SMALL CLUSTERS OF
DOLOMITE. CRYSTALS ARE CEMENTED BY MICRITE.

1185 - 1190 AS ABOVE

1190 - 1195 DOLOSTONE; VERY LIGHT ORANGE TO GRAYISH BROWN
POROSITY: INTERGRANULAR, INTERCRYSTALLINE; 90-100% ALTERED EUHEDRAL
GRAIN SIZE: VERY FINE; RANGE: MICROCRYSTALLINE TO MEDIUM
CEMENT TYPE(S): CALCILUTITE MATRIX
IDURATION RANGES FROM POOR TO MODERATE. CONE FORAMS
PRESENT.

1195 - 1200 DOLOSTONE; MODERATE YELLOWISH BROWN TO GRAYISH BROWN
POROSITY: INTERCRYSTALLINE, PIN POINT VUGS
90-100% ALTERED; EUHEDRAL
GRAIN SIZE: VERY FINE; RANGE: MICROCRYSTALLINE TO FINE
GOOD INDURATION
CEMENT TYPE(S): DOLOMITE CEMENT
ACCESSORY MINERALS: CALCILUTITE-01%

1200 - 1205 DOLOSTONE; MODERATE YELLOWISH BROWN TO GRAYISH BROWN
POROSITY: INTERCRYSTALLINE, PIN POINT VUGS
90-100% ALTERED; EUHEDRAL
GRAIN SIZE: VERY FINE; RANGE: MICROCRYSTALLINE TO FINE
GOOD INDURATION
CEMENT TYPE(S): DOLOMITE CEMENT
CONTAINS TRACE CALCITE.

1205 - 1210 AS ABOVE

1210 - 1215 AS ABOVE

1215 - 1220 DOLOSTONE; MODERATE YELLOWISH BROWN TO GRAYISH BROWN
POROSITY: INTERCRYSTALLINE, PIN POINT VUGS
90-100% ALTERED; EUHEDRAL
GRAIN SIZE: VERY FINE; RANGE: MICROCRYSTALLINE TO FINE
CEMENT TYPE(S): DOLOMITE CEMENT
FOSSILS: ECHINOID
ECHINOID PRESENCE POSSIBLY DUE TO CAVINGS. INDURATION RANGES FROM MODERATE TO GOOD. CONTAINS TRACE CALCITE AND MICRITE.

1220 - 1225 DOLOSTONE; MODERATE YELLOWISH BROWN TO GRAYISH BROWN
POROSITY: INTERCRYSTALLINE, PIN POINT VUGS
90-100% ALTERED; EUHEDRAL
GRAIN SIZE: VERY FINE; RANGE: MICROCRYSTALLINE TO FINE
CEMENT TYPE(S): DOLOMITE CEMENT
CONTAINS TRACE CALCITE AND MICRITE. INDURATION RANGES FROM MODERATE TO GOOD.

1225 - 1230 AS ABOVE

1230 - 1235 AS ABOVE

1235 - 1240 AS ABOVE
PRESENCE OF LEPIDOCYCLINA AND CONES POSSIBLY DUE TO CAVINGS AND REPRESENT ~1% OF SAMPLE INTERVAL

1240 - 1245 DOLOSTONE; NO COLOR GIVEN
90-100% ALTERED; EUHEDRAL
GRAIN SIZE: FINE; RANGE: MICROCRYSTALLINE TO MEDIUM
GOOD INDURATION
CEMENT TYPE(S): DOLOMITE CEMENT
CONTAINS TRACE MICRITE AND CALCITE.

1245 - 1250 AS ABOVE

1250 - 1255 AS ABOVE

1255 - 1260 AS ABOVE

1260 - 1265 DOLOSTONE; GRAYISH ORANGE TO DARK YELLOWISH BROWN
POROSITY: INTERCRYSTALLINE, PIN POINT VUGS
90-100% ALTERED; EUHEDRAL
GRAIN SIZE: FINE; RANGE: MICROCRYSTALLINE TO MEDIUM
GOOD INDURATION
CEMENT TYPE(S): DOLOMITE CEMENT
ACCESSORY MINERALS: CALCILUTITE-01%

1265 - 1270 AS ABOVE

1270 - 1275 AS ABOVE

1275 - 1280 DOLOSTONE; GRAYISH ORANGE TO DARK YELLOWISH BROWN
POROSITY: INTERCRYSTALLINE, PIN POINT VUGS
90-100% ALTERED; EUHEDRAL
GRAIN SIZE: FINE; RANGE: MICROCRYSTALLINE TO MEDIUM
GOOD INDURATION

CEMENT TYPE(S): DOLOMITE CEMENT
ACCESSORY MINERALS: CALCILUTITE-01%
ORGANIC LAMINATIONS PRESENT ON A FEW FRAGMENTS.

1280 - 1285 AS ABOVE

1285 - 1290 DOLOSTONE; GRAYISH ORANGE TO DARK YELLOWISH BROWN
POROSITY: INTERCRYSTALLINE, PIN POINT VUGS
90-100% ALTERED; EUHEDRAL
GRAIN SIZE: FINE; RANGE: MICROCRYSTALLINE TO MEDIUM
GOOD INDURATION
CEMENT TYPE(S): DOLOMITE CEMENT
ACCESSORY MINERALS: CALCILUTITE-01%

1290 - 1295 DOLOSTONE; GRAYISH ORANGE TO DARK YELLOWISH BROWN
POROSITY: INTERCRYSTALLINE, PIN POINT VUGS
90-100% ALTERED; EUHEDRAL
GRAIN SIZE: FINE; RANGE: MICROCRYSTALLINE TO MEDIUM
GOOD INDURATION
CEMENT TYPE(S): DOLOMITE CEMENT
ACCESSORY MINERALS: CALCILUTITE-03%
FOSSILS: BENTHIC FORAMINIFERA
A COUPLE FOSSILS FOUND, INCLUDING DICTYOCONUS AND
LEPIDACYCLINA, ARE PROBABLY CAVINGS. CONTAINS TRACE
CALCITE.

1295 - 1300 DOLOSTONE; GRAYISH ORANGE TO DARK YELLOWISH BROWN
POROSITY: INTERCRYSTALLINE, PIN POINT VUGS, INTERGRANULAR
90-100% ALTERED; EUHEDRAL
GRAIN SIZE: FINE; RANGE: MICROCRYSTALLINE TO MEDIUM
GOOD INDURATION
CEMENT TYPE(S): DOLOMITE CEMENT
ACCESSORY MINERALS: CALCILUTITE-05%
FOSSILS: BENTHIC FORAMINIFERA
INCREASED DICTYOCONUS PRESENCE.

1300 - 1305 DOLOSTONE; GRAYISH ORANGE TO DARK YELLOWISH BROWN
POROSITY: INTERCRYSTALLINE, PIN POINT VUGS, INTERGRANULAR
90-100% ALTERED; EUHEDRAL
GRAIN SIZE: FINE; RANGE: MICROCRYSTALLINE TO MEDIUM
GOOD INDURATION
CEMENT TYPE(S): DOLOMITE CEMENT
ACCESSORY MINERALS: CALCILUTITE-07%
FOSSILS: BENTHIC FORAMINIFERA
SOME ORGANIC LAMINATIONS PRESENT.

1305 - 1310 AS ABOVE

1310 - 1315 DOLOSTONE; GRAYISH ORANGE TO DARK YELLOWISH BROWN
POROSITY: INTERCRYSTALLINE, PIN POINT VUGS, INTERGRANULAR
90-100% ALTERED; EUHEDRAL
GRAIN SIZE: FINE; RANGE: MICROCRYSTALLINE TO MEDIUM
GOOD INDURATION
CEMENT TYPE(S): DOLOMITE CEMENT
ACCESSORY MINERALS: CALCILUTITE-10%
FOSSILS: BENTHIC FORAMINIFERA
DICTYOCONUS PRESENT. SOME ORGANIC LAMINATIONS PRESENT.

1315 - 1320 DOLOSTONE; GRAYISH ORANGE TO DARK YELLOWISH BROWN

POROSITY: INTERCRYSTALLINE, PIN POINT VUGS, INTERGRANULAR
90-100% ALTERED; EUHEDRAL
GRAIN SIZE: FINE; RANGE: MICROCRYSTALLINE TO MEDIUM
CEMENT TYPE(S): DOLOMITE CEMENT
ACCESSORY MINERALS: CALCILUTITE-10%
FOSSILS: BENTHIC FORAMINIFERA
INDURATION RANGES FROM POOR TO GOOD BUT IS MOSTLY
MODERATE. DICTYOCONUS IS PRESENT.

1320 - 1325 AS ABOVE

1325 - 1330 AS ABOVE
SOME ORGANIC LAMINATIONS PRESENT.

1330 - 1335 DOLOSTONE; DARK YELLOWISH BROWN TO GRAYISH ORANGE
POROSITY: INTERCRYSTALLINE, PIN POINT VUGS, INTERGRANULAR
90-100% ALTERED; EUHEDRAL
GRAIN SIZE: FINE; RANGE: MICROCRYSTALLINE TO MEDIUM
GOOD INDURATION
CEMENT TYPE(S): DOLOMITE CEMENT
ACCESSORY MINERALS: CALCILUTITE-05%
FOSSILS: BENTHIC FORAMINIFERA
DICTYOCONUS IS PRESENT. THE SAMPLE CONTAINS TRACE ORGANICS.

1335 - 1340 AS ABOVE

1340 - 1345 AS ABOVE

1345 - 1350 DOLOSTONE; GRAYISH ORANGE TO DARK YELLOWISH BROWN
POROSITY: INTERCRYSTALLINE, PIN POINT VUGS, INTERGRANULAR
90-100% ALTERED; EUHEDRAL
GRAIN SIZE: FINE; RANGE: MICROCRYSTALLINE TO MEDIUM
CEMENT TYPE(S): DOLOMITE CEMENT, CALCILUTITE MATRIX
ACCESSORY MINERALS: CALCILUTITE-07%
FOSSILS: BENTHIC FORAMINIFERA
DICTYOCONUS COOKEI IS PRESENT. INDURATION RANGES FROM
POOR TO GOOD.

1350 - 1355 AS ABOVE

1355 - 1360 DOLOSTONE; GRAYISH ORANGE TO DARK YELLOWISH BROWN
POROSITY: INTERCRYSTALLINE, PIN POINT VUGS, INTERGRANULAR
90-100% ALTERED; EUHEDRAL
GRAIN SIZE: FINE; RANGE: MICROCRYSTALLINE TO MEDIUM
CEMENT TYPE(S): DOLOMITE CEMENT, CALCILUTITE MATRIX
ACCESSORY MINERALS: CALCILUTITE-10%
FOSSILS: BENTHIC FORAMINIFERA
INDURATION RANGES FROM POOR TO GOOD. CONTAINS TRACE
ORGANICS. DICTYOCONUS IS PRESENT.

1360 - 1365 DOLOSTONE; GRAYISH ORANGE TO DARK YELLOWISH BROWN
POROSITY: INTERCRYSTALLINE, PIN POINT VUGS, INTERGRANULAR
90-100% ALTERED; EUHEDRAL
GRAIN SIZE: FINE; RANGE: MICROCRYSTALLINE TO MEDIUM
MODERATE INDURATION
CEMENT TYPE(S): DOLOMITE CEMENT, CALCILUTITE MATRIX
ACCESSORY MINERALS: CALCILUTITE-07%
FOSSILS: BENTHIC FORAMINIFERA, ALGAE
FOSSIL FOUND MAY BE LITUONELLA.

1365 - 1370 DOLOSTONE; GRAYISH ORANGE TO DARK YELLOWISH BROWN
POROSITY: INTERCRYSTALLINE, PIN POINT VUGS, INTERGRANULAR
90-100% ALTERED; EUHEDRAL
GRAIN SIZE: FINE; RANGE: MICROCRYSTALLINE TO MEDIUM
CEMENT TYPE(S): DOLOMITE CEMENT, CALCILUTITE MATRIX
ACCESSORY MINERALS: CALCILUTITE-10%
FOSSILS: BENTHIC FORAMINIFERA
DICTYOCONUS IS PRESENT. SAMPLE INTERVAL CONTAINS TRACE
ORGANICS. INDURATION RANGES FROM POOR TO GOOD.

1370 - 1375 DOLOSTONE; DARK YELLOWISH BROWN TO VERY LIGHT ORANGE
POROSITY: INTERCRYSTALLINE, PIN POINT VUGS, INTERGRANULAR
90-100% ALTERED; EUHEDRAL
GRAIN SIZE: FINE; RANGE: MICROCRYSTALLINE TO MEDIUM
CEMENT TYPE(S): DOLOMITE CEMENT, CALCILUTITE MATRIX
ACCESSORY MINERALS: CALCILUTITE-15%
FOSSILS: BENTHIC FORAMINIFERA
DICTYOCONUS IS PRESENT. INDURATION RANGES FROM POOR TO
GOOD. MICRITE CEMENTED SECTIONS HAVE POORER INDURATION.

1375 - 1380 DOLOSTONE; GRAYISH ORANGE TO DARK YELLOWISH BROWN
POROSITY: INTERCRYSTALLINE, PIN POINT VUGS, INTERGRANULAR
90-100% ALTERED; EUHEDRAL
GRAIN SIZE: FINE; RANGE: MICROCRYSTALLINE TO MEDIUM
GOOD INDURATION
CEMENT TYPE(S): DOLOMITE CEMENT, CALCILUTITE MATRIX
ACCESSORY MINERALS: CALCILUTITE-07%
FOSSILS: BENTHIC FORAMINIFERA
DICTYOCONUS IS PRESENT.

1380 - 1385 AS ABOVE

1385 - 1390 AS ABOVE
POOR INDURATION IN MICRITE CEMEMENTED DOLOMITE GRAINS

1390 - 1395 DOLOSTONE; GRAYISH ORANGE TO DARK YELLOWISH BROWN
POROSITY: INTERCRYSTALLINE, PIN POINT VUGS, INTERGRANULAR
90-100% ALTERED; EUHEDRAL
GRAIN SIZE: FINE; RANGE: MICROCRYSTALLINE TO MEDIUM
CEMENT TYPE(S): DOLOMITE CEMENT, CALCILUTITE MATRIX
ACCESSORY MINERALS: CALCILUTITE-05%
FOSSILS: BENTHIC FORAMINIFERA
DICTYOCONUS IS PRESENT. MOST OF SAMPLE HAS GOOD INDURATION HOWEVER
INDURATION RANGES FROM MODERATE TO GOOD.

1395 - 1398 AS ABOVE

1398 TOTAL DEPTH

OKF-105 Lithologic Description
1,400 to 2,500 feet below land surface

FROM	TO	DESCRIPTION
0	1,400	SEE FLORIDA GEOLOGICAL SURVEY DESCRIPTION.
1,400	1,430	DOLOSTONE, BROWN, SUCROSIC, INTERGRANULAR POROSITY AND PINPOINT VUGS, WELL INDURATED.
1,430	1,450	DOLOSTONE, BROWN TO BLACK, CRYSTALLINE, INTERCRYSTALLINE AND PINPOINT VUGS, WELL INDURATED.
1,450	1,460	DOLOSTONE, BROWN, SUCROSIC AND CRYSTALLINE, INTERGRANULAR POROSITY AND PINPOINT VUGS, WELL INDURATED, DOLOMITE CEMENT.
1,460	1,470	70% DOLOSTONE, BROWN, SUCROSIC AND CRYSTALLINE, INTERGRANULAR POROSITY AND PINPOINT VUGS, WELL INDURATED, DOLOMITE CEMENT AND 30% LIMESTONE, MUDSTONE, TAN, INTERGRANULAR TO VUGGY, CALCITE CEMENT.
1,470	1,480	LIMESTONE, MUDSTONE, TAN TO WHITE, INTERGRANULAR POROSITY AND PINPOINT VUGS, WELL INDURATED, CALCITE CEMENT, DICTYCONUS AMERICANUS, SOME DARK TO LIGHT LAYERING.
1,480	1,500	LIMESTONE, PACKSTONE, TAN TO WHITE, INTERGRANULAR POROSITY TO PINPOINT VUGS, WELL INDURATED, CALCITE CEMENT.
1,500	1,520	LIMESTONE, PACKSTONE, TAN TO WHITE, INTERGRANULAR POROSITY AND PINPOINT VUGS, WELL INDURATED, CALCITE CEMENT, 3% TAN DOLOMITE.
1,520	1,550	LIMESTONE, MUDSTONE, WHITE, INTERGRANULAR POROSITY AND PINPOINT VUGS, FRIABLE, CALCITE CEMENT.
1,550	1,560	LIMESTONE, MUDSTONE, TAN, INTERGRANULAR POROSITY AND PIN POINT VUGS, WELL INDURATED, CALCITE CEMENT.
1,560	1,570	LIMESTONE, MUDSTONE, TAN, INTERGRANULAR POROSITY AND PIN POINT VUGS, WELL INDURATED, CALCITE CEMENT.
1,570	1,610	75% LIMESTONE, MUDSTONE, WHITE, INTERGRANULAR POROSITY AND PINPOINT VUGS, FRIABLE, CALCITE CEMENT, 25% DARK BROWN CRYSTALLINE DOLOMITE.

1,610	1,620	DOLOSTONE, GREY TO TAN, PINPOINT VUGS, WELL INDURATED.
1,620	1,630	LIMESTONE, MUDSTONE, TAN TO LIGHT BROWN, PINPOINT VUGS, INTERGRANULAR, AND INTERCLAST POROSITY, WELL INDURATED, CALCITE CEMENT, SOME MOLLUSK CLASTS.
1,630	1,670	DOLOSTONE, TAN TO DARK BROWN, CRYSTALLINE, PINPOINT VUGS, WELL INDURATED.
1,670	1,680	DOLOSTONE, TAN TO DARK BROWN, CRYSTALLINE, PINPOINT VUGS, WELL INDURATED, 10% WHITE LIMESTONE (PACKSTONE).
1,680	1,690	DOLOSTONE, TAN TO DARK BROWN, CRYSTALLINE, PINPOINT VUGS, WELL INDURATED.
1,690	1,710	DOLOSTONE, TAN TO DARK BROWN, CRYSTALLINE, PINPOINT VUGS, WELL INDURATED, 10% WHITE LIMESTONE (PACKSTONE).
1,710	1,730	DOLOSTONE, TAN TO DARK BROWN, CRYSTALLINE, PINPOINT VUGS, WELL INDURATED.
1,730	1,740	DOLOSTONE, TAN TO DARK BROWN, CRYSTALLINE, PINPOINT VUGS, WELL INDURATED, 50% WHITE LIMESTONE (PACKSTONE), FRIABLE.
1,740	1,750	LIMESTONE, PACKSTONE, WHITE, PINPOINT VUGS, CALCITE CEMENT, FRIABLE.
1,750	1,760	DOLOSTONE, BROWN, CRYSTALLINE, PIN POINT VUGS, WELL INDURATED, SOME FOSSIL CLASTS.
1,760	1,770	LIMESTONE, PACKSTONE, WHITE, PINPOINT VUGS, FRIABLE, CALCITE CEMENT.
1,770	1,800	DOLOSTONE, BROWN, CRYSTALLINE, PIN POINT VUGS, WELL INDURATED, SOME ANHYDRITE.
1,800	1,820	DOLOSTONE, TAN TO BROWN, CRYSTALLINE, PINPOINT VUGS, WELL INDURATED, 40% WHITE LIMESTONE (PACKSTONE), FRIABLE, 5 TO 10% ANHYDRITE.
1,820	1,840	LIMESTONE, PACKSTONE, WHITE, INTERGRANULAR POROSITY, FRIABLE, CALCITE CEMENT, 10% BROWN CRYSTALLINE DOLOSTONE.
1,840	1,865	DOLOSTONE, TAN TO BROWN, CRYSTALLINE, PINPOINT VUGS, WELL INDURATED, 10% ANHYDRITE.

1,865	1,870	DOLOSTONE, TAN TO BROWN, CRYSTALLINE, PINPOINT VUGS, WELL INDURATED, 25% WHITE LIMESTONE (PACKSTONE), FRIABLE.
1,870	1,890	LIMESTONE, PACKSTONE, WHITE, PINPOINT VUGS, FRIABLE, CALCITE CEMENT, 5% BROWN DOLOSTONE AND ANHYDRITE.
1,890	1,895	DOLOSTONE, TAN TO WHITE, INTERGRANULAR POROSITY, WELL INDURATED, 5% WHITE LIMESTONE (PACKSTONE).
1,895	1,910	DOLOSTONE, TAN TO WHITE, SOME CRYSTALLINE, INTERGRANULAR POROSITY TO PINPOINT VUGS, WELL INDURATED, 15% WHITE LIMESTONE (GRAINSTONE).
1,910	1,920	DOLOSTONE, TAN TO BROWN, CRYSTALLINE, PINPOINT VUGS, WELL INDURATED, 1 TO 2% ANHYDRITE.
1,920	1,960	DOLOSTONE, TAN, CRYSTALLINE, PINPOINT VUGS, WELL INDURATED, 1 TO 2% ANHYDRITE.
1,960	2,015	DOLOSTONE, TAN, CRYSTALLINE, PINPOINT VUGS, WELL INDURATED, 10% ANHYDRITE.
2,015	2,025	DOLOSTONE, TAN, CRYSTALLINE, PINPOINT VUGS, WELL INDURATED, 10% ANHYDRITE, MINOR GYPSUM.
2,025	2,040	DOLOSTONE, TAN, CRYSTALLINE, PINPOINT VUGS, WELL INDURATED, 1% ANHYDRITE AND GYPSUM.
2,040	2,060	DOLOSTONE, TAN, CRYSTALLINE, PINPOINT VUGS, WELL INDURATED, 15 TO 20% ANHYDRITE AND GYPSUM.
2,060	2,070	LIMESTONE, WHITE TO TAN, PACKSTONE, INTERGRANULAR POROSITY TO PINPOINT VUGS, CALCITE CEMENT, FRIABLE, 1 TO 5% TAN CRYSTALLINE DOLOSTONE.
2,070	2,110	LIMESTONE, WHITE TO TAN, PACKSTONE, INTERGRANULAR AND MOLDIC POROSITY, SOME PINPOINT VUGS, CALCITE CEMENT, FRIABLE, MOLLUSK FRAGMENTS.
2,110	2,120	LIMESTONE, WHITE TO TAN, PACKSTONE, INTERGRANULAR AND MOLDIC POROSITY, SOME PINPOINT VUGS, CALCITE CEMENT, FRIABLE, MOLLUSK FRAGMENTS.
2,120	2,132	LIMESTONE, WHITE TO TAN, PACKSTONE, INTERGRANULAR AND MOLDIC POROSITY, SOME PINPOINT VUGS, CALCITE CEMENT, FRIABLE, 40% BROWN SUCROSIC DOLOSTONE.

2,132	2,140	DOLOSTONE, TAN, CRYSTALLINE, INTERCRYSTALLINE POROSITY, WELL INDURATED, 1% ANHYDRITE.
2,140	2,150	50% DOLOSTONE AND 50% LIMESTONE (MUDSTONE), DOLOSTONE IS TAN, LIMETSONE IS WHITE, BOTH EXHIBIT INTERGRANULAR POROSITY.
2,150	2,165	DOLOSTONE, TAN, CRYSTALLINE, PINPOINT VUGS, WELL INDURATED, 15% WHITE LIMESTONE(MUDSTONE TO PACKSTONE), FRIABLE.
2,165	2,175	DOLOSTONE, TAN, INTERGRANULAR POROSITY, 10 TO 15 % WHITE LIMESTONE (MUDSTONE).
2,175	2,190	DOLOSTONE, TAN, CRYSTALLINE, PINPOINT VUGS, WELL INDURATED, 30% WHITE LIMESTONE (WAKESTONE), FRIABLE, 1% ANHYDRITE, SOME BENTHIC FORAMS (POSSIBLE HELICOSTAGINA GYRALIS).
2,190	2,200	DOLOSTONE, TAN TO WHITE, INTERGRANULAR POROSITY, WELL INDURATED, 15% ANHYDRITE.
2,200	2,220	LIMESTONE, WHITE, WACKESTONE, INTERGRANULAR POROSITY TO PINPOINT VUGS, CALCITE CEMENT, FRIABLE, SOME GLAUCONITE.
2,220	2,230	LIMESTONE, WHITE TO TAN, PACKSTONE, INTERGRANULAR POROSITY, CALCITE CEMENT, FRIABLE.
2,230	2,240	LIMESTONE, TAN, PACKSTONE, INTERGRANULAR AND MOLDIC POROSITY, CALCITE CEMENT, FRIABLE, 10% TAN CRYSTALLINE DOLOSTONE.
2,240	2,250	LIMESTONE, WHITE, PACKSTONE, INTERGRANULAR AND MOLDIC POROSITY, CALCITE CEMENT, FRIABLE, 10% TAN CRYSTALLINE DOLOSTONE, 1% ANHYDRITE.
2,250	2,260	DOLOSTONE, TAN TO BROWN, SUCROSIC TO CRYSTALLINE, INTERCRYSTALLINE POROSITY, WELL INDURATED.
2,260	2,280	DOLOSTONE, WHITE TO TAN, CRYSTALLINE, INTERCRYSTALLINE POROSITY, WELL INDURATED, 10% WHITE LIMESTONE (MUDSTONE).
2,280	2,290	DOLOSTONE, GREY, CRYSTALLINE, INTERCRYSTALLINE POROSITY, WELL INDURATED, 40% GREY LIMESTONE (PACKSTONE).
2,290	2,295	LIMESTONE, WHITE, MUDSTONE, INTERGRANULAR POROSITY, FRIABLE, 20% TAN TO BROWN DOLOSTONE WITH PIN POINT VUGS.

2,295	2,300	LIMESTONE, WHITE, MUDSTONE TO WACKESTONE, INTERGRANULAR POROSITY, FRIABLE.
2,300	2,310	LIMESTONE, WHITE, MUDSTONE TO PACKSTONE, INTERGRANULAR POROSITY AND PINPOINT VUGS, CALCITE CEMENT, FRIABLE, 10% TAN CRYSTALLINE DOLOSTONE.
2,310	2,320	DOLOSTONE, TAN, CRYSTALLINE, INTERCRYSTALLINE POROSITY, WELL INDURATED, 10 TO 20% WHITE LIMESTONE (MUDSTONE).
2,320	2,325	DOLOSTONE, GREY SUCROSIC, INTERGRANULAR POROSITY, WELL INDURATED, 10 TO 20% LIGHT GREY LIMESTONE (MUDSTONE).
2,325	2,340	DOLOSTONE, TAN TO BROWN, CRYSTALLINE, INTERGRYSTALLINE POROSITY, WELL INDURATED, 1% ANHYDRITE AND WHITE LIMESTONE (MUDSTONE).
2,340	2,360	DOLOSTONE, TAN, CRYSTALLINE, INTERCYRSTALLINE POROSITY, WELL INDURATED.
2,360	2,370	DOLOSTONE, TAN, 20% GREY, CRYSTALLINE, INTERCYRSTALLINE POROSITY, WELL INDURATED.
2,370	2,380	DOLOSTONE, TAN, CRYSTALLINE, INTERCYRSTALLINE POROSITY, WELL INDURATED.
2,380	2,390	DOLOSTONE, TAN TO GREY, CRYSTALLINE, INTERCYRSTALLINE POROSITY, WELL INDURATED.
2,390	2,395	DOLOSTONE, TAN, CRYSTALLINE, INTERCYRSTALLINE POROSITY, WELL INDURATED, 30% WHITE TO GEY LIMSTONE (PACKSTONE).
2,395	2,410	LIMESTONE, WHITE, PACKSTONE, INTERGRANULAR POROSITY AND PINPOINT VUGS, CALCITE CEMENT, FRIABLE.
2,410	2,420	DOLOSTONE, LIGHT GREY TO TAN, INTERCRYSTALLINE POROSITY, WELL INDURATED.
2,420	2,425	DOLOSTONE, LIGHT GREY TO TAN, CRYSTALLINE,INTERCRYSTALLINE POROSITY, WELL INDURATED.
2,425	2,455	LIMESTONE, WHITE, MUDSTONE, INTERGRANULAR POROSITY AND PINPOINT VUGS, FRIABLE, 10% GREY CRYSTALLINE DOLOSTONE.
2,455	2,470	LIMESTONE, WHITE, WACKESTONE, INTERGRANULAR POROSITY AND PINPOINT VUGS, FRIABLE, 10% TAN CRYSTALLINE DOLOSTONE, SOME ECHINOIDS.

		LIMESTONE, WHITE, WACKESTONE, INTERGRANULAR POROSITY AND PINPOINT VUGS, FRIABLE, 30% TAN
2,470	2,475	CRYSTALLINE DOLOSTONE.
2,475	2,480	DOLOSTONE, TAN, CRYSTALLINE, INTERCRYSTALLINE POROSITY AND PINPOINT VUGS, WELL INDURATED, 40% WHITE LIMESTONE (WACKESTONE).
2,480	2,490	DOLOSTONE, TAN, CRYSTALLINE, INTERCRYTSALLINE POROSITY AND PINPOINT VUGS, WELL INDURATED.
2,490	2,500	DOLOSTONE, TAN TO DARK GREY, CRYSTALLINE, INTERCRYTALLINE POROSITY AND PIN POINT VUGS, WELL INDURATED.

SOUTH FLORIDA WMD - LITHO LOG PRINTOUT

W-0KF42
HIGHLANDS CO. T34S R31E SEC 23 27 30 07 N 81 11 46 W
TOTAL DEPTH- 1180 FT. ELEV.- FT. 118 SAMPLES- 0- 1180 FT.
COMPLETED- 82.04.21 DEPTH WORKED 1180 FT.

WELL NAME-
S65C- SFWMD EXPLORATORY WELL- ALVIN WOOSTER, DRILLER
REMARKS-
CUTTING COLLECTED AND DESCRIBED BY
JON SHAW, SFWMD, APRIL 30, 1982
GEOPHYSICAL LOGS AVAILABLE

HYDROGEOLOGIC UNITS

0.0-	180.0	SHALLOW AQUIFER SYSTEM
180.0-	370.0	HAWTHORN CONFINING BED
370.0-	1100.0	FLORIDAN AQUIFER SYSTEM

STRATIGRAPHIC FORMATIONS -

0.0-	180.0	UNDIFFERENTIATED SAND, CLAY AND SHELLS
180.0-	420.0	HAWTHORN FORMATION
420.0-	590.0	OCALA GROUP
590.0-	1180.0	AVON PARK LIMESTONE

LITHOLOGIC LOG
W-0KF42 . HIGHLANDS CO. T34S, R31E, SEC 23

0.0-	20.0	SAND, DARK BROWN TO MODERATE BROWN, POROSITY, INTERGRANULAR, GRAIN SIZE: MEDIUM, RANGE: FINE TO COARSE, SUB-ANGULAR, UNCONSOLIDATED, ORGANIC MATRIX, 05% IRON STAIN, NO FOSSIL, ORGANICS,
20.0-	40.0	SHELL BED, MODERATE GRAY TO LIGHT GRAY, POROSITY, INTERGRANULAR, MOLDIC, UNCONSOLIDATED, 40% QUARTZ SAND, 05% CLAY, VARVED, MOLLUSKS,
40.0-	50.0	CLAY, LIGHT OLIVE GRAY, POROSITY, LOW PERMEABILITY, UNCONSOLIDATED, CLAY MATRIX, CALCILUTITE MATRIX, 05% QUARTZ SAND, 03% PHOSPHATIC SAND, CALCAREOUS, MOLLUSKS,
50.0-	60.0	SAND, LIGHT OLIVE GRAY TO VERY LIGHT GRAY, POROSITY, INTERGRANULAR, LOW PERMEABILITY, GRAIN SIZE: FINE, RANGE: MICROCRYSTALLINE TO MEDIUM, ANGULAR, UNCONSOLIDATED, CLAY MATRIX, 05% PHOSPHATIC SAND, CALCAREOUS, MOLLUSKS, SHARK TEETH,
60.0-	70.0	SAND, GREENISH GRAY TO VERY LIGHT GRAY, POROSITY, INTERGRANULAR, MOLDIC, GRAIN SIZE: MEDIUM, RANGE: MICROCRYSTALLINE TO VERY COARSE, SUB-ANGULAR, UNCONSOLIDATED, CLAY MATRIX, 07% PHOSPHATIC SAND, 20% CLAY, MOLLUSKS, SHARK TEETH, CRUSTACEA,

LITHOLOGIC LOG
W-0KF42 . HIGHLANDS CO. T34S, R31E, SEC 23

70.0- 80.0 SAND, LIGHT OLIVE GRAY, POROSITY, INTERGRANULAR, GRAIN SIZE: MEDIUM, RANGE: MICROCRYSTALLINE TO COARSE, ANGULAR, UNCONSOLIDATED, CLAY MATRIX, 15% PHOSPHATIC SAND, 20% CLAY, MOLLUSKS,

SHELL BED, WHITE, POROSITY, MOLDIC, UNCONSOLIDATED, MOLLUSKS,

80.0- 90.0 SAND, LIGHT OLIVE GRAY, POROSITY, INTERGRANULAR, GRAIN SIZE: MEDIUM, RANGE: MICROCRYSTALLINE TO COARSE, ANGULAR, UNCONSOLIDATED, CLAY MATRIX, 15% PHOSPHATIC SAND, 15% CLAY, CALCAREOUS, MOLLUSKS,

PHOSPHATE PUBBLE

90.0- 100.0 SAND, LIGHT OLIVE GRAY, POROSITY, INTERGRANULAR, LOW PERMEABILITY, GRAIN SIZE: FINE, RANGE: MICROCRYSTALLINE TO MEDIUM, SUB-ANGULAR, UNCONSOLIDATED, CLAY MATRIX, 03% PHOSPHATIC SAND, 15% CLAY, CALCAREOUS, MOLLUSKS,

ARAGONITE NEEDLES

100.0- 110.0 SAND, GRAYISH OLIVE, POROSITY, INTERGRANULAR, LOW PERMEABILITY, GRAIN SIZE: VERY FINE, RANGE: MICROCRYSTALLINE TO MEDIUM, UNCONSOLIDATED, CLAY MATRIX, 03% PHOSPHATIC SAND, 20% CLAY, CALCAREOUS, MOLLUSKS,

110.0- 140.0 AS ABOVE,

140.0- 150.0 SANDSTONE, YELLOWISH GRAY, POROSITY, POSSIBLY HIGH PERMEABILITY, MODERATE INDURATION, SPARRY CALCITE CEMENT, SILICIC CEMENT, 75% QUARTZ SAND, 03% PHOSPHATIC SAND, CALCAREOUS, MOLLUSKS,

POSSIBLE GOOD AQUIFER

150.0- 170.0 AS ABOVE,

170.0- 180.0 SAND, GRAYISH OLIVE, POROSITY, INTERGRANULAR, LOW PERMEABILITY, GRAIN SIZE: FINE, RANGE: MICROCRYSTALLINE TO MEDIUM, SUB-ANGULAR, UNCONSOLIDATED, CLAY MATRIX, 25% CLAY, 01% PHOSPHATIC SAND, NO FOSSIL,

TOP OF CONFINING ZONE

180.0- 210.0 AS ABOVE,

SHELL CAVINGS FROM ABOVE

210.0- 240.0 AS ABOVE,

240.0- 250.0 SAND, LIGHT OLIVE GRAY, POROSITY, LOW PERMEABILITY, GRAIN SIZE: FINE, SUB-ANGULAR, UNCONSOLIDATED, CLAY MATRIX, 02% PHOSPHATIC SAND, NO FOSSIL,

LITHOLOGIC LOG
W-OKF42 . HIGHLANDS CO. T34S, R31E, SEC 23

250.0- 260.0 AS ABOVE,

260.0- 270.0 CLAY, OLIVE GRAY, POROSITY, LOW PERMEABILITY, UNCONSOLIDATED, 15% PHOSPHATIC SAND, 05% QUARTZ SAND, NO FOSSIL,

270.0- 310.0 AS ABOVE,

310.0- 320.0 CLAY, VERY LIGHT GRAY TO LIGHT GRAY, POROSITY, LOW PERMEABILITY, UNCONSOLIDATED, 30% PHOSPHATIC SAND, 05% QUARTZ SAND, CALCAREOUS, MOLLUSKS,

320.0- 330.0 LIMESTONE, VERY LIGHT GRAY, POROSITY, LOW PERMEABILITY, UNCONSOLIDATED, 25% PHOSPHATIC SAND, 15% QUARTZ SAND, 20% CLAY, CALCAREOUS, FOSSIL MOLDS,

LARGE PHOSPHATE PEBBLES

330.0- 350.0 AS ABOVE,

350.0- 360.0 SAND, YELLOWISH GRAY, POROSITY, LOW PERMEABILITY, GRAIN SIZE: FINE, RANGE: MICROCRYSTALLINE TO MEDIUM, ROUNDED, UNCONSOLIDATED, CLAY MATRIX, CALCILUTITE MATRIX, 05% PHOSPHATIC SAND, 10% CLAY, CALCAREOUS, FOSSIL FRAGMENTS,

360.0- 370.0 AS ABOVE,

SOME SPARRY CALCITE

370.0- 380.0 LIMESTONE, WHITE, POROSITY, POSSIBLY HIGH PERMEABILITY, GRAIN TYPE: CALCILUTITE, CRYSTALS, 10% ALLOCHEMICAL CONSTITUENTS, GRAIN SIZE: FINE, RANGE: MICROCRYSTALLINE TO MEDIUM, MODERATE INDURATION, CALCILUTITE MATRIX, SPARRY CALCITE CEMENT, 10% PHOSPHATIC SAND, CHALKY, MOLLUSKS,

TOP OF FLORIDAN AQUIFER SYSTEM

380.0- 390.0 AS ABOVE,

390.0- 400.0 LIMESTONE, WHITE TO GRAYISH BROWN, GRAIN TYPE: CALCILUTITE, CRYSTALS, INTRACLASTS, 05% ALLOCHEMICAL CONSTITUENTS, GRAIN SIZE: FINE, GOOD INDURATION, CALCILUTITE MATRIX, SPARRY CALCITE CEMENT, 15% PHOSPHATIC SAND, 02% QUARTZ SAND, CHALKY, MEDIUM RECRYSTALLIZATION, MOLLUSKS,

MIXTURE OF A CHALKY WHITE LIMESTONE AND A WELL INDURATED LIGHT BROWN LIMESTONE WITH QUARTZ AND PHOSPHATE INTERCLASTS

400.0- 410.0 AS ABOVE,

LITHOLOGIC LOG
W-OKF42 . HIGHLANDS CO. T34S, R31E, SEC 23

410.0- 420.0 LIMESTONE, WHITE TO VERY LIGHT GRAY, POROSITY, INTERGRANULAR, GRAIN TYPE: BIOGENIC, CRYSTALS, CALCILUTITE, 25% ALLOCHEMICAL CONSTITUENTS, GRAIN SIZE: MEDIUM, RANGE: FINE TO COARSE, MODERATE INDURATION, CALCILUTITE MATRIX, CHALKY, BENTHONIC FORAMINIFERA, BRYOZOA,

FIRST OCCURRENCE OF LEPIDOCYLINA SP.

420.0- 430.0 AS ABOVE,

WITH NUMULITES SP.

430.0- 440.0 LIMESTONE, WHITE, POROSITY, LOW PERMEABILITY, GRAIN TYPE: CALCILUTITE, BIOGENIC, 05% ALLOCHEMICAL CONSTITUENTS, GRAIN SIZE: VERY FINE, POOR INDURATION, CHALKY, BENTHONIC FORAMINIFERA, BRYOZOA,

EXTREMEY CHALKY

440.0- 450.0 LIMESTONE, WHITE, POROSITY, INTERGRANULAR, GRAIN TYPE: BIOGENIC, INTRACLASTS, CALCILUTITE, 25% ALLOCHEMICAL CONSTITUENTS, GRAIN SIZE: MEDIUM, RANGE: FINE TO COARSE, MODERATE INDURATION, CALCILUTITE MATRIX, CHALKY, BENTHONIC FORAMINIFERA, BRYOZOA,

LEPIDOCYLINA OCALANA

450.0- 460.0 AS ABOVE,

460.0- 470.0 LIMESTONE, WHITE, POROSITY, INTERGRANULAR, GRAIN TYPE: BIOGENIC, INTRACLASTS, 75% ALLOCHEMICAL CONSTITUENTS, GRAIN SIZE: MEDIUM, RANGE: FINE TO COARSE, MODERATE INDURATION, CALCILUTITE MATRIX, COQUINA, CHALKY, BENTHONIC FORAMINIFERA, BRYOZOA, MOLLUSKS,

LEP HASH

470.0- 520.0 AS ABOVE,

520.0- 530.0 LIMESTONE, WHITE TO VERY LIGHT GRAY, POROSITY, INTERGRANULAR, GRAIN TYPE: BIOGENIC, CRYSTALS, 85% ALLOCHEMICAL CONSTITUENTS, GRAIN SIZE: COARSE, RANGE: FINE TO VERY COARSE, POOR INDURATION, CALCILUTITE MATRIX, SPARRY CALCITE CEMENT, CLAY MATRIX, CHALKY, COQUINA, BENTHONIC FORAMINIFERA, BRYOZOA,

OPERCULINOIDES SP.
MANY LEPS ARE REPLACED WITH BLACK (ORGANIC OR PHOSPHATIC)MATERIAL

530.0- 580.0 AS ABOVE,

LITHOLOGIC LOG
W-OKF42 . HIGHLANDS CO. T34S, R31E, SEC 23

580.0- 590.0 LIMESTONE, VERY LIGHT GRAY TO VERY LIGHT ORANGE, POROSITY, INTERGRANULAR, VUGULAR, GRAIN TYPE: BIOGENIC, CRYSTALS, 75% ALLOCHEMICAL CONSTITUENTS, GRAIN SIZE: MEDIUM, RANGE: VERY FINE TO COARSE, POOR INDURATION, CALCILUTITE MATRIX, SPARRY CALCITE CEMENT, CHALKY, LOW RECRYSTALLIZATION, ECHINOID, BENTHONIC FORAMINIFERA, BRYOZOA, WORM TRACES, CONES,

FIRST OCCURRENCE OF DICTYOCONUS SP.
ECHINOIDS REPLACED BY BLOCKY SPARRY CALCITE

590.0- 600.0 LIMESTONE, VERY LIGHT ORANGE TO VERY LIGHT GRAY, POROSITY, INTERGRANULAR, VUGULAR, POSSIBLY HIGH PERMEABILITY, GRAIN TYPE: CRYSTALS, CALCILUTITE, BIOGENIC, 50% ALLOCHEMICAL CONSTITUENTS, GRAIN SIZE: MEDIUM, RANGE: VERY FINE TO COARSE, POOR INDURATION, SPARRY CALCITE CEMENT, CALCILUTITE MATRIX, CHALKY, LOW RECRYSTALLIZATION, ECHINOID, CONES, BENTHONIC FORAMINIFERA, BRYOZOA, WORM TRACES,

600.0- 620.0 AS ABOVE,

620.0- 630.0 LIMESTONE, VERY LIGHT ORANGE, POROSITY, VUGULAR, PIN POINT VUGS, GRAIN TYPE: CALCILUTITE, CRYSTALS, 30% ALLOCHEMICAL CONSTITUENTS, GRAIN SIZE: FINE, RANGE: MICROCRYSTALLINE TO COARSE, POOR INDURATION, CALCILUTITE MATRIX, SPARRY CALCITE CEMENT, CHALKY, ECHINOID, BENTHONIC FORAMINIFERA,

630.0- 660.0 AS ABOVE,

660.0- 670.0 LIMESTONE, VERY LIGHT ORANGE, POROSITY, PIN POINT VUGS, INTERGRANULAR, GRAIN TYPE: CALCILUTITE, CRYSTALS, IK? ALLOCHEMICAL CONSTITUENTS, GRAIN SIZE: FINE, RANGE: MICROCRYSTALLINE TO COARSE, POOR INDURATION, CALCILUTITE MATRIX, SPARRY CALCITE CEMENT, CHALKY, ECHINOID, BENTHONIC FORAMINIFERA, CONES, BRYOZOA,

670.0- 710.0 AS ABOVE,

710.0- 720.0 LIMESTONE, VERY LIGHT ORANGE TO GRAYISH ORANGE, POROSITY, INTERGRANULAR, VUGULAR, GRAIN TYPE: CRYSTALS, BIOGENIC, CALCILUTITE, 30% ALLOCHEMICAL CONSTITUENTS, GRAIN SIZE: FINE, RANGE: MICROCRYSTALLINE TO COARSE, POOR INDURATION, SPARRY CALCITE CEMENT, CALCILUTITE MATRIX, CHALKY, LOW RECRYSTALLIZATION, CONES, ECHINOID, BENTHONIC FORAMINIFERA, BRYOZOA,

720.0- 730.0 LIMESTONE, GRAYISH BROWN TO GRAYISH ORANGE, POROSITY, INTERGRANULAR, VUGULAR, GRAIN TYPE: CRYSTALS, CALCILUTITE, 25% ALLOCHEMICAL CONSTITUENTS, GRAIN SIZE: FINE, RANGE: MICROCRYSTALLINE TO COARSE, POOR INDURATION, SPARRY CALCITE CEMENT, DOLOMITE CEMENT, 01% QUARTZ SAND, DOLOMITIC, CHALKY, CONES, ECHINOID, BENTHONIC FORAMINIFERA, BRYOZOA,

LITHOLOGIC LOG
W-OKF42 . HIGHLANDS CO. T34S, R31E, SEC 23

730.0- 740.0 LIMESTONE, VERY LIGHT GRAY TO VERY LIGHT ORANGE, POROSITY, INTERGRANULAR, VUGULAR, GRAIN TYPE: CRYSTALS, CALCILUTITE, 25% ALLOCHEMICAL CONSTITUENTS, GRAIN SIZE: FINE, RANGE: MICROCRYSTALLINE TO COARSE, POOR INDURATION, SPARRY CALCITE CEMENT, 01% QUARTZ SAND, CHALKY, CONES, BENTHONIC FORAMINIFERA, BRYOZOA,

740.0- 750.0 LIMESTONE, VERY LIGHT GRAY TO LIGHT OLIVE GRAY, POROSITY, INTERGRANULAR, VUGULAR, GRAIN TYPE: CRYSTALS, CALCILUTITE, GRAIN SIZE: FINE, RANGE: MICROCRYSTALLINE TO COARSE, POOR INDURATION, SPARRY CALCITE CEMENT, CLAY MATRIX, 03% CLAY, 01% QUARTZ SAND, CHALKY, CONES, BENTHONIC FORAMINIFERA, BRYOZOA,

750.0- 760.0 LIMESTONE, VERY LIGHT GRAY TO MODERATE GRAY, POROSITY, INTERGRANULAR, VUGULAR, LOW PERMEABILITY, GRAIN TYPE: CRYSTALS, CALCILUTITE, 10% ALLOCHEMICAL CONSTITUENTS, GRAIN SIZE: VERY FINE, RANGE: MICROCRYSTALLINE TO COARSE, POOR INDURATION, SPARRY CALCITE CEMENT, CLAY MATRIX, 05% CLAY, 02% QUARTZ SAND, CHALKY, CONES, ECHINOID, BENTHONIC FORAMINIFERA, BRYOZOA,

760.0- 770.0 LIMESTONE, VERY LIGHT ORANGE, POROSITY, INTERGRANULAR, VUGULAR, GRAIN TYPE: CRYSTALS, CALCILUTITE, 25% ALLOCHEMICAL CONSTITUENTS, GRAIN SIZE: FINE, RANGE: MICROCRYSTALLINE TO COARSE, POOR INDURATION, SPARRY CALCITE CEMENT, CALCILUTITE MATRIX, CHALKY, CONES, ECHINOID, BENTHONIC FORAMINIFERA, BRYOZOA,

770.0- 790.0 AS ABOVE,

790.0- 800.0 DOLOMITE, GRAYISH BROWN TO MODERATE YELLOWISH BROWN, POROSITY, INTERGRANULAR, FRACTURE, POSSIBLY HIGH PERMEABILITY, 10-50% ALTERED, SUBHEDRAL, GRAIN SIZE: FINE, MODERATE INDURATION, SPARRY CALCITE CEMENT, CALCILUTITE MATRIX, BENTHONIC FORAMINIFERA, BRYOZOA,

800.0- 810.0 LIMESTONE, WHITE TO VERY LIGHT ORANGE, POROSITY, INTERGRANULAR, GRAIN TYPE: CRYSTALS, CALCILUTITE, BIOGENIC, 25% ALLOCHEMICAL CONSTITUENTS, GRAIN SIZE: FINE, RANGE: MICROCRYSTALLINE TO COARSE, POOR INDURATION, SPARRY CALCITE CEMENT, CALCILUTITE MATRIX, CHALKY, DOLOMITIC, LOW RECRYSTALLIZATION, BENTHONIC FORAMINIFERA, ECHINOID, BRYOZOA,

810.0- 820.0 LIMESTONE, WHITE TO VERY LIGHT ORANGE, POROSITY, INTERGRANULAR, PIN POINT VUGS, GRAIN TYPE: CRYSTALS, CALCILUTITE, BIOGENIC, 20% ALLOCHEMICAL CONSTITUENTS, GRAIN SIZE: VERY FINE, RANGE: MICROCRYSTALLINE TO MEDIUM, MODERATE INDURATION, SPARRY CALCITE CEMENT, CALCILUTITE MATRIX, CHALKY, DOLOMITIC, LOW RECRYSTALLIZATION, BENTHONIC FORAMINIFERA, ECHINOID, BRYOZOA, CONES,

820.0- 860.0 AS ABOVE,

LITHOLOGIC LOG
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860.0- 870.0 LIMESTONE, VERY LIGHT GRAY TO MODERATE LIGHT GRAY, POROSITY, INTERGRANULAR, PIN POINT VUGS, GRAIN TYPE: CRYSTALS, CALCILUTITE, BIOGENIC, 20% ALLOCHEMICAL CONSTITUENTS, GRAIN SIZE: VERY FINE, RANGE: MICROCRYSTALLINE TO MEDIUM, MODERATE INDURATION, SPARRY CALCITE CEMENT, CALCILUTITE MATRIX, CHALKY, DOLOMITIC, LOW RECRYSTALLIZATION, BENTHONIC FORAMINIFERA, ECHINOID, BRYOZOA, CONES,

870.0- 880.0 DOLOMITE, VERY LIGHT ORANGE TO GRAYISH BROWN, POROSITY, INTERGRANULAR, PIN POINT VUGS, MODERATE INDURATION, SPARRY CALCITE CEMENT, CALCILUTITE MATRIX, CHALKY, DOLOMITIC, MEDIUM RECRYSTALLIZATION, BENTHONIC FORAMINIFERA, ECHINOID, BRYOZOA, CONES,

880.0- 890.0 LIMESTONE, VERY LIGHT GRAY TO MODERATE LIGHT GRAY, POROSITY, INTERGRANULAR, PIN POINT VUGS, GRAIN TYPE: CRYSTALS, CALCILUTITE, BIOGENIC, 20% ALLOCHEMICAL CONSTITUENTS, GRAIN SIZE: VERY FINE, RANGE: MICROCRYSTALLINE TO MEDIUM, MODERATE INDURATION, SPARRY CALCITE CEMENT, CALCILUTITE MATRIX, CHALKY, DOLOMITIC, LOW RECRYSTALLIZATION, BENTHONIC FORAMINIFERA, ECHINOID, BRYOZOA, CONES,

890.0- 900.0 DOLOMITE, GRAYISH ORANGE TO GRAYISH BROWN, POROSITY, PIN POINT VUGS, POOR INDURATION, CALCILUTITE MATRIX, SPARRY CALCITE CEMENT, CHALKY, DOLOMITIC, LOW RECRYSTALLIZATION, BENTHONIC FORAMINIFERA, ECHINOID, BRYOZOA, CONES,

ABUNDANT SMALL FRAGMENTS OF ECHNOIDS SPINES, AND OTHER BIOGENIC MATERIAL

900.0- 910.0 LIMESTONE, WHITE TO VERY LIGHT GRAY, POROSITY, INTERGRANULAR, VUGULAR, GRAIN TYPE: CRYSTALS, CALCILUTITE, BIOGENIC, 15% ALLOCHEMICAL CONSTITUENTS, GRAIN SIZE: VERY FINE, RANGE: MICROCRYSTALLINE TO COARSE, POOR INDURATION, CALCILUTITE MATRIX, SPARRY CALCITE CEMENT, CHALKY, CONES, ECHINOID, BENTHONIC FORAMINIFERA, BRYOZOA,

DOLOMITE, VERY LIGHT ORANGE TO GRAYISH BROWN, POROSITY, INTERGRANULAR, FRACTURE, VUGULAR, 10-50% ALTERED, SUBHEDRAL, GRAIN SIZE: VERY FINE, RANGE: MICROCRYSTALLINE TO COARSE, MODERATE INDURATION, CALCILUTITE MATRIX, SPARRY CALCITE CEMENT, CHALKY, CONES, ECHINOID, BENTHONIC FORAMINIFERA, BRYOZOA,

910.0- 920.0 AS ABOVE,

920.0- 930.0 LIMESTONE, VERY LIGHT GRAY TO LIGHT GRAY, POROSITY, INTERGRANULAR, VUGULAR, GRAIN TYPE: CRYSTALS, CALCILUTITE, BIOGENIC, 10% ALLOCHEMICAL CONSTITUENTS, GRAIN SIZE: VERY FINE, RANGE: MICROCRYSTALLINE TO COARSE, POOR INDURATION, CALCILUTITE MATRIX, SPARRY CALCITE CEMENT, CHALKY, CONES, ECHINOID, BENTHONIC FORAMINIFERA, BRYOZOA,

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930.0- 940.0 DOLOMITE, GRAYISH ORANGE TO GRAYISH BROWN, POROSITY, INTERGRANULAR, VUGULAR, 10-50% ALTERED, SUBHEDRAL, GRAIN SIZE: VERY FINE, RANGE: MICROCRYSTALLINE TO COARSE, MODERATE INDURATION, CALCILUTITE MATRIX, DOLOMITE CEMENT, MEDIUM RECRYSTALLIZATION, CONES, ECHINOID, BENTHONIC FORAMINIFERA, BRYOZOA,

ABUNDANT DOLOMITIZED LOOSELY CEMENTED BENTHONIC FORAMS

940.0- 980.0 AS ABOVE,

980.0- 990.0 DOLOMITE, MODERATE YELLOWISH BROWN TO GRAYISH ORANGE, POROSITY, INTERGRANULAR, VUGULAR, 50-90% ALTERED, EUHEDRAL, GRAIN SIZE: FINE, RANGE: VERY FINE TO COARSE, POOR INDURATION, CALCILUTITE MATRIX, DOLOMITE CEMENT, 03% QUARTZ SAND, CHALKY, CONES, BENTHONIC FORAMINIFERA, BRYOZOA, ALGAE,

990.0- 1000.0 AS ABOVE,

1000.0- 1010.0 DOLOMITE, GRAYISH BROWN TO MODERATE YELLOWISH BROWN, POROSITY, VUGULAR, INTERGRANULAR, 50-90% ALTERED, EUHEDRAL, GRAIN SIZE: FINE, RANGE: MICROCRYSTALLINE TO MEDIUM, MODERATE INDURATION, CALCILUTITE MATRIX, DOLOMITE CEMENT, 02% QUARTZ SAND, MEDIUM RECRYSTALLIZATION, CONES, BENTHONIC FORAMINIFERA, BRYOZOA, ALGAE,

1010.0- 1040.0 AS ABOVE,

1040.0- 1050.0 LIMESTONE, VERY LIGHT GRAY TO VERY LIGHT ORANGE, POROSITY, INTERGRANULAR, GRAIN TYPE: CALCILUTITE, CALCILUTITE, BIOGENIC, 20% ALLOCHEMICAL CONSTITUENTS, GRAIN SIZE: FINE, RANGE: VERY FINE TO COARSE, MODERATE INDURATION, CALCILUTITE MATRIX, SPARRY CALCITE CEMENT, MEDIUM RECRYSTALLIZATION, CONES, BENTHONIC FORAMINIFERA,

ABUNDANT CONES WITH WORN TESTS

1050.0- 1060.0 AS ABOVE,

1060.0- 1070.0 LIMESTONE, VERY LIGHT ORANGE TO GRAYISH ORANGE, POROSITY, INTERGRANULAR, VUGULAR, GRAIN TYPE: CALCILUTITE, CRYSTALS, BIOGENIC, 10% ALLOCHEMICAL CONSTITUENTS, GRAIN SIZE: FINE, RANGE: MICROCRYSTALLINE TO COARSE, POOR INDURATION, CALCILUTITE MATRIX, SPARRY CALCITE CEMENT, CHALKY, MEDIUM RECRYSTALLIZATION, CONES, BENTHONIC FORAMINIFERA,

1070.0- 1090.0 AS ABOVE,

CAVINGS FROM OCALA

1090.0- 1100.0 LIMESTONE, VERY LIGHT ORANGE, POROSITY, INTERGRANULAR, GRAIN TYPE: CRYSTALS, CALCILUTITE, 20% ALLOCHEMICAL CONSTITUENTS, GRAIN SIZE: FINE, RANGE: VERY FINE TO COARSE, POOR INDURATION, CHALKY, CONES, ECHINOID, BENTHONIC FORAMINIFERA,

LITHOLOGIC LOG
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1100.0- 1110.0 LIMESTONE, WHITE TO VERY LIGHT GRAY, POROSITY, INTERGRANULAR, VUGULAR, GRAIN TYPE: CRYSTALS, CALCILUTITE, 10% ALLOCHEMICAL CONSTITUENTS, GRAIN SIZE: FINE, RANGE: VERY FINE TO COARSE, POOR INDURATION, CHALKY, CONES, ECHINOID, BENTHONIC FORAMINIFERA,

1110.0- 1130.0 AS ABOVE,

1130.0- 1140.0 DOLOMITE, VERY LIGHT ORANGE TO GRAYISH ORANGE, POROSITY, INTERGRANULAR, VUGULAR, 10-50% ALTERED, ANHEDRAL, GRAIN SIZE: FINE, RANGE: VERY FINE TO COARSE, MODERATE INDURATION, DOLOMITE CEMENT, SPARRY CALCITE CEMENT, MEDIUM RECRYSTALLIZATION, CONES, BENTHONIC FORAMINIFERA,

1140.0- 1150.0 DOLOMITE, VERY LIGHT ORANGE TO GRAYISH ORANGE, POROSITY, INTERGRANULAR, VUGULAR, 10-50% ALTERED, SUBHEDRAL, GRAIN SIZE: FINE, MODERATE INDURATION, DOLOMITE CEMENT, SPARRY CALCITE CEMENT, MEDIUM RECRYSTALLIZATION, CONES, BENTHONIC FORAMINIFERA,

1150.0- 1160.0 DOLOMITE, MODERATE YELLOWISH BROWN TO DARK YELLOWISH BROWN, POROSITY, INTERGRANULAR, FRACTURE, 50-90% ALTERED, EUHEDRAL, GRAIN SIZE: FINE, GOOD INDURATION, DOLOMITE CEMENT, SPARRY CALCITE CEMENT, HIGH RECRYSTALLIZATION,

1160.0- 1180.0 FROM 1160 TO 1180 IS A FINE, UNCONSOLIDATED DOLOSILT. THIS FINE MATERIAL WAS CLOGGING THE DRILL RODS. CAVED IN BACK TO 1152 WHEN GEOPHYSICALLY LOGGED

SOUTH FLORIDA WMD - LITHO LOG PRINTOUT

W-0KF42
HIGHLANDS CO. T34S R31E SEC 23 27 30 07 N 81 11 46 W
TOTAL DEPTH- 1180 FT. ELEV.- FT. 118 SAMPLES- 0- 1180 FT.
COMPLETED- 82.04.21 DEPTH WORKED 1180 FT.

WELL NAME-
S65C- SFWMD EXPLORATORY WELL- ALVIN WOOSTER, DRILLER
REMARKS-
CUTTING COLLECTED AND DESCRIBED BY
JON SHAW, SFWMD, APRIL 30, 1982
GEOPHYSICAL LOGS AVAILABLE

HYDROGEOLOGIC UNITS

0.0-	180.0	SHALLOW AQUIFER SYSTEM
180.0-	370.0	HAWTHORN CONFINING BED
370.0-	1100.0	FLORIDAN AQUIFER SYSTEM

STRATIGRAPHIC FORMATIONS -

0.0-	180.0	UNDIFFERENTIATED SAND, CLAY AND SHELLS
180.0-	420.0	HAWTHORN FORMATION
420.0-	590.0	OCALA GROUP
590.0-	1180.0	AVON PARK LIMESTONE

LITHOLOGIC LOG
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0.0-	20.0	SAND, DARK BROWN TO MODERATE BROWN, POROSITY, INTERGRANULAR, GRAIN SIZE: MEDIUM, RANGE: FINE TO COARSE, SUB-ANGULAR, UNCONSOLIDATED, ORGANIC MATRIX, 05% IRON STAIN, NO FOSSIL, ORGANICS,
20.0-	40.0	SHELL BED, MODERATE GRAY TO LIGHT GRAY, POROSITY, INTERGRANULAR, MOLDIC, UNCONSOLIDATED, 40% QUARTZ SAND, 05% CLAY, VARVED, MOLLUSKS,
40.0-	50.0	CLAY, LIGHT OLIVE GRAY, POROSITY, LOW PERMEABILITY, UNCONSOLIDATED, CLAY MATRIX, CALCILUTITE MATRIX, 05% QUARTZ SAND, 03% PHOSPHATIC SAND, CALCAREOUS, MOLLUSKS,
50.0-	60.0	SAND, LIGHT OLIVE GRAY TO VERY LIGHT GRAY, POROSITY, INTERGRANULAR, LOW PERMEABILITY, GRAIN SIZE: FINE, RANGE: MICROCRYSTALLINE TO MEDIUM, ANGULAR, UNCONSOLIDATED, CLAY MATRIX, 05% PHOSPHATIC SAND, CALCAREOUS, MOLLUSKS, SHARK TEETH,
60.0-	70.0	SAND, GREENISH GRAY TO VERY LIGHT GRAY, POROSITY, INTERGRANULAR, MOLDIC, GRAIN SIZE: MEDIUM, RANGE: MICROCRYSTALLINE TO VERY COARSE, SUB-ANGULAR, UNCONSOLIDATED, CLAY MATRIX, 07% PHOSPHATIC SAND, 20% CLAY, MOLLUSKS, SHARK TEETH, CRUSTACEA,

LITHOLOGIC LOG
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70.0- 80.0 SAND, LIGHT OLIVE GRAY, POROSITY, INTERGRANULAR, GRAIN SIZE: MEDIUM, RANGE: MICROCRYSTALLINE TO COARSE, ANGULAR, UNCONSOLIDATED, CLAY MATRIX, 15% PHOSPHATIC SAND, 20% CLAY, MOLLUSKS,

SHELL BED, WHITE, POROSITY, MOLDIC, UNCONSOLIDATED, MOLLUSKS,

80.0- 90.0 SAND, LIGHT OLIVE GRAY, POROSITY, INTERGRANULAR, GRAIN SIZE: MEDIUM, RANGE: MICROCRYSTALLINE TO COARSE, ANGULAR, UNCONSOLIDATED, CLAY MATRIX, 15% PHOSPHATIC SAND, 15% CLAY, CALCAREOUS, MOLLUSKS,

PHOSPHATE RUBBLE

90.0- 100.0 SAND, LIGHT OLIVE GRAY, POROSITY, INTERGRANULAR, LOW PERMEABILITY, GRAIN SIZE: FINE, RANGE: MICROCRYSTALLINE TO MEDIUM, SUB-ANGULAR, UNCONSOLIDATED, CLAY MATRIX, 03% PHOSPHATIC SAND, 15% CLAY, CALCAREOUS, MOLLUSKS,

ARAGONITE NEEDLES

100.0- 110.0 SAND, GRAYISH OLIVE, POROSITY, INTERGRANULAR, LOW PERMEABILITY, GRAIN SIZE: VERY FINE, RANGE: MICROCRYSTALLINE TO MEDIUM, UNCONSOLIDATED, CLAY MATRIX, 03% PHOSPHATIC SAND, 20% CLAY, CALCAREOUS, MOLLUSKS,

110.0- 140.0 AS ABOVE,

140.0- 150.0 SANDSTONE, YELLOWISH GRAY, POROSITY, POSSIBLY HIGH PERMEABILITY, MODERATE INDURATION, SPARRY CALCITE CEMENT, SILICIC CEMENT, 75% QUARTZ SAND, 03% PHOSPHATIC SAND, CALCAREOUS, MOLLUSKS,

POSSIBLE GOOD AQUIFER

150.0- 170.0 AS ABOVE,

170.0- 180.0 SAND, GRAYISH OLIVE, POROSITY, INTERGRANULAR, LOW PERMEABILITY, GRAIN SIZE: FINE, RANGE: MICROCRYSTALLINE TO MEDIUM, SUB-ANGULAR, UNCONSOLIDATED, CLAY MATRIX, 25% CLAY, 01% PHOSPHATIC SAND, NO FOSSIL,

TOP OF CONFINING ZONE

180.0- 210.0 AS ABOVE,

SHELL CAVINGS FROM ABOVE

210.0- 240.0 AS ABOVE,

240.0- 250.0 SAND, LIGHT OLIVE GRAY, POROSITY, LOW PERMEABILITY, GRAIN SIZE: FINE, SUB-ANGULAR, UNCONSOLIDATED, CLAY MATRIX, 02% PHOSPHATIC SAND, NO FOSSIL,

LITHOLOGIC LOG
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250.0- 260.0 AS ABOVE,

260.0- 270.0 CLAY, OLIVE GRAY, POROSITY, LOW PERMEABILITY, UNCONSOLIDATED, 15% PHOSPHATIC SAND, 05% QUARTZ SAND, NO FOSSIL,

270.0- 310.0 AS ABOVE,

310.0- 320.0 CLAY, VERY LIGHT GRAY TO LIGHT GRAY, POROSITY, LOW PERMEABILITY, UNCONSOLIDATED, 30% PHOSPHATIC SAND, 05% QUARTZ SAND, CALCAREOUS, MOLLUSKS,

320.0- 330.0 LIMESTONE, VERY LIGHT GRAY, POROSITY, LOW PERMEABILITY, UNCONSOLIDATED, 25% PHOSPHATIC SAND, 15% QUARTZ SAND, 20% CLAY, CALCAREOUS, FOSSIL MOLDS,

LARGE PHOSPHATE PEBBLES

330.0- 350.0 AS ABOVE,

350.0- 360.0 SAND, YELLOWISH GRAY, POROSITY, LOW PERMEABILITY, GRAIN SIZE: FINE, RANGE: MICROCRYSTALLINE TO MEDIUM, ROUNDED, UNCONSOLIDATED, CLAY MATRIX, CALCILUTITE MATRIX, 05% PHOSPHATIC SAND, 10% CLAY, CALCAREOUS, FOSSIL FRAGMENTS,

360.0- 370.0 AS ABOVE,

SOME SPARRY CALCITE

370.0- 380.0 LIMESTONE, WHITE, POROSITY, POSSIBLY HIGH PERMEABILITY, GRAIN TYPE: CALCILUTITE, CRYSTALS, 10% ALLOCHEMICAL CONSTITUENTS, GRAIN SIZE: FINE, RANGE: MICROCRYSTALLINE TO MEDIUM, MODERATE INDURATION, CALCILUTITE MATRIX, SPARRY CALCITE CEMENT, 10% PHOSPHATIC SAND, CHALKY, MOLLUSKS,

TOP OF FLORIDAN AQUIFER SYSTEM

380.0- 390.0 AS ABOVE,

390.0- 400.0 LIMESTONE, WHITE TO GRAYISH BROWN, GRAIN TYPE: CALCILUTITE, CRYSTALS, INTRACLASTS, 05% ALLOCHEMICAL CONSTITUENTS, GRAIN SIZE: FINE, GOOD INDURATION, CALCILUTITE MATRIX, SPARRY CALCITE CEMENT, 15% PHOSPHATIC SAND, 02% QUARTZ SAND, CHALKY, MEDIUM RECRYSTALLIZATION, MOLLUSKS,

MIXTURE OF A CHALKY WHITE LIMESTONE AND A WELL INDURATED LIGHT BROWN LIMESTONE WITH QUARTZ AND PHOSPHATE INTERCLASTS

400.0- 410.0 AS ABOVE,

LITHOLOGIC LOG
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410.0- 420.0 LIMESTONE, WHITE TO VERY LIGHT GRAY, POROSITY, INTERGRANULAR, GRAIN TYPE: BIOGENIC, CRYSTALS, CALCILUTITE, 25% ALLOCHEMICAL CONSTITUENTS, GRAIN SIZE: MEDIUM, RANGE: FINE TO COARSE, MODERATE INDURATION, CALCILUTITE MATRIX, CHALKY, BENTHONIC FORAMINIFERA, BRYOZOA,

FIRST OCCURRENCE OF LEPIDOCYLINA SP.

420.0- 430.0 AS ABOVE,

WITH NUMULITES SP.

430.0- 440.0 LIMESTONE, WHITE, POROSITY, LOW PERMEABILITY, GRAIN TYPE: CALCILUTITE, BIOGENIC, 05% ALLOCHEMICAL CONSTITUENTS, GRAIN SIZE: VERY FINE, POOR INDURATION, CHALKY, BENTHONIC FORAMINIFERA, BRYOZOA,

EXTREMEY CHALKY

440.0- 450.0 LIMESTONE, WHITE, POROSITY, INTERGRANULAR, GRAIN TYPE: BIOGENIC, INTRACLASTS, CALCILUTITE, 25% ALLOCHEMICAL CONSTITUENTS, GRAIN SIZE: MEDIUM, RANGE: FINE TO COARSE, MODERATE INDURATION, CALCILUTITE MATRIX, CHALKY, BENTHONIC FORAMINIFERA, BRYOZOA,

LEPIDOCYLINA OCALANA

450.0- 460.0 AS ABOVE,

460.0- 470.0 LIMESTONE, WHITE, POROSITY, INTERGRANULAR, GRAIN TYPE: BIOGENIC, INTRACLASTS, 75% ALLOCHEMICAL CONSTITUENTS, GRAIN SIZE: MEDIUM, RANGE: FINE TO COARSE, MODERATE INDURATION, CALCILUTITE MATRIX, COQUINA, CHALKY, BENTHONIC FORAMINIFERA, BRYOZOA, MOLLUSKS,

LEP HASH

470.0- 520.0 AS ABOVE,

520.0- 530.0 LIMESTONE, WHITE TO VERY LIGHT GRAY, POROSITY, INTERGRANULAR, GRAIN TYPE: BIOGENIC, CRYSTALS, 85% ALLOCHEMICAL CONSTITUENTS, GRAIN SIZE: COARSE, RANGE: FINE TO VERY COARSE, POOR INDURATION, CALCILUTITE MATRIX, SPARRY CALCITE CEMENT, CLAY MATRIX, CHALKY, COQUINA, BENTHONIC FORAMINIFERA, BRYOZOA,

OPERCULINOIDES SP.
MANY LEPS ARE REPLACED WITH BLACK (ORGANIC OR PHOSPHATIC)MATERIAL

530.0- 580.0 AS ABOVE,

LITHOLOGIC LOG
W-OKF42 . HIGHLANDS CO. T34S, R31E, SEC 23

580.0- 590.0 LIMESTONE, VERY LIGHT GRAY TO VERY LIGHT ORANGE, POROSITY, INTERGRANULAR, VUGULAR, GRAIN TYPE: BIOGENIC, CRYSTALS, 75% ALLOCHEMICAL CONSTITUENTS, GRAIN SIZE: MEDIUM, RANGE: VERY FINE TO COARSE, POOR INDURATION, CALCILUTITE MATRIX, SPARRY CALCITE CEMENT, CHALKY, LOW RECRYSTALLIZATION, ECHINOID, BENTHONIC FORAMINIFERA, BRYOZOA, WORM TRACES, CONES,

FIRST OCCURRENCE OF DICTYOCONUS SP.
ECHINOIDS REPLACED BY BLOCKY SPARRY CALCITE

590.0- 600.0 LIMESTONE, VERY LIGHT ORANGE TO VERY LIGHT GRAY, POROSITY, INTERGRANULAR, VUGULAR, POSSIBLY HIGH PERMEABILITY, GRAIN TYPE: CRYSTALS, CALCILUTITE, BIOGENIC, 50% ALLOCHEMICAL CONSTITUENTS, GRAIN SIZE: MEDIUM, RANGE: VERY FINE TO COARSE, POOR INDURATION, SPARRY CALCITE CEMENT, CALCILUTITE MATRIX, CHALKY, LOW RECRYSTALLIZATION, ECHINOID, CONES, BENTHONIC FORAMINIFERA, BRYOZOA, WORM TRACES,

600.0- 620.0 AS ABOVE,

620.0- 630.0 LIMESTONE, VERY LIGHT ORANGE, POROSITY, VUGULAR, PIN POINT VUGS, GRAIN TYPE: CALCILUTITE, CRYSTALS, 30% ALLOCHEMICAL CONSTITUENTS, GRAIN SIZE: FINE, RANGE: MICROCRYSTALLINE TO COARSE, POOR INDURATION, CALCILUTITE MATRIX, SPARRY CALCITE CEMENT, CHALKY, ECHINOID, BENTHONIC FORAMINIFERA,

630.0- 660.0 AS ABOVE,

660.0- 670.0 LIMESTONE, VERY LIGHT ORANGE, POROSITY, PIN POINT VUGS, INTERGRANULAR, GRAIN TYPE: CALCILUTITE, CRYSTALS, IK% ALLOCHEMICAL CONSTITUENTS, GRAIN SIZE: FINE, RANGE: MICROCRYSTALLINE TO COARSE, POOR INDURATION, CALCILUTITE MATRIX, SPARRY CALCITE CEMENT, CHALKY, ECHINOID, BENTHONIC FORAMINIFERA, CONES, BRYOZOA,

670.0- 710.0 AS ABOVE,

710.0- 720.0 LIMESTONE, VERY LIGHT ORANGE TO GRAYISH ORANGE, POROSITY, INTERGRANULAR, VUGULAR, GRAIN TYPE: CRYSTALS, BIOGENIC, CALCILUTITE, 30% ALLOCHEMICAL CONSTITUENTS, GRAIN SIZE: FINE, RANGE: MICROCRYSTALLINE TO COARSE, POOR INDURATION, SPARRY CALCITE CEMENT, CALCILUTITE MATRIX, CHALKY, LOW RECRYSTALLIZATION, CONES, ECHINOID, BENTHONIC FORAMINIFERA, BRYOZOA,

720.0- 730.0 LIMESTONE, GRAYISH BROWN TO GRAYISH ORANGE, POROSITY, INTERGRANULAR, VUGULAR, GRAIN TYPE: CRYSTALS, CALCILUTITE, 25% ALLOCHEMICAL CONSTITUENTS, GRAIN SIZE: FINE, RANGE: MICROCRYSTALLINE TO COARSE, POOR INDURATION, SPARRY CALCITE CEMENT, DOLOMITE CEMENT, 01% QUARTZ SAND, DOLOMITIC, CHALKY, CONES, ECHINOID, BENTHONIC FORAMINIFERA, BRYOZOA,

LITHOLOGIC LOG
W-OKF42 . HIGHLANDS CO. T34S, R31E, SEC 23

730.0- 740.0 LIMESTONE, VERY LIGHT GRAY TO VERY LIGHT ORANGE, POROSITY, INTERGRANULAR, VUGULAR, GRAIN TYPE: CRYSTALS, CALCILUTITE, 25% ALLOCHEMICAL CONSTITUENTS, GRAIN SIZE: FINE, RANGE: MICROCRYSTALLINE TO COARSE, POOR INDURATION, SPARRY CALCITE CEMENT, 01% QUARTZ SAND, CHALKY, CONES, BENTHONIC FORAMINIFERA, BRYOZOA,

740.0- 750.0 LIMESTONE, VERY LIGHT GRAY TO LIGHT OLIVE GRAY, POROSITY, INTERGRANULAR, VUGULAR, GRAIN TYPE: CRYSTALS, CALCILUTITE, GRAIN SIZE: FINE, RANGE: MICROCRYSTALLINE TO COARSE, POOR INDURATION, SPARRY CALCITE CEMENT, CLAY MATRIX, 03% CLAY, 01% QUARTZ SAND, CHALKY, CONES, BENTHONIC FORAMINIFERA, BRYOZOA,

750.0- 760.0 LIMESTONE, VERY LIGHT GRAY TO MODERATE GRAY, POROSITY, INTERGRANULAR, VUGULAR, LOW PERMEABILITY, GRAIN TYPE: CRYSTALS, CALCILUTITE, 10% ALLOCHEMICAL CONSTITUENTS, GRAIN SIZE: VERY FINE, RANGE: MICROCRYSTALLINE TO COARSE, POOR INDURATION, SPARRY CALCITE CEMENT, CLAY MATRIX, 05% CLAY, 02% QUARTZ SAND, CHALKY, CONES, ECHINOID, BENTHONIC FORAMINIFERA, BRYOZOA,

760.0- 770.0 LIMESTONE, VERY LIGHT ORANGE, POROSITY, INTERGRANULAR, VUGULAR, GRAIN TYPE: CRYSTALS, CALCILUTITE, 25% ALLOCHEMICAL CONSTITUENTS, GRAIN SIZE: FINE, RANGE: MICROCRYSTALLINE TO COARSE, POOR INDURATION, SPARRY CALCITE CEMENT, CALCILUTITE MATRIX, CHALKY, CONES, ECHINOID, BENTHONIC FORAMINIFERA, BRYOZOA,

770.0- 790.0 AS ABOVE,

790.0- 800.0 DOLOMITE, GRAYISH BROWN TO MODERATE YELLOWISH BROWN, POROSITY, INTERGRANULAR, FRACTURE, POSSIBLY HIGH PERMEABILITY, 10-50% ALTERED, SUBHEDRAL, GRAIN SIZE: FINE, MODERATE INDURATION, SPARRY CALCITE CEMENT, CALCILUTITE MATRIX, BENTHONIC FORAMINIFERA, BRYOZOA,

800.0- 810.0 LIMESTONE, WHITE TO VERY LIGHT ORANGE, POROSITY, INTERGRANULAR, GRAIN TYPE: CRYSTALS, CALCILUTITE, BIOGENIC, 25% ALLOCHEMICAL CONSTITUENTS, GRAIN SIZE: FINE, RANGE: MICROCRYSTALLINE TO COARSE, POOR INDURATION, SPARRY CALCITE CEMENT, CALCILUTITE MATRIX, CHALKY, DOLOMITIC, LOW RECRYSTALLIZATION, BENTHONIC FORAMINIFERA, ECHINOID, BRYOZOA,

810.0- 820.0 LIMESTONE, WHITE TO VERY LIGHT ORANGE, POROSITY, INTERGRANULAR, PIN POINT VUGS, GRAIN TYPE: CRYSTALS, CALCILUTITE, BIOGENIC, 20% ALLOCHEMICAL CONSTITUENTS, GRAIN SIZE: VERY FINE, RANGE: MICROCRYSTALLINE TO MEDIUM, MODERATE INDURATION, SPARRY CALCITE CEMENT, CALCILUTITE MATRIX, CHALKY, DOLOMITIC, LOW RECRYSTALLIZATION, BENTHONIC FORAMINIFERA, ECHINOID, BRYOZOA, CONES,

820.0- 860.0 AS ABOVE,

LITHOLOGIC LOG
W-OKF42 . HIGHLANDS CO. T34S, R31E, SEC 23

860.0- 870.0 LIMESTONE, VERY LIGHT GRAY TO MODERATE LIGHT GRAY, POROSITY, INTERGRANULAR, PIN POINT VUGS, GRAIN TYPE: CRYSTALS, CALCILUTITE, BIOGENIC, 20% ALLOCHEMICAL CONSTITUENTS, GRAIN SIZE: VERY FINE, RANGE: MICROCRYSTALLINE TO MEDIUM, MODERATE INDURATION, SPARRY CALCITE CEMENT, CALCILUTITE MATRIX, CHALKY, DOLOMITIC, LOW RECRYSTALLIZATION, BENTHONIC FORAMINIFERA, ECHINOID, BRYOZOA, CONES,

870.0- 880.0 DOLOMITE, VERY LIGHT ORANGE TO GRAYISH BROWN, POROSITY, INTERGRANULAR, PIN POINT VUGS, MODERATE INDURATION, SPARRY CALCITE CEMENT, CALCILUTITE MATRIX, CHALKY, DOLOMITIC, MEDIUM RECRYSTALLIZATION, BENTHONIC FORAMINIFERA, ECHINOID, BRYOZOA, CONES,

880.0- 890.0 LIMESTONE, VERY LIGHT GRAY TO MODERATE LIGHT GRAY, POROSITY, INTERGRANULAR, PIN POINT VUGS, GRAIN TYPE: CRYSTALS, CALCILUTITE, BIOGENIC, 20% ALLOCHEMICAL CONSTITUENTS, GRAIN SIZE: VERY FINE, RANGE: MICROCRYSTALLINE TO MEDIUM, MODERATE INDURATION, SPARRY CALCITE CEMENT, CALCILUTITE MATRIX, CHALKY, DOLOMITIC, LOW RECRYSTALLIZATION, BENTHONIC FORAMINIFERA, ECHINOID, BRYOZOA, CONES,

890.0- 900.0 DOLOMITE, GRAYISH ORANGE TO GRAYISH BROWN, POROSITY, PIN POINT VUGS, POOR INDURATION, CALCILUTITE MATRIX, SPARRY CALCITE CEMENT, CHALKY, DOLOMITIC, LOW RECRYSTALLIZATION, BENTHONIC FORAMINIFERA, ECHINOID, BRYOZOA, CONES,

ABUNDANT SMALL FRAGMENTS OF ECHNOIDS SPINES, AND OTHER BIOGENIC MATERIAL

900.0- 910.0 LIMESTONE, WHITE TO VERY LIGHT GRAY, POROSITY, INTERGRANULAR, VUGULAR, GRAIN TYPE: CRYSTALS, CALCILUTITE, BIOGENIC, 15% ALLOCHEMICAL CONSTITUENTS, GRAIN SIZE: VERY FINE, RANGE: MICROCRYSTALLINE TO COARSE, POOR INDURATION, CALCILUTITE MATRIX, SPARRY CALCITE CEMENT, CHALKY, CONES, ECHINOID, BENTHONIC FORAMINIFERA, BRYOZOA,

DOLOMITE, VERY LIGHT ORANGE TO GRAYISH BROWN, POROSITY, INTERGRANULAR, FRACTURE, VUGULAR, 10-50% ALTERED, SUBHEDRAL, GRAIN SIZE: VERY FINE, RANGE: MICROCRYSTALLINE TO COARSE, MODERATE INDURATION, CALCILUTITE MATRIX, SPARRY CALCITE CEMENT, CHALKY, CONES, ECHINOID, BENTHONIC FORAMINIFERA, BRYOZOA,

910.0- 920.0 AS ABOVE,

920.0- 930.0 LIMESTONE, VERY LIGHT GRAY TO LIGHT GRAY, POROSITY, INTERGRANULAR, VUGULAR, GRAIN TYPE: CRYSTALS, CALCILUTITE, BIOGENIC, 10% ALLOCHEMICAL CONSTITUENTS, GRAIN SIZE: VERY FINE, RANGE: MICROCRYSTALLINE TO COARSE, POOR INDURATION, CALCILUTITE MATRIX, SPARRY CALCITE CEMENT, CHALKY, CONES, ECHINOID, BENTHONIC FORAMINIFERA, BRYOZOA,

LITHOLOGIC LOG
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930.0- 940.0 DOLOMITE, GRAYISH ORANGE TO GRAYISH BROWN, POROSITY, INTERGRANULAR, VUGULAR, 10-50% ALTERED, SUBHEDRAL, GRAIN SIZE: VERY FINE, RANGE: MICROCRYSTALLINE TO COARSE, MODERATE INDURATION, CALCILUTITE MATRIX, DOLOMITE CEMENT, MEDIUM RECRYSTALLIZATION, CONES, ECHINOID, BENTHONIC FORAMINIFERA, BRYOZOA,

ABUNDANT DOLOMITIZED LOOSELY CEMENTED BENTHONIC FORAMS

940.0- 980.0 AS ABOVE,

980.0- 990.0 DOLOMITE, MODERATE YELLOWISH BROWN TO GRAYISH ORANGE, POROSITY, INTERGRANULAR, VUGULAR, 50-90% ALTERED, EUHEDRAL, GRAIN SIZE: FINE, RANGE: VERY FINE TO COARSE, POOR INDURATION, CALCILUTITE MATRIX, DOLOMITE CEMENT, 03% QUARTZ SAND, CHALKY, CONES, BENTHONIC FORAMINIFERA, BRYOZOA, ALGAE,

990.0- 1000.0 AS ABOVE,

1000.0- 1010.0 DOLOMITE, GRAYISH BROWN TO MODERATE YELLOWISH BROWN, POROSITY, VUGULAR, INTERGRANULAR, 50-90% ALTERED, EUHEDRAL, GRAIN SIZE: FINE, RANGE: MICROCRYSTALLINE TO MEDIUM, MODERATE INDURATION, CALCILUTITE MATRIX, DOLOMITE CEMENT, 02% QUARTZ SAND, MEDIUM RECRYSTALLIZATION, CONES, BENTHONIC FORAMINIFERA, BRYOZOA, ALGAE,

1010.0- 1040.0 AS ABOVE,

1040.0- 1050.0 LIMESTONE, VERY LIGHT GRAY TO VERY LIGHT ORANGE, POROSITY, INTERGRANULAR, GRAIN TYPE: CALCILUTITE, CALCILUTITE, BIOGENIC, 20% ALLOCHEMICAL CONSTITUENTS, GRAIN SIZE: FINE, RANGE: VERY FINE TO COARSE, MODERATE INDURATION, CALCILUTITE MATRIX, SPARRY CALCITE CEMENT, MEDIUM RECRYSTALLIZATION, CONES, BENTHONIC FORAMINIFERA,

ABUNDANT CONES WITH WORN TESTS

1050.0- 1060.0 AS ABOVE,

1060.0- 1070.0 LIMESTONE, VERY LIGHT ORANGE TO GRAYISH ORANGE, POROSITY, INTERGRANULAR, VUGULAR, GRAIN TYPE: CALCILUTITE, CRYSTALS, BIOGENIC, 10% ALLOCHEMICAL CONSTITUENTS, GRAIN SIZE: FINE, RANGE: MICROCRYSTALLINE TO COARSE, POOR INDURATION, CALCILUTITE MATRIX, SPARRY CALCITE CEMENT, CHALKY, MEDIUM RECRYSTALLIZATION, CONES, BENTHONIC FORAMINIFERA,

1070.0- 1090.0 AS ABOVE,

CAVINGS FROM OCALA

1090.0- 1100.0 LIMESTONE, VERY LIGHT ORANGE, POROSITY, INTERGRANULAR, GRAIN TYPE: CRYSTALS, CALCILUTITE, 20% ALLOCHEMICAL CONSTITUENTS, GRAIN SIZE: FINE, RANGE: VERY FINE TO COARSE, POOR INDURATION, CHALKY, CONES, ECHINOID, BENTHONIC FORAMINIFERA,

LITHOLOGIC LOG
W-OKF42 . HIGHLANDS CO. T34S, R31E, SEC 23

1100.0- 1110.0 LIMESTONE, WHITE TO VERY LIGHT GRAY, POROSITY, INTERGRANULAR, VUGULAR, GRAIN TYPE: CRYSTALS, CALCILUTITE, 10% ALLOCHEMICAL CONSTITUENTS, GRAIN SIZE: FINE, RANGE: VERY FINE TO COARSE, POOR INDURATION, CHALKY, CONES, ECHINOID, BENTHONIC FORAMINIFERA,

1110.0- 1130.0 AS ABOVE,

1130.0- 1140.0 DOLOMITE, VERY LIGHT ORANGE TO GRAYISH ORANGE, POROSITY, INTERGRANULAR, VUGULAR, 10-50% ALTERED, ANHEDRAL, GRAIN SIZE: FINE, RANGE: VERY FINE TO COARSE, MODERATE INDURATION, DOLOMITE CEMENT, SPARRY CALCITE CEMENT, MEDIUM RECRYSTALLIZATION, CONES, BENTHONIC FORAMINIFERA,

1140.0- 1150.0 DOLOMITE, VERY LIGHT ORANGE TO GRAYISH ORANGE, POROSITY, INTERGRANULAR, VUGULAR, 10-50% ALTERED, SUBHEDRAL, GRAIN SIZE: FINE, MODERATE INDURATION, DOLOMITE CEMENT, SPARRY CALCITE CEMENT, MEDIUM RECRYSTALLIZATION, CONES, BENTHONIC FORAMINIFERA,

1150.0- 1160.0 DOLOMITE, MODERATE YELLOWISH BROWN TO DARK YELLOWISH BROWN, POROSITY, INTERGRANULAR, FRACTURE, 50-90% ALTERED, EUHEDRAL, GRAIN SIZE: FINE, GOOD INDURATION, DOLOMITE CEMENT, SPARRY CALCITE CEMENT, HIGH RECRYSTALLIZATION,

1160.0- 1180.0 FROM 1160 TO 1180 IS A FINE, UNCONSOLIDATED DOLOSILT. THIS FINE MATERIAL WAS CLOGGING THE DRILL RODS. CAVED IN BACK TO 1152 WHEN GEOPHYSICALLY LOGGED

CORE ANALYSIS REPORT

FOR

SOUTH FLORIDA WATER MANAGEMENT DISTRICT

OKF-105
LOWER KISSIMEE BASIN FIELD
OKEECHOBEE COUNTY, FLORIDA

These analyses, opinions or interpretations are based on observations and materials supplied by the client to whom; and for whose exclusive and confidential use; this report is made. The interpretations or opinions expressed represent the best judgment of Core Laboratories (all errors and omissions excepted); but Core Laboratories and its officers and employees, assume no responsibility and make no warranty or representations, as to the productivity, proper operations, or profitableness of any oil, gas or other mineral well or formation in connection with which such report is used or relied upon.

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August 31, 2009

SOUTH FLORIDA WATER MANAGEMENT DISTRICT
P.O. Box 24680
West Palm Beach, Florida 33416-4680

File No.: 57181-19639
Subject: Core Analysis
OKF-150
Lower Kissimee Basin Field
Okeechobee County, Florida

Gentlemen:

The subject well was cored using diamond coring equipment and brine to obtain 4 inch diameter cores from 1700 to 2115 feet from the Undesignated formation.

Core analysis data is presented in tabular and graphical form for your convenience. A porosity vs. permeability plot was prepared for statistical evaluatddn. Core analysis data and digital core photographs are contained on a CD.

We trust these data will be useful in the evaluation of your property and thank you for the opportunity of serving you.

Very truly yours,
CORE LABORATORIES

John Sebian
Laboratory Supervisor

JS/yn

CLB Listed NYSE

The cores were transported to Midland by South Florida Water Management District personnel.

Core analysis was made on selected intervals requested on full diameter samples.

Fluid removal was achieved using a convection oven drying.

Saturations were not requested.

Full diameter porosity was determined by direct pore volume measurement using Boyle's law helium expansion. Bulk volume was measured by Archimedes Principles. Grain density was calculated from dry weight, bulk volume and pore volume measurements.

$$\text{Grain Density} = \frac{\text{Dry Weight}}{\text{Bulk Vol.} - \text{Pore Vol.}}$$

Steady State Air Permeability was measured in two horizontal directions and vertically while the core was confined in a Hassler rubber sleeve at 400 psig confining stress.

Hydraulic conductivity in meters per second was calculated from the observed data using the following equation:
$K = (V + L)/(A + T + P)$

Where K = Hydraulic conductivity,m/sec
V = Incremental produced volume,m3
L = Length,m
P = Differential pressure,mH20
T = Incremental time,sec

K(m/sec) is converted to k(ft/day) by multiplying by 283,464.6. A regression on K(ft/day) y-axis to permeability (md) x-axis yields a slope of 0.1534588.

Thin section and XRD-billets adjacent to each sample were shipped to Core Laboratories in Houston for thin section prep, descriptions and XRD-extended analysis.

The core was slabbed and boxed after analysis.

The slabbed core was photographed under natural light.

The core remnants and slabs were returned to SFWMD at 3301 Gun Club Road, West Palm Beach, Florida 33406 upon completion of analysis.

CORE LABORATORIES

Company : SOUTH FLORIDA WATER MANAGEMENT DISTRICT
Well : OKF-105
Location : LATITUDE/LONGITUDE 272407.3 / 810651.1
Co,State : OKEECHOBEE COUNTY, FLORIDA

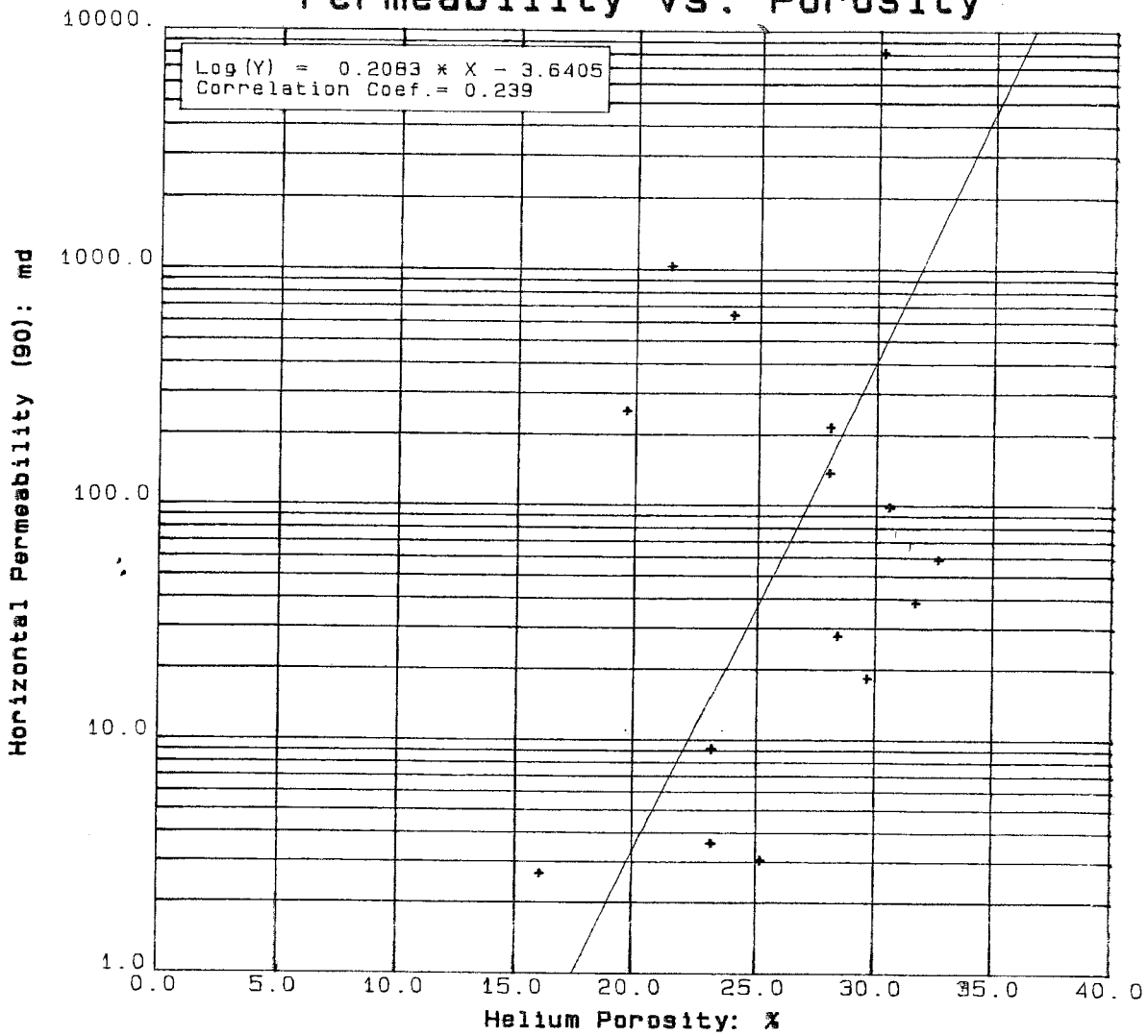
Field : LOWER KISSIMEE BASIN
Formation :
Coring Fluid : WATER
Elevation : -40 FT NGVD

File No.: 57181-19639
Date : 8/27/09
API No. :
Analysts: SEBIAN

CORE ANALYSIS RESULTS

SAMPLE NUMBER	DEPTH ft	PERMEABILITY (MAXIMUM) Kair md	PERMEABILITY (90 DEG) Kair md	PERMEABILITY (VERTICAL) Kair md	POROSITY (HELIUM) %	GRAIN DENSITY gm/cc	DESCRIPTION
1	1700.0- 01.0	7660.	8085.	2839.	30.2	2.82	Dol, ixp, sli vug
2	1702.0- 03.0	954.	248.	213.	19.6	2.81	Dol, sli ixp, sli pp, kl sli frac
3	1704.0- 05.0	3267.	638.	1708.	23.9	2.83	Dol, ixp, sli vug
4	1705.0- 06.0	1548.	1025.	1027.	21.4	2.82	Dol, tr ixp, ppm, kl sli frac
5	2100.0- 01.0	127.	136.	83.0	28.0	2.70	Lim, sli chalk ixp
6	2101.0- 02.0	235.	213.	125.	28.0	2.70	Lim, sli chalk ixp
7	2103.0- 04.0	93.9	97.0	54.5	30.6	2.70	Lim, sli chalk ixp
8	2104.0- 05.0	58.2	58.2	35.9	32.7	2.71	Lim, sli chalk ixp ppm
9	2105.0- 06.0	39.9	38.1	19.3	31.7	2.71	Lim, sli chalk ixp ppm
10	2106.0- 07.0	27.7	27.4	16.0	28.4	2.72	Lim, tr dol, sli chalk ixp
11	2107.0- 08.0	17.6	18.1	16.2	29.7	2.71	Lim, sli dol, sli ixp
12	2109.0- 10.0	2.47	2.65	2.54	16.1	2.79	Dol, lim, sli ixp
13	2111.0- 12.0	3.06	3.03	2.51	25.2	2.71	Lim, tr dol, sli ixp
14	2112.0- 13.0	8.48	9.10	9.15	23.2	2.76	Lim, v/dol, sli ixp
15	2114.0- 15.0	3.51	3.57	3.36	23.2	2.75	Lim, v/dol, sli ixp

Permeability vs. Porosity



SOUTH FLORIDA WATER MANAGEMENT DI OKF-105 LOWER KISSIMEE BASIN FIELD (1700-2115 feet) Core Laboratories 8/27/09	- LEGEND - LOWER KISSIMEE

CORE LABORATORIES

Company : SOUTH FLORIDA WATER MANAGEMENT DISTRICT
Well : OKF-105
Field : LOWER KISSIMEE BASIN
Formation : LOWER KISSIMEE
File No.: 57181-19639
Date : 8/27/09

TABLE I

SUMMARY OF CORE DATA

ZONE AND CUTOFF DATA

ZONE:
- Identification -------- LOWER KISSIMEE
- Top Depth ---------- 1700.0 ft
- Bottom Depth ---------- 2115.0 ft
- Number of Samples -------- 15

DATA TYPE:
- Porosity ---------- (HELIUM)
- Permeability ---------- (90 DEG) Kair

CUTOFFS:
- Porosity (Minimum) ------- 0.0 %
- Porosity (Maximum) ------- 100.0 %
- Permeability (Minimum) --- 0.0100 md
- Permeability (Maximum) --- 10000. md
- Water Saturation (Maximum)
- Oil Saturation (Minimum) -
- Grain Density (Minimum) -- 2.00 gm/cc
- Grain Density (Maximum) -- 3.00 gm/cc
- Lithology Excluded ------- NONE

CHARACTERISTICS REMAINING AFTER CUTOFFS

ZONE:

Number of Samples -----	15
Thickness Represented -	15.0 ft

POROSITY:

Storage Capacity ------	391.9 ϕ-ft
Arithmetic Average ----	26.1 %
Minimum ----------	16.1 %
Maximum ----------	32.7 %
Median ----------	28.0 %
Standard Deviation ----	±4.8 %

GRAIN DENSITY:

Arithmetic Average ----	2.75 gm/cc
Minimum ----------	2.70 gm/cc
Maximum ----------	2.83 gm/cc
Median ----------	2.72 gm/cc
Standard Deviation ----	±0.05 gm/cc

PERMEABILITY:

Flow Capacity ---------	10602.4 md-ft
Arithmetic Average ----	707. md
Geometric Average -----	63.3 md
Harmonic Average ------	11.9 md
Minimum ----------	2.65 md
Maximum ----------	8085. md
Median ----------	58.2 md
Standard Dev. (Geom) --	$K \cdot 10^{\pm 1.002}$ md

HETEROGENEITY (Permeability):

Dykstra-Parsons Var. --	0.901
Lorenz Coefficient ----	0.860

AVERAGE SATURATIONS (Pore Volume):

Oil ----------	
Water ----------	

Core Lab
RESERVOIR OPTIMIZATION

CORE ANALYSIS AND HYDRAULIC CONDUCTIVITY REPORT

COMPANY: South Florida Water Management District
WELL: OKF - 105
Co., St: Okeechobee, Florida

File Number: 57181-19693
Date: 8/31/2009

Sample NO	DEPTH TOP feet	DEPTH BOTTOM feet	K(1) md	K(2) md	K(vert) md	POR %	GD gm/cc	Description	K(1) HC m/sec =(ft/da)/283464.6	K(1) HC ft/day =(md)*0.1534588	K(2) HC m/sec	K(2) HC ft/day	K(vert) HC m/sec	K(vert) HC ft/day
1	1700.0	1701.0	7660.13	8085.04	2838.99	30.2	2.82	Dol, ixp, sli vug	0.004147	1175.5	0.004377	1240.7	0.001537	435.7
2	1702.0	1703.0	953.83	248.39	213.40	19.6	2.81	Dol, sli ixp sli pp, k1 sli frac	0.000516	146.4	0.000134	38.1	0.000116	32.7
3	1704.0	1705.0	3266.96	638.33	1708.04	23.9	2.83	Dol, ixp, sli vug	0.001769	501.3	0.000346	98.0	0.000925	262.1
4	1705.0	1706.0	1547.62	1024.64	1027.34	21.4	2.82	Dol, tr ixp ppm, k1 sli frac	0.000838	237.5	0.000555	157.2	0.000556	157.7
5	2100.0	2101.0	126.54	135.75	82.96	28.0	2.70	Lim, sli chalk ixp	0.000069	19.4	0.000073	20.8	0.000045	12.7
6	2101.0	2102.0	235.26	213.07	125.25	28.0	2.70	Lim, sli chalk ixp	0.000127	36.1	0.000115	32.7	0.000068	19.2
7	2103.0	2104.0	93.95	97.02	54.50	30.6	2.70	Lim, sli chalk ixp	0.000051	14.4	0.000053	14.9	0.000030	8.4
8	2104.0	2105.0	58.15	58.15	35.88	32.7	2.71	Lim, sli chalk ixp ppm	0.000031	8.9	0.000031	8.9	0.000019	5.5
9	2105.0	2106.0	39.89	38.14	19.34	31.7	2.71	Lim, sli chalk ixp ppm	0.000022	6.1	0.000021	5.9	0.000010	3.0
10	2106.0	2107.0	27.71	27.41	16.05	28.4	2.72	Lim, tr dol, sli chalk ixp	0.000015	4.3	0.000015	4.2	0.000009	2.5
11	2107.0	2108.0	17.57	18.09	16.18	29.7	2.71	Lim, sli dol, sli ixp	0.000010	2.7	0.000010	2.8	0.000009	2.5
12	2109.0	2110.0	2.47	2.65	2.54	16.1	2.79	Dol, lim, sli ixp	0.000001	0.4	0.000001	0.4	0.000001	0.4
13	2111.0	2112.0	3.06	3.03	2.51	25.2	2.71	Lim, tr dol, sli ixp	0.000002	0.5	0.000002	0.5	0.000001	0.4
14	2112.0	2113.0	8.48	9.10	9.15	23.2	2.76	Lim, v/dol, sli ixp	0.000005	1.3	0.000005	1.4	0.000005	1.4
15	2114.0	2115.0	3.51	3.57	3.36	23.2	2.75	Lim, v/dol, sli ixp	0.000002	0.5	0.000002	0.5	0.000002	0.5

SOUTH FLORIDA WATER MNGT.
OKF 150
1700 to 1707.15 ft.

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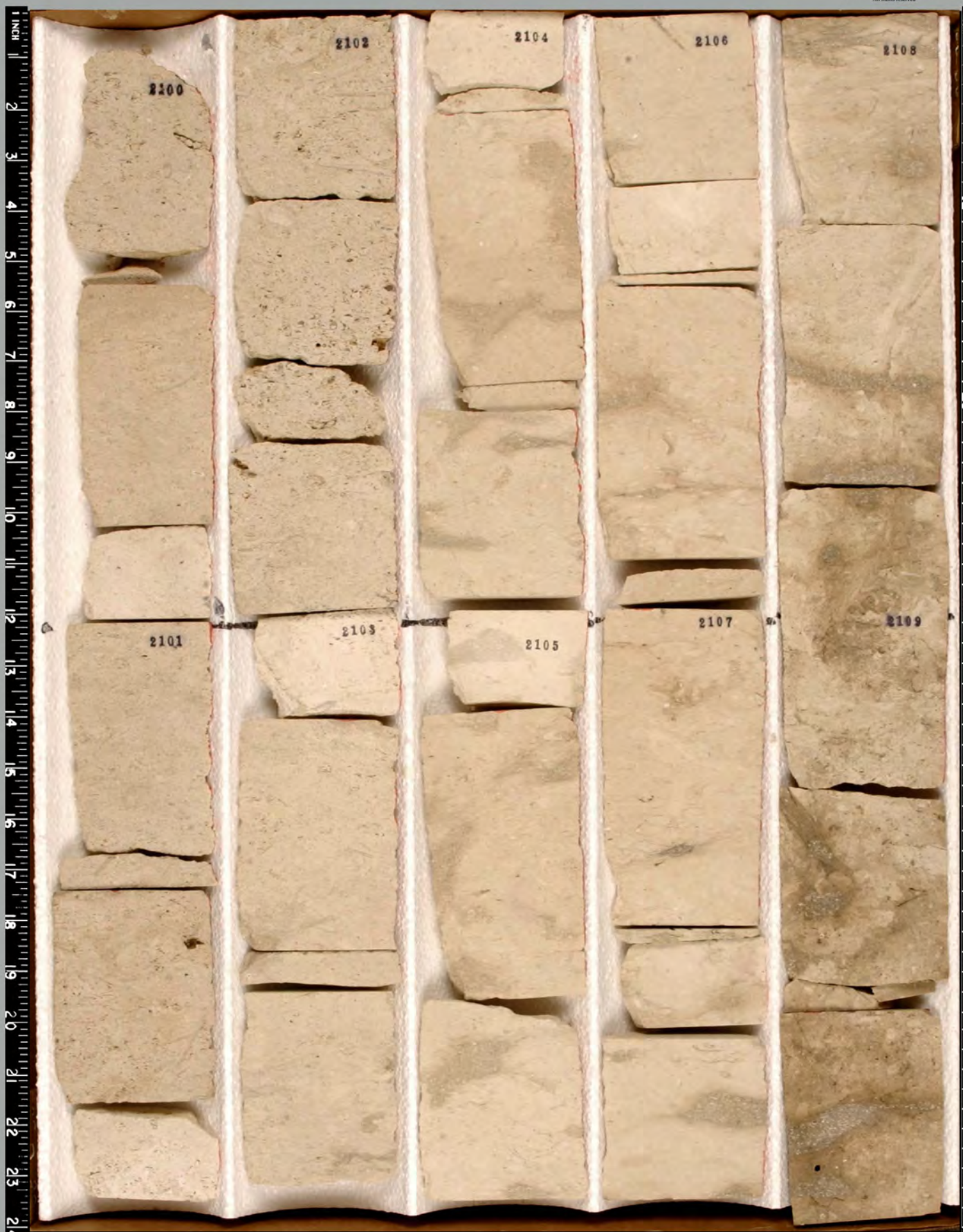
Bottom of Core #1

SOUTH FLORIDA WATER MNGT.
OKF 150
2100 to 2110 ft.



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SOUTH FLORIDA WATER MNGT.
OKF 150
2110 to 2115 ft.

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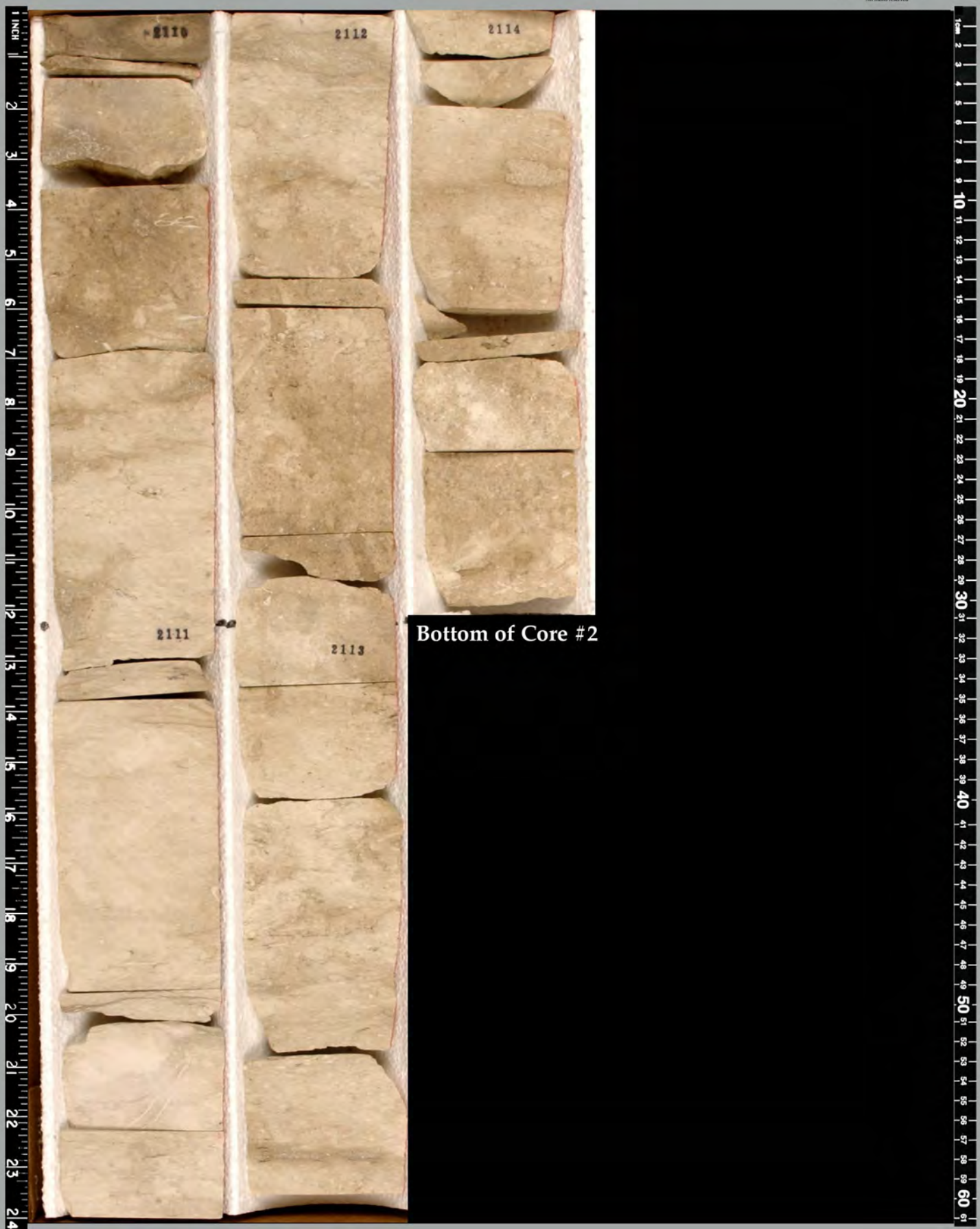

PETROGRAPHIC EVALUATION OF SELECTED SAMPLES FROM THE AVON PARK FORMATION, FROM THE OKF-105 WELL, OKEECHOBEE COUNTY, FLORIDA

File: 090739G
October 2008

Performed for

SOUTH FLORIDA WATER MANAGEMENT DISTRICT

Performed by:

Core Laboratories Advanced Technology Center
Petroleum Services, Reservoir Geology
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October 31st, 2009

South Florida Water Management District
3301 Gun Club Road
West Palm Beach, FL 33406

Attention: Emily Richardson
Subject: Petrographic Study on the OKF-105 Well, Okeechobee County, Florida.

Ms Richardson:

This report presents a summary of the results of thin section petrography (TS) on fifteen (15) samples and X-ray diffraction (XRD) on fifteen (15) samples from the OKF-105 well, Okeechobee County, Florida. These samples were sent for analysis to determine the overall mineralogy, the nature of pore system and pore-filling authigenic minerals. In addition, the timing and nature of the dolomitization and probable depositional environments were determined. A list of samples analyzed and a summary of sample data is presented in Table 1 and the XRD data is presented in Table 2. TS photomicrographs are provided in plates 1A-C through 15A-C.

If you have any questions, or wish further explanation about any aspect of these samples, please feel free to contact me.

Sincerely,

Joseph Beckner
Staff Geologist/Project Manager
Core Laboratories Petroleum Services
713-328-2561 joseph.beckner@corelab.com

PETROGRAPHY

Introduction

A total of fifteen (15) samples were analyzed from the OKF-105 Well, four dolostones (Plates 1, 2, 3, & 4) from the Upper Zone, and eleven limestones, dolomitic limestones and dolostones from the Lower Zone (Plates 5, 6, 7, 8, 9, 10, 11, 12, 13, 14 & 15). Carbonate pore type classification was followed from Choquette and Pray (1970), as given in Figure 3.

Lower Zone Limestones/Dolomitic Limestones (2100.90, 2101.90, 2103.10, 2104.10, 2105.10, 2106.4, 2107.6, 2110.20, 2111.85, 2113.10 and 2114.7 feet)

Textures

These samples range from bioclast dolopackstone/dolowackestones (base) to bioclast peloid grainstones (top). Primary textures in the dolostones are well preserved. The distribution of matrix in these samples is irregular, suggesting that they were bioturbated.

Grain Types

Bioclasts range from moderate (deeper, muddier samples) to abundant (shallower, cleaner samples). Identifiable types include echinoderm fragments, gastropods, benthic foraminifera (e.g. textularids, rotalids and miliolids, planktic foraminifera, dasyclad algal grains, red algae, and mollusks. Other allochemical grains include intraclasts (mudstone/wackestone clasts) and peloids

Matrix

Micrite matrix varies from absent (Plates 5 and 6) to common (Plates 7, 8 & 9), to abundant (Plates 11, 12, 13, 14, 15). In some of the samples, the matrix was extensively (preferentially dolomitized).

Authigenic Mineralogy

In most samples, two types of early calcite cement are observed. The first type consists of clear, very finely to finely crystalline, pore-lining calcite cement; the second consists of syntaxial calcite overgrowths which typically nucleate around echinoderm fragments. Early pyrite cements likely formed around the same time as the early calcite cements, often precipitating inside bioclasts.

Paragenetic Sequence:

- Grain micritization and leaching of aragonitic skeletal grains, and neomorphism of micrite to microspar.
- Precipitation of isopachous calcite cement and coarse spar in grainstone and syntaxial calcite overgrowths on echinoderm fragments. Most of these samples were well cemented before dolomitization.
- Dissolution of bioclasts, forming molds and vugs.
- Dolomitization.

The overall dolomite coarseness and preservation of original limestone fabrics (indicating slow crystallization), plus evidence of syntaxial rims, suggest that these dolomites were formed by meteoric water-sea water mixing in the subsurface.

Pore Types
Macropores are common the shallowest limestones (2100.9, 2101.9, 2103.1 and 2104.1 feet); primary between particle pores are well preserved due to the lack of significant matrix or calcite cementation. Primary within particle pores, moldic pores, vuggy pores and secondary within particle pores. The deeper dolomitic limestones and dolostones contain common to abundant matrix and fewer macropores. In these samples, moldic and vuggy pores are as common, or more common than primary between particle pores

In general, dolomitization has improved the overall storage/recovery potential for these samples.

Environment of Deposition
The fairly wide variety of allochemical types suggest that these sediments were deposited on a normal marine, shallow carbonate shelf. The deepest samples are packstone/wackestones to mud-rich packstones; these samples also contain planktonic foraminifera. These sediments were deposited in deeper water, below tidal and wave influence.

As we move to the shallower samples, the ratio of mud to grains decreases and the overall grain size increases. This indicates a shift from a low energy, subtidal environment to mixed energy intertidal environment.

The shallowest samples are mud lean packstone to grainstones. The lack of mud indicates constant reworking by currents. These sediments were deposited in a shallower portion of the intertidal zone, but there is no evidence of subareal exposure.

Client information indicates that anhydrite is present in the core. The anhydrite was likely deposited in a peritidal environment with high rates of evaporation. This would be stratigraphically above the shallowest sample (2100.9 feet) from this zone.

Upper Zone Dolomites (1700.0, 1701.9, 1704.2 and 1706.0 feet)

Textures
Dolomite replacement produced a variety of fabrics, including those with some of the fabric retained (Plates 1, 2 and 4) and those where the dolomite forms a texture of interlocking crystals with little evidence of the original rock fabric (Plate 3).

Grain Types
Bioclast ghosts are difficult to recognize, but include benthic foraminifera (e.g. textularids, rotalids), calcareous algae, gastropods and mollusk fragment. Other recognizable allochemical grains include peloids and intraclasts.

Authigenic Mineralogy
Dolomite is the primary mineral phase in these samples; some authigenic pyrite is noted. It can be assumed that before dolomitization, these samples experienced the same diagenetic effects as the previously deposited limestones:

- Grain micritization and leaching of aragonitic skeletal grains, and neomorphism of micrite to microspar.
- Precipitation of isopachous calcite cement and coarse spar in grainstone and syntaxial calcite overgrowths on echinoderm fragments. Unlike the sample from he

lower zone, these samples appear to have been well cemented before dolomitization (much fewer primary pores were preserved.
- Dissolution of bioclasts, forming molds and vugs.
- Dolomitization (but not necessarily the same event as before).
- Sample fracturing and the formation of compaction seams

The dolomite crystals are relatively coarse and preservation of original limestone fabrics (indicating slow crystallization) is good, Most of what were interparticle pores were cemented with calcite (some evidence of syntaxial rims), suggesting that these dolomites were formed by meteoric water-sea water mixing in the subsurface. The dolomitization process improved the storage/recovery potential for these samples.

Pore Types

Overall, macropores are common in these dolomites. Moldic and vuggy pores are the most common type in the samples where there is enough preserved texture to determine pore types. In one sample, intercrystal pores are more common than other types.

Environment of Deposition

The variety of preserved allochemical grains suggest that these sediments were deposited on an open, shallow carbonate shelf. The grainstone texture indicates that these sediments were deposited in a high energy environment, perhaps a carbonate shoal.

ANALYTICAL PROCEDURES

Thin Section Petrography

Thin sections were prepared by first impregnating the samples with epoxy to augment cohesion and to prevent loss of material during grinding. Blue dye was added to the epoxy to highlight the pore spaces. Each thinly sliced sample was mounted on a frosted glass slide and then cut and ground in water to an approximate thickness of 30 microns. The thin sections were stained with Alizarin Red-S to differentiate calcite (stains red) from dolomite and potassium ferricyanide (stains blue or purple) to distinguish ferroan varieties. The thin sections were analyzed using standard petrographic techniques.

X-ray Diffraction Analysis

Sample Preparation

Samples submitted for whole-rock and clay-fraction XRD mineral analyses are first cleaned of obvious drilling contaminants and then disaggregated in a mortar and pestle. Approximately five grams of each sample are transferred to isopropyl alcohol and pulverized using a McCrone micronizing mill. The resultant powders are dried, disaggregated, and packed into aluminum sample holders to produce random whole-rock mounts. A separate split of each sample is dispersed in a dilute sodium phosphate solution using a sonic probe. The suspensions are then centrifugally size-fractionated to isolate clay-size (<4 micron ESD) materials for a separate clay-fraction mount. The suspensions are then vacuum-deposited on silver membrane filters to produce oriented clay mineral aggregates. Membrane mounts are attached to stainless steel slugs and exposed to ethylene glycol vapor for a minimum of 24 hours.

Analytical Procedures

XRD analyses of the samples are performed utilizing a Scintag or Philips automated powder diffractometer equipped with a copper source (40kV, 40mA) and a solid state or scintillation detector. The whole-rock samples are analyzed over an angular range of 2-60 degrees 2-theta at a scan rate of one degree/minute. The glycol-solvated clay-fraction mounts are analyzed over an angular range of 2–50 degrees 2-theta at a rate of 1.5 degrees/minute.

Semi-quantitative determinations of whole-rock mineral amounts are done utilizing integrated peak areas (derived from peak-decomposition / profile-fitting methods) and empirical reference intensity ratio (RIR) factors determined specifically for the diffractometer used in data collection. The total clay mineral (including mica) abundance of each sample is determined from the whole-rock XRD patterns using combined {00l} and {hkl} clay mineral reflections and suitable empirical RIR factors.

XRD patterns from glycol-solvated clay-fraction samples are analyzed using techniques similar to those described above. Determinations of mixed-layer clay ordering and expandability are done by comparing experimental diffraction data from the glycol-solvated clay mineral aggregates with simulated one dimensional diffraction profiles generated using the program NEWMOD written by R.C. Reynolds (1985).

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TABLE 1

South Florida Water Management District, OKF-105 Well

ANALYTICAL PROGRAM AND SAMPLE SUMMARY

Plate #:	Depth (ft)	Thin Section	XRD	Geologic Unit	Classification (modified Dunham, 1962)	Lithology	Depositional Environment	Deposition Rates	Pore Types	Storage / Recovery
1	1700.0	X	X	Avon Park Formation	Bioclast dolograinstone	Dolostone	Carbonate Shoals?	High	MO/VG > IC	Good
2	1701.90	X	X	Avon Park Formation	Bioclast peloid dolograinstone	Dolostone	Carbonate Shoals?	High	MO/VG > IC	Good
3	1704.20	X	X	Avon Park Formation	Bioclast dolograinstone	Dolostone	Carbonate Shoals?	High	VG > IC > MO	Good
4	1706.0	X	X	Avon Park Formation	Bioclast peloid dolograinstone	Dolostone	Carbonate Shoals?	High	IC > MO > VG	Good
5	2100.90	X	X	Avon Park Formation	Bioclast peloid grainstone	Limestone	Carbonate Shelf - Intertidal	High	PBP >> PWP > MO/VG > SWP	Good
6	2101.90	X	X	Avon Park Formation	Bioclast packstone	Limestone	Carbonate Shelf - Intertidal	Mixed	PBP >> PWP > MO/VG > SWP	Good
7	2103.10	X	X	Avon Park Formation	Bioclast packstone	Limestone	Carbonate Shelf - Intertidal	Mixed	PBP > > PWP > MO/VG > SWP	Good
8	2104.10	X	X	Avon Park Formation	Bioclast packstone	Limestone	Carbonate Shelf - Intertidal	Mixed	PBP > > PWP > MO/VG > SWP	Good
9	2105.10	X	X	Avon Park Formation	Bioclast peloid packstone	Limestone	Carbonate Shelf - Subtidal	Mixed	PBP/PWP > MO/VG > SWP	Poor
10	2106.40	X	X	Avon Park Formation	Dolomitic bioclast packstone	Limestone	Carbonate Shelf - Subtidal	Low	PBP / PWP > MO/VG > SWP	Fair
11	2107.60	X	X	Avon Park Formation	Dolomitic bioclast packstone	Limestone	Carbonate Shelf - Subtidal	Low	PBP/PWP > MO/VG > SWP	Poor
12	2110.20	X	X	Avon Park Formation	Bioclast peloid dolopackstone	Dolostone	Carbonate Shelf - Subtidal	Low	PBP/PWP > MO/VG > SWP	Fair
13	2111.85	X	X	Avon Park Formation	Dolomitic bioclast packstone/ wackstone	Limestone	Carbonate Shelf - Subtidal	Low	PWP > MO/VG, PBP > SWP	Poor
14	2113.10	X	X	Avon Park Formation	Bioclast dolopackstone/ dolowackestone	Dolostone	Carbonate Shelf - Subtidal	Low	PWP > MO/VG, PBP > SWP	Poor
15	2114.70	X	X	Avon Park Formation	Bioclast dolopackstone/ dolowackestone	Dolostone	Carbonate Shelf - Subtidal	Low	PWP > MO/VG, PBP > SWP	Poor

MO= Moldic Pores
VG= Vuggy Pores
PWP = Primary within particle pores
PBP = Primary between particle pores
SWP = Secondary within particle pores

TABLE 2

MINERALOGY DETERMINED BY X-RAY DIFFRACTION
South Florida Water Management District, Well: OKF-105

Sample ID	Depth (ft):	Whole Rock Mineralogy (Weight %)									Clay Abundance (Weight %)				
		Quartz	K-Feldspar	Plagioclase	Calcite	Dolomite	Siderite	Gypsum	Pyrite	Total Clay	Illite / Smectite	Illite & Mica	Kaolinite	Chlorite	% Smectite in I/S
1	1700.0	Tr	0	0	3	97	0	0	0	0	0	0	0	0	
2	1701.9	1	0	0	3	96	0	0	0	0	0	0	0	0	
3	1704.2	1	0	0	2	97	0	0	0	0	0	0	0	0	
4	1706.0	1	0	0	3	96	0	0	0	0	0	0	0	0	
5	2100.9	1	0	0	98	1	0	0	0	0	0	0	0	0	
6	2101.9	Tr	0	0	99	1	0	0	0	0	0	0	0	0	
7	2103.1	Tr	0	0	99	1	0	0	0	0	0	0	0	0	
8	2104.1	Tr	0	0	98	2	0	0	0	0	0	0	0	0	
9	2105.1	Tr	0	0	99	1	0	0	0	0	0	0	0	0	
10	2106.4	Tr	0	0	82	18	0	0	0	0	0	0	0	0	
11	2107.6	Tr	0	0	90	10	0	0	0	0	0	0	0	0	
12	2110.2	Tr	0	0	32	68	0	0	0	0	0	0	0	0	
13	2111.9	Tr	0	0	88	12	0	0	0	0	0	0	0	0	
14	2113.1	Tr	0	0	30	70	0	0	0	0	0	0	0	0	
15	2114.7	1	0	0	38	61	0	0	0	0	0	0	0	0	

PLATE 1A-1C

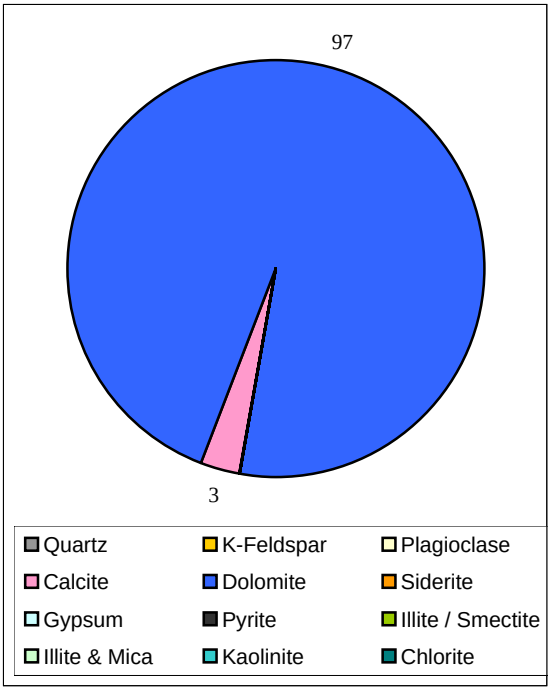
South Florida Water Management District

Well: OKF-105
L. Kissimee Basin, Okeechobee Co., Fla

Depth (ft): 1700.0

The original texture of this sample has been obscured by dolomite replacement, but it was probably a bioclast grainstone. This sample contains "ghosts" of what were probably benthic foraminifera (ForB) and algae fragments (alg); most allochemical grains are not recognizable. The moldic pores (MO) were originally bioclasts or intraclasts. Vuggy pores (VG) developed where dissolution continued past grain boundaries. Many pores lack or have uncertain textural references and are classified as intercrystal pores (IC). A very irregular clay-rich seam (cla) horizontally crosses the sample. Because this sample has abundant macropores (blue), and they seem well interconnected. it has good to very good storage/recovery potential.

Mineralogy Determined by X-Ray Diffraction (Weight %)



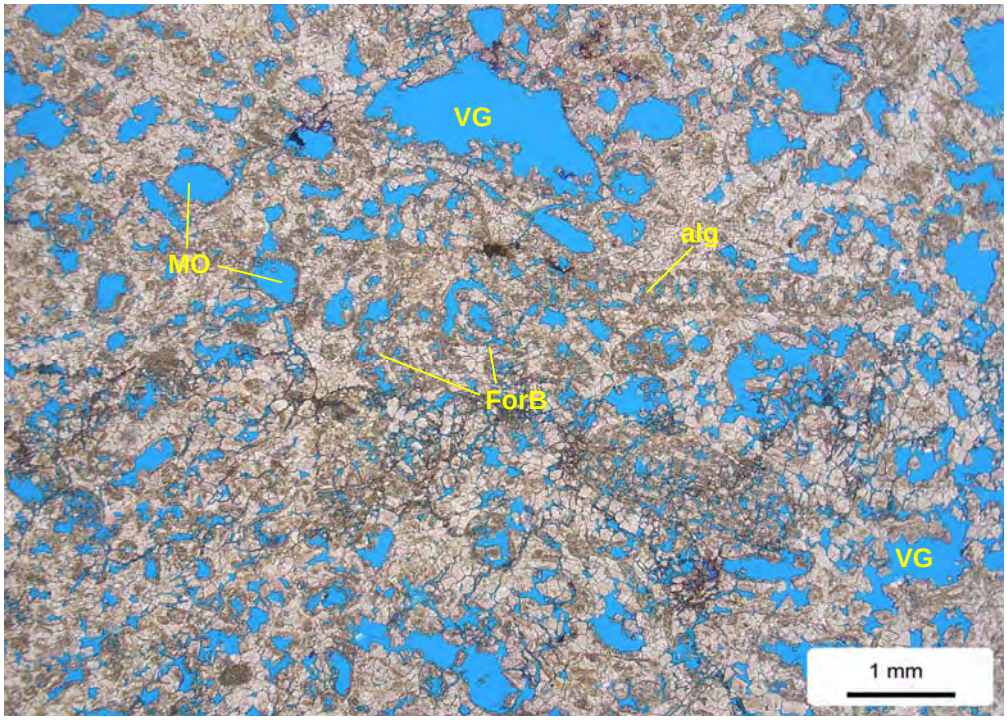
XRD-Whole Rock Mineralogy (Weight %)

Quartz	Tr	Siderite	0
K-Feldspar	0	Gypsum	0
Plagioclase	0	Pyrite	0
Calcite	3	Total Clay	0
Dolomite	97		

Clay Abundance (Weight %)

Illite / Smect	0	Kaolinite	0
Illite & Mica	0	Chlorite	0

PLATE 1A-1C



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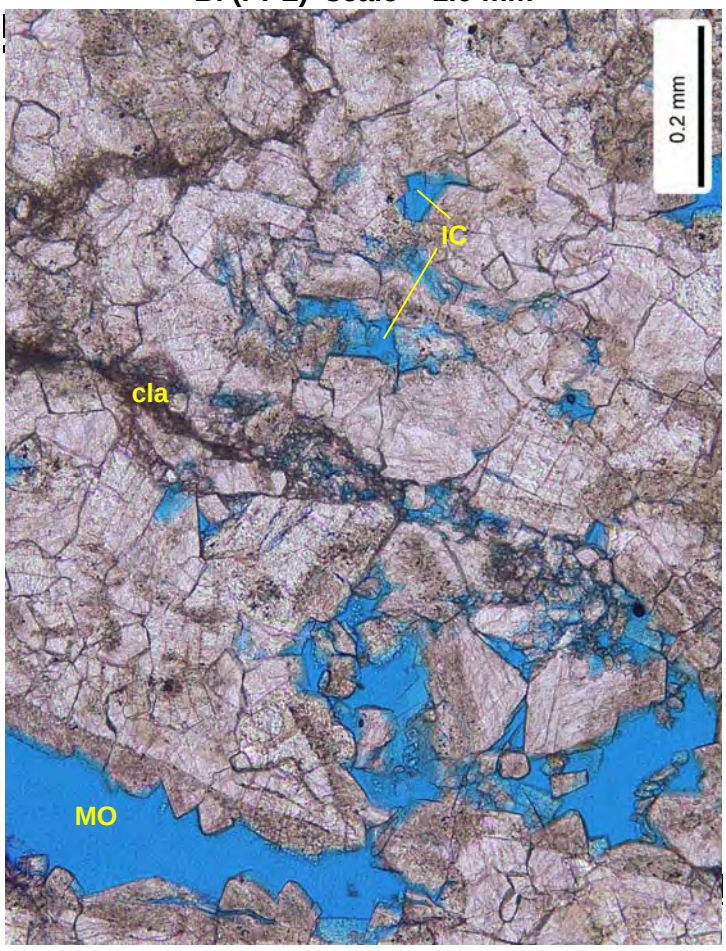
B. (PPL) scale = 1.0 mm



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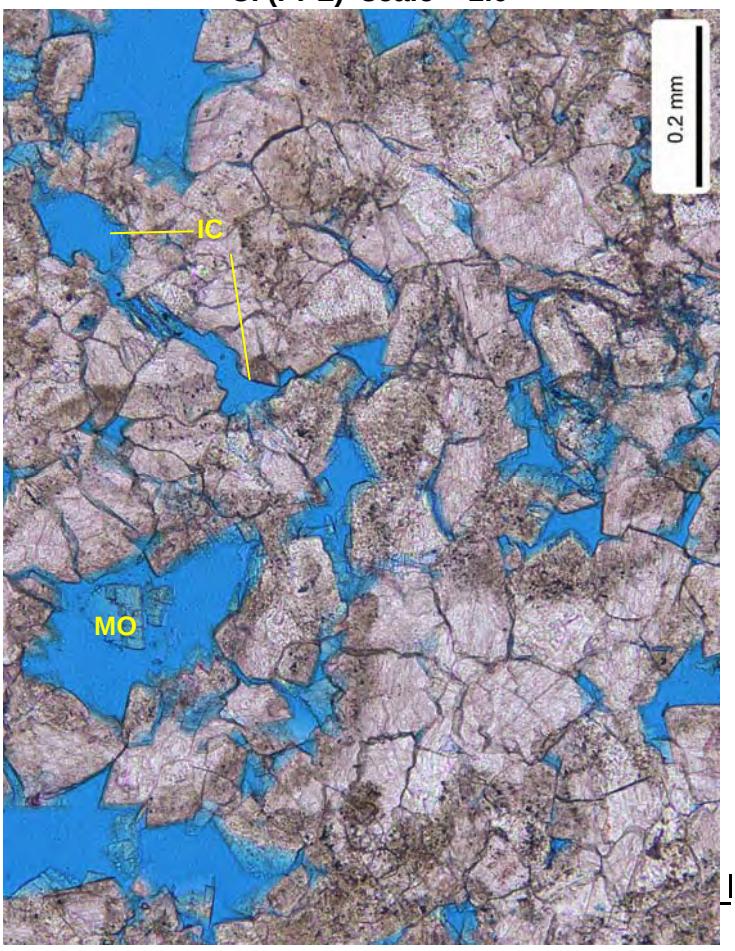


South Florida Water Management District
Well: OKF-105
L. Kissimee Basin, Okeechobee Co., Fla

PLATE 2A-2C

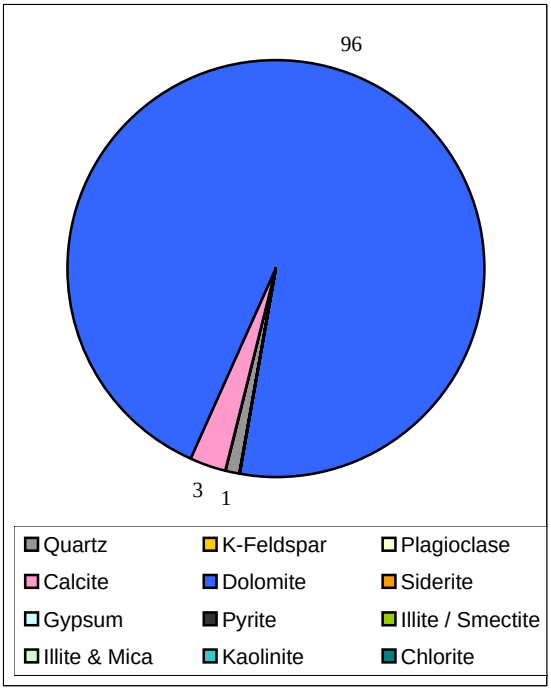
South Florida Water Management District

Well: OKF-105
L. Kissimee Basin, Okeechobee Co., Fla

Depth (ft): 1701.9

Like the previous sample, before dolomitization this sample was likely a bioclast grainstone. Unlike the previous sample, most of the recognizable bioclast "ghosts" appear to be mollusk fragments (mol). Peloids (pel) and intraclasts (IN) are also observed. Moldic pores (MO) and vuggy pores (VG) are the most common types of macropores in this dolostone. The moldic pores were formed by the dissolution of bioclasts or large intraclasts; the vuggy pores were formed by more extensive dissolution. Many pores lack or have uncertain textural references and are classified as intercrystal pores (IC). The total amount of macropores (blue) in this sample appear common, and they seem well interconnected. This sample should have good storage/recovery potential.

Mineralogy Determined by X-Ray Diffraction (Weight %)



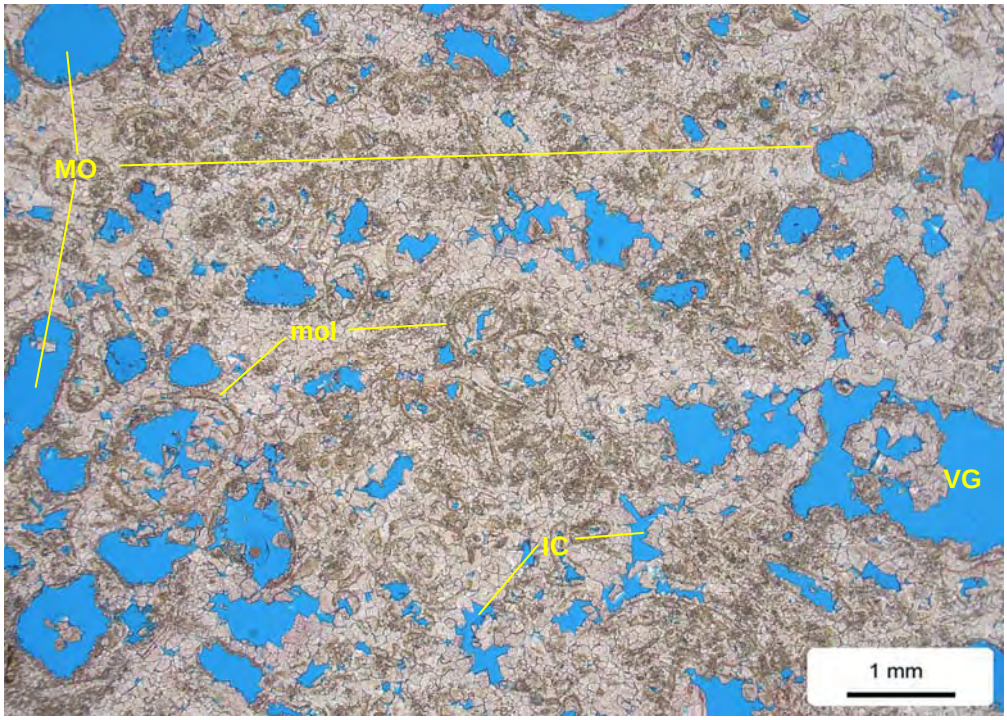
XRD-Whole Rock Mineralogy (Weight %)

Quartz	1	Siderite	0
K-Feldspar	0	Gypsum	0
Plagioclase	0	Pyrite	0
Calcite	3	Total Clay	0
Dolomite	96		

Clay Abundance (Weight %)

Illite / Smect	0	Kaolinite	0
Illite & Mica	0	Chlorite	0

PLATE 2A-2C



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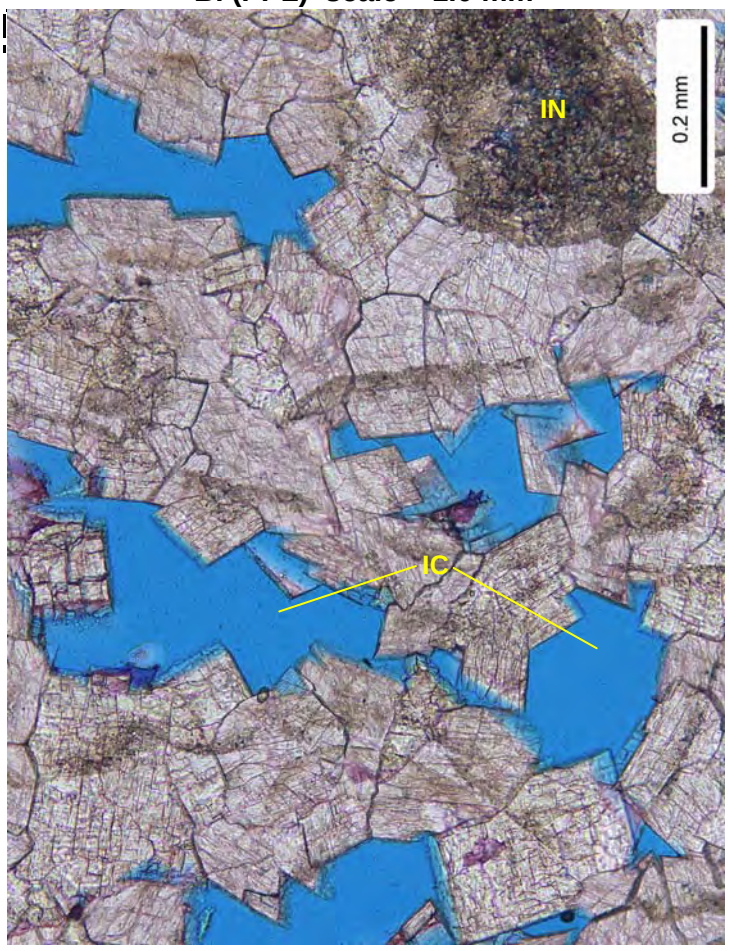
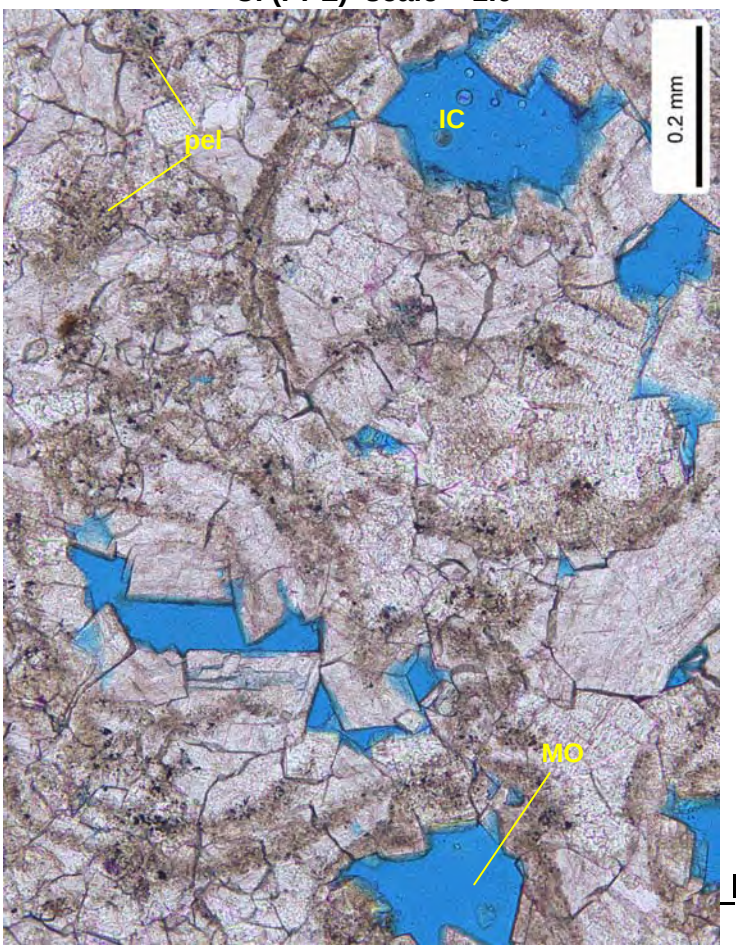
B. (PPL) scale = 1.0 mm



C. (PPL) scale = 1.0



South Florida Water Management District
Well: OKF-105
L. Kissimee Basin, Okeechobee Co., Fla

PLATE 3A-3C

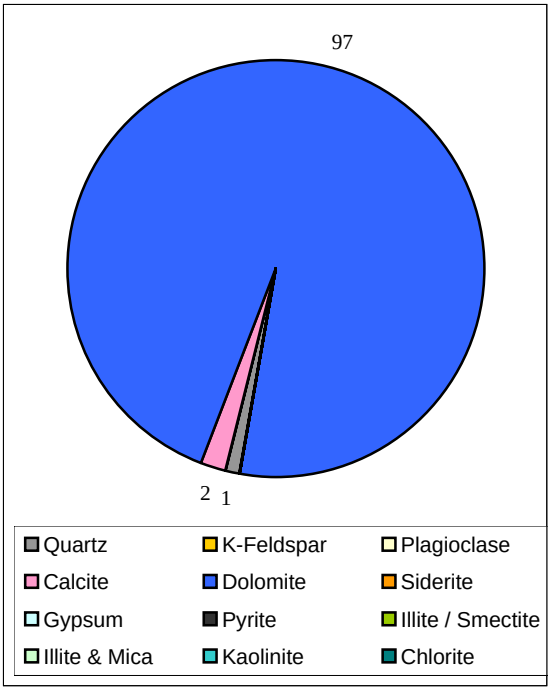
South Florida Water Management District

Well: OKF-105
L. Kissimee Basin, Okeechobee Co., Fla

Depth (ft): 1704.2

Dissolution appears more extensive in this dolostone than the previous samples; vuggy pores (VG) and intercrystal pores are the most common type of pore. Vuggy pores (VG) developed where dissolution continued past grain boundaries. Many pores lack or have uncertain textural references and are classified as intercrystal pores (IC). The original texture of this dolostone has been somewhat obscured by dolomite replacement, but was probably a bioclast peloid grainstone. The clay in Plate B is along a thin seam. The clay in Plate C appears more like a clay clast. The abundant macropores (blue) seem well interconnected, suggesting that this sample has good to very good storage/recovery potential.

Mineralogy Determined by X-Ray Diffraction (Weight %)



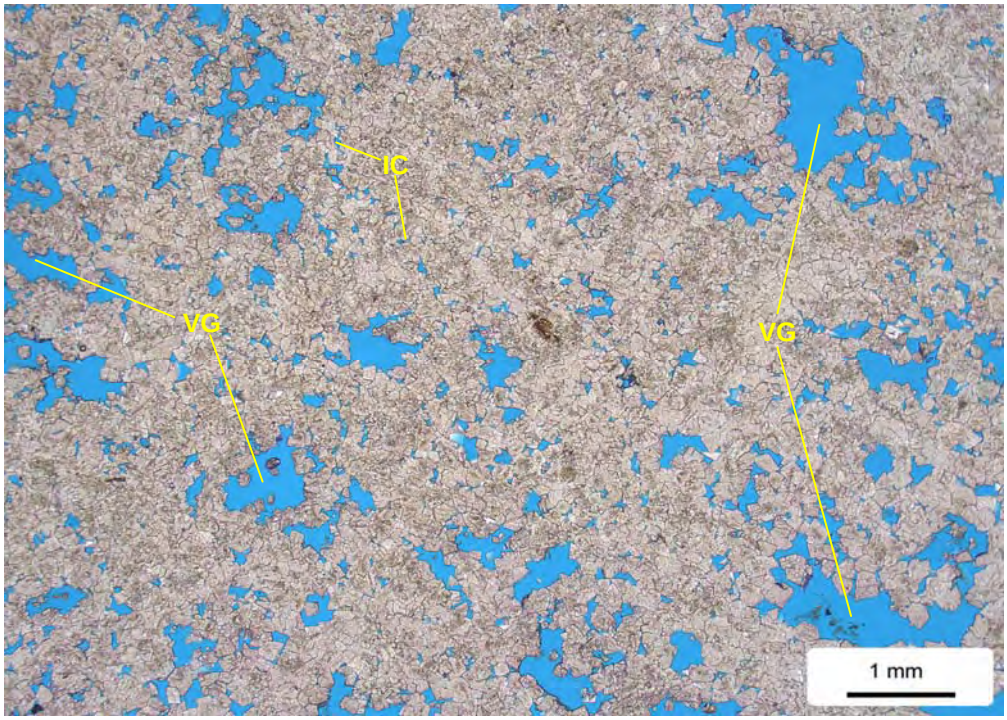
XRD-Whole Rock Mineralogy (Weight %)

Quartz	1	Siderite	0
K-Feldspar	0	Gypsum	0
Plagioclase	0	Pyrite	0
Calcite	2	Total Clay	0
Dolomite	97		

Clay Abundance (Weight %)

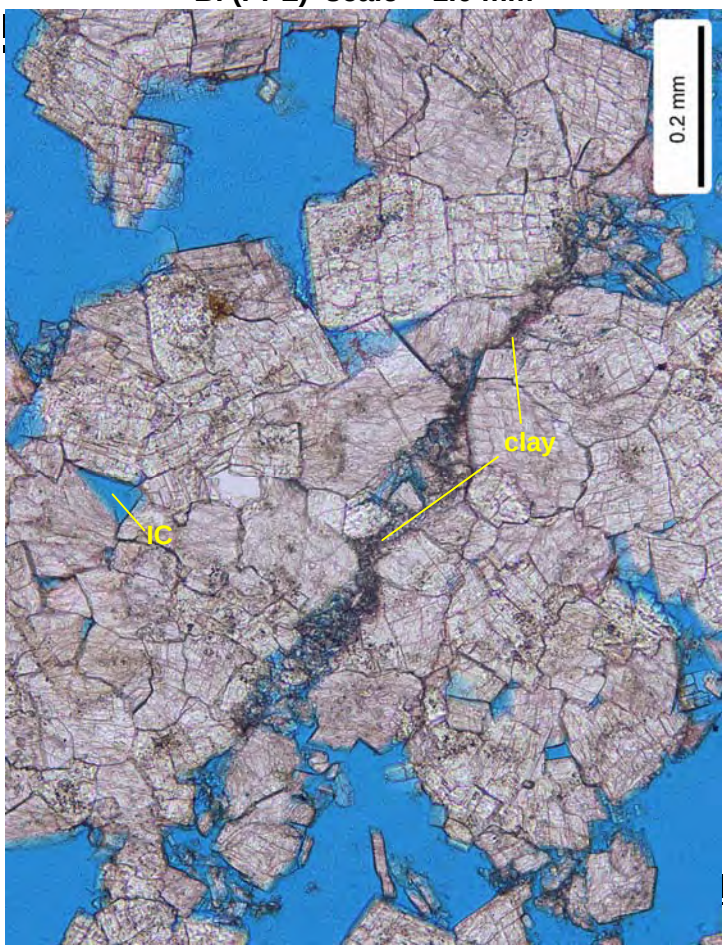
Illite / Smect	0	Kaolinite	0
Illite & Mica	0	Chlorite	0

PLATE 3A-3C

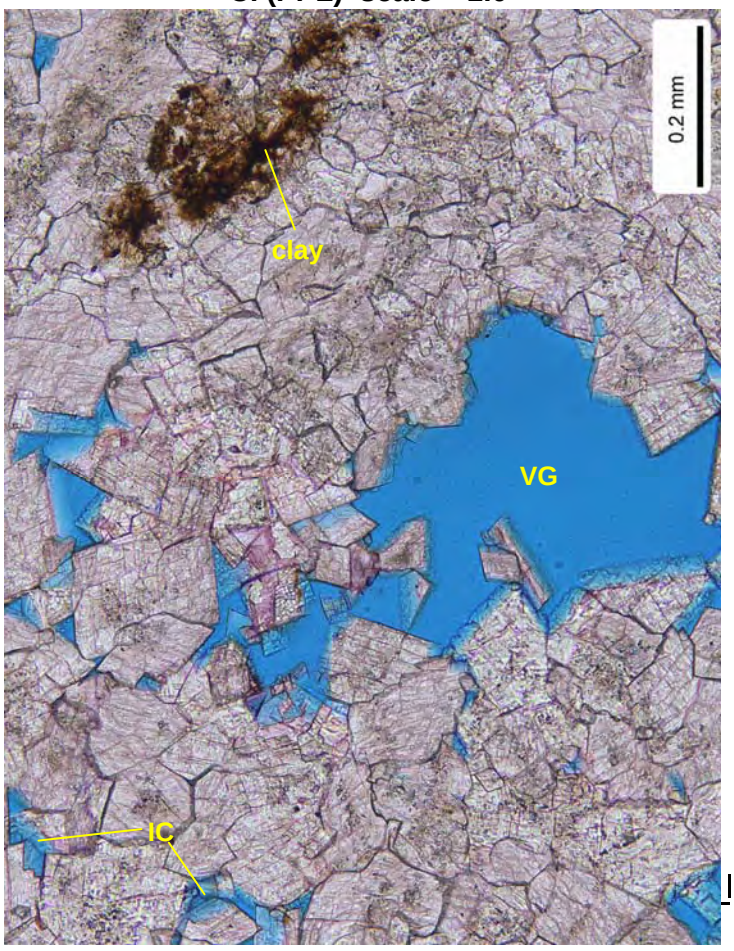


A. (PPL) scale = 1.0 mm

B. (PPL) scale = 1.0 mm



C. (PPL) scale = 1.0



South Florida Water Management District
Well: OKF-105
L. Kissimee Basin, Okeechobee Co., Fla

PLATE 4A-4C

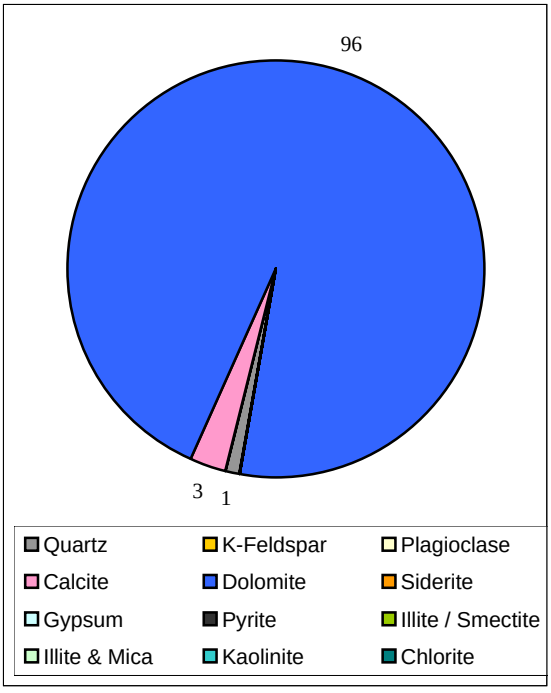
South Florida Water Management District

Well: OKF-105
L. Kissimee Basin, Okeechobee Co., Fla

Depth (ft): 1706.0

Before dolomitization this sample was likely a peloid grainstone. The remnant of a gastropod (gst) and a peloid (P) can be identified; most allochemical grains were rendered unrecognizable by the dolomitization. Moldic pores (MO) and intercrystal pores (IC) are the most common types of macropores in this dolostone. The moldic pores were formed by the dissolution of bioclasts or large intraclasts; those pores that lack or have uncertain textural references and are classified as intercrystal pores (IC). The total amount of macropores (blue) in this sample appear common. This sample should have good storage/recovery potential.

Mineralogy Determined by X-Ray Diffraction (Weight %)



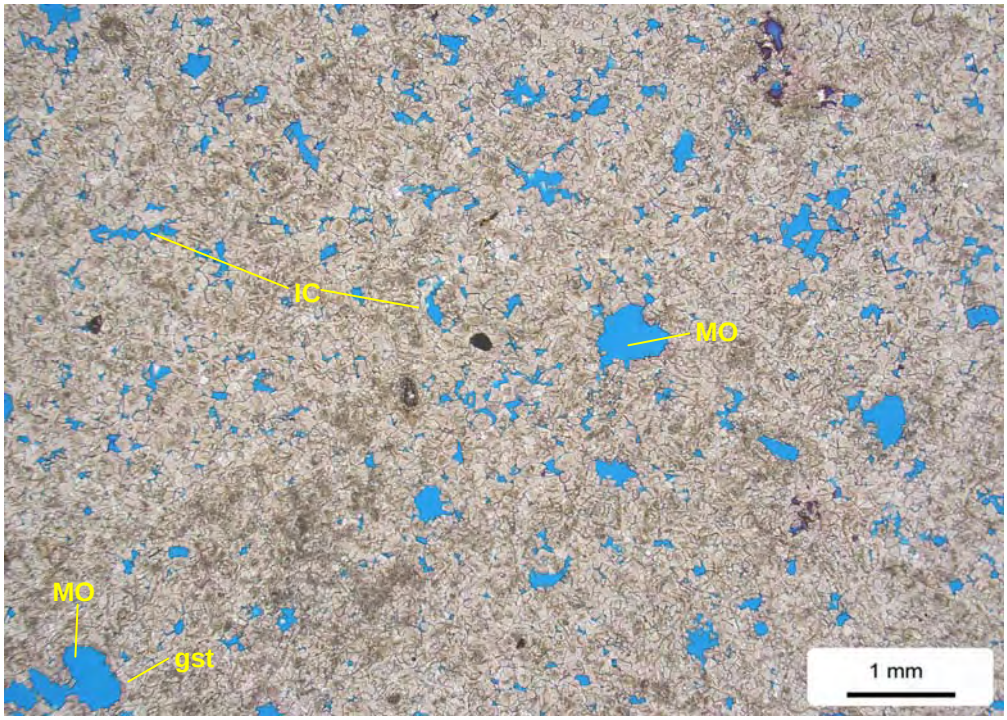
XRD-Whole Rock Mineralogy (Weight %)

Quartz	1	Siderite	0
K-Feldspar	0	Gypsum	0
Plagioclase	0	Pyrite	0
Calcite	3	Total Clay	0
Dolomite	96		

Clay Abundance (Weight %)

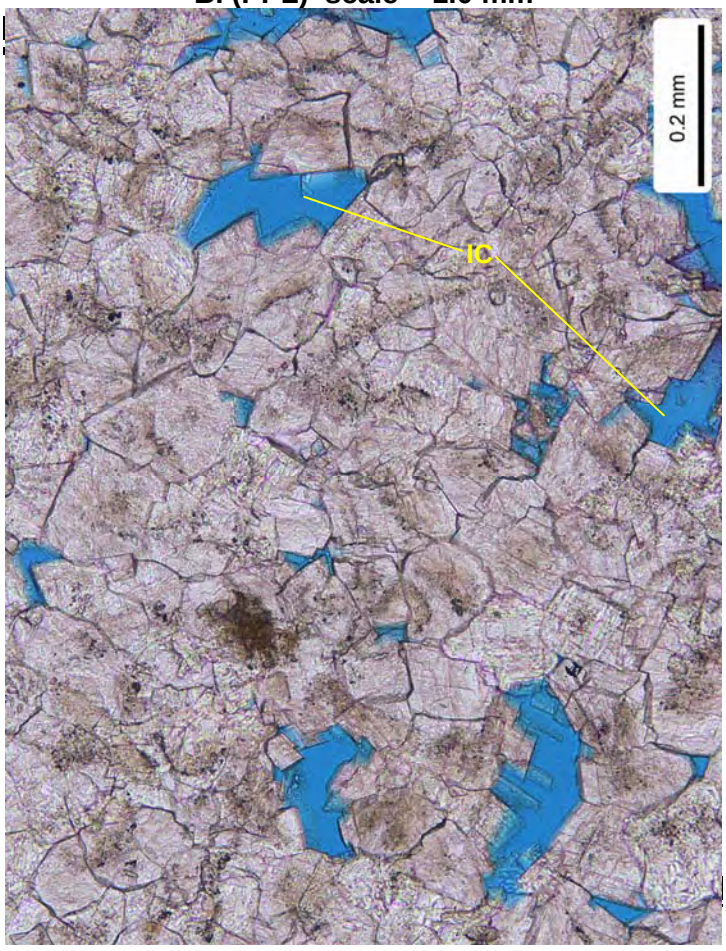
Illite / Smect	0	Kaolinite	0
Illite & Mica	0	Chlorite	0

PLATE 4A-4C

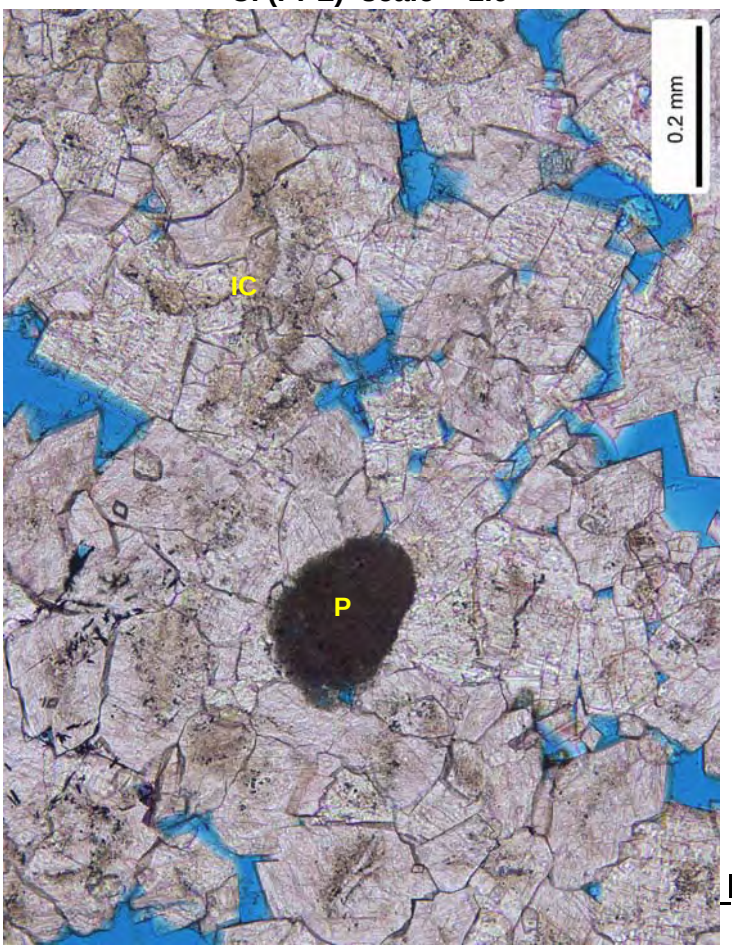


A. (PPL) scale = 1.0 mm

B. (PPL) scale = 1.0 mm



C. (PPL) scale = 1.0



South Florida Water Management District
Well: OKF-105
L. Kissimee Basin, Okeechobee Co., Fla

PLATE 5A-5C

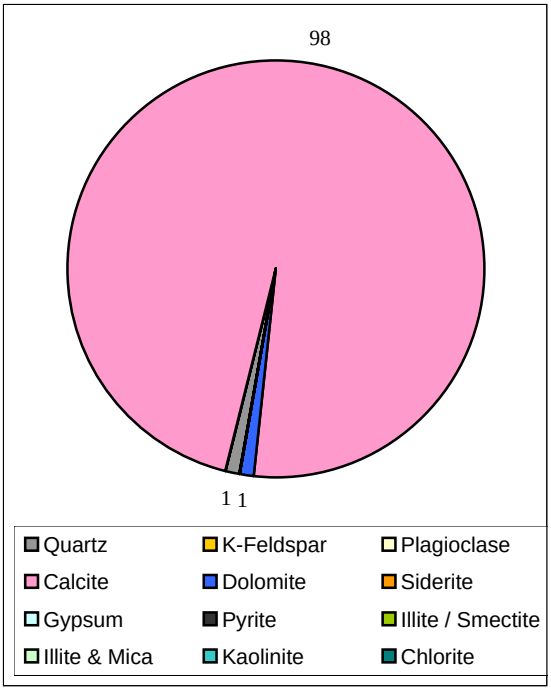
South Florida Water Management District

Well: OKF-105
L. Kissimee Basin, Okeechobee Co., Fla

Depth (ft): 2100.9

This sample is an upper fine-grained bioclast peloid grainstone; sorting and compaction are moderate. Calcite cement has two basic types, an early pore-fringing cement (cal1) and a later syntaxial pore-filing cement (cal2). The syntaxial calcite cement preferentially nucleates on echinoderm grains (ech). Primary between particle pores (PBP) are common and appear well inerconnected; primary within particle pores (PWP; mostly within benthic foramnifera) are minor in abundance. Vuggy pores (VG) and other secondary pores are rare. Bioclasts include benthic foraminifera (miliolids and rotalids), dasyclad algal grains, red algae (rd) and mollusks. Other allochemical grains include intraclasts (IN) and peloids (P).

Mineralogy Determined by X-Ray Diffraction (Weight %)



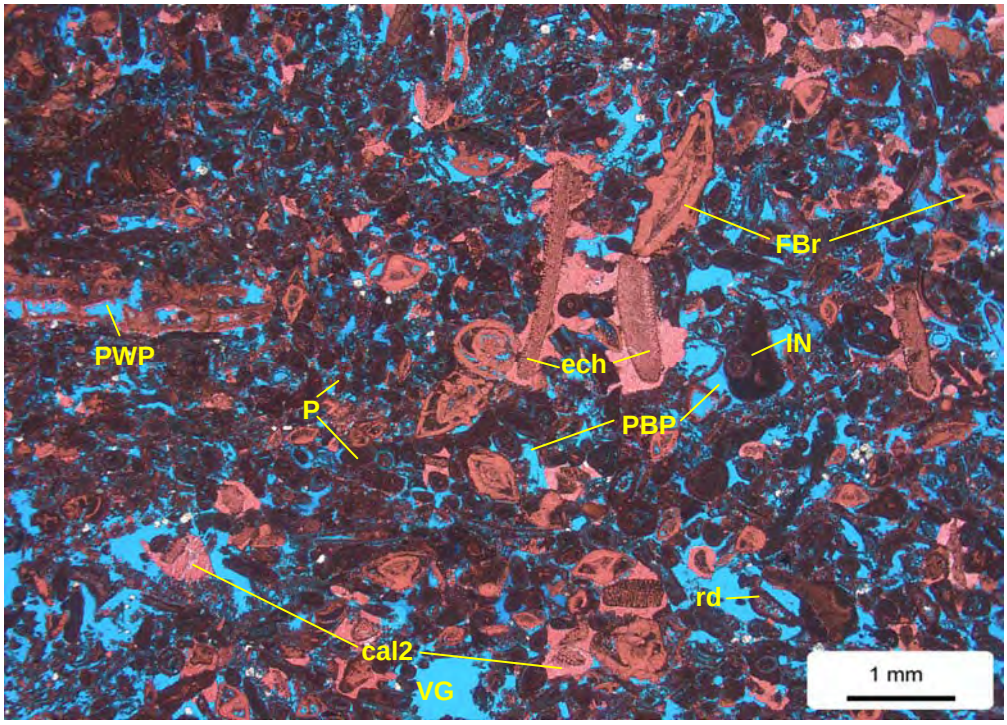
XRD-Whole Rock Mineralogy (Weight %)

Quartz	1	Siderite	0
K-Feldspar	0	Gypsum	0
Plagioclase	0	Pyrite	0
Calcite	98	Total Clay	0
Dolomite	1		

Clay Abundance (Weight %)

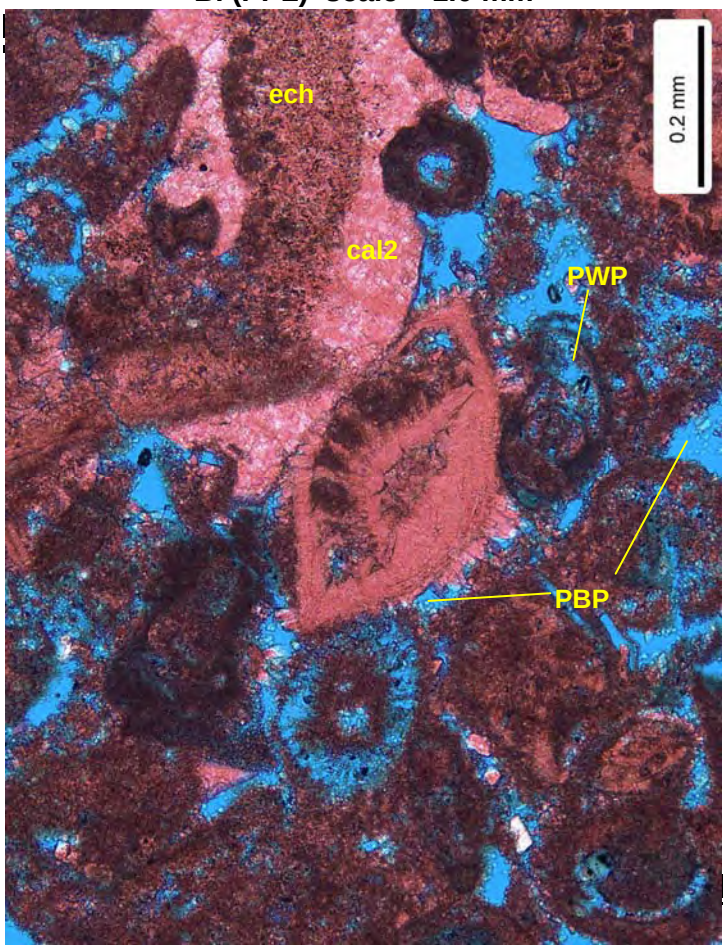
Illite / Smect	0	Kaolinite	0
Illite & Mica	0	Chlorite	0

PLATE 5A-5C

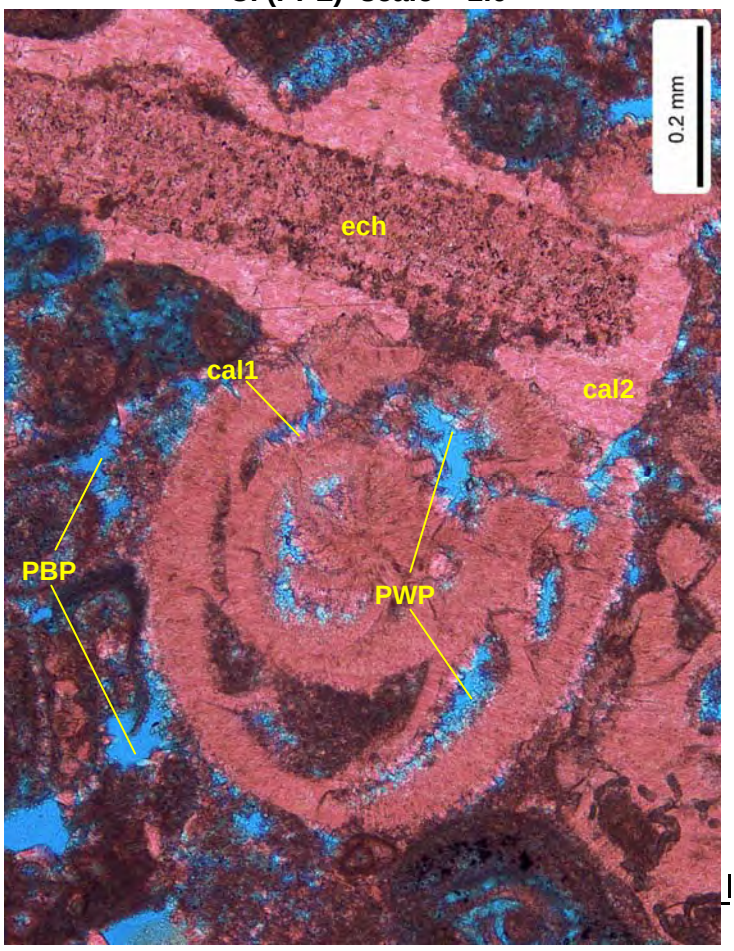


A. (PPL) scale = 1.0 mm

B. (PPL) scale = 1.0 mm



C. (PPL) scale = 1.0



South Florida Water Management District
Well: OKF-105
L. Kissimee Basin, Okeechobee Co., Fla

PLATE 6A-6C

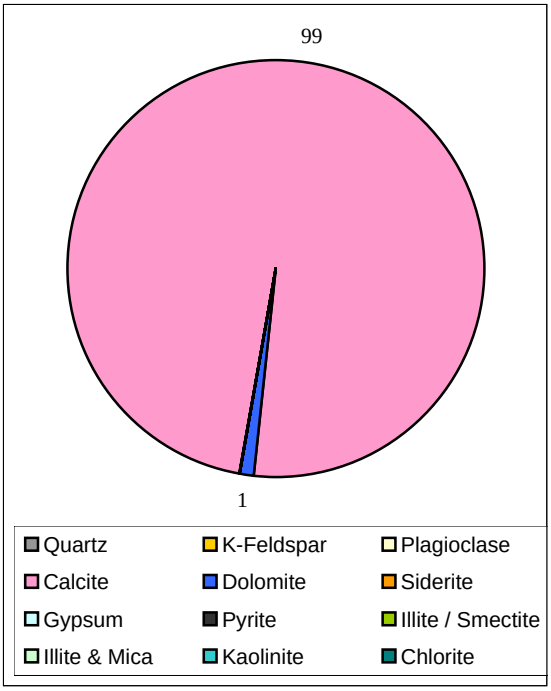
South Florida Water Management District

Well: OKF-105
L. Kissimee Basin, Okeechobee Co., Fla

Depth (ft): 2101.9

Bioclasts in this poorly sorted, upper fine-grained bioclast mud-lean packstone include benthic foraminifera (miliolids and rotalids (FBr)), echinoderms (ech) dasyclad algal grains, red algae (rd) and mollusks (mol). Other allochemical grains include intraclasts and peloids (P). Calcite cement comes in two basic types, an early pore-fringing cement (cal1) and a later syntaxial pore-filing cement (cal2). Authigenic dolomite (dol) is a minor cement; pyrite (py) is commonly associated with bioclasts. Primary between particle pores (PBP) are common and appear well inerconnected; primary within particle pores (PWP; mostly within benthic foramnifera) are minor in abundance. Moldic pores (VG) and secondary within particle pores (SWP) are less abundant.

Mineralogy Determined by X-Ray Diffraction (Weight %)



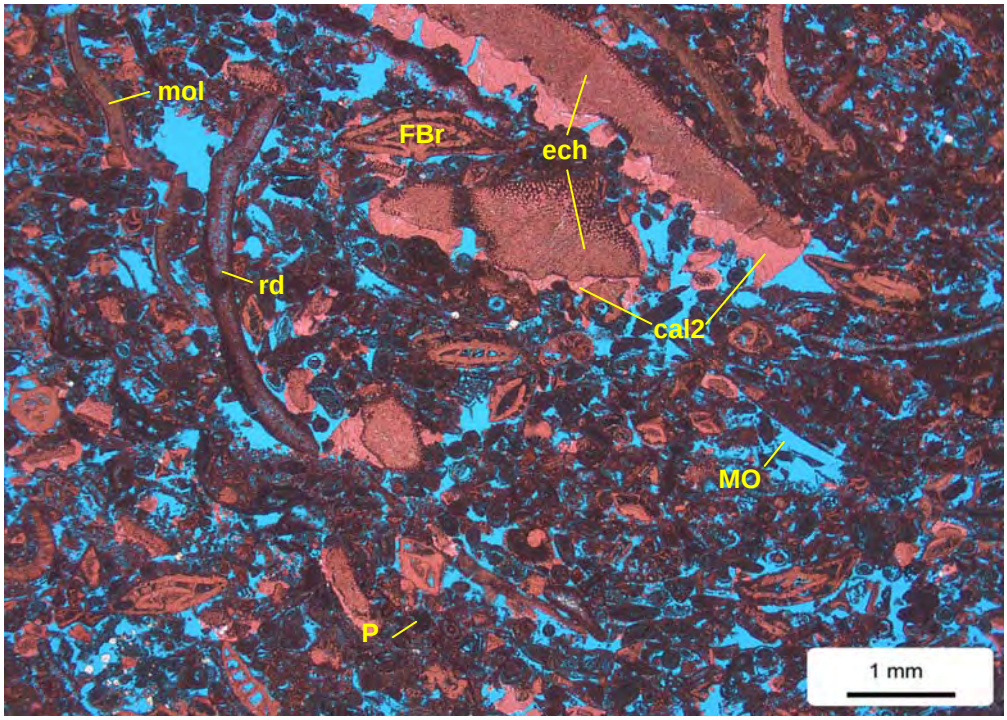
XRD-Whole Rock Mineralogy (Weight %)

Quartz	Tr	Siderite	0
K-Feldspar	0	Gypsum	0
Plagioclase	0	Pyrite	0
Calcite	99	Total Clay	0
Dolomite	1		

Clay Abundance (Weight %)

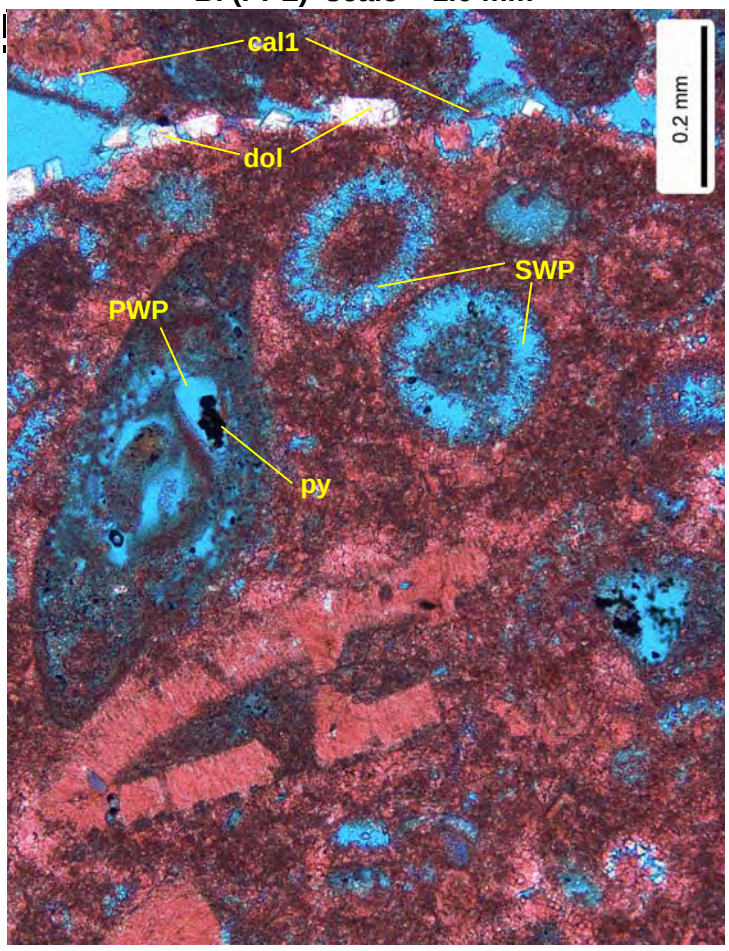
Illite / Smect	0	Kaolinite	0
Illite & Mica	0	Chlorite	0

PLATE 6A-6C

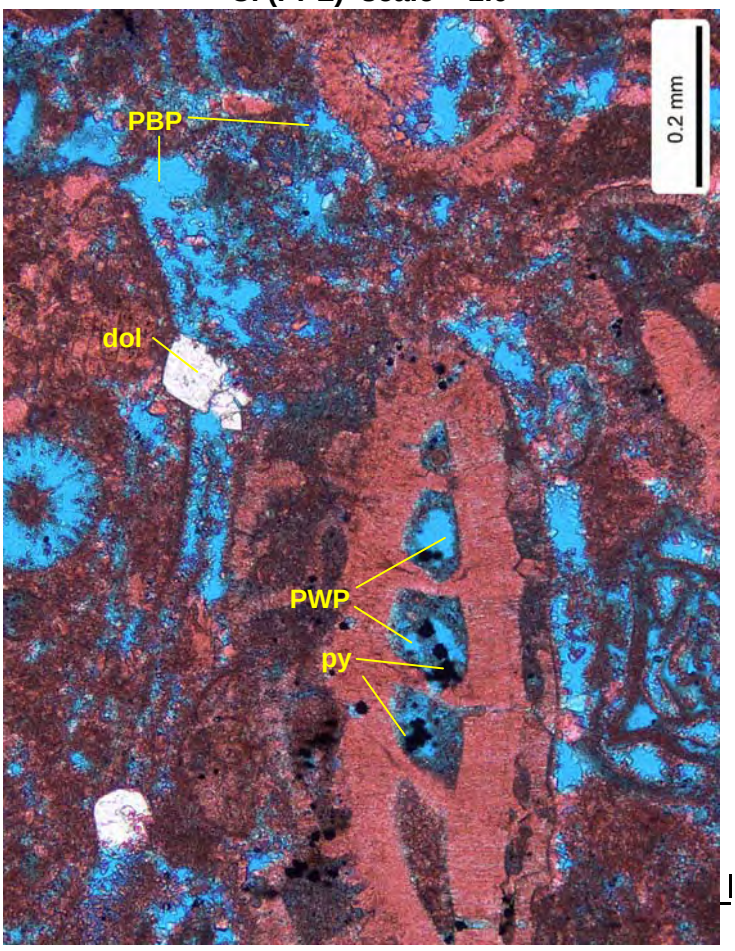


A. (PPL) scale = 1.0 mm

B. (PPL) scale = 1.0 mm



C. (PPL) scale = 1.0



South Florida Water Management District
Well: OKF-105
L. Kissimee Basin, Okeechobee Co., Fla

PLATE 7A-7C

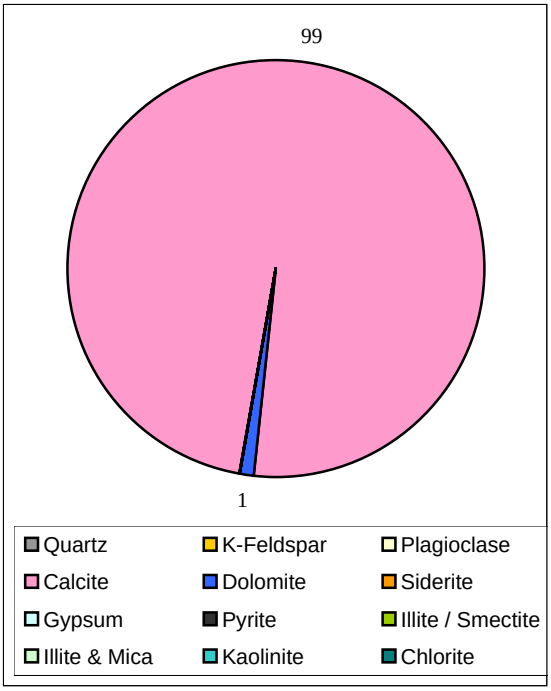
South Florida Water Management District

Well: OKF-105
L. Kissimee Basin, Okeechobee Co., Fla

Depth (ft): 2103.1

In this poorly sorted bioclast grainstone, the calcite cement has two basic varieties, an early pore-fringing cement (cal1) and a later syntaxial pore-filing cement (cal2). Overall, pore-filling cements are minor in abundance. Dolomite (dol) and pyrite (py) are trace cements. Primary between particle pores (PBP) are common and appear well inerconnected; primary within particle pores (PWP; mostly within benthic foramnifera) are minor in abundance. Vuggy pores (VG) and other secondary pores are rare. Bioclasts include benthic foraminifera (miliolids and rotalids), dasyclad algal grains, red algae (rd) and mollusks (mol). Other allochemical grains include intraclasts and peloids.

Mineralogy Determined by X-Ray Diffraction (Weight %)



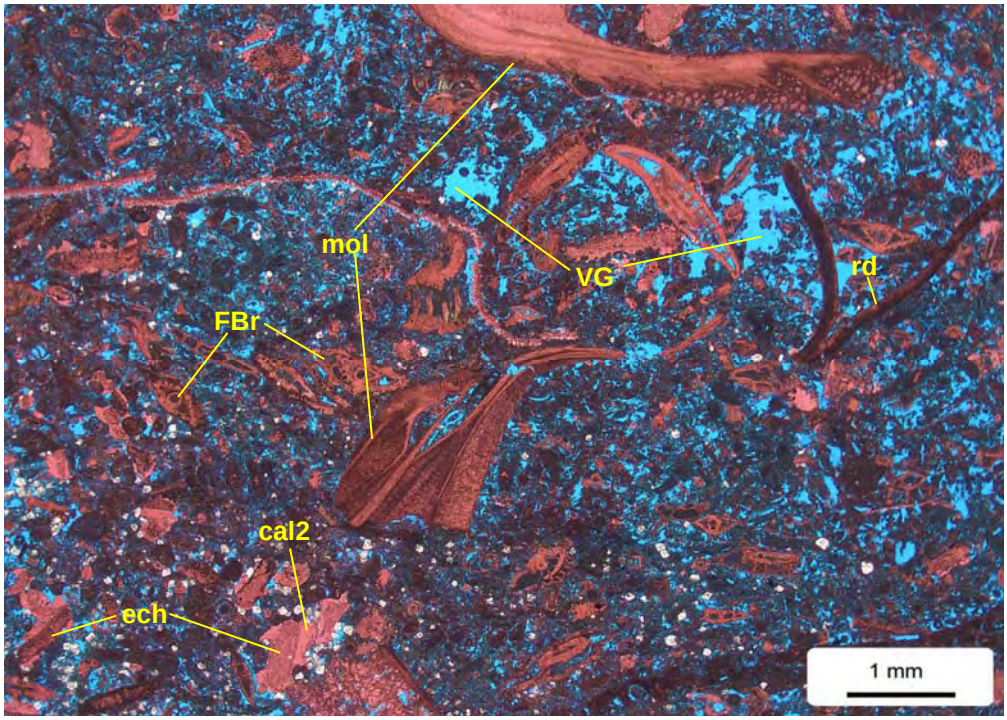
XRD-Whole Rock Mineralogy (Weight %)

Quartz	Tr	Siderite	0
K-Feldspar	0	Gypsum	0
Plagioclase	0	Pyrite	0
Calcite	99	Total Clay	0
Dolomite	1		

Clay Abundance (Weight %)

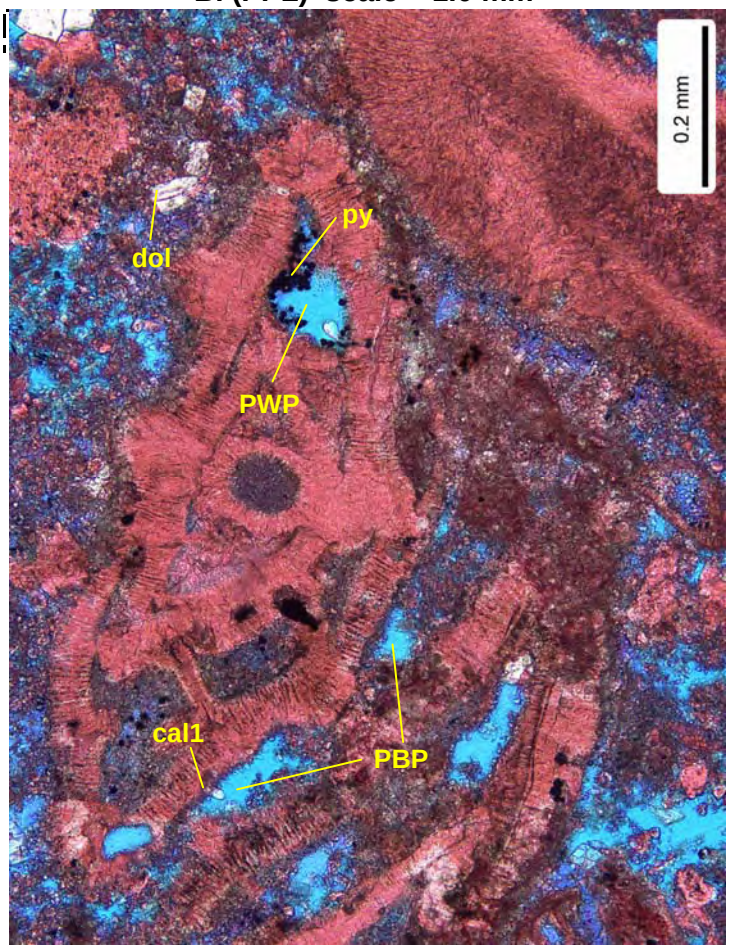
Illite / Smect	0	Kaolinite	0
Illite & Mica	0	Chlorite	0

PLATE 7A-7C

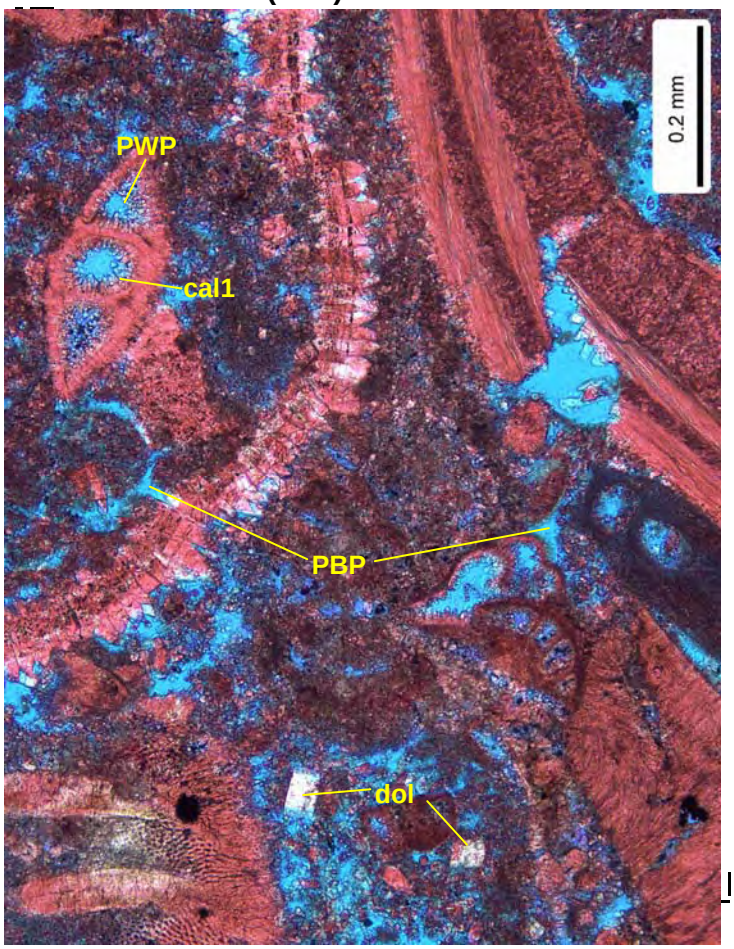


A. (PPL) scale = 1.0 mm

B. (PPL) scale = 1.0 mm



C. (PPL) scale = 1.0



South Florida Water Management District
Well: OKF-105
L. Kissimee Basin, Okeechobee Co., Fla

PLATE 8A-8C

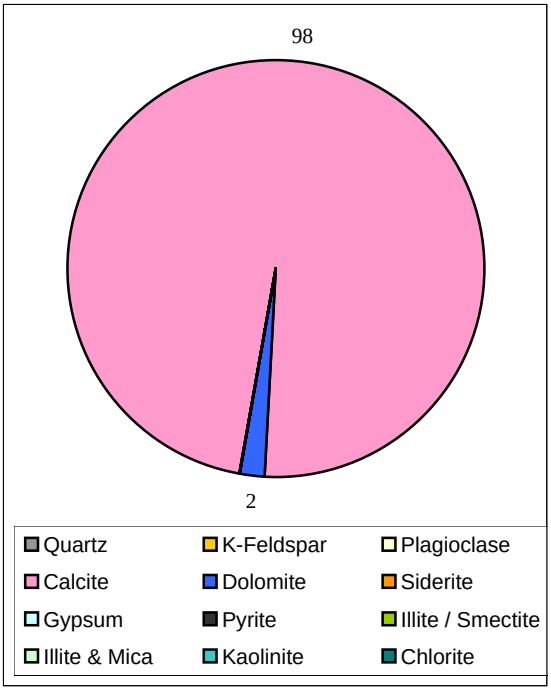
South Florida Water Management District

Well: OKF-105
L. Kissimee Basin, Okeechobee Co., Fla

Depth (ft): 2104.1

Primary between particle pores (PBP) in this upper fine-grained bioclast packstone are common and appear well interconnected; primary within particle pores (PWP; mostly within benthic foramnifera) are minor in abundance. Moldic pores (MP) are more common in this sample than in many of the previous limestones; the morphology of the molds suggest that they may have been mollusk grains. Overall, macropores are very common. Bioclasts include benthic foraminifera (miliolids and rotalids (FBr), dasyclad algal grains and red algae (rd). Other allochemical grains include intraclasts and peloids. Early pore-fringing cement (cal1) is locally observed; authigenic dolomite (dol) is a minor mineral in this sample.

Mineralogy Determined by X-Ray Diffraction (Weight %)



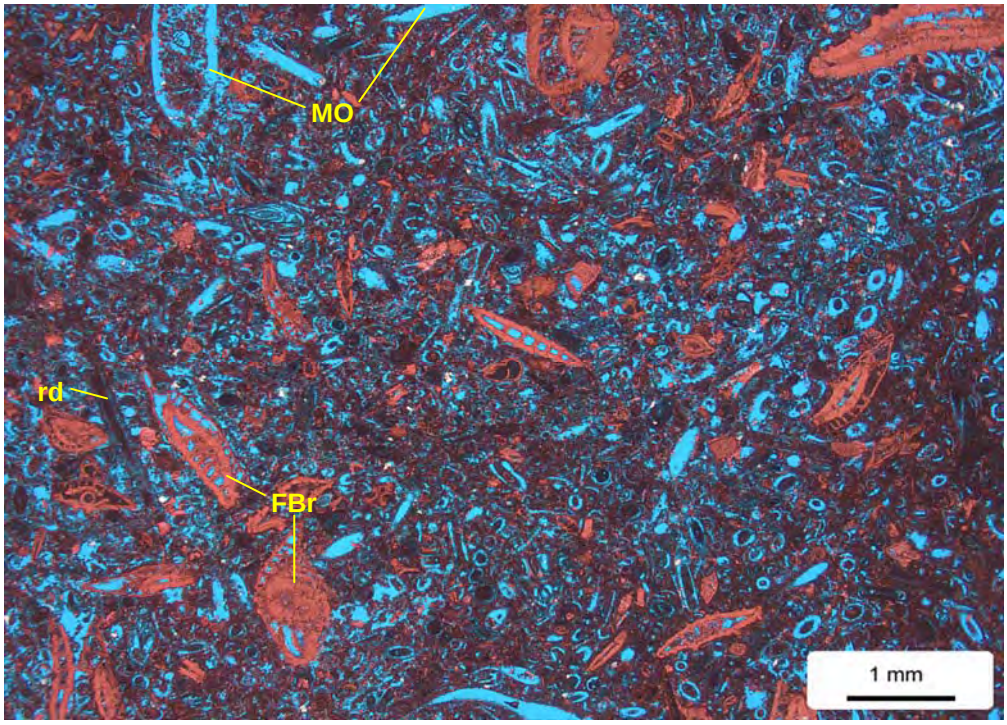
XRD-Whole Rock Mineralogy (Weight %)

Quartz	Tr	Siderite	0
K-Feldspar	0	Gypsum	0
Plagioclase	0	Pyrite	0
Calcite	98	Total Clay	0
Dolomite	2		

Clay Abundance (Weight %)

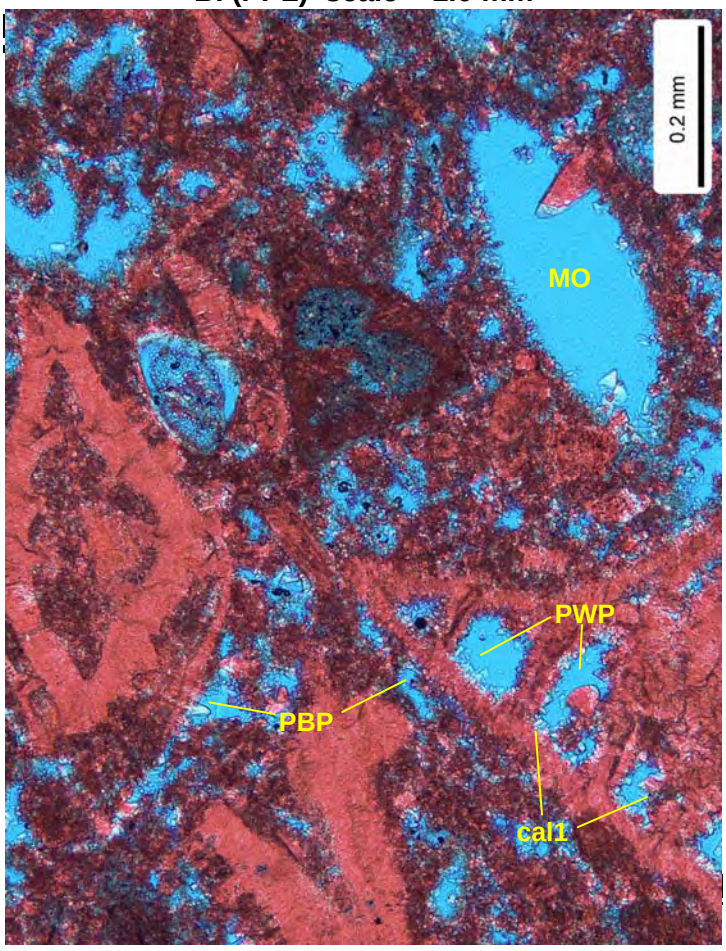
Illite / Smect	0	Kaolinite	0
Illite & Mica	0	Chlorite	0

PLATE 8A-8C

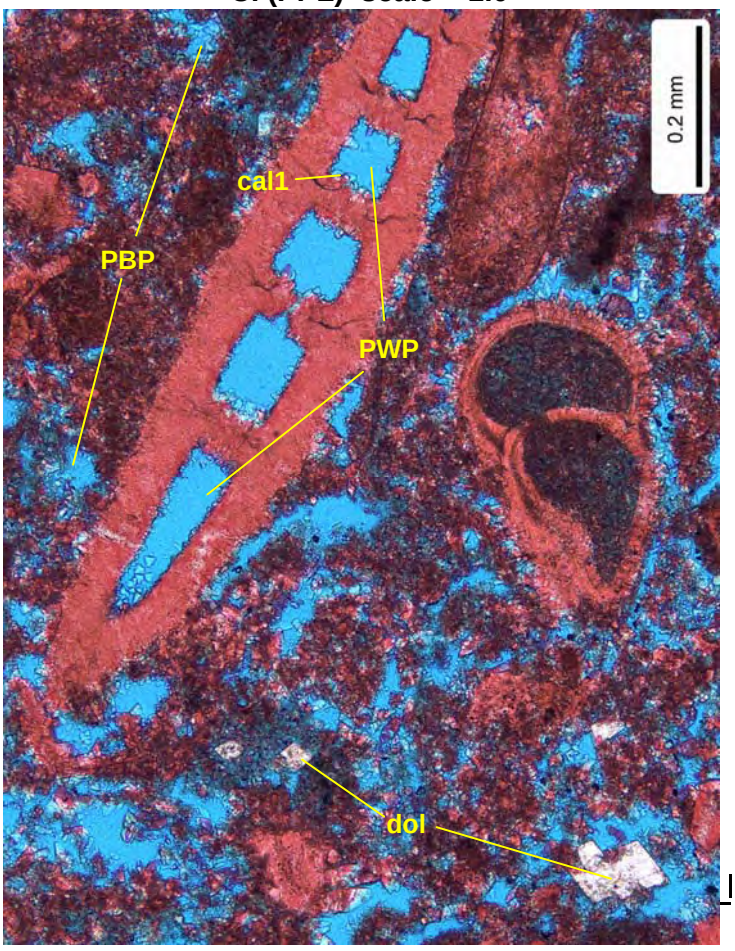


A. (PPL) scale = 1.0 mm

B. (PPL) scale = 1.0 mm



C. (PPL) scale = 1.0



South Florida Water Management District
Well: OKF-105
L. Kissimee Basin, Okeechobee Co., Fla

PLATE 9A-9C

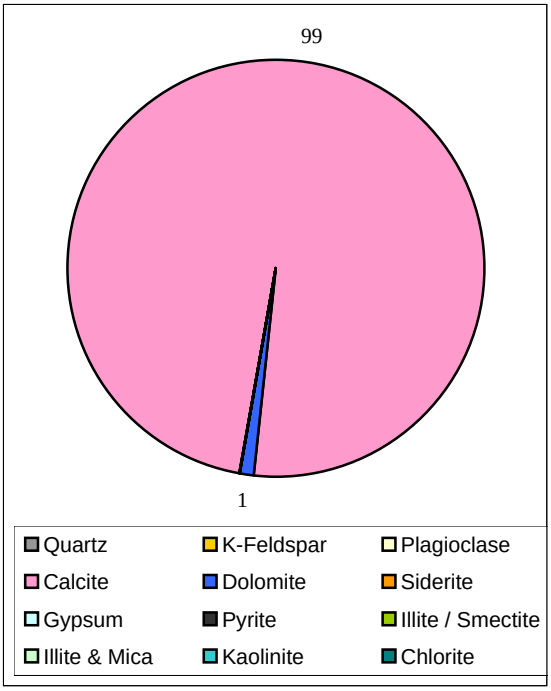
South Florida Water Management District

Well: OKF-105
L. Kissimee Basin, Okeechobee Co., Fla

Depth (ft): 2105.1

This sample is an bioclast peloid packstone; micrite matrix is common and fills most interparticle areas. Calcite cement comes in two basic varieties, and early pore-fringing cement (cal1) an a later syntaxial pore-filing cement (cal2). The later syntaxial calcite cement nucleated on echinoderm grains (ech) and filled local primary between particle pores (PBP). Authigenic dolomite (dol) and pyrite (py) are minor constituents of this sample. Both primary between particle pores and primary within particle pores (PWP; mostly within benthic foramnifera) are minor in abundance. Secondary pores are also minor to rare. Bioclasts include benthic foraminifera (miliolids and rotalids(FBr)), planktonic foraminifera (FP) and mollusks. Other allochemical grains include intraclasts and peloids (P).

Mineralogy Determined by X-Ray Diffraction (Weight %)



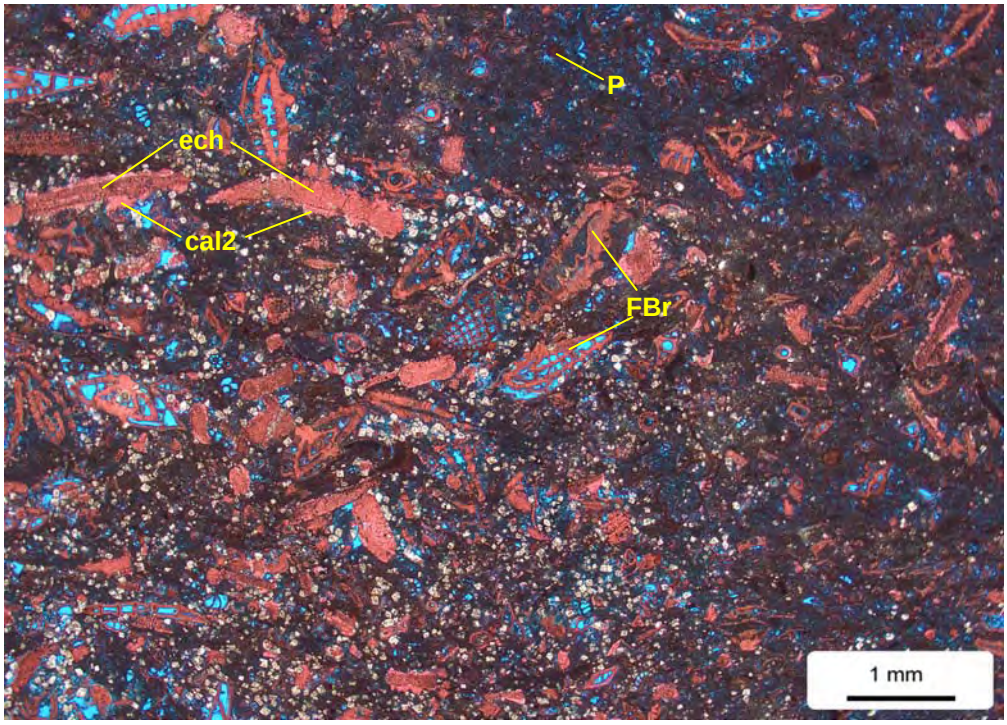
XRD-Whole Rock Mineralogy (Weight %)

Quartz	Tr	Siderite	0
K-Feldspar	0	Gypsum	0
Plagioclase	0	Pyrite	0
Calcite	99	Total Clay	0
Dolomite	1		

Clay Abundance (Weight %)

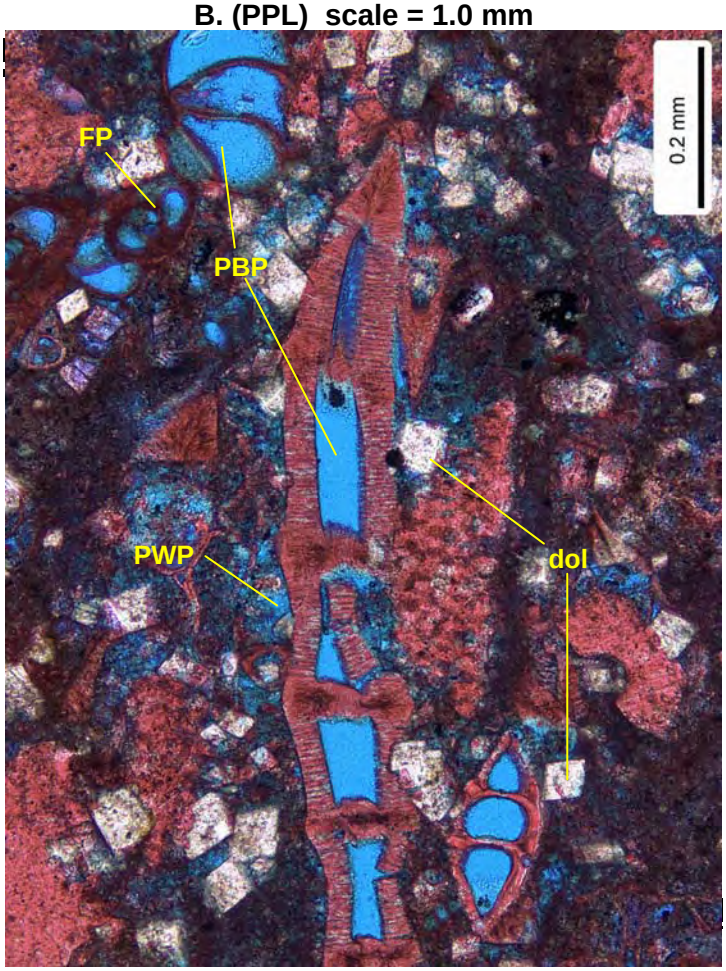
Illite / Smect	0	Kaolinite	0
Illite & Mica	0	Chlorite	0

PLATE 9A-9C

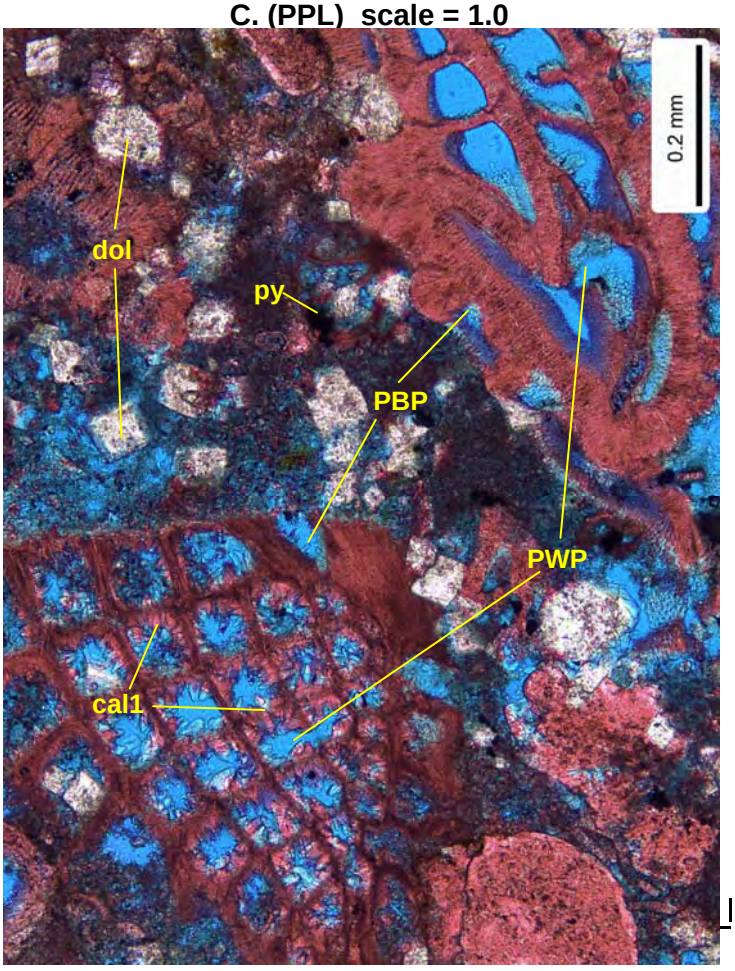


A. (PPL) scale = 1.0 mm

B. (PPL) scale = 1.0 mm



C. (PPL) scale = 1.0



South Florida Water Management District
Well: OKF-105
L. Kissimee Basin, Okeechobee Co., Fla

PLATE 10A-10C

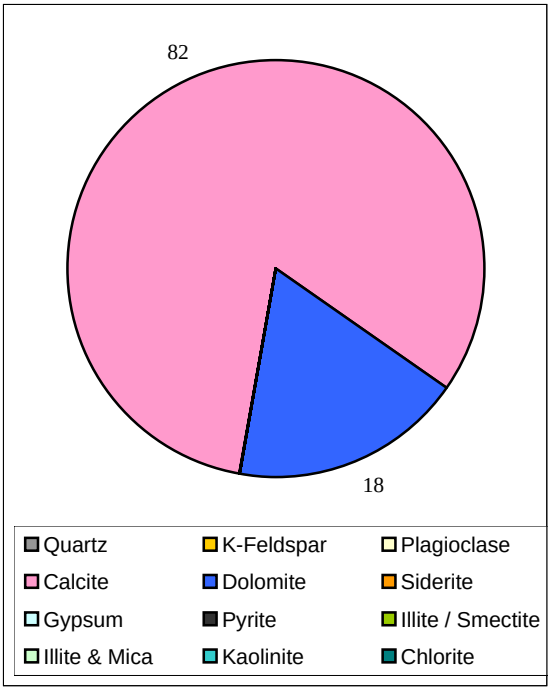
South Florida Water Management District

Well: OKF-105
L. Kissimee Basin, Okeechobee Co., Fla

Depth (ft): 2106.4

Bioclasts in this dolomitic bioclast packstone include benthic foraminifera (miliolids and rotalids (FBr)), gastropods (gst), echinoderms (ech) and mollusks. Other allochemical grains include intraclasts and peloids. Early pore-fringing cement (cal1) is very rare; authigenic dolomite (dol) is a common mineral, replacing matrix and locally filling pores. Primary between particle pores (PBP) are moderate to common in abundance; primary within particle pores (PWP; mostly within benthic foramnifera) are minor. Moldic pores (VG) and other secondary pores are less abundant.

Mineralogy Determined by X-Ray Diffraction (Weight %)



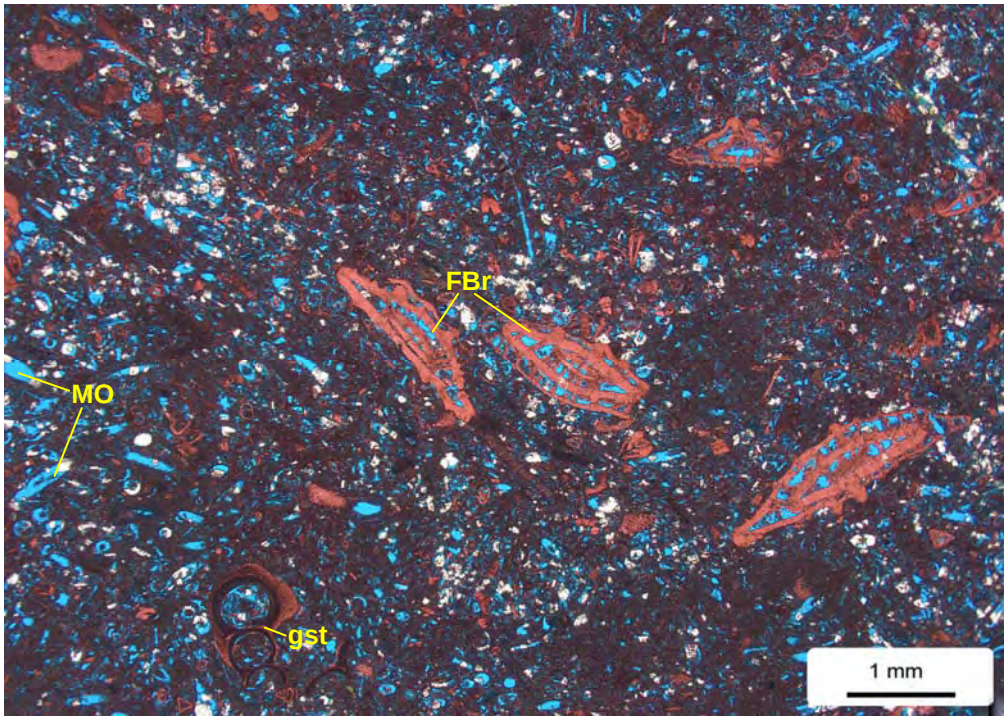
XRD-Whole Rock Mineralogy (Weight %)

Quartz	Tr	Siderite	0
K-Feldspar	0	Gypsum	0
Plagioclase	0	Pyrite	0
Calcite	82	Total Clay	0
Dolomite	18		

Clay Abundance (Weight %)

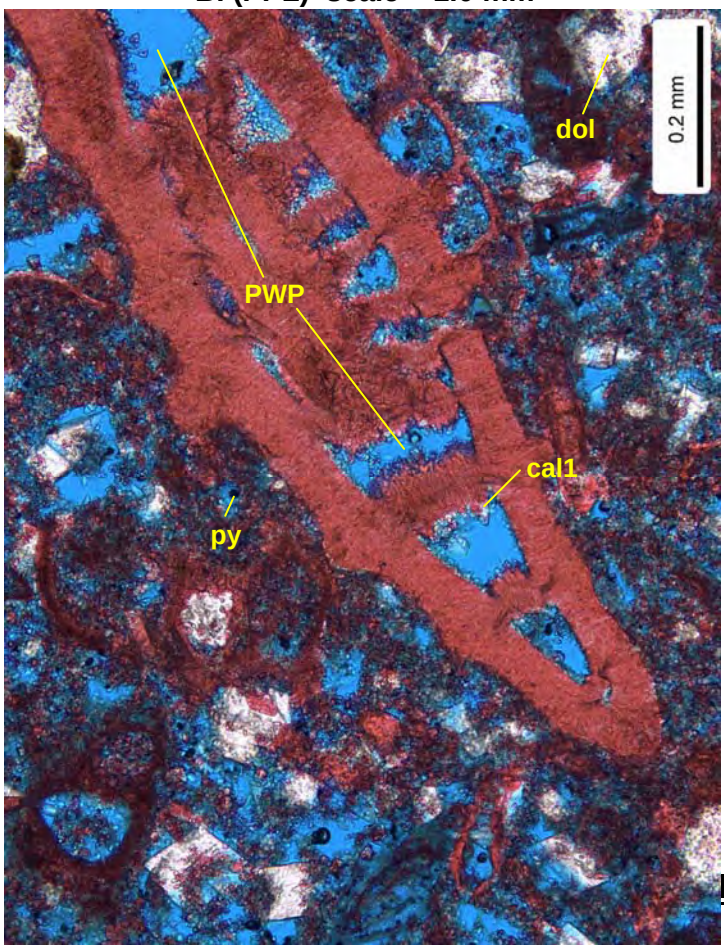
Illite / Smect	0	Kaolinite	0
Illite & Mica	0	Chlorite	0

PLATE 10A-10C

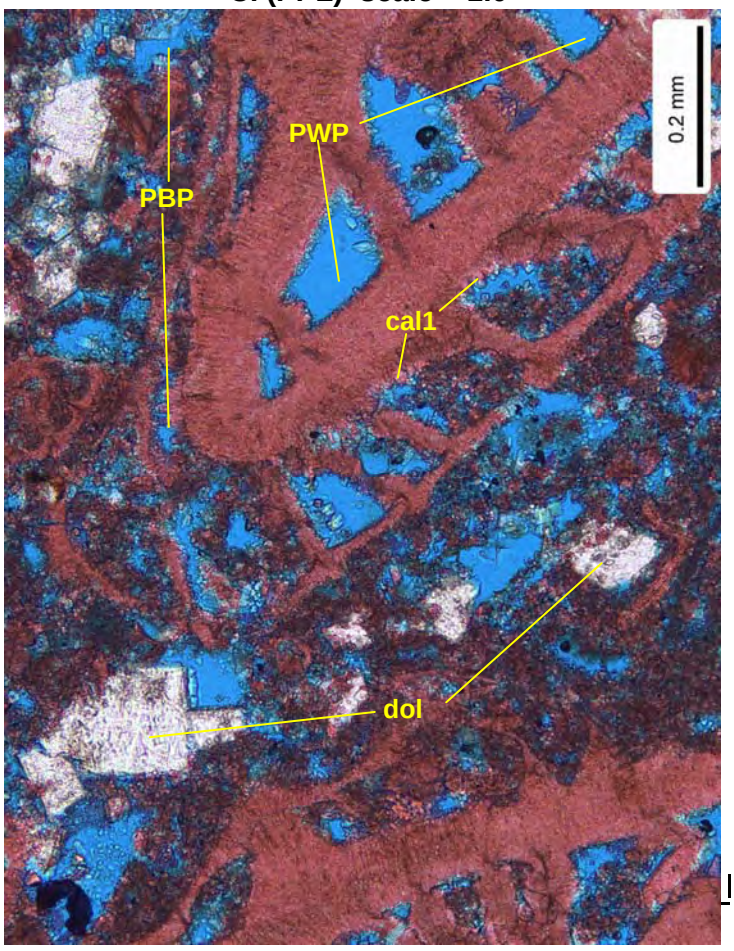


A. (PPL) scale = 1.0 mm

B. (PPL) scale = 1.0 mm



C. (PPL) scale = 1.0



South Florida Water Management District
Well: OKF-105
L. Kissimee Basin, Okeechobee Co., Fla

PLATE 11A-11C

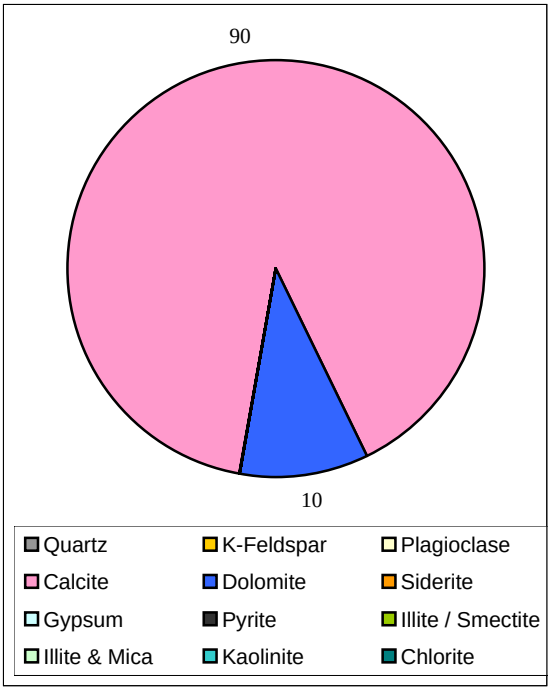
South Florida Water Management District

Well: OKF-105
L. Kissimee Basin, Okeechobee Co., Fla

Depth (ft): 2107.6

In this dolomitic lime packstone one of the first minerals to form was pore-fringing cement (cal1). This calcite partially filled in primary intraparticle and interparticle pores. Later authigenic dolomite (dol) further filled in primary interparticle pores and replaced portions of grains and matrix. Primary between particle pores (PBP) are minor as are primary within particle pores (PWP; mostly within benthic foramnifera). Some secondary within particle pores are noted, overall secondary pores are rare. Bioclasts include benthic foraminifera (miliolids and rotalids), planktonic foraminifera (FP), echinoderms (ech), bryozoans and mollusks. Other allochemical grains include intraclasts and peloids.

Mineralogy Determined by X-Ray Diffraction (Weight %)



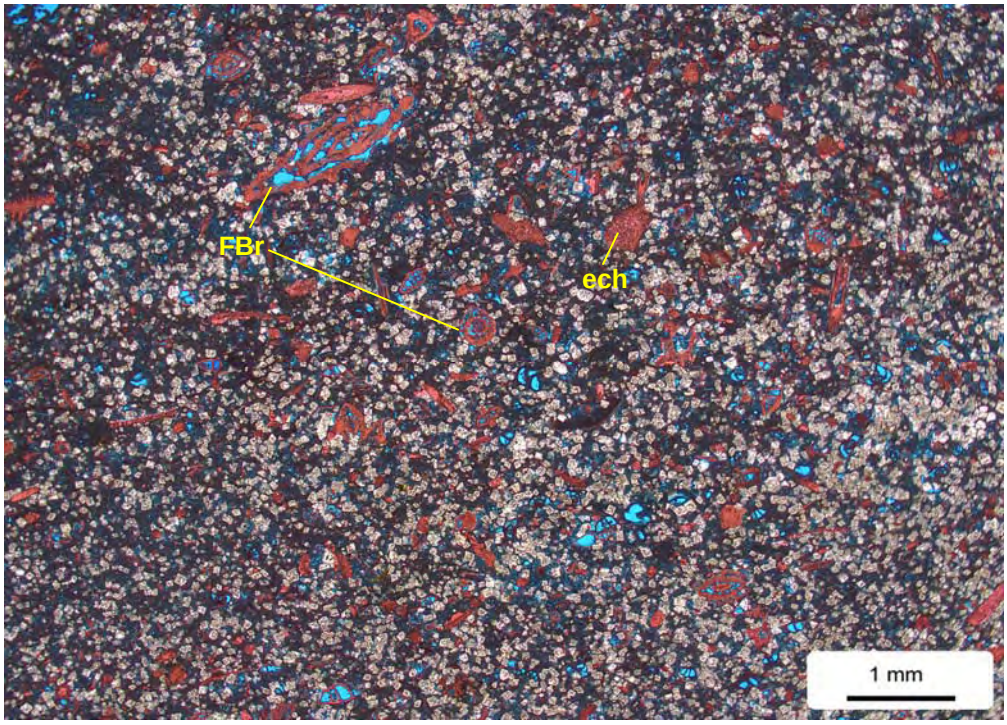
XRD-Whole Rock Mineralogy (Weight %)

Quartz	Tr	Siderite	0
K-Feldspar	0	Gypsum	0
Plagioclase	0	Pyrite	0
Calcite	90	Total Clay	0
Dolomite	10		

Clay Abundance (Weight %)

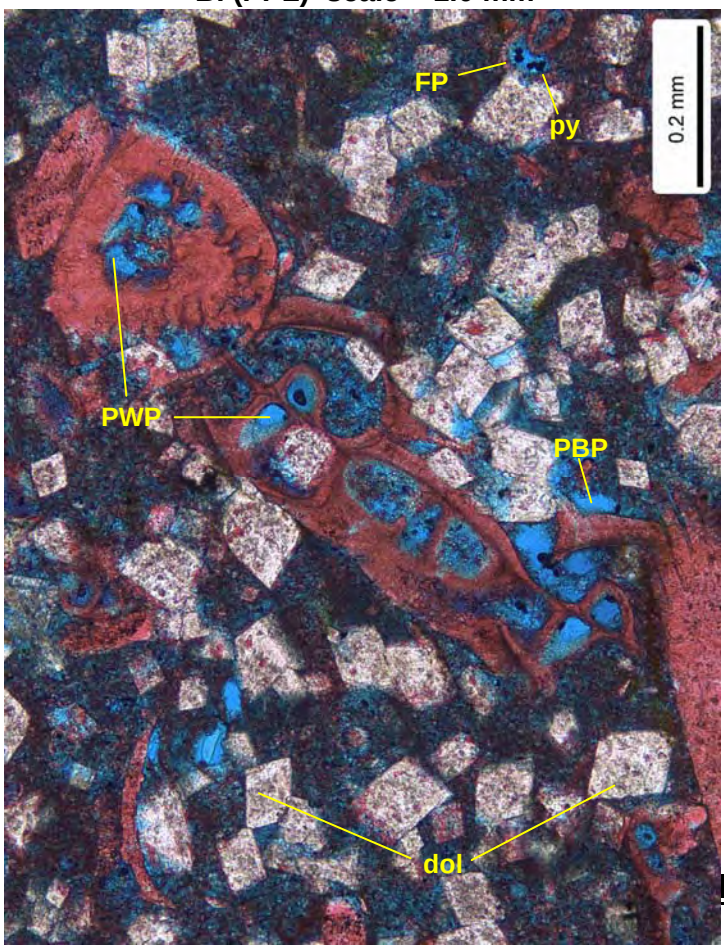
Illite / Smect	0	Kaolinite	0
Illite & Mica	0	Chlorite	0

PLATE 11A-11C

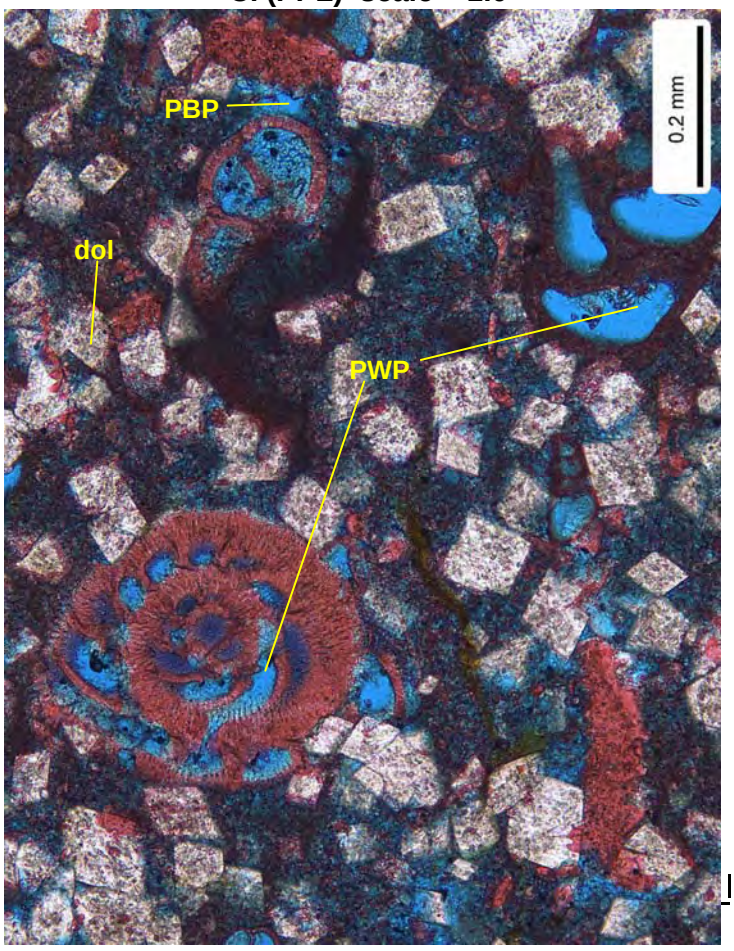


A. (PPL) scale = 1.0 mm

B. (PPL) scale = 1.0 mm



C. (PPL) scale = 1.0



South Florida Water Management District
Well: OKF-105
L. Kissimee Basin, Okeechobee Co., Fla

PLATE 12A-12C

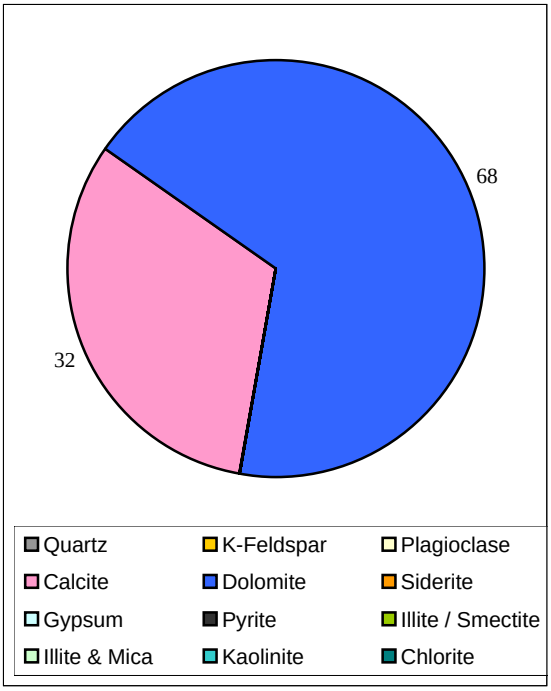
South Florida Water Management District

Well: OKF-105
L. Kissimee Basin, Okeechobee Co., Fla

Depth (ft): 2110.2

This bioclast peloid dolopackstone most of the allochemical grains and matrix were repalced by dolomite. Early pore-fringing cement and later syntaxial pore-filing cement were either poorly developed or replaced by the dolomite (dol). Authigenic pyrite (py) is a minor constituents of this sample. Both primary between particle pores (PBP) and primary within particle pores (PWP; mostly within benthic foramnifera) are minor in abundance. Secondary pores are also minor to rare. Overall macropores are moderate to common in this sample, although they may not be well interconnected. Bioclasts include benthic foraminifera (miliolids and rotalids(FBr)) echinoderms (ech) and mollusks (mol).

Mineralogy Determined by X-Ray Diffraction (Weight %)



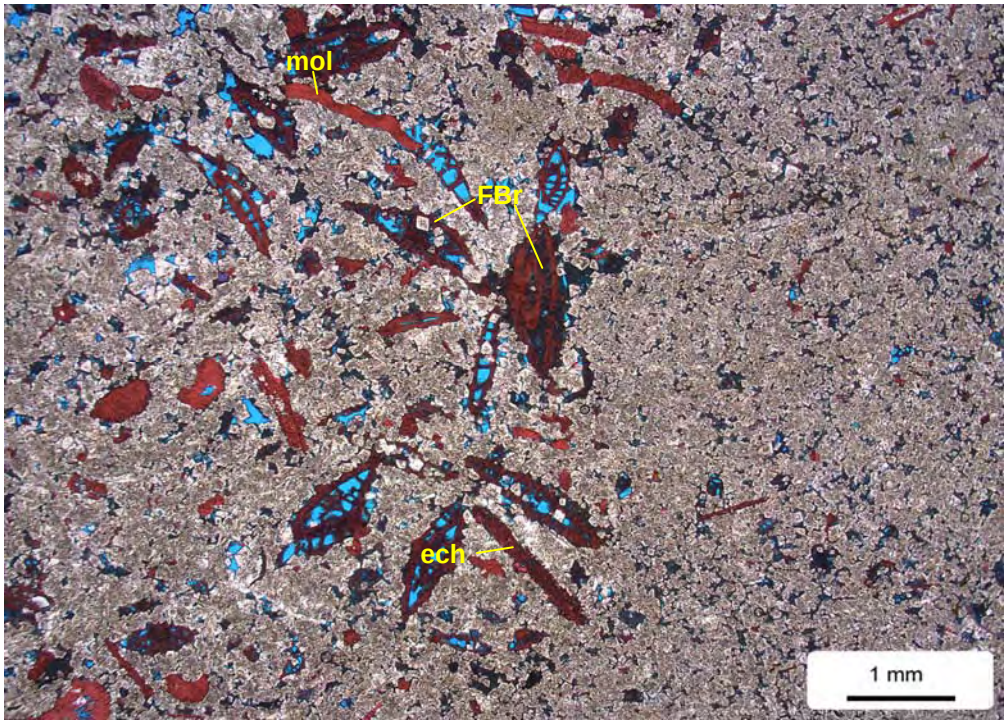
XRD-Whole Rock Mineralogy (Weight %)

Quartz	Tr	Siderite	0
K-Feldspar	0	Gypsum	0
Plagioclase	0	Pyrite	0
Calcite	32	Total Clay	0
Dolomite	68		

Clay Abundance (Weight %)

Illite / Smect	0	Kaolinite	0
Illite & Mica	0	Chlorite	0

PLATE 12A-12C



A. (PPL) scale = 1.0 mm

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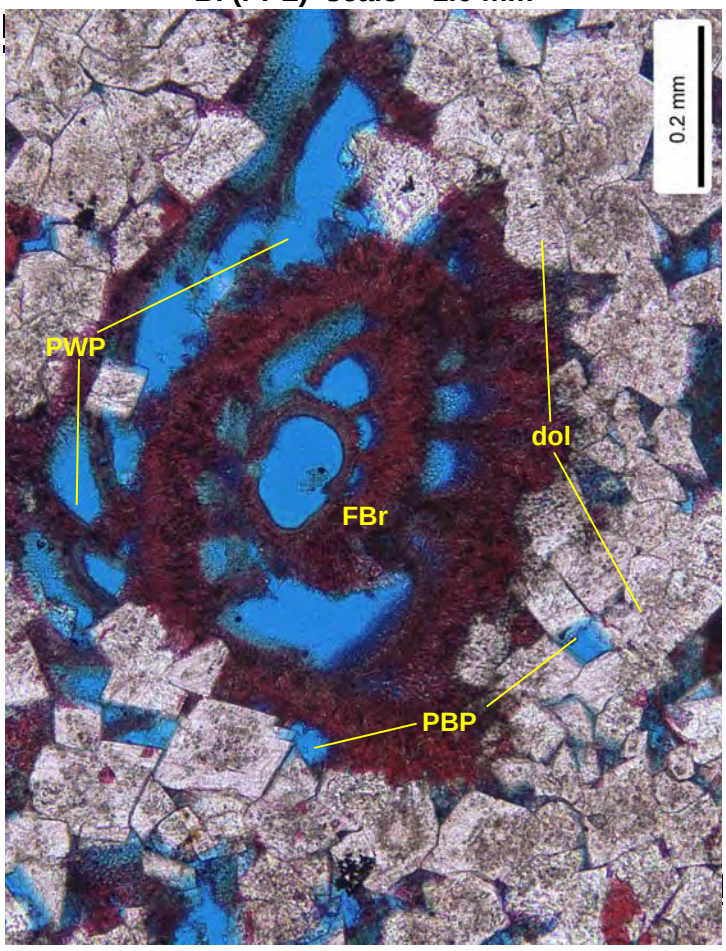
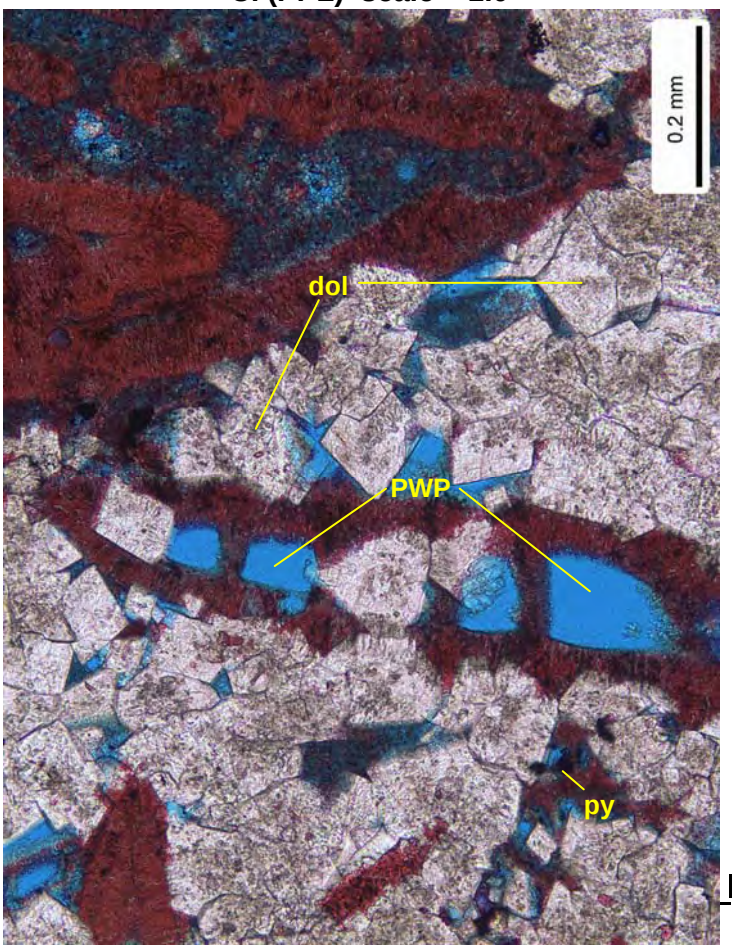


C. (PPL) scale = 1.0



South Florida Water Management District
Well: OKF-105
L. Kissimee Basin, Okeechobee Co., Fla

PLATE 13A-13C

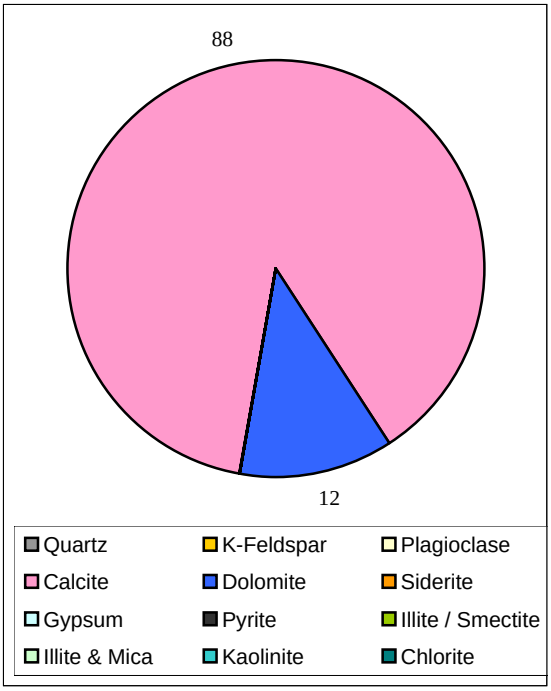
South Florida Water Management District

Well: OKF-105
L. Kissimee Basin, Okeechobee Co., Fla

Depth (ft): 2111.85

Primary between particle pores (PBP) in this dolomitic bioclast packstone/wackestone due to the high matrix content; primary within particle pores (PWP; mostly within benthic foramnifera) are minor in abundance. Secondary pores are generally rare and isolated. Overall, macropores are moderate in abundance. Bioclasts include benthic foraminifera (miliolids and rotalids (FBr), bryozoans, mollusks, planktonic foraminifera and echinoderms. Other allochemical grains include intraclasts and peloids. Early pyrite (py) cement is often associated with skeletal grains; dolomite (dol) has replaced portions of allochemical grains and matrix, in addition to filling primary pores.

Mineralogy Determined by X-Ray Diffraction (Weight %)



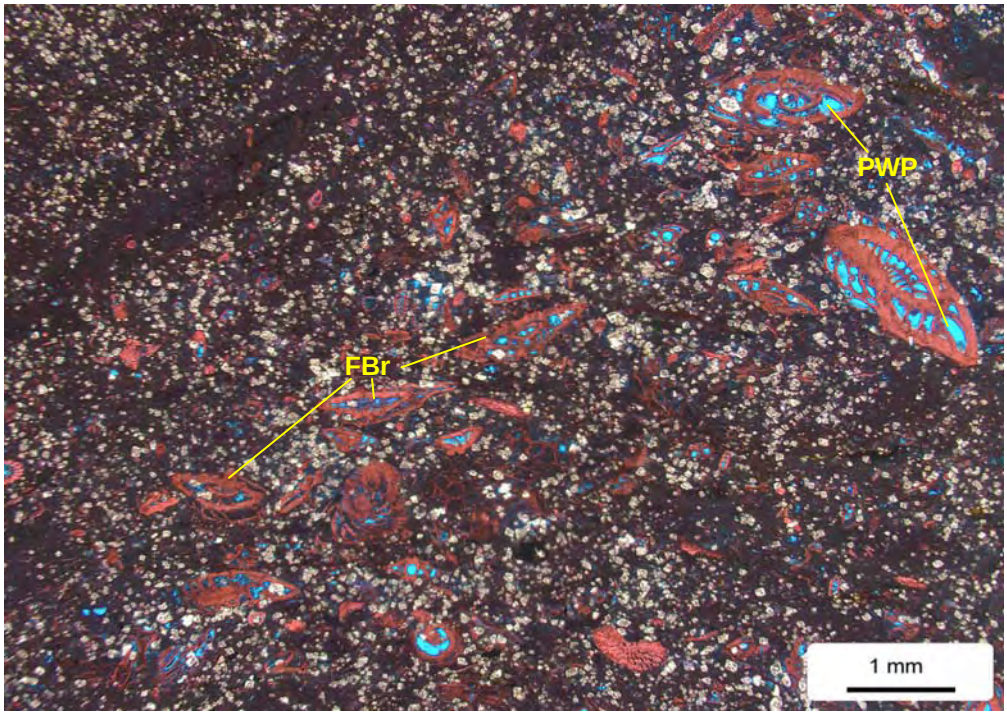
XRD-Whole Rock Mineralogy (Weight %)

Quartz	Tr	Siderite	0
K-Feldspar	0	Gypsum	0
Plagioclase	0	Pyrite	0
Calcite	88	Total Clay	0
Dolomite	12		

Clay Abundance (Weight %)

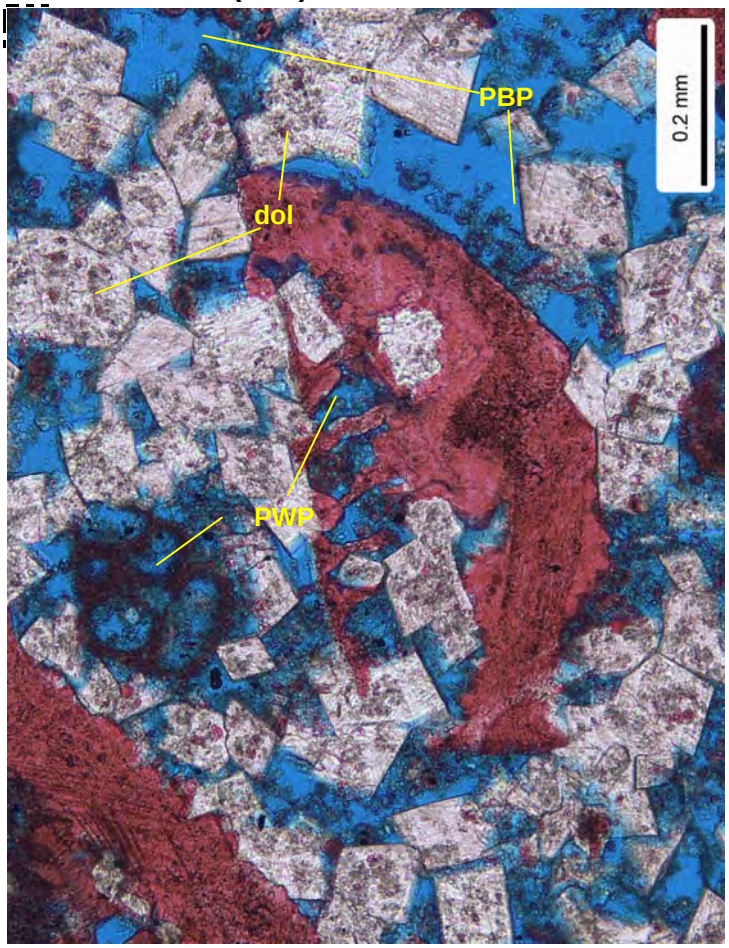
Illite / Smect	0	Kaolinite	0
Illite & Mica	0	Chlorite	0

PLATE 13A-13C

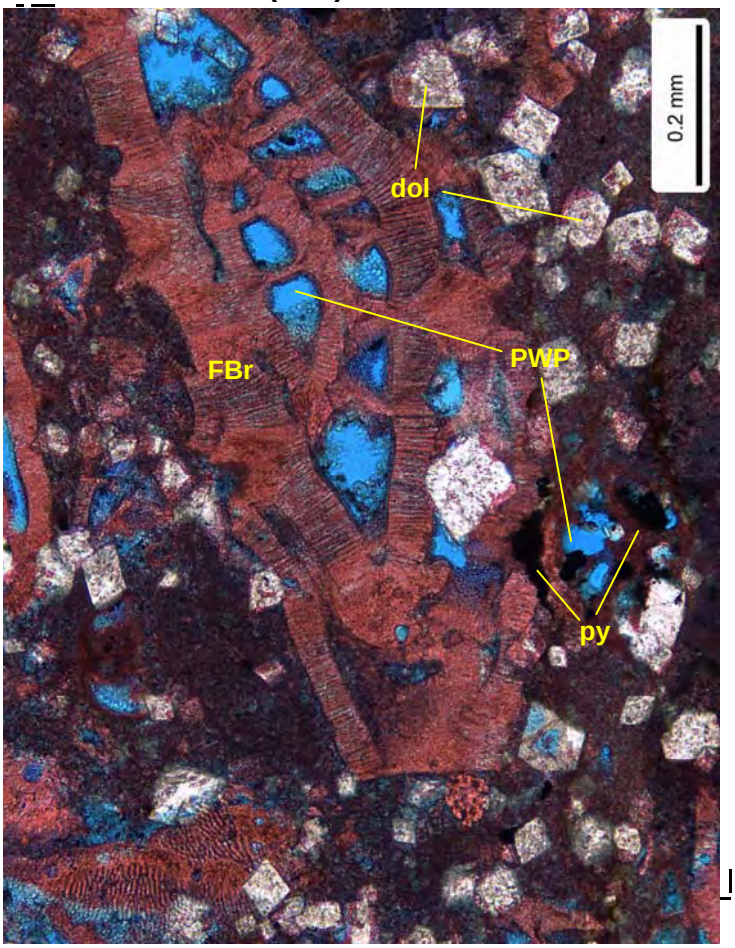


A. (PPL) scale = 1.0 mm

B. (PPL) scale = 1.0 mm



C. (PPL) scale = 1.0



South Florida Water Management District
Well: OKF-105
L. Kissimee Basin, Okeechobee Co., Fla

PLATE 14A-14C

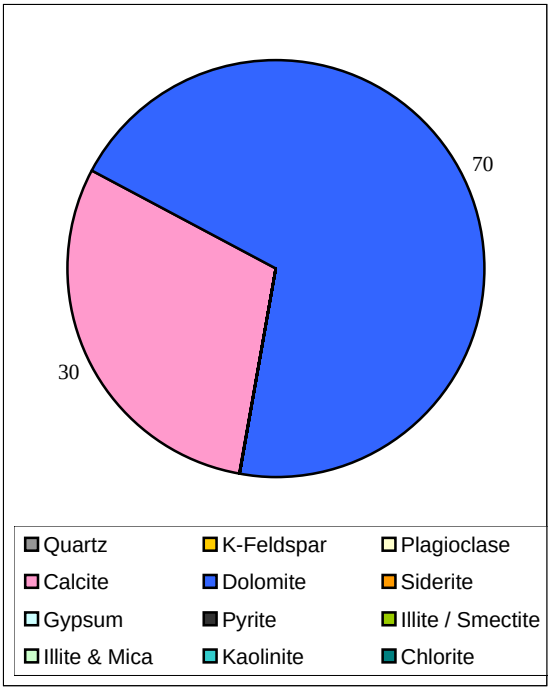
South Florida Water Management District

Well: OKF-105
L. Kissimee Basin, Okeechobee Co., Fla

Depth (ft): 2113.1

This bioclast peloid dolopackstone/dolowackestone most of the allochemical grains and matrix were replaced by dolomite (dol). Early pore-fringing cement (cal1) and later syntaxial pore-filing cement were either poorly developed or replaced by the dolomite. Both primary between particle pores (PBP) and primary within particle pores (PWP) are rare. Secondary pores are also minor to rare. Overall macropores are minor in this sample, although they may not be well interconnected. Bioclasts include benthic foraminifera (miliolids and rotalids(FBr)), planktonic foraminifera, echinoderms and mollusks.

Mineralogy Determined by X-Ray Diffraction (Weight %)



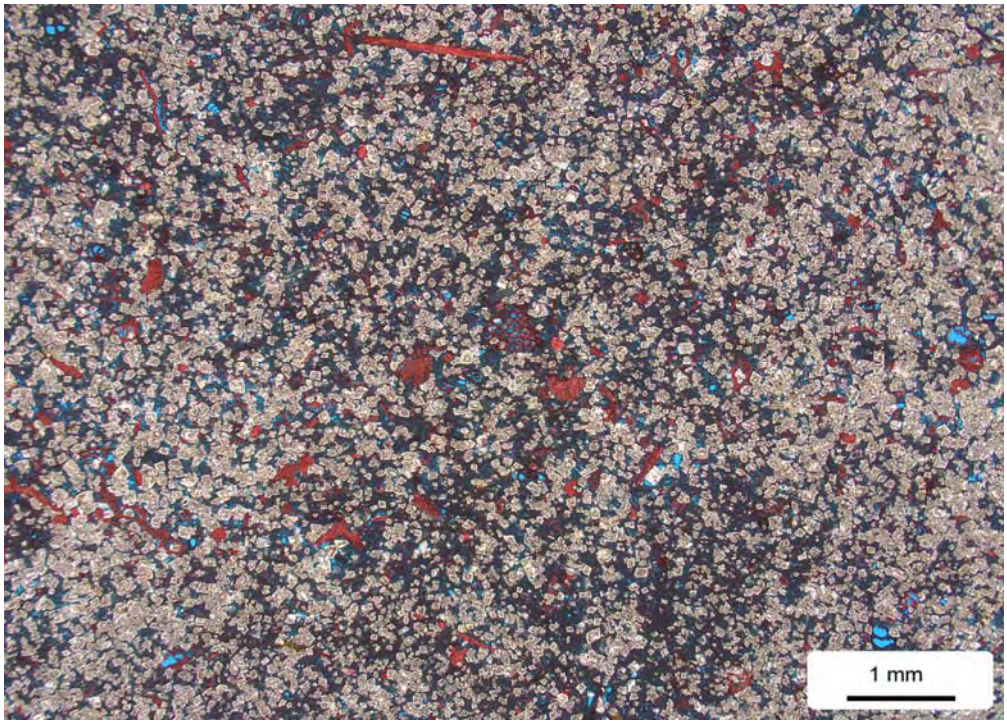
XRD-Whole Rock Mineralogy (Weight %)

Quartz	Tr	Siderite	0
K-Feldspar	0	Gypsum	0
Plagioclase	0	Pyrite	0
Calcite	30	Total Clay	0
Dolomite	70		

Clay Abundance (Weight %)

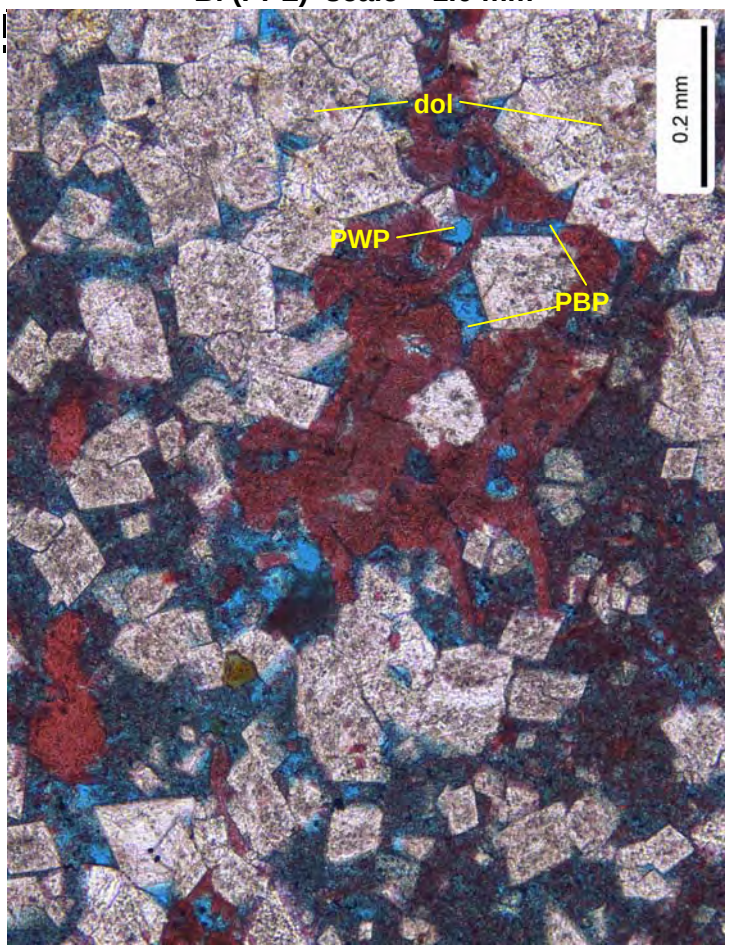
Illite / Smect	0	Kaolinite	0
Illite & Mica	0	Chlorite	0

PLATE 14A-14C

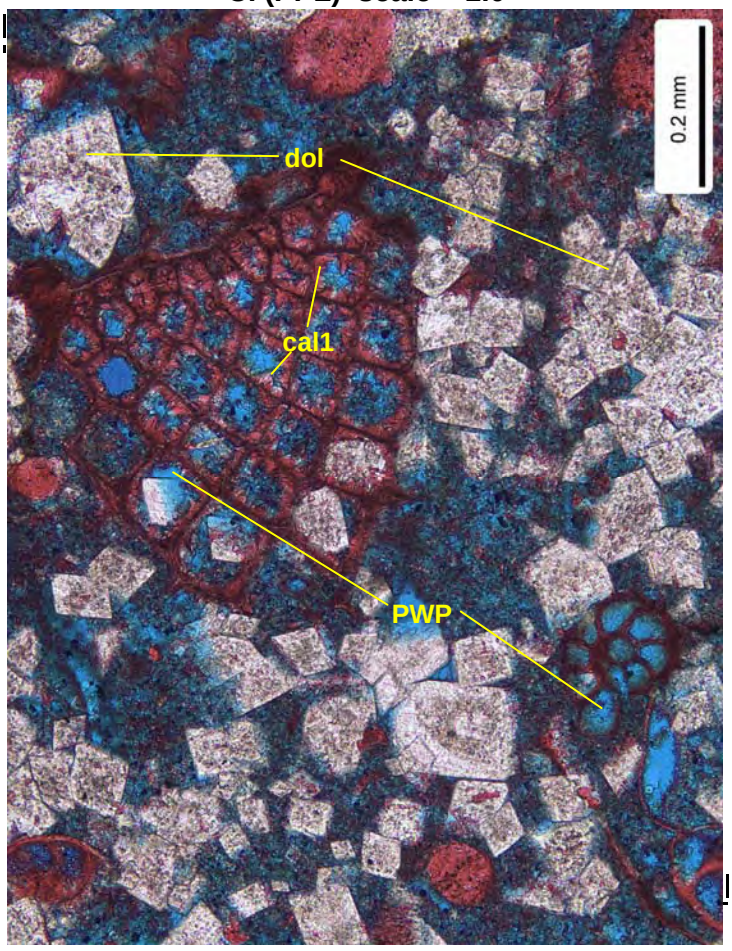


A. (PPL) scale = 1.0 mm

B. (PPL) scale = 1.0 mm



C. (PPL) scale = 1.0



South Florida Water Management District
Well: OKF-105
L. Kissimee Basin, Okeechobee Co., Fla

PLATE 15A-15C

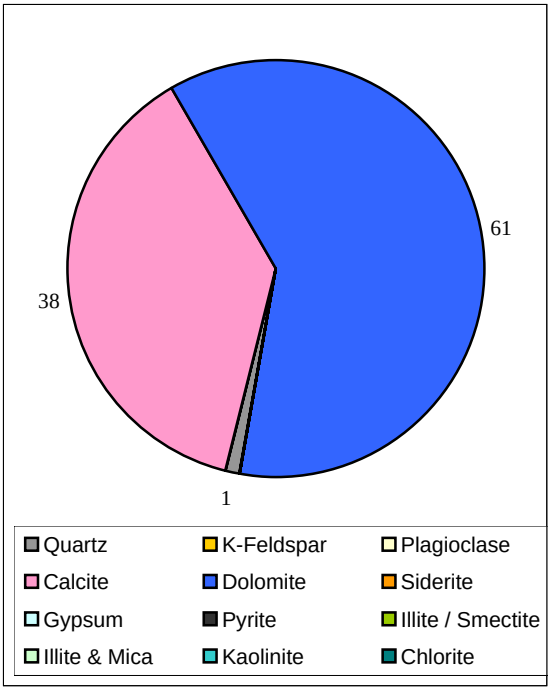
South Florida Water Management District

Well: OKF-105
L. Kissimee Basin, Okeechobee Co., Fla

Depth (ft): 2114.7

This bioclast dolopackstone/dolowackestone contains only moderate amounts of macropores; the abundant micrite matrix and the lack of significant secondary pores are the primary cause of the lower reservoir quality. Primary between particle pores (PBP) and primary within particle pores (PWP) are generally rare and isolated; secondary pores are poorly developed. Bioclasts include bryozoans (bry), echinoderms (ech) and benthic rotalid foraminifera (FBr). Dolomite (dol) has replaced portions of the matrix and filled in primary pores.

Mineralogy Determined by X-Ray Diffraction (Weight %)



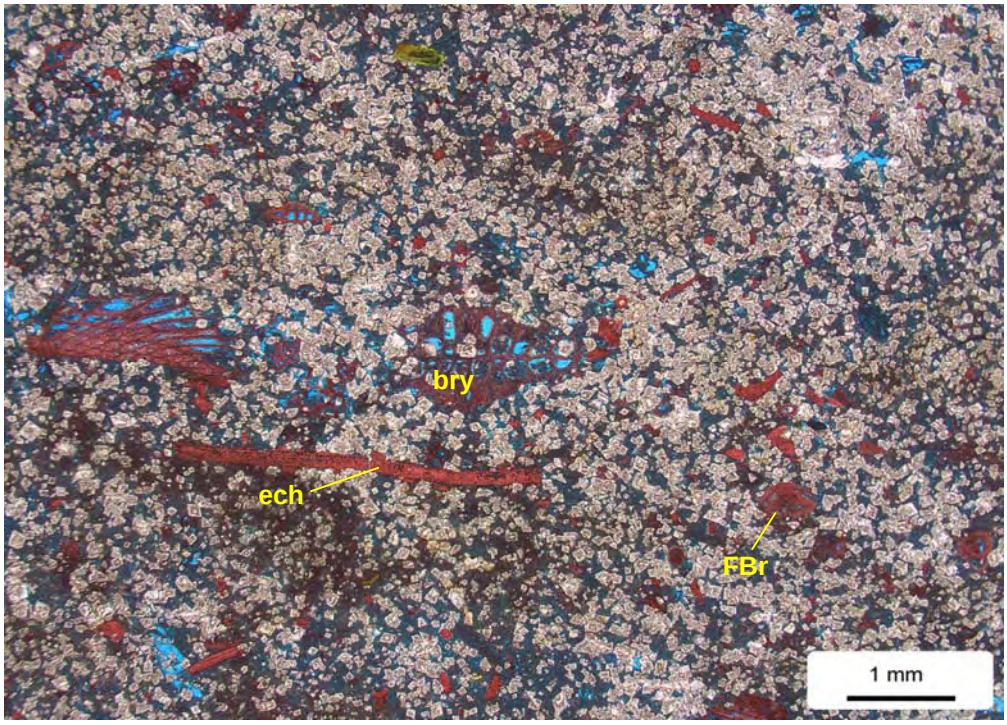
XRD-Whole Rock Mineralogy (Weight %)

Quartz	1	Siderite	0
K-Feldspar	0	Gypsum	0
Plagioclase	0	Pyrite	0
Calcite	38	Total Clay	0
Dolomite	61		

Clay Abundance (Weight %)

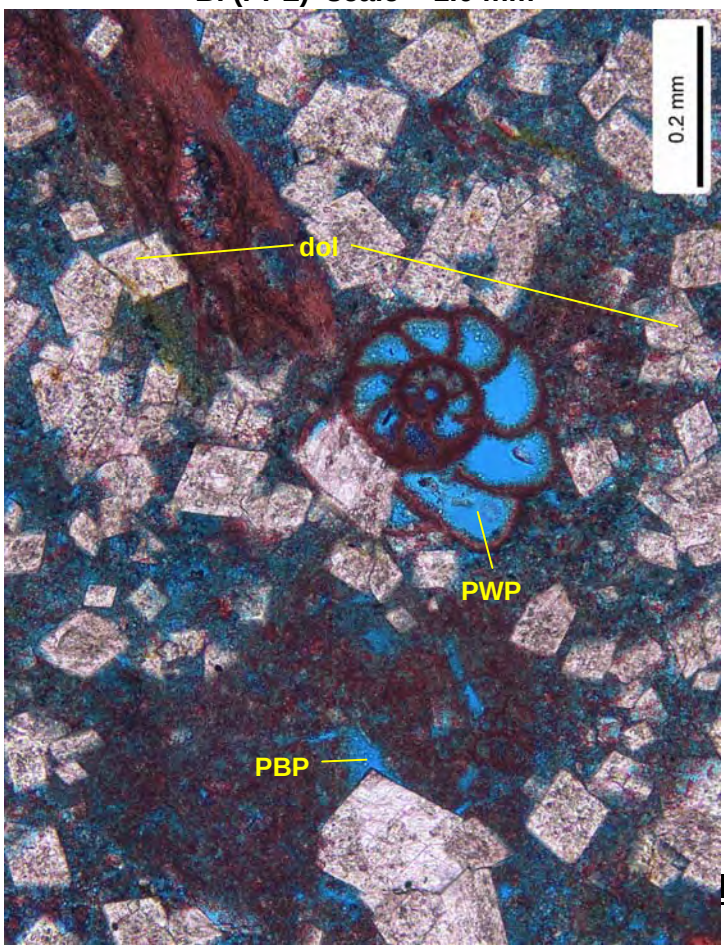
Illite / Smect	0	Kaolinite	0
Illite & Mica	0	Chlorite	0

PLATE 15A-15C

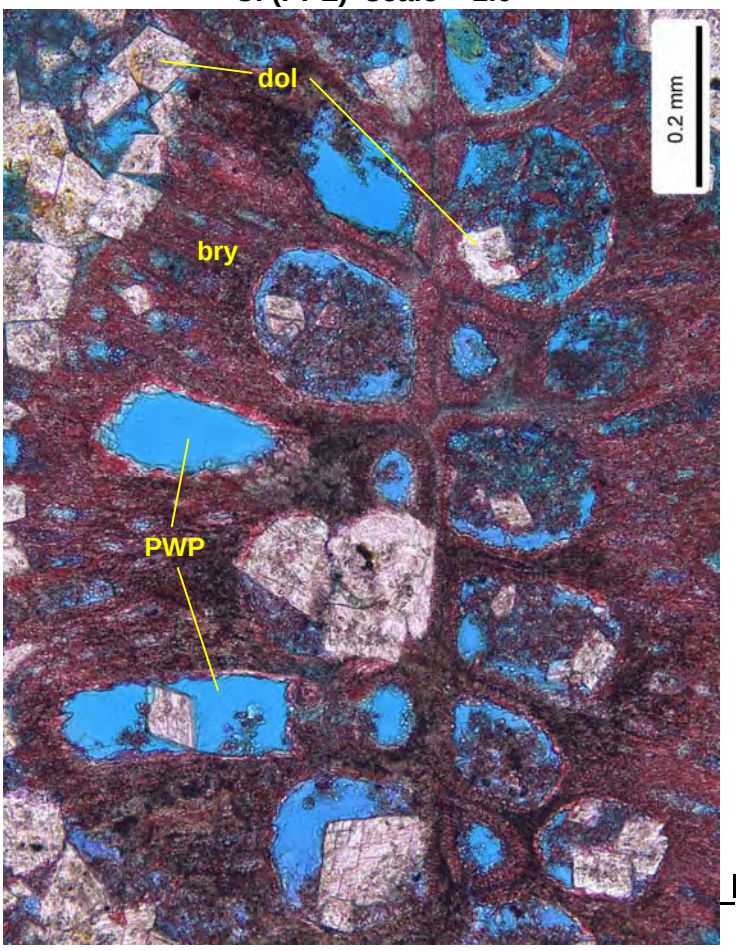


A. (PPL) scale = 1.0 mm

B. (PPL) scale = 1.0 mm



C. (PPL) scale = 1.0



South Florida Water Management District
Well: OKF-105
L. Kissimee Basin, Okeechobee Co., Fla

Jupiter Environmental Laboratories, Inc.
150 S. Old Dixie Highway
Jupiter, FL 33458
Phone: (561)575-0030
Fax: (561)575-4118
www.jupiterlabs.com
clientservices@jupiterlabs.com

November 24, 2008

Randy Keyser
Tetra-Tech EC, Inc.
759 S. Federal Hwy
Ste. 100
Stuart, FL 34994

RE: LOG# 821511
Project ID: SFWMD-Packer Test
COC# 36683

Dear Randy Keyser:

Enclosed are the analytical results for sample(s) received by the laboratory on Friday, October 31, 2008. Results reported herein conform to the most current NELAC standards, where applicable, unless indicated by * in the body of the report.

The enclosed Chain of Custody is a component of this package and should be retained with the package and incorporated therein.

Results for all solid matrices are reported in dry weight unless otherwise noted. Results for all liquid matrices are reported as received in the laboratory unless otherwise noted.

Samples are disposed of after 30 days of their receipt by the laboratory unless archiving is requested in writing. The laboratory maintains the right to charge storage fees for archived samples.

Certain analyses are subcontracted to outside NELAC certified laboratories, please see the Footnotes section of this report for NELAC certification numbers of laboratories used.

A Statement of Qualifiers is available upon request.

If you have any questions concerning this report, please feel free to contact me.

Sincerely,

Erin Forsythe for
Kacia Baldwin
kbaldwin@jupiterlabs.com

Enclosures

FDOH# E86546

CERTIFICATE OF ANALYSIS

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Jupiter, FL 33458
Phone: (561)575-0030
Fax: (561)575-4118

SAMPLE ANALYTE COUNT

LOG# 821511

Project ID: SFWMD-Packer Test

Lab ID	Sample ID	Method	Analytes Reported
821511001	OKF-105-GW001	EPA 200.8 (Total)	5
821511001	OKF-105-GW001	EPA 300.0	1
821511001	OKF-105-GW001	EPA 300.0	1
821511001	OKF-105-GW001	SM 2320B	1
821511001	OKF-105-GW001	EPA 300.0	1
821511001	OKF-105-GW001	EPA 200.7	1
821511001	OKF-105-GW001	SM 5310B	1
821511001	OKF-105-GW001	SM 2540C	1
821511001	OKF-105-GW001	SM 4500CL-E	1

FDOH# E86546

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Fax: (561)575-4118

SAMPLE SUMMARY

LOG# 821511

Project ID: SFWMD-Packer Test

Lab ID	Sample ID	Matrix	Date Collected	Date Received
821511001	OKF-105-GW001	Aqueous Liquid	10/31/2008 11:07	10/31/2008 13:25

FDOH# E86546

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Phone: (561)575-0030
Fax: (561)575-4118

ANALYTICAL RESULTS

LOG# 821511
Project ID: SFWMD-Packer Test

Lab ID: **821511001** Date Received: 10/31/2008 Matrix: Aqueous Liquid
Sample ID: **OKF-105-GW001** Date Collected: 10/31/2008

Parameters	Results	Units	Report Limit	MDL	DF	Prepared	By	Analyzed	By	Qual	CAS
Analysis Desc: Sulfate by 300.0 (W)			Analytical Method: EPA 300.0								
Sulfate	190	mg/L	5.0	0.755	10			11/11/08	USB		14808-79-8
Analysis Desc: Chloride by SM 4500CL-E [REF] (W)			Analytical Method: SM 4500CL-E								
Chloride	140	mg/L	1.0	0.500	1			11/15/08	USB		16887-00-6
Analysis Desc: Silica 200.7 [REF] (W)			Analytical Method: EPA 200.7								
Silica	11800	ug/L	32.0	8.00	1			11/13/08	BNCH		7631-86-9
Analysis Desc: TOC by SM 5310B [REF] (W)			Analytical Method: SM 5310B								
TOC	1.0	mg/L	1.0	0.500	1			11/08/08	USB		
Analysis Desc: Fluoride by EPA 300.0 (W)			Analytical Method: EPA 300.0								
Fluoride	U	mg/L	2.0	0.300	10			11/11/08	USB		16984-48-8
Analysis Desc: Alkalinity, SM 2320B (W)			Analytical Method: SM 2320B								
Alkalinity	80	mg/L	0.050	0.0200	1			11/14/08	USB		
Analysis Desc: Bromide by EPA 300.0 [REF] (W)			Analytical Method: EPA 300.0								
Bromide	U	mg/L	5.0	0.522	10			11/11/08	USB		24959-67-9
Analysis Desc: TDS by 2540C [REF] (W)			Analytical Method: SM 2540C								
Total Dissolved Solids	670	mg/L	7.0	7.00	1			11/06/08	USB		
Analysis Desc: EPA 200.8 Metals (W)			Preparation Method: EPA 200.2 mod. Analytical Method: EPA 200.8 (Total)								
Strontium	23000	ug/L	4.0	2.0	1	11/03/08	ZS	11/03/08	ZS		7440-24-6
Sodium	74000	ug/L	7.0	3.5	1	11/03/08	ZS	11/03/08	ZS	J4	7440-23-5
Magnesium	35000	ug/L	2.0	0.41	1	11/03/08	ZS	11/03/08	ZS	J4	7439-95-4
Potassium	1500	ug/L	6.8	3.4	1	11/03/08	ZS	11/03/08	ZS		7440-09-7
Calcium	27000	ug/L	48	24	1	11/03/08	ZS	11/03/08	ZS	J4	7440-70-2

FDOH# E86546

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ANALYTICAL RESULTS QUALIFIERS

LOG# 821511
Project ID: SFWMD-Packer Test

PARAMETER QUALIFIERS

J4	MS/MSD recovery exceeded control limits due to matrix interference. LCS/LCSD recovery was within acceptable range.

PROJECT COMMENTS

821511	A reported value of U indicates that the compound was analyzed for but not detected above the MDL. A value flagged with an "i" flag indicates that the reported value is between the laboratory method detection limit and the practical quantitation limit. Report Limit = PQL

SUBCONTRACTOR NELAC CERTIFICATION

821511	BNCH = E84167
821511	USB = E86240

FDOH# E86546
CERTIFICATE OF ANALYSIS

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BAR CODE

Chain of Custody Record

LAB USE ONLY

J.E.L. Log # 821511
P.O. #
Quote#

Jupiter Environmental Laboratories

Company Name Tetra Tech FC
Address 759 Federal Hwy.
City Stuart State FL Zip 34994
Sampling Site Address Okeechobee Cnty 27°24'7.30" -81°6'51.10"
Attn: Randy Keyser Fax/Email ext 3401
Project Name SFWMD-packer test Project #
Sampler Name/Signature E. Edgerly E. Edgerly

LAB ANALYSIS

#	Sample Label (Client ID)	Collected Date	Collected Time	Matrix Code*	# of Cont	Press Codes	TDS	Bromide	TOC	Cl, SO4, FL	Alk	Metals (Ca mg K Na Sr)	Silica					Field Filtered (Y/N)	Integrity OK (Y/N)
	Parameters						A	B	E	A	A	B	A						
1	OKF-105-GW001	10.31.08	1107	GW	7		X	X	X	X	X	X	X						
2																			
3																			
4																			
5																			
6																			
7																			
8																			
9																			
10																			

Comments
need ADaPT
① Per EE
KTB 10/31/08

ORIGINAL

Matrix Codes*
S Soil/Solid Sediment; SW Surface Water
GW Ground Water; SL Sludge
WW Waste Water; O Other (Please Specify)
DW Drinking Water

Pres Codes**
A none; I- Ice
B- HNO_3; O- Other
C- H_2SO_4; M- MeOH
D- NaOH
E- HCl

Relinquished by	Date	Time	Received by	Date	Time
E. Edgerly	10/31/08	1325	Diane Shoemaker	10/31/08	1325

QA/QC level with report
None ___1___2___3___ See price guide for applicable fees

T.A.T. Request
___ Standard
___ Rush
FDEP___
SFWMD ✓
Date Required___

Temp Control: 4 °C

Jupiter Environmental Laboratories, Inc.
150 Old Dixie Highway, Jupiter, FL 33458
(561) 575-0030 • Fax (561) 575-4118 • clientservices@jupiterlabs.com

C.O.C.# 36683

Login Checklist

Cooler Unpacked/Checked by: Diane Shoe Date: 10/31/08

Project ID: 821511

Cooler Check

Cooler ID	Cooler Temp (C)	# of Samples in Cooler	*Tracking #	Evidence Tape			
				Present?		Intact?	
				Yes	No	Yes	No
	4	1					

Note: if the temperature of a cooler is above 6C or an evidence seal is damaged then identify the bottles in the affected cooler(s) on the sample discrepancy form.
*Write tracking number only if waybill copy cannot be placed in the folder

Condition of Containers:

Loose Caps: Yes_____ No ✓
If yes, fill out sample discrepancy form.

Broken Containers: Yes_____ No ✓
If yes, fill out sample discrepancy form.

Acid Preserved Samples: Are their pHs </=2 ?Yes ✓ No_____ N/A_____
If no, fill out sample discrepancy form and check unpreserved containers with same Field ID.

Base Preserved Samples: Are their pHs >/=12 or 9 ?Yes_____ No_____ N/A ✓
(Cyanide >/= 12; Sulfide >/=9)
If no, fill out sample discrepancy form and check unpreserved containers with same Field ID.

Are all samples in cooler on COC?: Yes ✓ No_____
If no, fill out sample discrepancy form.

Are all samples on COC in cooler?: Yes ✓ No_____
If no, fill out sample discrepancy form.

N/A = not Applicable

Columbia Analytical Services
9143 Phillips Hwy, Suite 200 | Jacksonville, FL 32256 | 904.739.2277 | 904.749.2011 fax | www.caslab.com

July 06, 2009

Service Request No: J0903104

Sue Farland
South Florida Water Management District
1480-9 Skees Road
West Palm Beach, FL 33411

Laboratory Results for: OKF-10/P44908

Dear Sue:

Enclosed are the results of the sample(s) submitted to our laboratory on June 25, 2009. For your reference, these analyses have been assigned our service request number **J0903104**.

All analyses were performed according to our laboratory's quality assurance program. The test results meet requirements of the NELAP standards except as noted in the case narrative report. All results are intended to be considered in their entirety, and Columbia Analytical Services, Inc. (CAS) is not responsible for use of less than the complete report. Results apply only to the items submitted to the laboratory for analysis and individual items (samples) analyzed, as listed in the report. In accordance to the NELAC 2003 Standard, a statement on the estimated uncertainty of measurement of any quantitative analysis will be supplied upon request.

Please contact me if you have any questions. My extension is 4409. You may also contact me via email at CMyers@caslab.com.

Respectfully submitted,

Columbia Analytical Services, Inc.

Craig Myers
Project Manager

CAS Jacksonville is NELAC-accredited by the State of Florida, #E82502 valid through 6/30/09. Other state accreditations include: Georgia, #958 valid through 6/30/09; Louisiana, #02086 valid through 6/30/09; Texas, #T104704197-06-TX valid through 5/31/09; North Carolina, #527 valid through 12/31/09; South Carolina, #96021001 valid through 6/30/09.

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Florida DEP Data Qualifiers

B	Results based upon colony counts outside the acceptable range.
D	Measurement was made in the field.
H	Value based on field kit determination; results may not be accurate.
i	The reported value is between the laboratory method detection limit and the laboratory practical quantitation limit.
J	Estimated value (one of the following reasons is discussed in the project case narrative). 1. The result may be inaccurate because the surrogate recovery limits have been exceeded. 2. No known quality control criteria exists for the component. 3. The reported value failed to meet the established quality control criteria for either precision or accuracy. 4. The sample matrix interfered with the ability to make any accurate determination (e.g., primary and confirmation results show greater than 40% RPD). 5. The data is questionable because of improper laboratory or field protocols (e.g., GC/MS Tune did not meet method criteria).
K	Off scale low. The value is less than the lowest calibration standard but greater than the method reporting limit (MRL).
L	Off scale high. The analyte is above the upper limit of the linear calibration range.
M	The MDL/MRL has been elevated because the analyte could not be accurately quantified due to matrix interference.
N	Presumptive evidence of the analyte. Confirmation was not performed.
Q	Sample held beyond the accepted holding time.
T	Value reported is less than the laboratory method detection limit. The value is reported for informational purposes only.
U	Indicates that the compound was analyzed for but not detected.
V	Indicates that the analyte was detected in both the sample and the associated method blank.
Y	The laboratory analysis was from an improperly preserved sample.
Z	Too many colonies were present (TNTC). The numeric value represents the filtration volume.

Acronyms

ASTM	American Society for Testing and Materials
A2LA	American Association for Laboratory Accreditation
CARB	California Air Resources Board
CAS Number	Chemical Abstract Service registry Number
CFC	Chlorofluorocarbon
CFU	Colony-Forming Unit
DEC	Department of Environmental Conservation
DEQ	Department of Environmental Quality
DHS	Department of Health Services
DOE	Department of Ecology
DOH	Department of Health
EPA	U. S. Environmental Protection Agency
ELAP	Environmental Laboratory Accreditation Program
GC	Gas Chromatography
GC/MS	Gas Chromatography/Mass Spectrometry
LUFT	Leaking Underground Fuel Tank
M	Modified
MCL	Maximum Contaminant Level is the highest permissible concentration of a substance allowed in drinking water as established by the USEPA.
MDL	Method Detection Limit
MPN	Most Probable Number
MRL	Method Reporting Limit
NA	Not Applicable
NC	Not Calculated
NCASI	National Council of the Paper Industry for Air and Stream Improvement
ND	Not Detected
NIOSH	National Institute for Occupational Safety and Health
PQL	Practical Quantitation Limit
RCRA	Resource Conservation and Recovery Act
SIM	Selected Ion Monitoring
TPH	Total Petroleum Hydrocarbons
tr	Trace level is the concentration of an analyte that is less than the PQL but greater than or equal to the MDL.

Client: South Florida Water Management District
Project: OKF-10/P44908

Service Request: J0903104

SAMPLE CROSS-REFERENCE

SAMPLE #	CLIENT SAMPLE ID	DATE	TIME
J0903104-001	P44908-1	6/19/09	18:45

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client : South Florida Water Management District
Project Name : OKF-10
Project Number : P44908
Sample Matrix : WATER

Service Request : J0903104
Date Collected : 06/19/09
Date Received : 06/25/09

Bromide

Analysis Method : 300.0
Test Notes :

Units : mg/L (ppm)
Basis : NA

Sample Name	Lab Code	MRL	MDL	Dilution Factor	Date/Time Analyzed	Result	Result Notes
P44908-1	J0903104-001	40	4.3	100	07/01/09 14:02	80	
Method Blank	J0903104-MB	0.4	0.043	1	07/01/09 14:02	U	

Report By: Palimi

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client :	South Florida Water Management District	**Service Request :**	J0903104
Project Name :	OKF-10	**Date Collected :**	NA
Project Number :	P44908	**Date Received :**	NA
Sample Matrix :	WATER	**Date Extracted :**	NA
		Date Analyzed :	07/01/09

Laboratory Control Sample Summary
Inorganic Parameters

Sample Name :	Laboratory Control Sample	Units :	mg/L (ppm)
Lab Code :	J0903104-LCS	Basis :	NA
Test Notes :			

Analyte	Prep Method	Analysis Method	True Value	Result	Percent Recovery	CAS Percent Recovery Acceptance Limits	Result Notes
Bromide	None	300.0	5.00	5.42	108	90-110	

Report By: Palimi

Columbia Analytical Services, Inc.
Cooler Receipt and Preservation Form

Client: SFWMD Service Request # J0903109

Project: Bromide Analysis

Cooler received on 6/25/09 and opened on 6/25/09 by 880

COURIER: CAS UPS (FEDEX) DHL CLIENT Tracking # 797707386856

1	Were custody seals on outside of cooler?	Yes	(No)	N/A
2	Were seals intact, signed and dated?	Yes	No	(N/A)
3	Were custody papers properly filled out?	(Yes)	No	N/A
4	Temperature of cooler(s) upon receipt (Should be 4 +/- 2 degrees C) 0.5			
5	Correct Temperature?	(Yes)	No	N/A
6	Were Ice or Ice Packs present	(Yes)	No	N/A
7	Did all bottles arrive in good condition (unbroken, etc....)?	(Yes)	No	N/A
8	Were all bottle labels complete (sample ID, preservation, etc....)?	(Yes)	No	N/A
9	Did all bottle labels and tags agree with custody papers?	(Yes)	No	N/A
10	Were the correct bottles used for the tests indicated?	(Yes)	No	N/A
11	Were all of the preserved bottles received with the appropriate preservative?	Yes	No	(N/A)

HNO3 pH<2 H2SO4 pH<2 ZnAc2/NaOH pH>9 NaOH pH>12 HCl pH<2

Preservative additions noted below

12	Were all samples received within analysis holding times?	(Yes)	No	N/A
13	Were VOA vials checked for absence of air bubbles? If present, note below	Yes	No	(N/A)
14	Where did the bottles originate?	CAS	(Client)	

Sample ID	Reagent	Manuf. Lot # or CAS Chem ID	ml added	Inititials

Additional comments and/or explanation of all discrepancies noted above:

Client approval to run samples if discrepancies noted: Date: 7

SR #: J 0903104 Date: 6/25/09 Initials: SBO

Note that pH is checked and meets the required pH criterion listed in the column heading unless otherwise noted on cooler receipt form.

	Bottle Code																												
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Container	40mL G	40mL G	40mL G	40mL G	125mL P	125mL P	125mL P	125mL P	250mL P	250mL P	250mL P	250mL P	250mL P	250mL G	250mL G	500mL P	500mL P	500mL P	1L P	1L P	1L G	1L G	1L G	2oz G	4oz G	8oz G	16oz G	5g ENC	100mL P	Misc. Misc.
Pres.		HCl	Sodium Thiosulfate	H2SO4		HCl	H2SO4	HNO3		H2SO4	HNO3	ZnAcetate NaOH	NaOH		HNO3		H2SO4	HNO3		HNO3		HCl	H2SO4						Sodium Thiosulfate	
Req. pH	N/A	<2	N/A	<2	N/A	<2	<2	<2	N/A	<2	<2	>9	>12	N/A	<2	N/A	<2	<2	N/A	<2	N/A	<2	<2	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Sample #	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		-	-	-				-	-
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-040																														

South Florida Water Management District, DHRS Certification E46077

Prelogin Summary Report

Jun, 10, 2009 02:54 PM

J0903104

[redacted]

Prelogin Number: P44908

Collector 1: Simon Sunderland

Collector 2:

Collector 3:

Sample ID	Project	Col. Date	Time	Station	UD	DS	WE	Type	Program	Method	Matrix	First Trigger Date/Time	Depth	Tdepth	SDD	# Bottles
P44908-1	OKF-10	6/19/09	18:45	OKF-105				SAMP	MON	G	GW		2412			4
Comments:	Packer test #1, Specific conductance = 47,223 uS/cm															
ACODES: ALKA, CA, CL, F, K, MG, NA, SO4, TDS, TDSSR + Bromide (to contract lab)																
~~P44908-2~~	~~OKF-10~~			~~OKF-105~~				SAMP	MON	G	GW	acd				
Comments:																
~~ACODES: ALKA, CA, CL, F, K, MG, NA, SO4, TDS, TDSSR~~ acd																

Parameters Crossed out by: _____

Collector Initials (non-signature pages only): MSA

Summer Stream
CAS
6/25/09
Fedex@ 0945

6

Instrument Calibrated/Verified according to FDEP SOP's FT1000-FT1500 (DO calibration performed in saturated air)

South Florida Water Management District, DHRS Certification E46077

Prelogin Summary Report

Jun, 10, 2009 02:54 PM

[redacted]

Prelogin Number: P44908

Collector 1: Simon Sunderland

Collector 2: _____

Collector 3: _____

Sample ID	Project	Col. Date	Time	Station	UD	DS	WE	Type	Program	Method	Matrix	First Trigger Date/Time	Depth	Tdepth	SDD	# Bottles
ADDITIONAL SAMPLES:																
Sample ID	Project	Col. Date	Time	Station	UD	DS	WE	Type	Prog	Meth	Mat	First Trigger Date	Depth	Tdepth	SDD	# Bottles
Comments:																
ACODES:																
Comments:																
ACODES:																
Comments:																
ACODES:																

Signature: _____ **Reviewed** _____ **Relinquished By:** _____ **Received By:** _____

Date: 6/19/09 **Date:** _____ **Date:** _____ **Date:** 6/23/09

Courier: FEDEX **Custody Seal Applied:** _____ **Samples Shipped on ice?** ____ (Y/N) **Custody Seal Intact?** ____ (Y/N)

Tracking#: _____ **Purchase Order#:** _____ **Samples Received on ice?** ____ (Y/N) **Acidified?** Y (Y/N)

PM REVIEW: _____

Date: _____

Summerostrom
CAS
6/25/09 0945

Parameters Crossed out by: _____

Collector Initials (non-signature pages only): _____

Instrument Calibrated/Verified according to FDEP SOP's FT1000-FT1500 (DO calibration performed in saturated air)

South Florida Water Management District

Field Test Report

Sample Analyst: _____
IC/ICV Analyst: _____
CCV Analyst: _____
Instrument ID#: _____

IC/ICV Location: _____
IC/ICV Solution Set ID: _____
CCV Location: _____
CCV Solution Set ID: _____

Acceptance Criteria:

DO	+/- 0.3 mg/L
Specific Conductance	+/- 5 Percent
pH	+/- 0.2 pH Units

Field Sample ID	Tvalue	Precal Reading (IC's only)	Sp Conductance (uS/cm)	Dissolved Oxygen(mg/L)	pH	Temperature (Degree C)	Salinity (ppt)	Redox (mv)	Date/Time Analyzed	P/F
IC 1 (COND)										
IC 2 (COND)										
ICV 1 (COND)										
IC 1 (pH)										
IC 2 (pH)										
IC 3 (pH)										
IC 1 (DO)										
P44908-1			47,223		7.13	30.98			6/19/09 18:45	
P44908-2										
CCV 1 (COND)										
CCV 2 (COND)										
CCV 1 (pH)										
CCV 2 (pH)										
CCV 1 (DO)										

Signature: _____ **Date:** 6/19/09 **Reviewed By:** _____ **Date:** _____

11

Fedex@

Summer Ostrom 6/25/09 0945

Summer Ostrom CAS

Instrument Calibrated/Verified according to FDEP SOP's FT1000-FT1500 (DO calibration performed in saturated air)

Columbia Analytical Services, Inc. 9143 Philips Hwy, Suite 200 | Jacksonville, FL 32256 | 904.739.2277 | 904.749.2011 fax | www.caslab.com

July 09, 2009 Service Request No: J0903160

Sue Farland
South Florida Water Management District
1480-9 Skees Road
West Palm Beach, FL 33411

Laboratory Results for: OKF-10/P44909

Dear Sue:

Enclosed are the results of the sample(s) submitted to our laboratory on June 30, 2009. For your reference, these analyses have been assigned our service request number **J0903160**.

All analyses were performed according to our laboratory's quality assurance program. The test results meet requirements of the NELAP standards except as noted in the case narrative report. All results are intended to be considered in their entirety, and Columbia Analytical Services, Inc. (CAS) is not responsible for use of less than the complete report. Results apply only to the items submitted to the laboratory for analysis and individual items (samples) analyzed, as listed in the report. In accordance to the NELAC 2003 Standard, a statement on the estimated uncertainty of measurement of any quantitative analysis will be supplied upon request.

Please contact me if you have any questions. My extension is 4409. You may also contact me via email at CMyers@caslab.com.

Respectfully submitted,

Columbia Analytical Services, Inc.

Craig Myers
Project Manager

CAS Jacksonville is NELAC-accredited by the State of Florida, #E82502 valid through 6/30/09. Other state accreditations include: Georgia, #958 valid through 6/30/09; Louisiana, #02086 valid through 6/30/09; Texas, #T104704197-06-TX valid through 5/31/09; North Carolina, #527 valid through 12/31/09; South Carolina, #96021001 valid through 6/30/09.

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Florida DEP Data Qualifiers

B	Results based upon colony counts outside the acceptable range.
D	Measurement was made in the field.
H	Value based on field kit determination; results may not be accurate.
i	The reported value is between the laboratory method detection limit and the laboratory practical quantitation limit.
J	Estimated value (one of the following reasons is discussed in the project case narrative). 1. The result may be inaccurate because the surrogate recovery limits have been exceeded. 2. No known quality control criteria exists for the component. 3. The reported value failed to meet the established quality control criteria for either precision or accuracy. 4. The sample matrix interfered with the ability to make any accurate determination (e.g., primary and confirmation results show greater than 40% RPD). 5. The data is questionable because of improper laboratory or field protocols (e.g., GC/MS Tune did not meet method criteria).
K	Off scale low. The value is less than the lowest calibration standard but greater than the method reporting limit (MRL).
L	Off scale high. The analyte is above the upper limit of the linear calibration range.
M	The MDL/MRL has been elevated because the analyte could not be accurately quantified due to matrix interference.
N	Presumptive evidence of the analyte. Confirmation was not performed.
Q	Sample held beyond the accepted holding time.
T	Value reported is less than the laboratory method detection limit. The value is reported for informational purposes only.
U	Indicates that the compound was analyzed for but not detected.
V	Indicates that the analyte was detected in both the sample and the associated method blank.
Y	The laboratory analysis was from an improperly preserved sample.
Z	Too many colonies were present (TNTC). The numeric value represents the filtration volume.

Acronyms

ASTM	American Society for Testing and Materials
A2LA	American Association for Laboratory Accreditation
CARB	California Air Resources Board
CAS Number	Chemical Abstract Service registry Number
CFC	Chlorofluorocarbon
CFU	Colony-Forming Unit
DEC	Department of Environmental Conservation
DEQ	Department of Environmental Quality
DHS	Department of Health Services
DOE	Department of Ecology
DOH	Department of Health
EPA	U. S. Environmental Protection Agency
ELAP	Environmental Laboratory Accreditation Program
GC	Gas Chromatography
GC/MS	Gas Chromatography/Mass Spectrometry
LUFT	Leaking Underground Fuel Tank
M	Modified
MCL	Maximum Contaminant Level is the highest permissible concentration of a substance allowed in drinking water as established by the USEPA.
MDL	Method Detection Limit
MPN	Most Probable Number
MRL	Method Reporting Limit
NA	Not Applicable
NC	Not Calculated
NCASI	National Council of the Paper Industry for Air and Stream Improvement
ND	Not Detected
NIOSH	National Institute for Occupational Safety and Health
PQL	Practical Quantitation Limit
RCRA	Resource Conservation and Recovery Act
SIM	Selected Ion Monitoring
TPH	Total Petroleum Hydrocarbons
tr	Trace level is the concentration of an analyte that is less than the PQL but greater than or equal to the MDL.

Client: South Florida Water Management District
Project: OKF-10/P44909

Service Request: J0903160

SAMPLE CROSS-REFERENCE

SAMPLE #	CLIENT SAMPLE ID	DATE	TIME
J0903160-001	P44909-1	6/23/09	19:20

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client : South Florida Water Management District
Project Name : OKF-10
Project Number : P44909
Sample Matrix : WATER

Service Request : J0903160
Date Collected : 06/23/09
Date Received : 06/30/09

Bromide

Units : mg/L (ppm)
Analysis Method : 300.0
Basis : NA
Test Notes :

Sample Name	Lab Code	MRL	MDL	Dilution Factor	Date/Time Analyzed	Result	Result Notes
P44909-1	J0903160-001	0.4	0.043	1	07/06/09 16:15	2.2	
Method Blank	J0903160-MB	0.4	0.043	1	07/06/09 16:15	U	

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client :	South Florida Water Management District	**Service Request :**	J0903160
Project Name :	OKF-10	**Date Collected :**	NA
Project Number :	P44909	**Date Received :**	NA
Sample Matrix :	WATER	**Date Prepared :**	NA
		Date Analyzed :	07/06/09

Laboratory Control Sample Summary
Inorganic Parameters

Sample Name :	Laboratory Control Sample	Units :	mg/L (ppm)
Lab Code :	J0903160-LCS	Basis :	NA
Test Notes :			

Analyte	Prep Method	Analysis Method	True Value	Result	Percent Recovery	CAS Percent Recovery Acceptance Limits	Result Notes
Bromide	None	300.0	5.00	4.99	100	90-110	

Report By:GJordan

Columbia Analytical Services, Inc.
Cooler Receipt and Preservation Form

Client: SFWMD Service Request # 5090360

Project: P44909

Cooler received on 6/30/09 and opened on 6/30/09 by SC

COURIER: CAS UPS FEDEX DHL CLIENT Tracking # 7967 3288 4391

1	Were custody seals on outside of cooler?	Yes	No	N/A
2	Were seals intact, signed and dated?	Yes	No	N/A
3	Were custody papers properly filled out?	Yes	No	N/A
4	Temperature of cooler(s) upon receipt (Should be 4 +/- 2 degrees C)	0.1 ,		
5	Correct Temperature?	Yes	No	N/A
6	Were Ice or Ice Packs present	Yes	No	N/A
7	Did all bottles arrive in good condition (unbroken, etc....)?	Yes	No	N/A
8	Were all bottle labels complete (sample ID, preservation, etc....)?	Yes	No	N/A
9	Did all bottle labels and tags agree with custody papers?	Yes	No	N/A
10	Were the correct bottles used for the tests indicated?	Yes	No	N/A
11	Were all of the preserved bottles received with the appropriate preservative?	Yes	No	N/A

HNO3 pH<2 H2SO4 pH<2 ZnAc2/NaOH pH>9 NaOH pH>12 HCl pH<2

Preservative additions noted below

12	Were all samples received within analysis holding times?	Yes	No	N/A
13	Were VOA vials checked for absence of air bubbles? If present, note below	Yes	No	N/A
14	Where did the bottles originate?	CAS	Client	

Sample ID	Reagent	Manuf. Lot # or CAS Chem ID	ml added	Inititials

Additional comments and/or explanation of all discrepancies noted above:

Client approval to run samples if discrepancies noted: Date: 7

SR # : J0903160 Date: 6/30/09 Initials: SC

Note that pH is checked and meets the required pH criterion listed in the column heading unless otherwise noted on cooler receipt form.

	Bottle Code																													
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Container	40mL G	40mL G	40mL G	40mL G	125mL P	125mL P	125mL P	125mL P	250mL P	250mL P	250mL P	250mL P	250mL P	250mL G	250mL G	500mL P	500mL P	500mL P	1L P	1L P	1L G	1L G	1L G	2oz G	4oz G	8oz G	16oz G	5g ENC	100mL P	Misc. Misc.
Pres.		HCl	Sodium Thiosulfate	H2SO4		HCl	H2SO4	HNO3		H2SO4	HNO3	ZnAcetate NaOH	NaOH		HNO3		H2SO4	HNO3		HNO3		HCl	H2SO4						Sodium Thiosulfate	
Req. pH	N/A	<2	N/A	<2	N/A	<2	<2	<2	N/A	<2	<2	>9	>12	N/A	<2	N/A	<2	<2	N/A	<2	N/A	<2	<2	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Sample #	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
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J0903160

South Florida Water Management District, DHRS Certification E46077
Prelogin Summary Report
Jun, 10, 2009 02:54 PM

[redacted]

Prelogin Number: P44909

RSA 6/23/09

Collector 1: Simon Sunderland
Collector 2:
Collector 3:

Sample ID	Project	~~Col. Date~~ Time	~~Time~~ Col. Date	Station	UD	DS	WE	Type	Program	Method	Matrix	First Trigger Date/Time	Depth	Tdepth	SDD	# Bottles
P44909-1	OKF-10	19:20	6/23/09	OKF-105				SAMP	MON	G	GW		2170			4
Comments:	Packer test # 2 ; Specific Conductance = 3,210 uS/cm															
ACODES: ALKA, CA, CL, F, K, MG, NA, SO4, TDS, TDSSR + Bromide (contract lab)																
~~P44909-2~~	~~OKF-10~~			~~OKF-105~~				~~SAMP~~	~~MON~~	~~G~~	~~GW~~					
~~Comments:~~																
~~ACODES: ALKA, CA, CL, F, K, MG, NA, SO4, TDS, TDSSR~~ RSA 6/25/09																

Parameters Crossed out by: [signature]

Collector Initials (non-signature pages only): RSA

[signature]
6/30/09 1010

Instrument Calibrated/Verified according to FDEP SOP's FT1000-FT1500 (DO calibration performed in saturated air)

J0903160

[redacted]

South Florida Water Management District, DHRS Certification E46077
Prelogin Summary Report
Jun, 10, 2009 02:54 PM

Prelogin Number: P44909

Collector 1: Simon Sunderland
Collector 2: _____
Collector 3: _____

Sample ID	Project	Col. Date	Time	Station	UD	DS	WE	Type	Program	Method	Matrix	First Trigger Date/Time	Depth	Tdepth	SDD	# Bottles
ADDITIONAL SAMPLES:																
Sample ID	Project	Col. Date	Time	Station	UD	DS	WE	Type	Prog	Meth	Mat	First Trigger Date	Depth	Tdepth	SDD	# Bottles
Comments:																
ACODES:																
Comments:																
ACODES:																
Comments:																
ACODES:																

Signature: [signature] **Reviewed** _____ **Relinquished By:** _____ **Received By:** [signature]
Date: 6/23/09 **Date:** _____ **Date:** _____ **Date:** 6/25/09

Courier: _____ **Custody Seal Applied:** _____ **Samples Shipped on ice?** ____ (Y/N) **Custody Seal Intact?** ____ (Y/N)
Tracking#: _____ **Purchase Order#:** _____ **Samples Received on ice?** ____ (Y/N) **Acidified?** Y (Y/N)

PM REVIEW: _____
Date: _____

Parameters Crossed out by: _____
Collector Initials (non-signature pages only): _____

Instrument Calibrated/Verified according to FDEP SOP's FT1000-FT1500 (DO calibration performed in saturated air)

Columbia Analytical Services™ 9143 Philips Hwy, Suite 200 | Jacksonville, FL 32256 | 904.739.2277 | 904.749.2011 fax | www.caslab.com

July 09, 2009 Service Request No: J0903161

Sue Farland
South Florida Water Management District
1480-9 Skees Road
West Palm Beach, FL 33411

Laboratory Results for: OKF-10/P44910

Dear Sue:

Enclosed are the results of the sample(s) submitted to our laboratory on June 30, 2009. For your reference, these analyses have been assigned our service request number **J0903161**.

All analyses were performed according to our laboratory's quality assurance program. The test results meet requirements of the NELAP standards except as noted in the case narrative report. All results are intended to be considered in their entirety, and Columbia Analytical Services, Inc. (CAS) is not responsible for use of less than the complete report. Results apply only to the items submitted to the laboratory for analysis and individual items (samples) analyzed, as listed in the report. In accordance to the NELAC 2003 Standard, a statement on the estimated uncertainty of measurement of any quantitative analysis will be supplied upon request.

Please contact me if you have any questions. My extension is 4409. You may also contact me via email at CMyers@caslab.com.

Respectfully submitted,

Columbia Analytical Services, Inc.

Craig Myers
Project Manager

CAS Jacksonville is NELAC-accredited by the State of Florida, #E82502 valid through 6/30/09. Other state accreditations include: Georgia, #958 valid through 6/30/09; Louisiana, #02086 valid through 6/30/09; Texas, #T104704197-06-TX valid through 5/31/09; North Carolina, #527 valid through 12/31/09; South Carolina, #96021001 valid through 6/30/09.

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Florida DEP Data Qualifiers

B	Results based upon colony counts outside the acceptable range.
D	Measurement was made in the field.
H	Value based on field kit determination; results may not be accurate.
i	The reported value is between the laboratory method detection limit and the laboratory practical quantitation limit.
J	Estimated value (one of the following reasons is discussed in the project case narrative). 1. The result may be inaccurate because the surrogate recovery limits have been exceeded. 2. No known quality control criteria exists for the component. 3. The reported value failed to meet the established quality control criteria for either precision or accuracy. 4. The sample matrix interfered with the ability to make any accurate determination (e.g., primary and confirmation results show greater than 40% RPD). 5. The data is questionable because of improper laboratory or field protocols (e.g., GC/MS Tune did not meet method criteria).
K	Off scale low. The value is less than the lowest calibration standard but greater than the method reporting limit (MRL).
L	Off scale high. The analyte is above the upper limit of the linear calibration range.
M	The MDL/MRL has been elevated because the analyte could not be accurately quantified due to matrix interference.
N	Presumptive evidence of the analyte. Confirmation was not performed.
Q	Sample held beyond the accepted holding time.
T	Value reported is less than the laboratory method detection limit. The value is reported for informational purposes only.
U	Indicates that the compound was analyzed for but not detected.
V	Indicates that the analyte was detected in both the sample and the associated method blank.
Y	The laboratory analysis was from an improperly preserved sample.
Z	Too many colonies were present (TNTC). The numeric value represents the filtration volume.

Acronyms

ASTM	American Society for Testing and Materials
A2LA	American Association for Laboratory Accreditation
CARB	California Air Resources Board
CAS Number	Chemical Abstract Service registry Number
CFC	Chlorofluorocarbon
CFU	Colony-Forming Unit
DEC	Department of Environmental Conservation
DEQ	Department of Environmental Quality
DHS	Department of Health Services
DOE	Department of Ecology
DOH	Department of Health
EPA	U. S. Environmental Protection Agency
ELAP	Environmental Laboratory Accreditation Program
GC	Gas Chromatography
GC/MS	Gas Chromatography/Mass Spectrometry
LUFT	Leaking Underground Fuel Tank
M	Modified
MCL	Maximum Contaminant Level is the highest permissible concentration of a substance allowed in drinking water as established by the USEPA.
MDL	Method Detection Limit
MPN	Most Probable Number
MRL	Method Reporting Limit
NA	Not Applicable
NC	Not Calculated
NCASI	National Council of the Paper Industry for Air and Stream Improvement
ND	Not Detected
NIOSH	National Institute for Occupational Safety and Health
PQL	Practical Quantitation Limit
RCRA	Resource Conservation and Recovery Act
SIM	Selected Ion Monitoring
TPH	Total Petroleum Hydrocarbons
tr	Trace level is the concentration of an analyte that is less than the PQL but greater than or equal to the MDL.

SAMPLE CROSS-REFERENCE

SAMPLE #	CLIENT SAMPLE ID	DATE	TIME
J0903161-001	P44910-1	6/24/09	16:02

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client : South Florida Water Management District
Project Name : OKF-10
Project Number : P44910
Sample Matrix : WATER

Service Request : J0903161
Date Collected : 06/24/09
Date Received : 06/30/09

Bromide

Units : mg/L (ppm)
Analysis Method : 300.0
Basis : NA
Test Notes :

Sample Name	Lab Code	MRL	MDL	Dilution Factor	Date/Time Analyzed	Result	Result Notes
P44910-1	J0903161-001	0.8	0.086	2	07/06/09 16:15	14	
Method Blank	J0903161-MB	0.4	0.043	1	07/06/09 16:15	U	

Report By:GJordan

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client :	South Florida Water Management District	**Service Request :**	J0903161
Project Name :	OKF-10	**Date Collected :**	NA
Project Number :	P44910	**Date Received :**	NA
Sample Matrix :	WATER	**Date Prepared :**	NA
		Date Analyzed :	07/06/09

Laboratory Control Sample Summary
Inorganic Parameters

Sample Name :	Laboratory Control Sample	Units :	mg/L (ppm)
Lab Code :	J0903161-LCS	Basis :	NA

Test Notes :

Analyte	Prep Method	Analysis Method	True Value	Result	Percent Recovery	CAS Percent Recovery Acceptance Limits	Result Notes
Bromide	None	300.0	5.00	4.99	100	90-110	

Report By:GJordan

Columbia Analytical Services, Inc.
Cooler Receipt and Preservation Form

Client: SFWMD Service Request # JO903161

Project: P44910

Cooler received on 6/30/09 and opened on 6/30/09 by SL

COURIER: CAS UPS (FEDEX) DHL CLIENT Tracking # 7967 3288 4391

1	Were custody seals on outside of cooler?	Yes	(No)	N/A
2	Were seals intact, signed and dated?	Yes	No	(N/A)
3	Were custody papers properly filled out?	(Yes)	No	N/A
4	Temperature of cooler(s) upon receipt (Should be 4 +/- 2 degrees C) 0.1			
5	Correct Temperature?	(Yes)	No	N/A
6	Were Ice or Ice Packs present	(Yes)	No	N/A
7	Did all bottles arrive in good condition (unbroken, etc....)?	(Yes)	No	N/A
8	Were all bottle labels complete (sample ID, preservation, etc....)?	(Yes)	No	N/A
9	Did all bottle labels and tags agree with custody papers?	(Yes)	No	N/A
10	Were the correct bottles used for the tests indicated?	(Yes)	No	N/A
11	Were all of the preserved bottles received with the appropriate preservative?	Yes	No	(N/A)

HNO3 pH<2 H2SO4 pH<2 ZnAc2/NaOH pH>9 NaOH pH>12 HCl pH<2

Preservative additions noted below

12	Were all samples received within analysis holding times?	(Yes)	No	N/A
13	Were VOA vials checked for absence of air bubbles? If present, note below	Yes	No	(N/A)
14	Where did the bottles originate?	CAS	(Client)	

Sample ID	Reagent	Manuf. Lot # or CAS Chem ID	ml added	Inititials

Additional comments and/or explanation of all discrepancies noted above:

Client approval to run samples if discrepancies noted: Date: 7

SR #: J0903161 Date: 6/30/09 Initials: SL

Note that pH is checked and meets the required pH criterion listed in the column heading unless otherwise noted on cooler receipt form.

	Bottle Code																												
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Container	40mL G	40mL G	40mL G	40mL G	125mL P	125mL P	125mL P	125mL P	250mL P	250mL P	250mL P	250mL P	250mL P	250mL G	250mL G	500mL P	500mL P	500mL P	1L P	1L P	1L G	1L G	1L G	2oz G	4oz G	8oz G	16oz G	5g ENC	100mL P	Misc. Misc.
Pres.		HCl	Sodium Thiosulfate	H2SO4		HCl	H2SO4	HNO3		H2SO4	HNO3	ZnAcetate NaOH	NaOH		HNO3		H2SO4	HNO3		HNO3		HCl	H2SO4						Sodium Thiosulfate	
Req. pH	N/A	<2	N/A	<2	N/A	<2	<2	<2	N/A	<2	<2	>9	>12	N/A	<2	N/A	<2	<2	N/A	<2	N/A	<2	<2	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Sample #	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
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-040																														

J0903161

[redacted]

South Florida Water Management District, DHRS Certification E46077
Prelogin Summary Report
Jun, 10, 2009 02:55 PM

Prelogin Number: P44910

Collector 1: Simon Sunderland
Collector 2:
Collector 3:

Sample ID	Project	Col. Date	Time	Station	UD	DS	WE	Type	Program	Method	Matrix	First Trigger Date/Time	Depth	Tdepth	SDD	# Bottles
P44910-1	OKF-10	6/24/09	16:02	OKF-105				SAMP	MON	G	GW		16/4			4
Comments: Packer #3, Specific conductance = 10931 us/cm																
ACODES: ALKA, CA, CL, F, K, MG, NA, SO4, TDS, TDSSR + Bromide (contract lab)																
~~P44910-2~~	~~OKF-10~~			~~OKF-105~~				SAMP	MON	G	~~GW~~					
~~Comments:~~																
~~ACODES: ALKA, CA, CL, F, K, MG, NA, SO4, TDS, TDSSR~~																

Parameters Crossed out by: [signature] 6/25/09

Collector Initials (non-signature pages only): RSD

Shawn Lyttle
CAS
6/30/09 1010

Wednesday, June 10, 2009 2:55:03 PM
Page 1 of 5

Instrument Calibrated/Verified according to FDEP SOP's FT1000-FT1500 (DO calibration performed in saturated air)

South Florida Water Management District, DHRS Certification E46077

Prelogin Summary Report

Jun, 10, 2009 02:55 PM

J0903161

Prelogin Number: P44910

Collector 1: Simon Sunderland [redacted]

Collector 2:

Collector 3:

Sample ID	Project	Col. Date	Time	Station	UD	DS	WE	Type	Program	Method	Matrix	First Trigger Date/Time	Depth	Tdepth	SDD	# Bottles
ADDITIONAL SAMPLES:																
Sample ID	Project	Col. Date	Time	Station	UD	DS	WE	Type	Prog	Meth	Mat	First Trigger Date	Depth	Tdepth	SDD	# Bottles
Comments:																
ACODES:																
Comments:																
ACODES:																
Comments:																
ACODES:																

Signature: [signature]

Date: 6/24/09

Reviewed

Date:

Relinquished By:

Date:

Received By: [signature]

Date: 6/25/09

Courier:

Tracking#:

Custody Seal Applied:

Purchase Order#:

Samples Shipped on ice? ____ (Y/N)

Samples Received on ice? ____ (Y/N)

Custody Seal Intact? ____ (Y/N)

Acidified? Y (Y/N)

PM REVIEW:

Date:

Parameters Crossed out by:

Collector Initials (non-signature pages only):

10

Instrument Calibrated/Verified according to FDEP SOP's FT1000-FT1500 (DO calibration performed in saturated air)

9143 Philips Highway, Suite 200 Jacksonville, FL 32256 (904) 739-2277 (904) 739-2011 fax

Columbia Analytical Services INC.
An Employee - Owned Company

August 07, 2009

Service Request No: J0903669

Sue Farland
South Florida Water Management District
1480-9 Skees Road
West Palm Beach, FL 33411

Laboratory Results for: OKF-105/P44911

Dear Sue:

Enclosed are the results of the sample(s) submitted to our laboratory on July 28, 2009. For your reference, these analyses have been assigned our service request number **J0903669**.

All analyses were performed according to our laboratory's quality assurance program. The test results meet requirements of the NELAP standards except as noted in the case narrative report. All results are intended to be considered in their entirety, and Columbia Analytical Services, Inc. (CAS) is not responsible for use of less than the complete report. Results apply only to the items submitted to the laboratory for analysis and individual items (samples) analyzed, as listed in the report.

Please contact me if you have any questions. My extension is 4409. You may also contact me via email at CMyers@caslab.com.

Respectfully submitted,

Columbia Analytical Services, Inc.

Craig Myers
Project Manager

For a specific list of NELAP-accredited analytes, refer to the certifications section at www.caslab.com.

Florida DEP Data Qualifiers

B	Results based upon colony counts outside the acceptable range.
D	Measurement was made in the field.
H	Value based on field kit determination; results may not be accurate.
i	The reported value is between the laboratory method detection limit and the laboratory practical quantitation limit.
J	Estimated value (one of the following reasons is discussed in the project case narrative). 1. The result may be inaccurate because the surrogate recovery limits have been exceeded. 2. No known quality control criteria exists for the component. 3. The reported value failed to meet the established quality control criteria for either precision or accuracy. 4. The sample matrix interfered with the ability to make any accurate determination (e.g., primary and confirmation results show greater than 40% RPD). 5. The data is questionable because of improper laboratory or field protocols (e.g., GC/MS Tune did not meet method criteria).
K	Off scale low. The value is less than the lowest calibration standard but greater than the method reporting limit (MRL).
L	Off scale high. The analyte is above the upper limit of the linear calibration range.
M	The MDL/MRL has been elevated because the analyte could not be accurately quantified due to matrix interference.
N	Presumptive evidence of the analyte. Confirmation was not performed.
Q	Sample held beyond the accepted holding time.
T	Value reported is less than the laboratory method detection limit. The value is reported for informational purposes only.
U	Indicates that the compound was analyzed for but not detected.
V	Indicates that the analyte was detected in both the sample and the associated method blank.
Y	The laboratory analysis was from an improperly preserved sample.
Z	Too many colonies were present (TNTC). The numeric value represents the filtration volume.

Acronyms

ASTM	American Society for Testing and Materials
A2LA	American Association for Laboratory Accreditation
CARB	California Air Resources Board
CAS Number	Chemical Abstract Service registry Number
CFC	Chlorofluorocarbon
CFU	Colony-Forming Unit
DEC	Department of Environmental Conservation
DEQ	Department of Environmental Quality
DHS	Department of Health Services
DOE	Department of Ecology
DOH	Department of Health
EPA	U. S. Environmental Protection Agency
ELAP	Environmental Laboratory Accreditation Program
GC	Gas Chromatography
GC/MS	Gas Chromatography/Mass Spectrometry
LUFT	Leaking Underground Fuel Tank
M	Modified
MCL	Maximum Contaminant Level is the highest permissible concentration of a substance allowed in drinking water as established by the USEPA.
MDL	Method Detection Limit
MPN	Most Probable Number
MRL	Method Reporting Limit
NA	Not Applicable
NC	Not Calculated
NCASI	National Council of the Paper Industry for Air and Stream Improvement
ND	Not Detected
NIOSH	National Institute for Occupational Safety and Health
PQL	Practical Quantitation Limit
RCRA	Resource Conservation and Recovery Act
SIM	Selected Ion Monitoring
TPH	Total Petroleum Hydrocarbons
tr	Trace level is the concentration of an analyte that is less than the PQL but greater than or equal to the MDL.

Client: South Florida Water Management District
Project: OKF-105/P44911

Service Request: J0903669

SAMPLE CROSS-REFERENCE

SAMPLE #	CLIENT SAMPLE ID	DATE	TIME
J0903669-001	P44911-1	7/24/09	11:30

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client : South Florida Water Management District
Project Name : OKF-105
Project Number : P44911
Sample Matrix : WATER

Service Request : J0903669
Date Collected : 07/24/09
Date Received : 07/28/09

Bromide

Units : mg/L (ppm)
Analysis Method : 300.0
Basis : NA
Test Notes :

Sample Name	Lab Code	MRL	MDL	Dilution Factor	Date/Time Analyzed	Result	Result Notes
P44911-1	J0903669-001	4	0.43	10	08/03/09 18:01	36	
Method Blank	J0903669-MB	0.4	0.043	1	08/03/09 18:01	U	

Report By: Palimi

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client :	South Florida Water Management District	**Service Request :**	J0903669
Project Name :	OKF-105	**Date Collected :**	NA
Project Number :	P44911	**Date Received :**	NA
Sample Matrix :	WATER	**Date Extracted :**	NA
		Date Analyzed :	08/03/09

Laboratory Control Sample Summary
Inorganic Parameters

Sample Name :	Laboratory Control Sample	Units :	mg/L (ppm)
Lab Code :	J0903669-LCS	Basis :	NA
Test Notes :			

Analyte	Prep Method	Analysis Method	True Value	Result	Percent Recovery	CAS Percent Recovery Acceptance Limits	Result Notes
Bromide	None	300.0	5.00	5.37	107	90-110	

Report By: Palimi

Columbia Analytical Services, Inc.
Cooler Receipt and Preservation Form

Client: SFWMD Service Request # J0903669

Project: PW911

Cooler received on 7-28-09 and opened on 7-28-09 by GB

COURIER: CAS UPS (FEDEX) DHL CLIENT Tracking # 797795360211

1	Were custody seals on outside of cooler?	Yes	(No)	N/A
2	Were seals intact, signed and dated?	Yes	No	(N/A)
3	Were custody papers properly filled out?	(Yes)	No	N/A
4	Temperature of cooler(s) upon receipt (Should be 4 +/- 2 degrees C)	0.1 °C		
5	Correct Temperature?	(Yes)	No	N/A
6	Were Ice or Ice Packs present	(Yes)	No	N/A
7	Did all bottles arrive in good condition (unbroken, etc....)?	(Yes)	No	N/A
8	Were all bottle labels complete (sample ID, preservation, etc....)?	(Yes)	No	N/A
9	Did all bottle labels and tags agree with custody papers?	(Yes)	No	N/A
10	Were the correct bottles used for the tests indicated?	(Yes)	No	N/A
11	Were all of the preserved bottles received with the appropriate preservative?	Yes	No	(N/A)

HNO3 pH<2 H2SO4 pH<2 ZnAc2/NaOH pH>9 NaOH pH>12 HCl pH<2

Preservative additions noted below

12	Were all samples received within analysis holding times?	(Yes)	No	N/A
13	Were VOA vials checked for absence of air bubbles? If present, note below	Yes	No	(N/A)
14	Where did the bottles originate?	CAS	(Client)	

Sample ID	Reagent	Manuf. Lot # or CAS Chem ID	ml added	Inititials

Additional comments and/or explanation of all discrepancies noted above:

Client approval to run samples if discrepancies noted: Date: 7

SR # : J 0903669 Date: 7.28.09 Initials: GB

Note that pH is checked and meets the required pH criterion listed in the column heading unless otherwise noted on cooler receipt form.

	Bottle Code																												
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
	40mL	40mL	40mL	40mL	125mL	125mL	125mL	125mL	250mL	250mL	250mL	250mL	250mL	250mL	250mL	500mL	500mL	500mL	1L	1L	1L	1L	1L	2oz	4oz	8oz	16oz	5g	100mL	Misc.
Container	G	G	G	G	P	P	P	P	P	P	P	P	P	G	G	P	P	P	P	P	G	G	G	G	G	G	G	ENC	P	Misc.
Pres.		HCl	Sodium Thiosulfate	H2SO4		HCl	H2SO4	HNO3		H2SO4	HNO3	ZnAcetate NaOH	NaOH		HNO3		H2SO4	HNO3		HNO3		HCl	H2SO4						Sodium Thiosulfate	
Req. pH	N/A	<2	N/A	<2	N/A	<2	<2	<2	N/A	<2	<2	>9	>12	N/A	<2	N/A	<2	<2	N/A	<2	N/A	<2	<2	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Sample #	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-		-	-	-				-	-
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J0903669

[redacted]

South Florida Water Management District, DHRS Certification E46077
Prelogin Summary Report
Jun, 10, 2009 02:55 PM

Prelogin Number: P44911

Collector 1: Simon Sunderland
Collector 2:
Collector 3:

Sample ID	Project	Col. Date	Time	Station	UD	DS	WE	Type	Program	Method	Matrix	First Trigger Date/Time	Depth	Tdepth	SDD	# Bottles
P44911-1	OKF-105	7/24/09	11:30	OKF-105				SAMP	MON	G	GW		2,130	2250		4
Comments: Packer test #4 Sample from 2,130 to 2250 feet bls. Specific conductance = 27,668 uS/cm																
ACODES: ALKA, CA, CL, F, K, MG, NA, SO4, TDS, TDSSR + Bromide (to a contract lab)																
P44911-2	OKF-10			OKF-105				SAMP	MON	G	GW					
Comments:																
ACODES: ALKA, CA, CL, F, K, MG, NA, SO4, TDS, TDSSR																

Parameters Crossed out by: Simon Sunderland

Collector Initials (non-signature pages only): JS SC

JM CAS
GBauer 7.28.09
0935

Instrument Calibrated/Verified according to FDEP SOP's FT1000-FT1500 (DO calibration performed in saturated air)

South Florida Water Management District, DHRS Certification E46077

Prelogin Summary Report

Jun, 10, 2009 02:55 PM

Prelogin Number: P44911

Collector 1: Simon Sunderland

Collector 2: _____

Collector 3: _____

Sample ID	Project	Col. Date	Time	Station	UD	DS	WE	Type	Program	Method	Matrix	First Trigger Date/Time	Depth	Tdepth	SDD	# Bottles
ADDITIONAL SAMPLES:																
Sample ID	Project	Col. Date	Time	Station	UD	DS	WE	Type	Prog	Meth	Mat	First Trigger Date	Depth	Tdepth	SDD	# Bottles
Comments:																
ACODES:																
Comments:																
ACODES:																
Comments:																
ACODES:																

Signature: [signature] **Date:** 7/24/09

Reviewed _____ **Date:** _____

Relinquished By: _____ **Date:** _____

Received By: [signature] **Date:** 7-24-09

Courier: _____ **Custody Seal Applied:** _____ **Samples Shipped on ice?** ____ (Y/N) **Custody Seal Intact?** ____ (Y/N)

Tracking#: _____ **Purchase Order#:** _____ **Samples Received on ice?** ____ (Y/N) **Acidified?** Y (Y/N)

PM REVIEW: _____

Date: _____

Parameters Crossed out by: [signature]

Collector Initials (non-signature pages only): _____

10

Instrument Calibrated/Verified according to FDEP SOP's FT1000-FT1500 (DO calibration performed in saturated air)

South Florida Water Management District

Field Test Report

Sample Analyst: _____
IC/ICV Analyst: _____
CCV Analyst: _____
Instrument ID#: _____

IC/ICV Location: _____
IC/ICV Solution Set ID: _____
CCV Location: _____
CCV Solution Set ID: _____

Acceptance Criteria:

DO	+/- 0.3 mg/L
Specific Conductance	+/- 5 Percent
pH	+/- 0.2 pH Units

Field Sample ID	Tvalue	Precal Reading (IC's only)	Sp Conductance (uS/cm)	Dissolved Oxygen(mg/L)	pH	Temperature (Degree C)	Salinity (ppt)	Redox (mv)	Date/Time Analyzed	P/F
IC 1 (COND)										
IC 2 (COND)										
ICV 1 (COND)										
IC 1 (pH)										
IC 2 (pH)										
IC 3 (pH)										
IC 1 (DO)										
P44911-1			27,668		6.65	31.19			7/24/09 11:30	
~~P44911-2~~										
CCV 1 (COND)										
CCV 2 (COND)										
CCV 1 (pH)										
CCV 2 (pH)										
CCV 1 (DO)										

Signature: _____ **Date:** 7/24/09 **Reviewed By:** _____ **Date:** _____

Instrument Calibrated/Verified according to FDEP SOP's FT1000-FT1500 (DO calibration performed in saturated air)

South Florida Water Management District

Field Test Report

Sample Analyst: _____
IC/ICV Analyst: _____
CCV Analyst: _____
Instrument ID#: _____

IC/ICV Location: _____
IC/ICV Solution Set ID: _____
CCV Location: _____
CCV Solution Set ID: _____

Acceptance Criteria:

DO	+/- 0.3 mg/L
Specific Conductance	+/- 5 Percent
pH	+/- 0.2 pH Units

Field Sample ID	Tvalue	Precal Reading (IC's only)	Sp Conductance (uS/cm)	Dissolved Oxygen(mg/L)	pH	Temperature (Degree C)	Salinity (ppt)	Redox (mv)	Date/Time Analyzed	P/F

ADDITIONAL SAMPLES:

Field Sample ID	Tvalue	Precal Reading (IC's only)	Sp Conductance (uS/cm)	Dissolved Oxygen(mg/L)	pH	Temperature (Degree C)	Salinity (ppt)	Redox (mv)	Date/Time Analyzed	P/F

Analyst Signature: _____ **Reviewed By:** _____

Notes: _____

Instrument Calibrated/Verified according to FDEP SOP's FT1000-FT1500 (DO calibration performed in saturated air)

South Florida Water Management District, DHRS Certification E46077
Chemistry Field Data Log - Data Table
Jun, 10, 2009 02:55 PM

Station - 8 Characters or less, Must register with WQM.
Depth - Depth in meters
Temp - Water temperature in degrees Centigrade
PH - pH value in uits.
Cond - Specific Conductivity Value in umhos/cm.
DO - Dissolved Oxygen value in mg/L.
SDO - Depth in meters where secchi disk is available.
Redox - Oxidation/reduction potential in mv.
TDepth - Total water column depth in meters.

Type - Sample Type, Valid Codes Below
- SAMP - Regular Sample
- EB - Equipment Blank
- FB - Field Blank
- FD - Field Duplicate
- RS - Replicate Sample
- SS - Split Sample
- FCEB - Field Cleaned EB

Prog - Program Samples are being collected for.
- EXP - Experimental/Reasearch
- MON - Monitoring

Matrix - Valid codes for the type of material being sampled
- SE - Sediment
- SO - Soil
- GW - Groundwater
- SW - Surface Water
- RA - Rain
- SA - Saline
- BFI - Biological - Fish
- BAN - Biological - Animal
- BFE - Biological - Feather
- BPL - Biological - Plant
- PW - Pore Water

UD - Valid Codes for Up/Downstream
- 1 - Upstream
- 2 - Downstream
- Leave blank for no observation

DS - Valid Codes for Discharge
- 1 - Flow
- 2 - No Flow
- 3 - Reverse Flow or Backpumping
- Leave blank for no observation

Collect Date - Te collect date is the date and time the samples was collected
1st Trigger Date - The date/time of when the autosampler was first triggered

WE - Valid Codes for Weather
- 1 - Clear Skies
- 2 - Slight Overcast
- 3 - Medium Overcast
- 4 - Very Overcast
- 5 - Drizzle
- 6 - Rain
- Leave blank for no observation

Method - Valid Codes for Collection Method
- CIC - Composite Integrated Core
- ACF - Autosampler Composite Flow Proportional
- ACT - Autosampler Composite Time Proportional
- ADF - Autosampler Discreet Flow Proportional
- ADT - Autosampler Discreet Time Proportional
- CDI - Composite Depth Integrated
- CWI - Composite Width Integrated
- CXI - Composite Cross Section Integrated
- CSI - Composite Site Integrated
- CXC - Composite Cross Section Core
- G - Grab
- GB - Grab Bailer
- GP - Grab Pump
- BLK -Bulk
- WET - Wet (Atmospheric Deposition/Rain)
- DRY - Dry (Atmospheric Deposition/Rain)
- FP - Field Parameters (In-Situ, No Sample)
- ELC - Electro Shock
- NET - Seine or Dip Net
- HAL - Hook and Line
- TRP - Trap
- MAN - Manual

Species - Valid Codes for Species

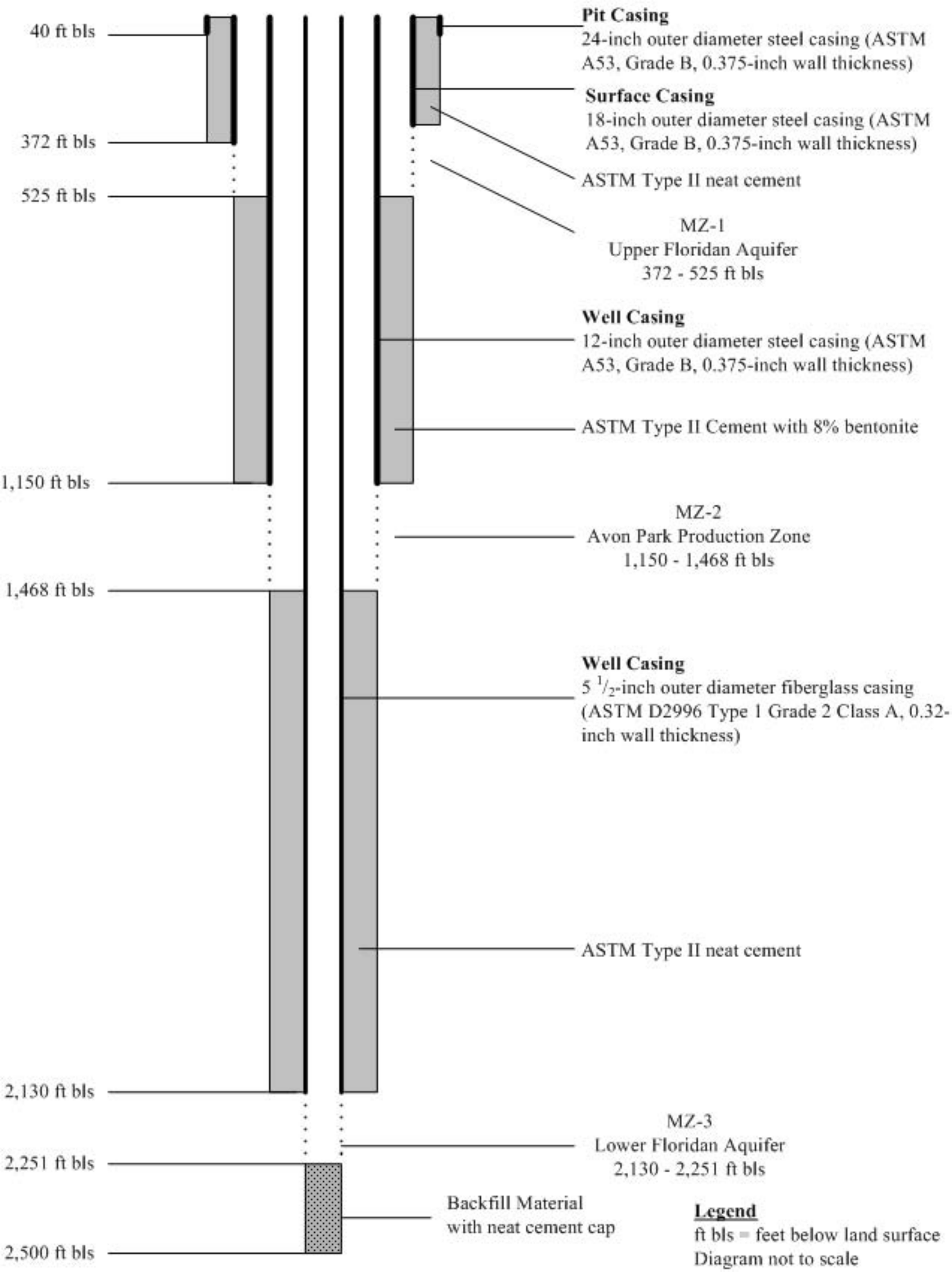
1- Largemouth Bass	5 - Spotted Sunfish
2 - Bluegill	6 - Warmouth
3 - Dollar Sunfish	7 - Mosquito Fish
4 - Redear Sunfish	8 - Great Egret

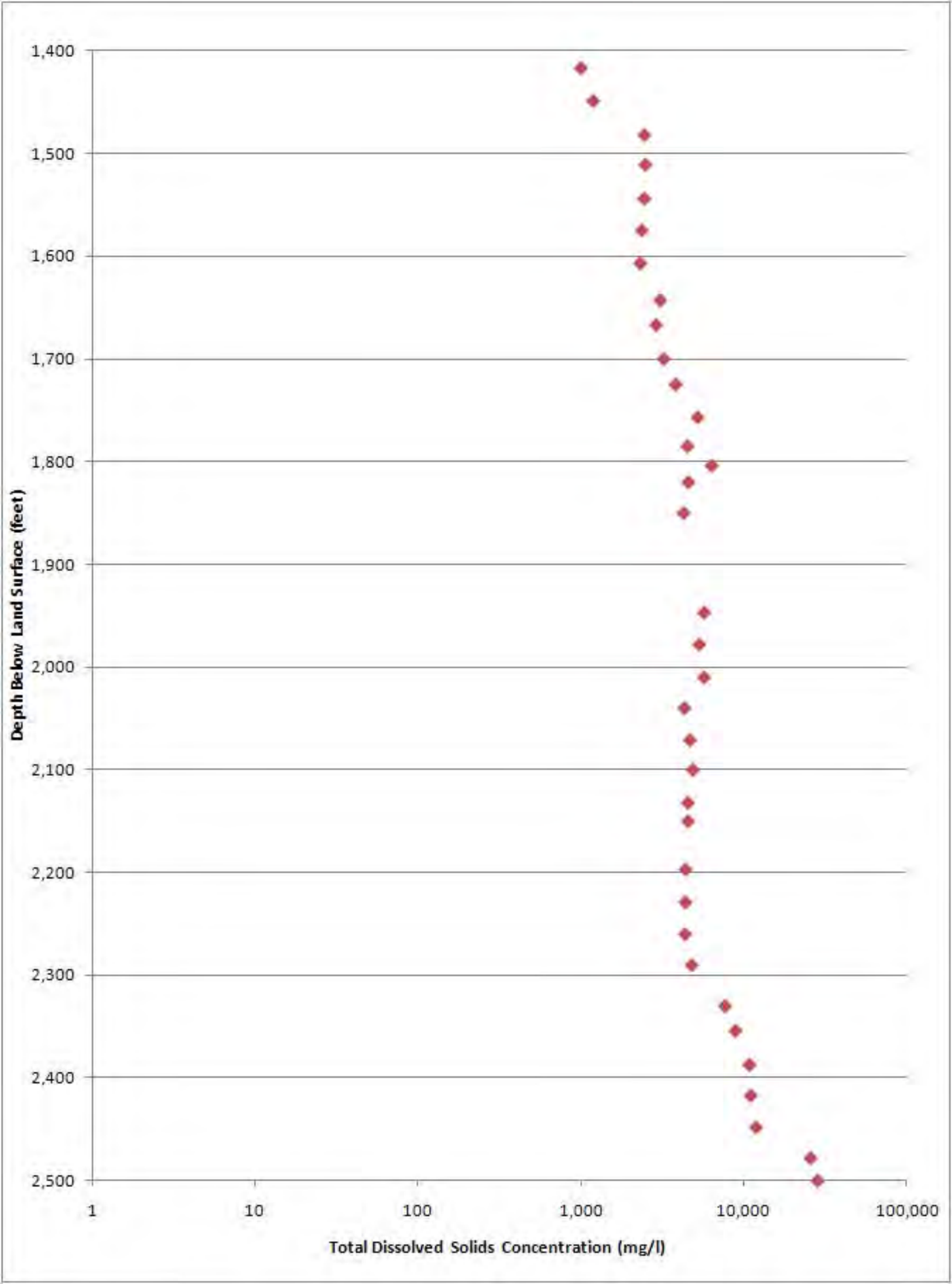
Length - Millimeters no decimals
Weight - Grams no decimals
Sex - 1-Male 2 - Female 3 - Undetermined
Bill Length - Millimeters no decimals
Total Breadth - Total Breadth of an egg in Millimeters

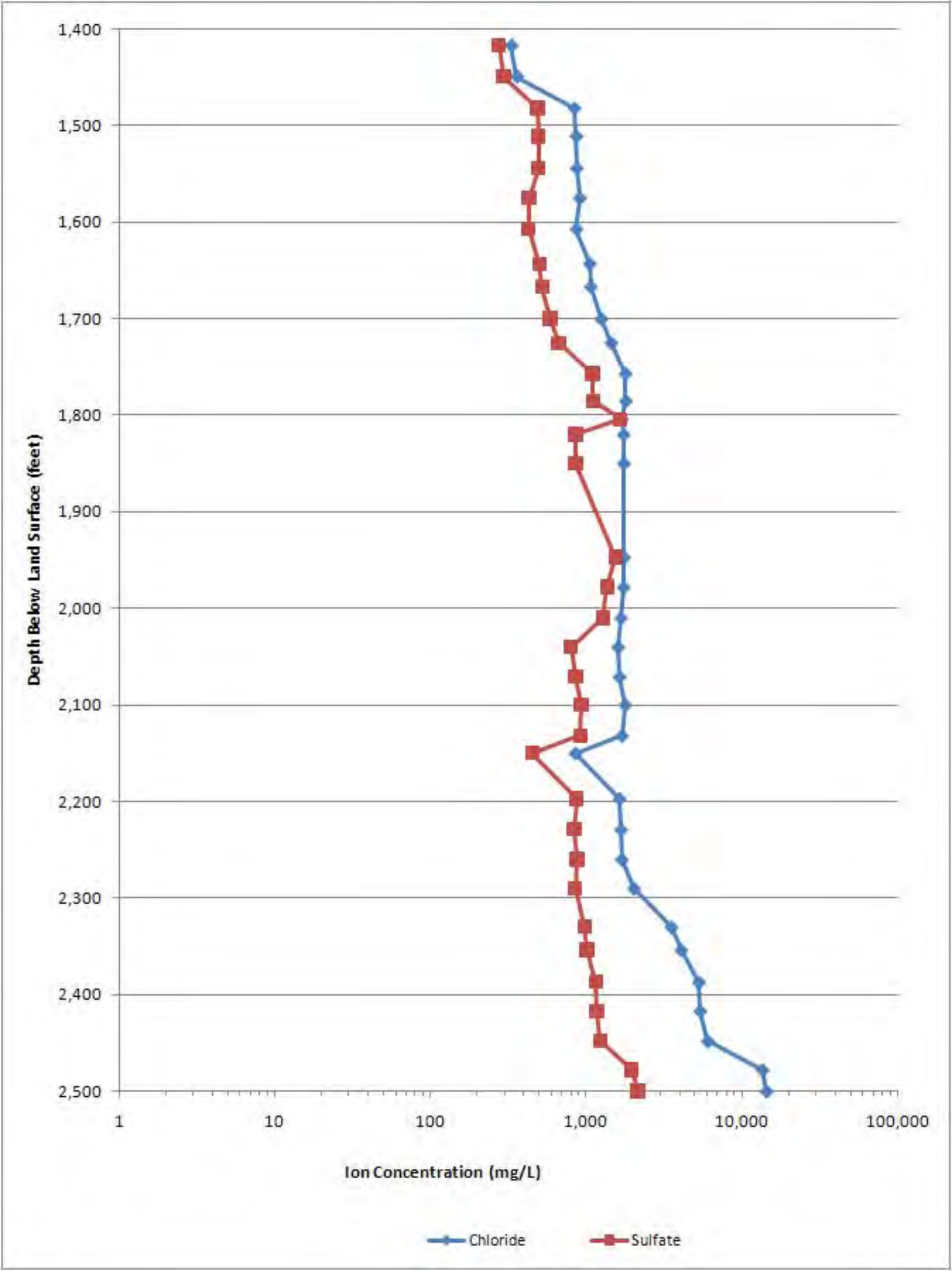
Tissue Types -

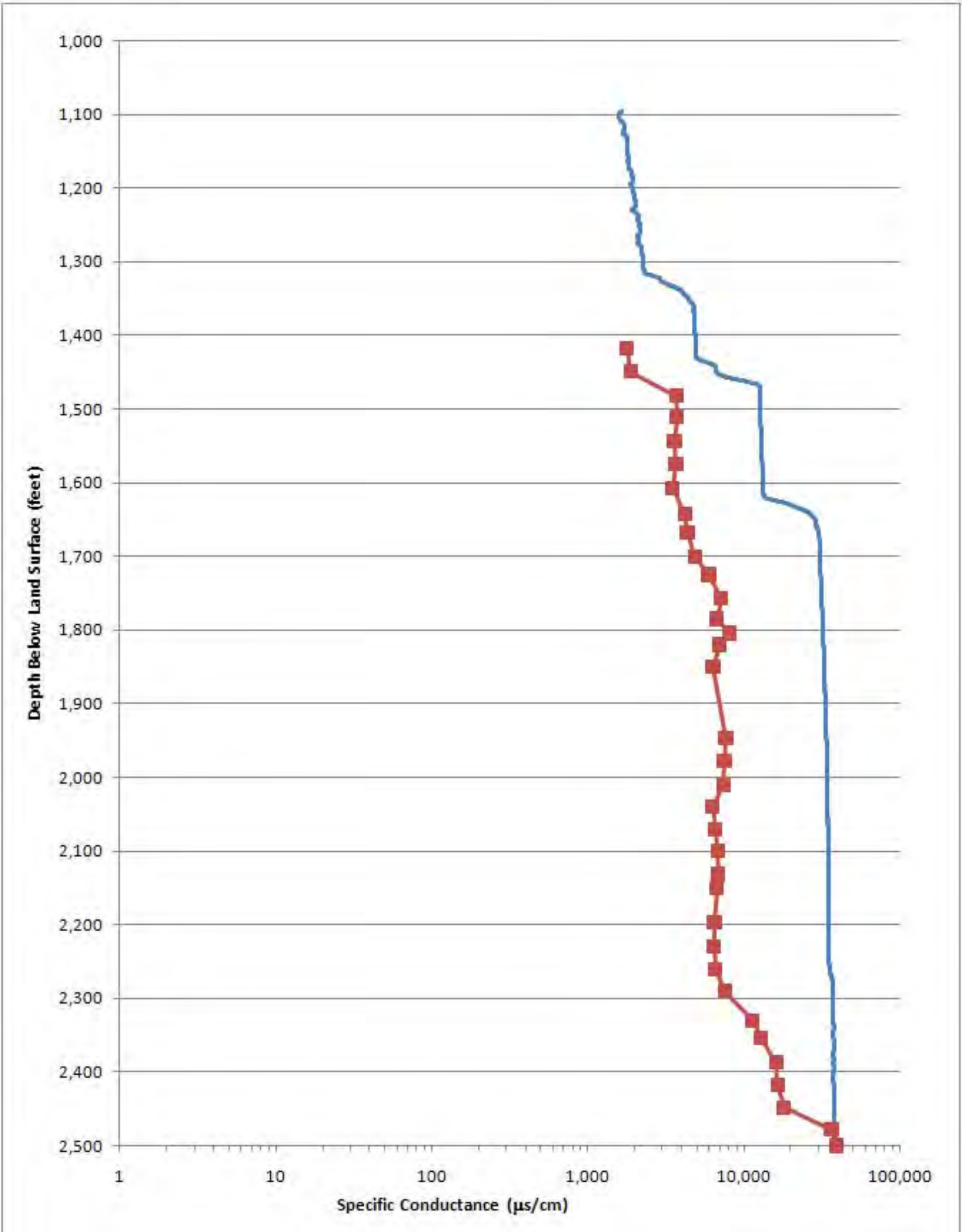
1 - Fillet	5 - Composite
2 - Whole Fish	6 -Liver
3 - Feather	7 - Kidney
4 - Egg	8 - Brain

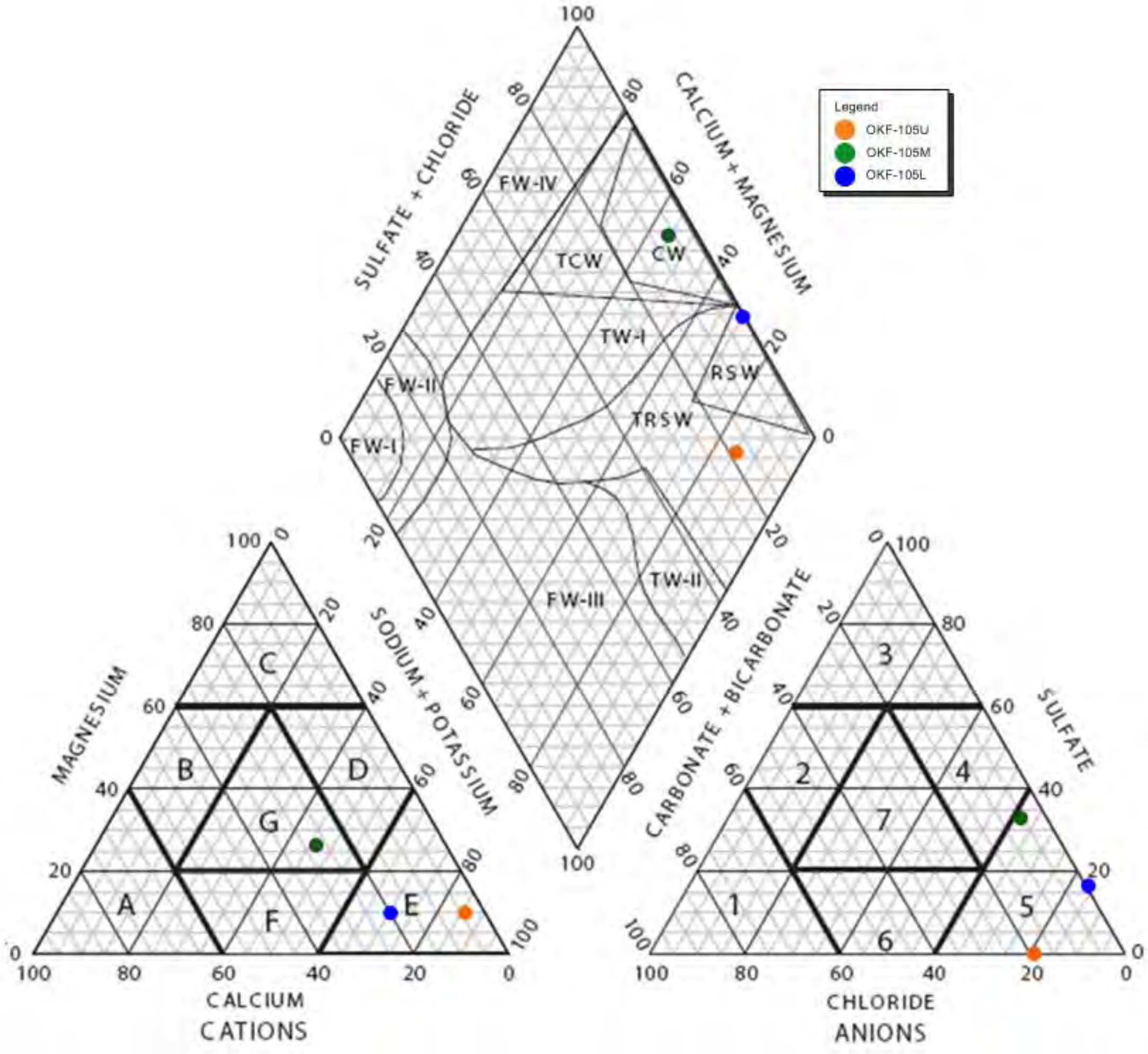
Instrument Calibrated/Verified according to FDEP SOP's FT1000-FT1500 (DO calibration performed in saturated air)

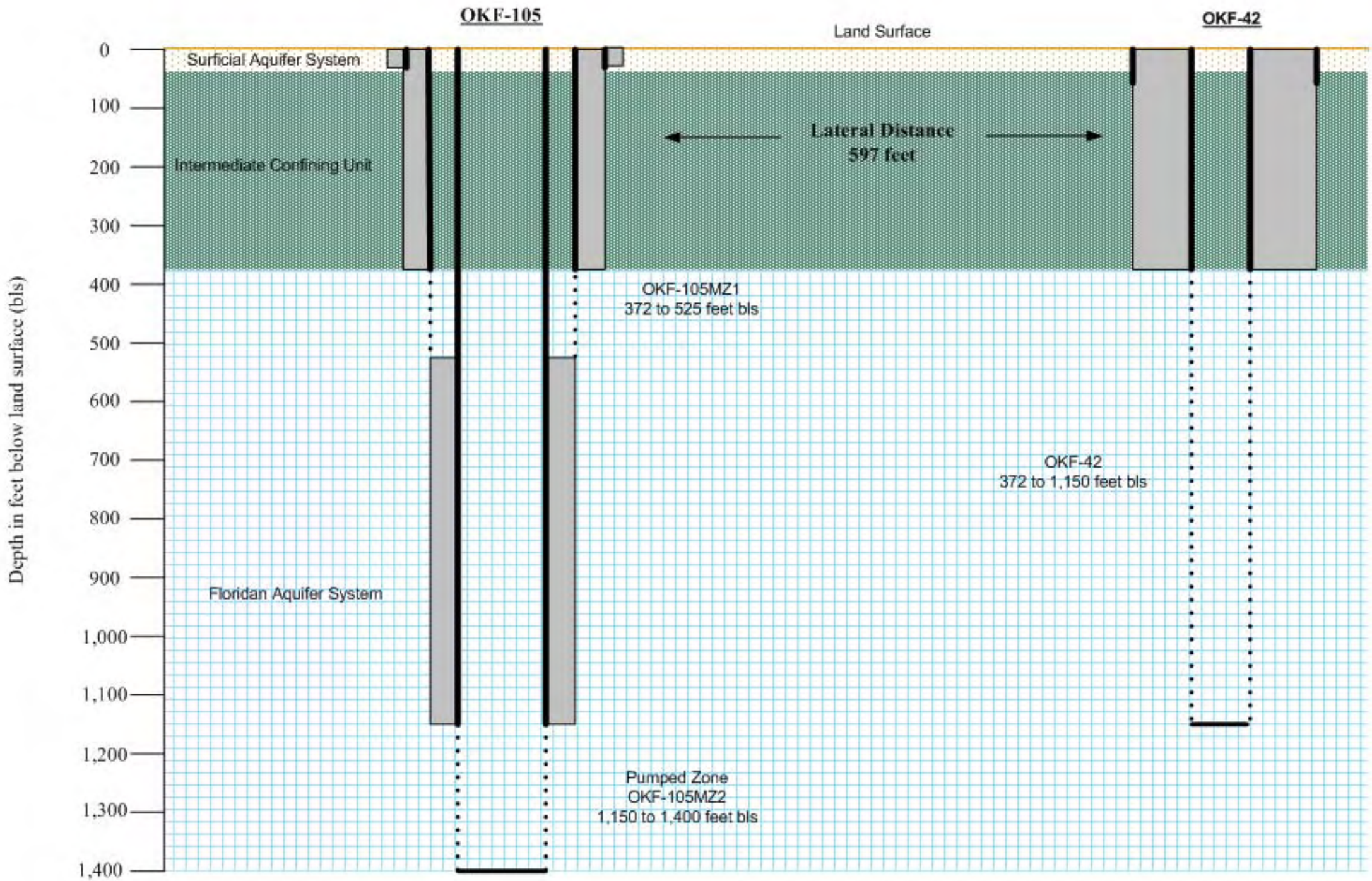

40 ft bls
372 ft bls
525 ft bls
1,150 ft bls
1,468 ft bls
2,130 ft bls
2,251 ft bls
2,500 ft bls
Pit Casing
24-inch outer diameter steel casing (ASTM A53, Grade B, 0.375-inch wall thickness)
Surface Casing
18-inch outer diameter steel casing (ASTM A53, Grade B, 0.375-inch wall thickness)
ASTM Type II neat cement
MZ-1
Upper Floridan Aquifer
372 - 525 ft bls
Well Casing
12-inch outer diameter steel casing (ASTM A53, Grade B, 0.375-inch wall thickness)
ASTM Type II Cement with 8% bentonite
MZ-2
Avon Park Production Zone
1,150 - 1,468 ft bls
Well Casing
5 1/2-inch outer diameter fiberglass casing (ASTM D2996 Type 1 Grade 2 Class A, 0.32-inch wall thickness)
ASTM Type II neat cement
MZ-3
Lower Floridan Aquifer
2,130 - 2,251 ft bls
Backfill Material
with neat cement cap
Legend
ft bls = feet below land surface
Diagram not to scale

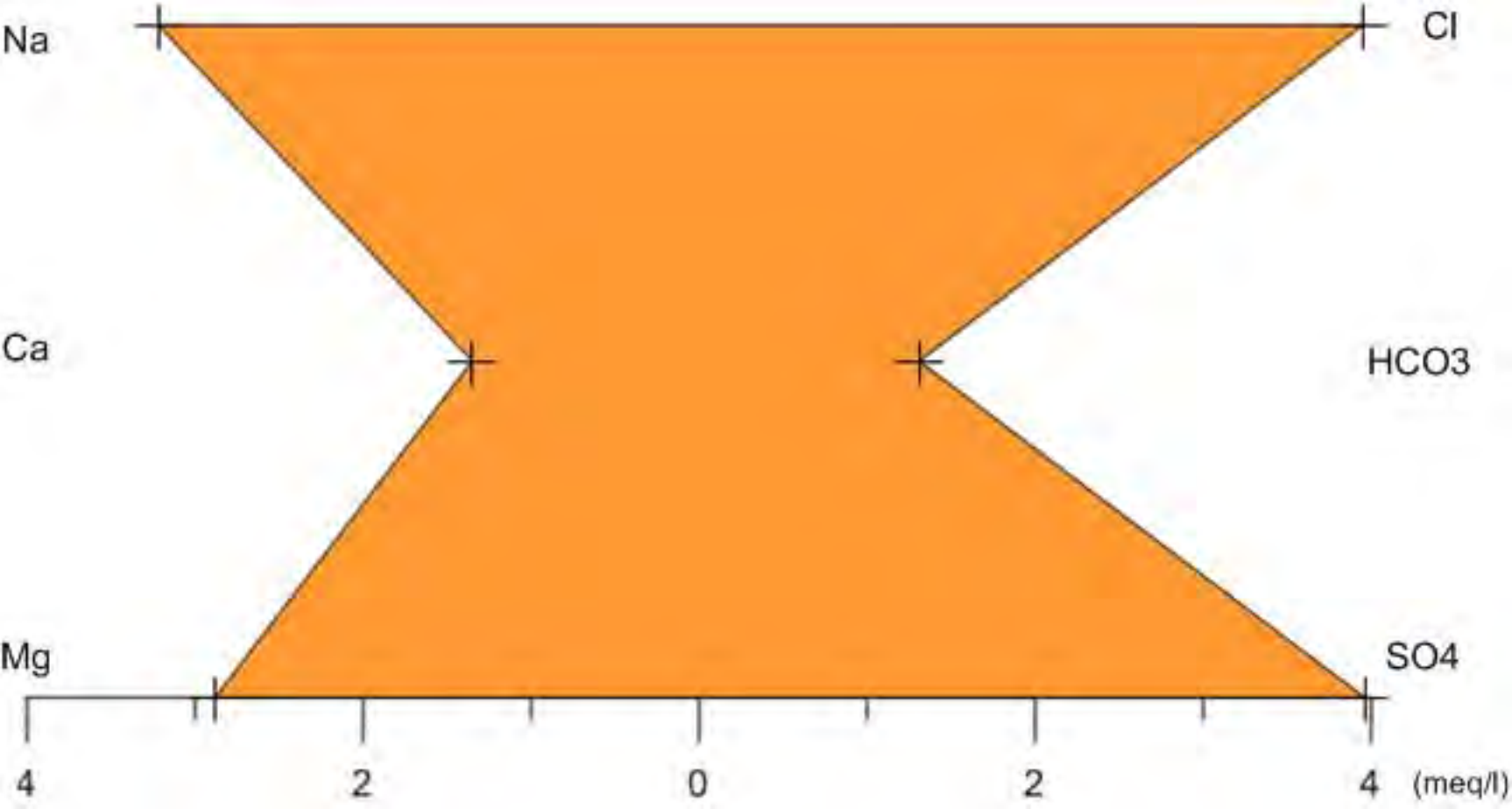

1,400
1,500
1,600
1,700
1,800
1,900
2,000
2,100
2,200
2,300
2,400
2,500
Depth Below Land Surface (feet)
1
10
100
1,000
10,000
100,000
Total Dissolved Solids Concentration (mg/l)

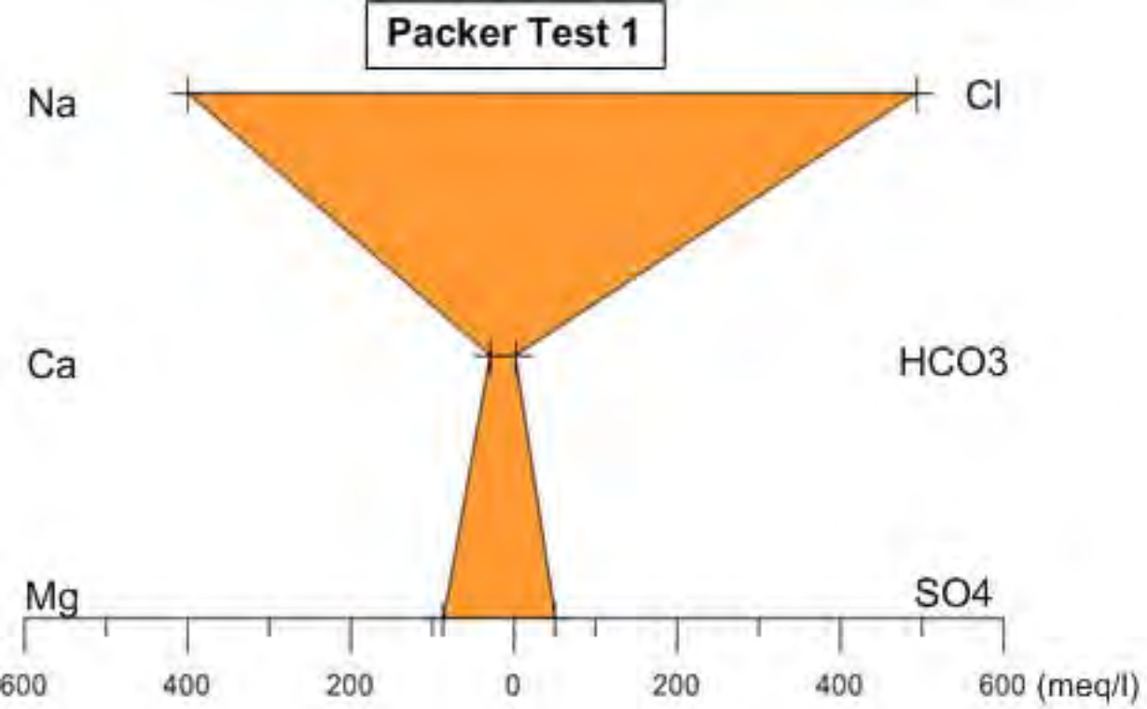

1,400
1,500
1,600
1,700
1,800
1,900
2,000
2,100
2,200
2,300
2,400
2,500
Depth Below Land Surface (feet)
1
10
100
1,000
10,000
100,000
Ion Concentration (mg/L)
Chloride
Sulfate

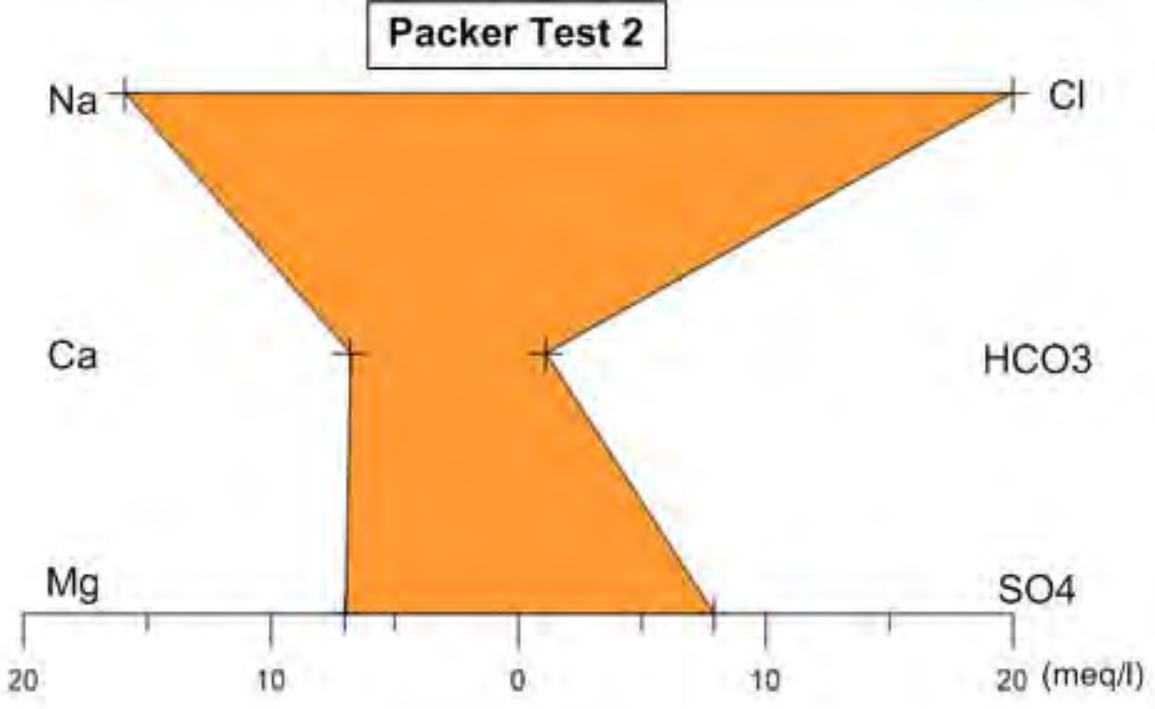

1,000
1,100
1,200
1,300
1,400
1,500
1,600
1,700
1,800
1,900
2,000
2,100
2,200
2,300
2,400
2,500
Depth Below Land Surface (feet)
1
10
100
1,000
10,000
100,000
Specific Conductance (µs/cm)

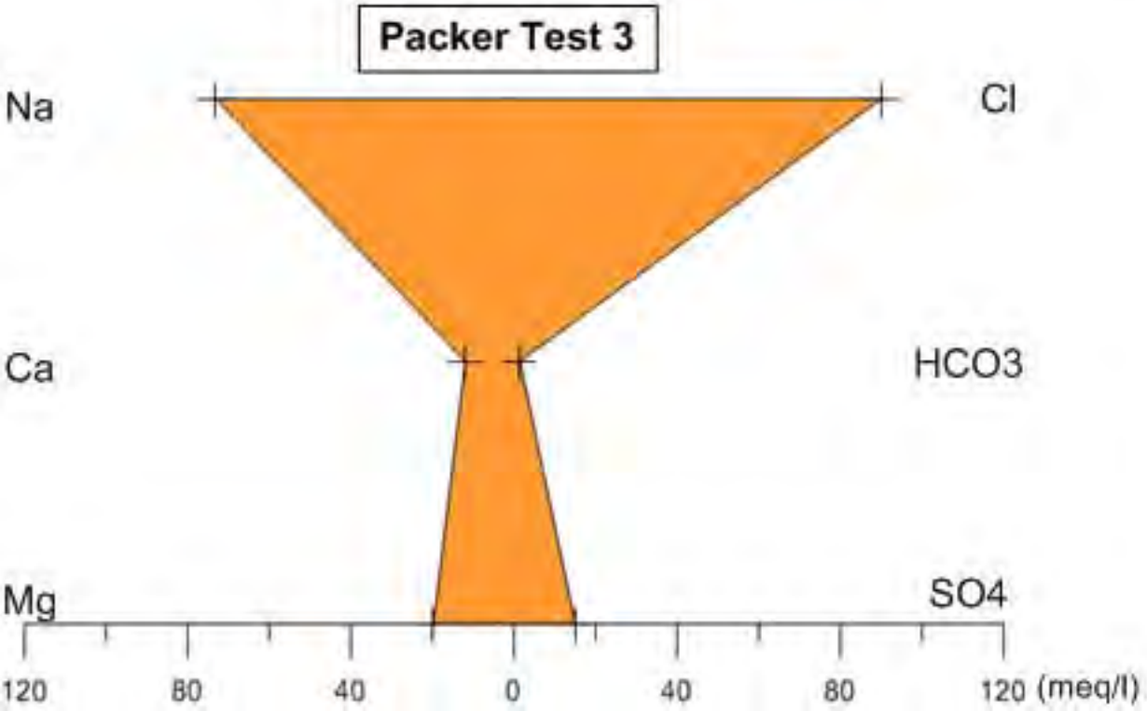

SULFATE + CHLORIDE
CALCIUM + MAGNESIUM
SODIUM + POTASSIUM
CARBONATE + BICARBONATE
Legend
OKF-105U
OKF-105M
OKF-105L
FW-IV
TCW
CW
TW-I
RSW
FW-II
TRSW
FW-I
FW-III
TW-II
MAGNESIUM
CALCIUM
CATIONS
A
B
C
D
E
F
G
CHLORIDE
SULFATE
ANIONS
1
2
3
4
5
6
7

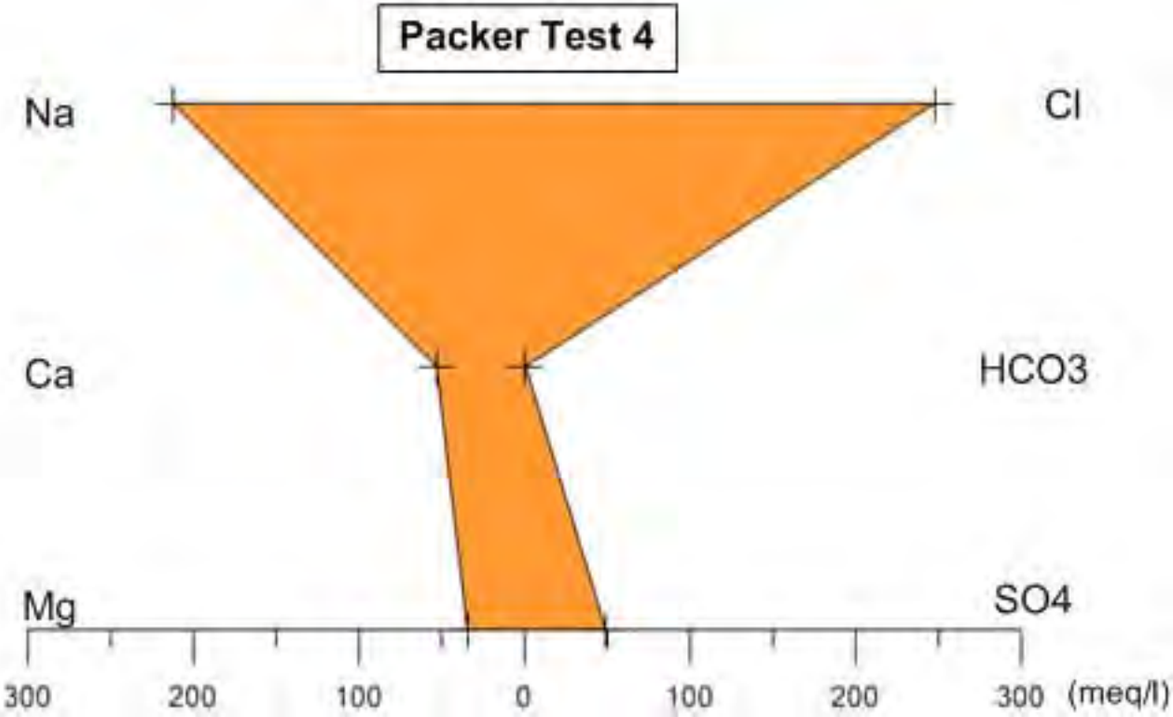

OKF-105
Land Surface
OKF-42
Surficial Aquifer System
Intermediate Confining Unit
Lateral Distance
597 feet
OKF-105MZ1
372 to 525 feet bls
OKF-42
372 to 1,150 feet bls
Floridan Aquifer System
Pumped Zone
OKF-105MZ2
1,150 to 1,400 feet bls
Depth in feet below land surface (bls)
0
100
200
300
400
500
600
700
800
900
1,000
1,100
1,200
1,300
1,400

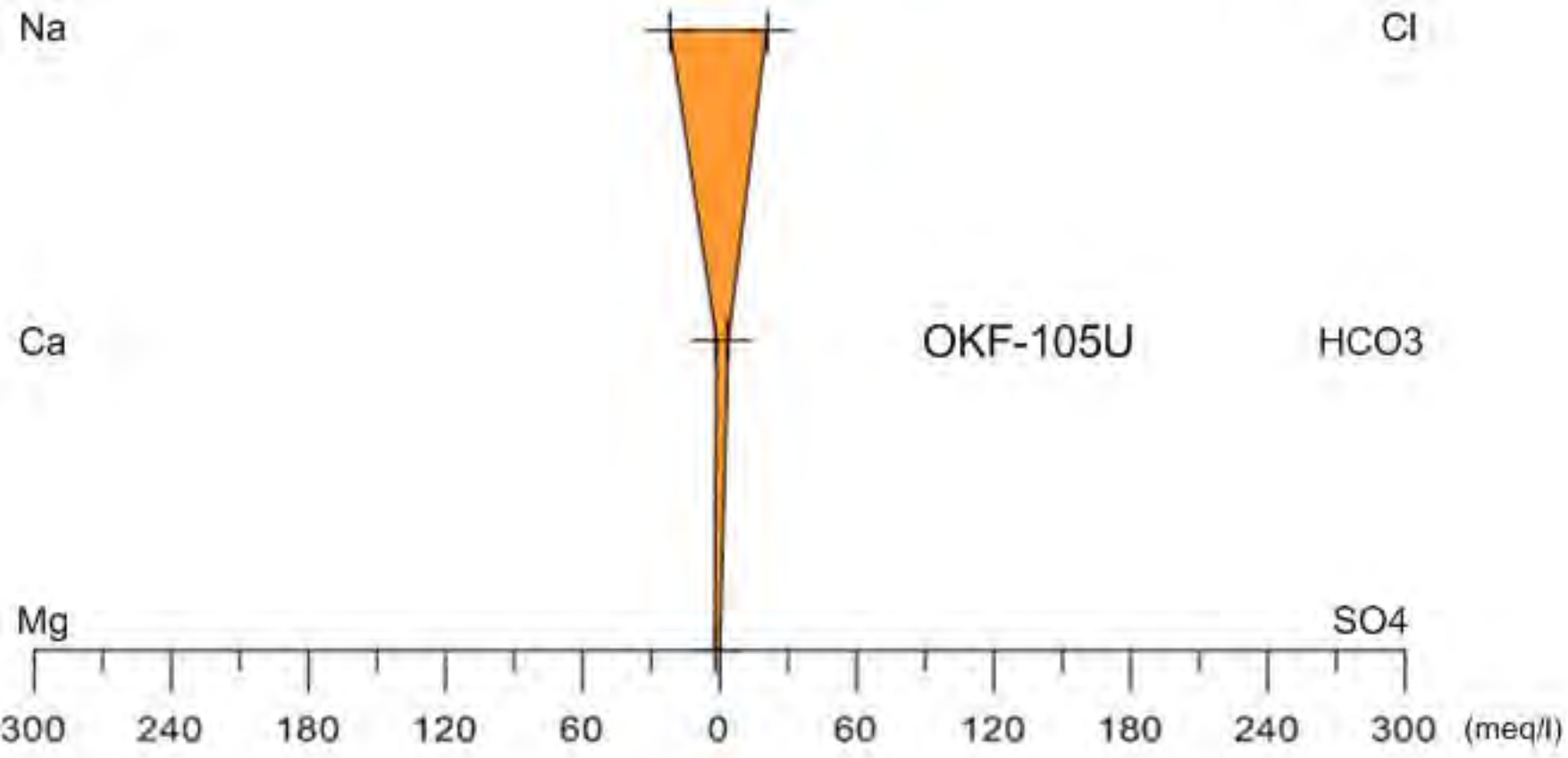

Na
Cl
Ca
HCO3
Mg
SO4
4
2
0
2
4
(meq/l)

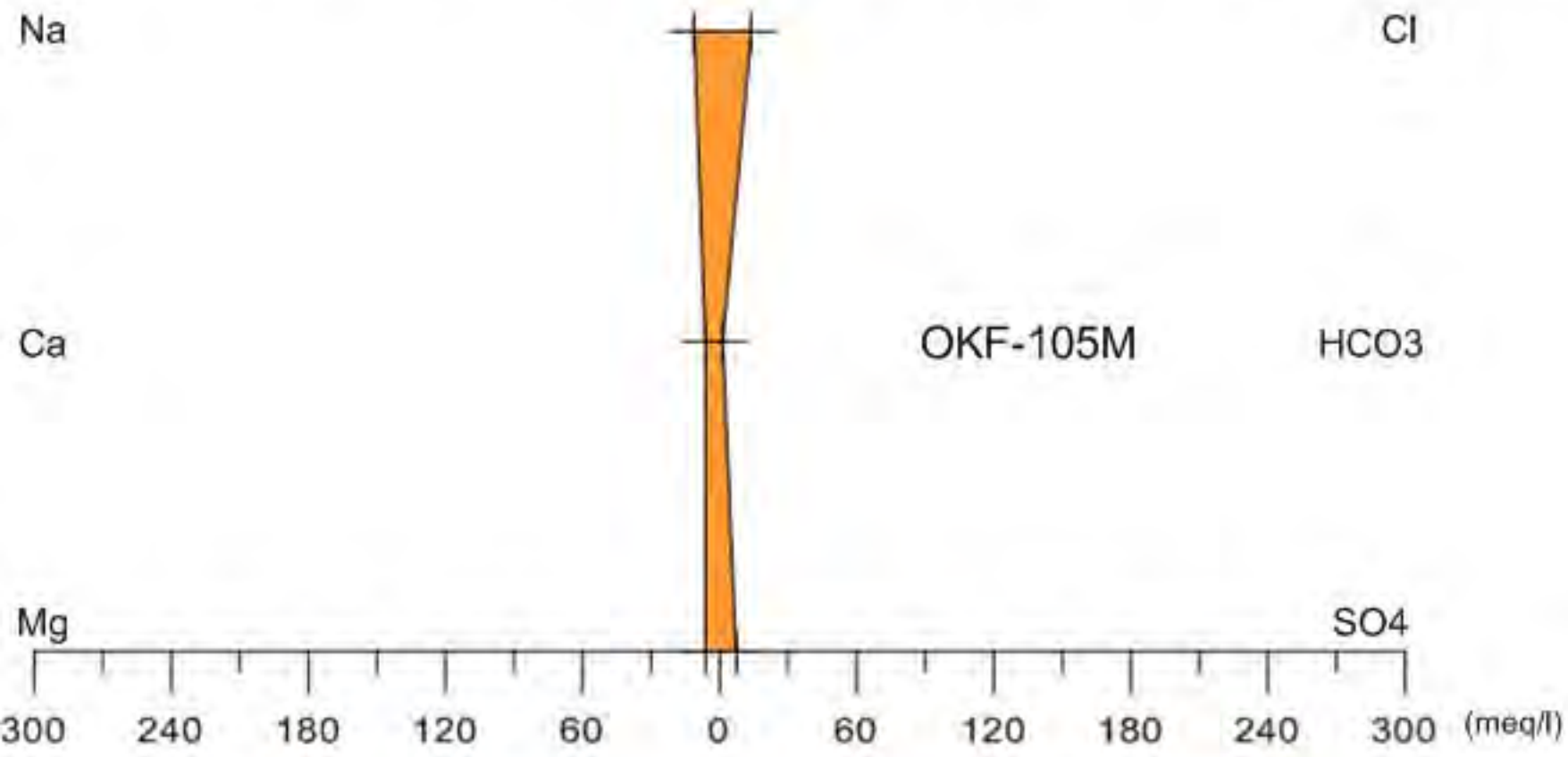

Packer Test 1
Na
Cl
Ca
HCO3
Mg
SO4
600
400
200
0
200
400
600 (meq/l)

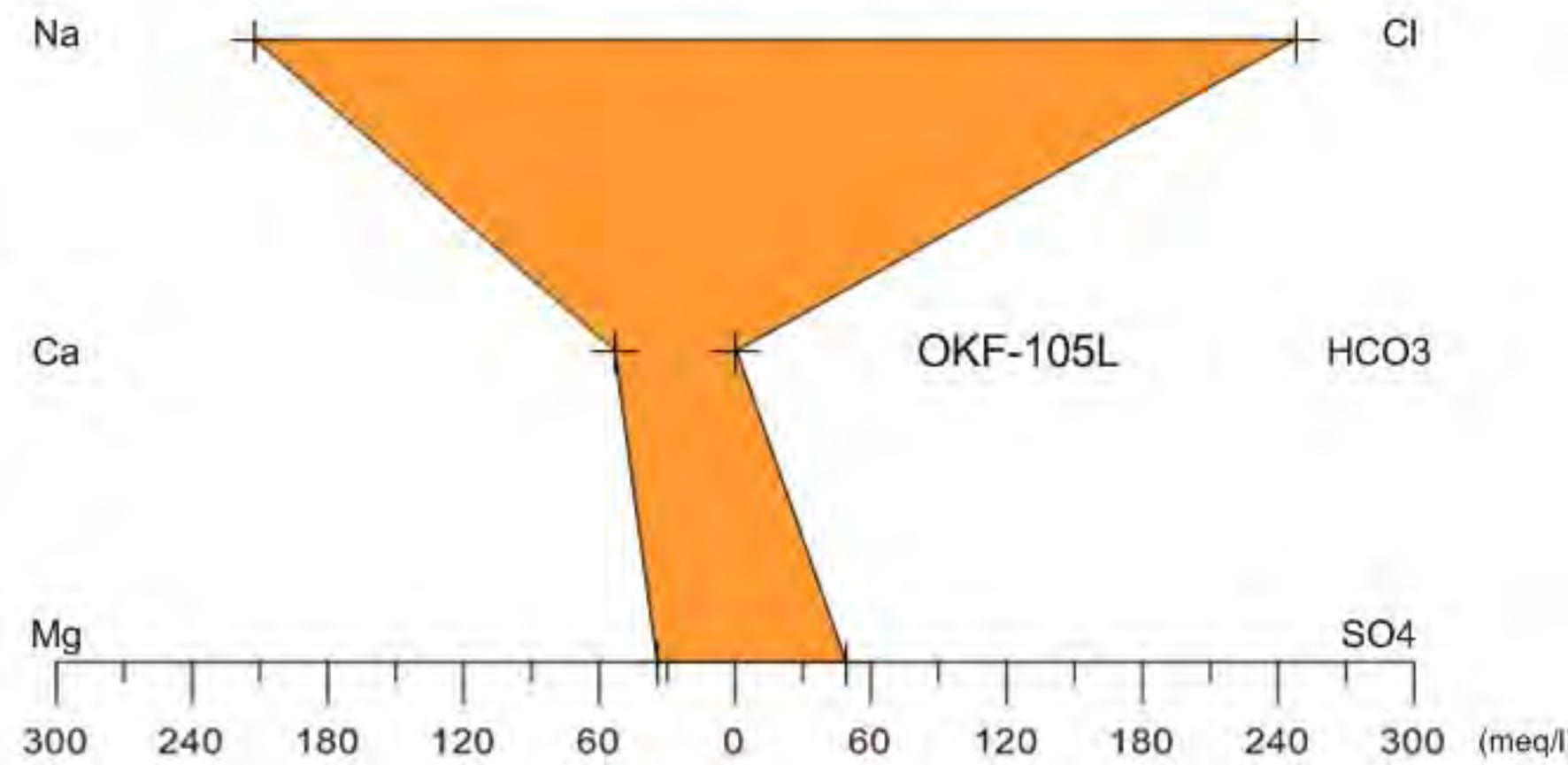

Packer Test 2
Na
Cl
Ca
HCO3
Mg
SO4
20
10
0
10
20 (meq/l)


Packer Test 3
Na
Cl
Ca
HCO3
Mg
SO4
120
80
40
0
40
80
120 (meq/l)


Packer Test 4
Na
Cl
Ca
HCO3
Mg
SO4
300
200
100
0
100
200
300 (meq/l)


Na
Cl
Ca
OKF-105U
HCO3
Mg
SO4
300 240 180 120 60 0 60 120 180 240 300 (meq/l)


Na
Cl
Ca
OKF-105M
HCO3
Mg
SO4
300 240 180 120 60 0 60 120 180 240 300 (meq/l)


Na
Cl
Ca
OKF-105L
HCO3
Mg
SO4
300 240 180 120 60 0 60 120 180 240 300 (meq/l)