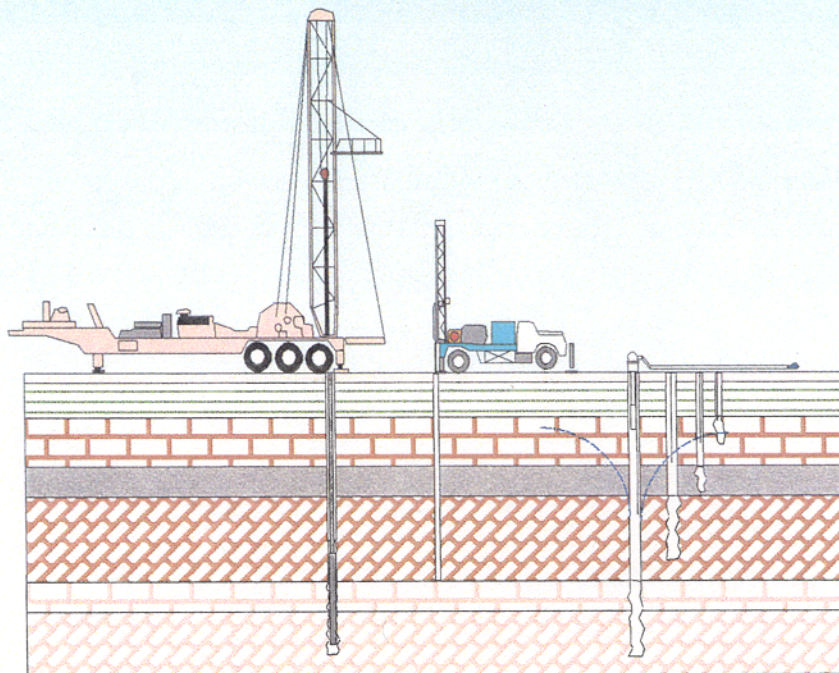


ROMP 9.5
INTERMEDIATE AQUIFER SYSTEM
MONITOR WELL SITE
DESOTO COUNTY, FLORIDA

PHASE ONE

CORE DRILLING
AND TESTING



Geohydrologic Data Section
Resource Data Department
Southwest Florida Water Management District
December 1998

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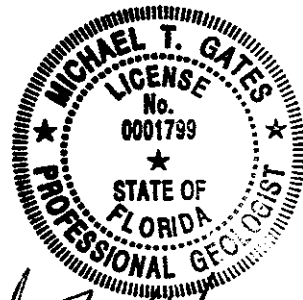
**ROMP 9.5
INTERMEDIATE AQUIFER SYSTEM
MONITOR WELL SITE
DESOTO COUNTY, FLORIDA**

PHASE ONE

CORE DRILLING AND TESTING

December 1998

The geological evaluations and interpretations contained in the *ROMP 9.5 Core Drilling and Testing Report* have been prepared by or approved by a certified Professional Geologist in the State of Florida, in accordance with Chapter 492, Florida Statutes.



Michael T. Gates

Michael T. Gates
Professional Geologist
License No. PG 1799

Date: 12-21-1998

**ROMP 9.5
INTERMEDIATE AQUIFER SYSTEM
MONITOR WELL SITE
DESOTO COUNTY, FLORIDA**

PHASE ONE

CORE DRILLING AND TESTING

By Michael T. Gates

Southwest Florida Water Management District

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December 1998

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1.0 INTRODUCTION

The ROMP (Regional Observation and Monitor-well Program) 9.5 Intermediate Aquifer System (IAS) monitor well site is the pilot site for a joint project between the Southwest Florida Water Management District (District) and United States Geological Survey (USGS). The project will determine the regional hydrogeologic framework of the intermediate aquifer system in West Central Florida.

The intermediate aquifer system is present in the southern half of the District. The IAS covers approximately 5,000 square miles, roughly the same area as the Southern Water Use Caution Area (SWUCA) shown in Figure 1. The SWUCA was established by the District in October 1992 because of increasing concerns about over pumping and saltwater intrusion. The SWUCA includes all of DeSoto, Hardee, Manatee, and Sarasota Counties and parts of Charlotte, Highlands, Hillsborough, and Polk Counties (SFWWMD, 1993).

Drilling, testing, and monitor well construction at ROMP 9.5 was planned in two phases. The data collected is presented as a two phase report: *Phase One - Core Drilling and Testing* and *Phase Two - Monitor Well Construction and Aquifer Performance Testing*. The first phase, exploratory coring from land surface to 543 feet (ft) below land surface (bls), began November 1996 and was completed in March 1997. The next phase of work, monitor well construction and aquifer performance testing (APT) was initiated in May 1997 and was completed in February 1988. This report, *Phase One - Core Drilling and Testing*, presents the data collected from the core drilling and testing at ROMP 9.5. Additional information on the intermediate aquifer system will be presented in a USGS report by G. L. Barr entitled *Hydrogeology and Geochemistry of the Intermediate Aquifer System in Southern Florida, with Emphasis in Charlotte, DeSoto, and Sarasota Counties* scheduled for publication in July 1999.

2.0 SITE LOCATION

The ROMP 9.5 well site is located in DeSoto County, northeast of the city of Northport on the R.V. Griffin Reserve (Figure 2). The well site is located in Section 31, Township 38 South, Range 23 East at latitude: 27° 7' 59" longitude: 82°3' 20" at a surface elevation of 38 feet above the National Geodetic Vertical Datum of 1929 (NGVD) (Figure 3). The ROMP 9.5 monitor well site diagram is presented in Figure 4.

3.0 DATA COLLECTION METHODS

Hollow-stem auger, wire-line coring, and mud rotary drilling methods were used to collect lithologic and aqueous samples with depth. The hollow-stem auger method was used initially in the unconsolidated sediments. The wire-line coring method was employed after encountering competent limestone. The mud-rotary method was used to install casing at various locations in order to advance the core-hole. A wire-line deployed, off-bottom packer, and a 2-inch submersible pump were used to collect the ground-water samples while coring. All ground-water samples were collected in accordance with ROMP water quality sampling protocol.

3.1 LITHOLOGIC SAMPLING

Drilling at ROMP 9.5 during the coring phase of work was performed with the District-owned Central Mine Exploration (CME) 75 core drilling rig. Continuous core was collected from land surface to 543 ft bls from November 1996 to March 1997. Figure 5 presents a diagram of the wire-line coring apparatus.

Ten-inch hollow-stem augers and a six-inch split spoon sampler were used to collect continuous lithologic samples from land surface to 38 ft bls. Solidified shell and clay was encountered at 38 ft bls terminating the auger hole. The auger hole was then converted to a four-inch polyvinyl-chloride (PVC) deep surficial aquifer monitor well (Figure 6).

A new 13-inch diameter borehole was drilled to 43 ft bls using the mud-rotary method. Eight-inch diameter PVC was installed to 43 ft bls and grouted in place. Four inch diameter temporary HW steel casing was installed inside the eight inch PVC to 43 feet bls and seated in the grout. Wire-line coring began at 43 feet bls inside the four inch steel HW casing. Three-inch outside diameter (OD) NQ core rods were used to collect the approximate two-inch diameter core. The core was collected continuously and retrieved at five foot intervals. Coring continued to 148 ft bls, then the four inch HW casing was removed and a six inch borehole was advanced from 43 ft bls to 143 ft bls. The HW casing was re-installed to 143 ft bls and wire-line coring resumed. Wire-line coring continued in this borehole to a depth of 543 ft bls. Coring was terminated at 543 feet bls in the Suwannee Limestone

after confirming the top of the Upper Floridan aquifer at 468 feet bls. Figure 7 presents the configuration of the core hole during coring.

3.2 GROUND-WATER SAMPLING

Ground-water samples were collected using an inflatable, off-bottom packer developed for use in the NQ core rods. The packer allowed the collection of discrete water quality samples and head levels. During coring the core was examined for visual porosity features. Packer test intervals were determined in the field based on core sample lithology. Following installation of the packer, a submersible pump was installed inside the core rods and the sample was collected from the pump discharge. Figure 8 presents a diagram of the packer.

The ground-water samples were collected at approximate 20 feet intervals during wire-line coring. The samples were split and one sample was analyzed in the field for temperature, specific conductance, pH, chloride, sulfate, and density, while the other sample was delivered to the District Environmental Chemistry Laboratory for more extensive analyses. Chain-of-Custody forms were used to track the samples. Tables 1 and 2 present the results of the sample analyses. Results of the ground-water samples analyses are discussed in Section 6.0.

3.3 HYDRAULIC TESTING

Core hole water levels were measured daily while coring through the surficial, intermediate, and Upper Floridan aquifers. The daily core hole water level measurements are presented in Table 3. During packer testing, water level changes were measured with pressure transducers and recorded with a data logger. The specific capacity of the test intervals were calculated and are presented in Table 4. The drawdown and recovery curves of each test interval are presented in Appendix A.

Several core samples were sent to the Florida Geological Survey (FGS) for vertical permeability and porosity analysis. The FGS performed falling-head permeameter tests on 10 core samples selected from ROMP 9.5. The samples (2-inch diameter by 3 to 6 inches in length) were from permeable and confining units within the intermediate and Upper Floridan aquifers. Table 5 presents the hydraulic values obtained from the permeameter tests.

3.4 GEOPHYSICAL LOGGING

Borehole geophysical logs were collected at ROMP 9.5 during various stages of drilling and well construction. Geophysical logs were used to delineate stratigraphic units, characterize water quality, and determine grouting requirements. Figure 9 presents the geophysical logs run during the core drilling phase. All logs were run with the District's digital geophysical logging equipment and are archived with the ROMP 9.5 File of Record. Geophysical logs for ROMP 9.5 can also be found on the GeoSys™ statewide database.

4.0 GEOLOGY

The ROMP 9.5 well site is located within the Gulf Coastal Lowlands physiographic province, a division of the Mid-Peninsular zone of the Florida Peninsula (White, 1970). The well site is within the District Peace River Hydrologic Basin and is located approximately four miles west of Horse Creek, a tributary of the Peace River (Figure 1).

4.1 STRATIGRAPHY

The ROMP 9.5 well site stratigraphy was defined from lithologic descriptions of the core samples collected during core drilling from land surface to 543 feet bls. Figure 10 depicts the geology and hydrogeology described at the ROMP 9.5 well site. The lithologic log for ROMP 9.5 is presented in Appendix B.

4.1.1 Undifferentiated Surficial Deposits

The Pliocene to Recent age undifferentiated surficial deposits are the uppermost geologic unit at the ROMP 9.5 well site. This unit is comprised of very fine to medium grained, unconsolidated, quartz sand, with some inter-bedded silt, clay and organic matter. The undifferentiated surficial deposits extend from land surface to 11.5 feet bls.

4.1.2 Tamiami Formation

The Tamiami Formation, Pliocene to Pleistocene in age, underlies the undifferentiated surficial deposits and extends from 11.5 feet bls to 34 feet bls. The Tamiami is comprised of fine to coarse quartz sand, phosphatic sand, and mollusc shell beds.

4.1.3 Peace River Formation

The Peace River Formation is a lower Pliocene to Miocene age marine siliciclastic unit that lies unconformably below the Tamiami Formation at ROMP 9.5. The Peace River Formation is part of the Hawthorn Group sediments described by Scott (1988). In the area of ROMP 9.5 the Peace River Formation is comprised of a thin sequence of siliciclastic sediments extending from 34 feet bls to 53 feet bls. Quartz sand, phosphatic sand and gravel, clay, and limestone lenses comprise the Peace River sediments at ROMP 9.5.

4.1.4 Arcadia Formation

The Arcadia Formation, part of the Hawthorn Group is middle-Miocene in age and underlies the Peace River Formation. The Arcadia Formation as described by Scott (1988), consists primarily of limestone and dolostone with some quartz sand, clay and phosphate grains. In the area of ROMP 9.5 the Arcadia Formation extends from 53 feet bls to 454 feet bls and is characterized by moderately indurated calcarenite, inter-bedded quartz sand, phosphatic sand and gravel, and some clay and dolostone. Foram, mollusk, and echinoid molds are common and account for the high permeability in the middle part of the unit.

The Tampa Member of the Arcadia Formation was described from 224 feet bls to 254 feet bls at ROMP 9.5. The Tampa Member is composed of fossiliferous limestone with some minor interbedded quartz and phosphatic sand and dolostone. Undifferentiated Arcadia is present between the overlying Tampa Member and the underlying Nocatee Member.

The Nocatee Member of the Arcadia Formation was described from 398 feet bls to 454 feet bls. The Nocatee consists of limestone with interbedded silt-sized dolostone, quartz sand and

phosphatic sand and clay. At the ROMP 9.5 site, the Nocatee Member was mostly fine grained, waxy, and of low permeability.

4.1.5 Suwannee Limestone

The Suwannee Limestone is Oligocene in age and extends from 454 feet bls to more than 543 feet bls (coring was stopped at 543 feet bls) at the ROMP 9.5 well site. The Suwannee Limestone is distinguished from the overlying Arcadia Formation by the absence of phosphatic sediments. The Suwannee consists of a chalky, fossiliferous, limestone alternating with thin beds of clay, dolostone, and quartz sand. Limestone beds are primarily sandy, clayey calcarenite, poor to moderate induration with varying permeability.

5.0 HYDROLOGY

The ROMP 9.5 well site hydrogeology was defined during initial wire-line coring. Aquifer systems were delineated from lithologic descriptions of permeable and non-permeable units, potentiometric levels, and water quality data collected during drilling. Changes in water levels were recorded while core drilling through the various aquifers. Figure 11 presents a graph of the water levels versus depth while drilling from land surface to the total cored depth of 543 feet bls.

5.1 SURFICIAL AQUIFER

The surficial aquifer at ROMP 9.5 is unconfined and extends from land surface to approximately 38 feet bls. Organics, silt, and quartz sand of the undifferentiated surficial deposits and quartz and phosphatic sands from the Tamiami and Peace River Formations form the surficial aquifer. The base of the surficial aquifer (38 feet bls) is formed by a lens of compact shell and clay. The water level in the surficial aquifer measured 1.7 feet bls (36.3 feet NGVD) in December 1997.

5.2 INTERMEDIATE AQUIFER SYSTEM

The intermediate aquifer system is a confined aquifer system located between the overlying surficial aquifer system and the underlying Upper Floridan aquifer system. In DeSoto County and other

nearby counties, as many as three separate permeable artesian zones have been described within the intermediate aquifer system (Duerr and Enos, 1991). At ROMP 9.5 in DeSoto County, two confined permeable zones were delineated within the intermediate aquifer system. Both permeable zones occur in the Arcadia Formation. The intermediate aquifer system is approximately 430 feet thick and extends from 38 feet bls to 468 feet bls.

In a report by Barr (1996) the uppermost permeable zone in the intermediate aquifer system, Permeable zone 1, is described as a transmissive unit lying just above the Venice Clay but hydraulically separated from the surficial aquifer. Neither the Venice Clay nor the Permeable zone 1 was identified at ROMP 9.5.

The uppermost confined permeable zone identified at ROMP 9.5 extends from 61 feet bls to 77 feet bls in the Arcadia Formation. This unit may be equivalent to the "Tamiami-upper Hawthorn Aquifer" described by Wolansky (1983) and/or the Permeable zone 2 unit described by Barr (1996). A monitor well (MW-18) was constructed in this zone as a water supply well for coring. Water levels in this well were occasionally above land surface causing the well to flow slightly when uncapped. During the core drilling phase, numerous water level changes were noted in this well. This was an indication of offsite pumping of a well or wells tapping this zone. The potentiometric surface of this zone measured 3.1 feet bls (34.9 feet NGVD) in December 1997. Figures 12 and 13 present potentiometric maps of the Tamiami-upper Hawthorn zone of the IAS for May and September 1997.

The major permeable zone of the IAS at ROMP 9.5 occurs in the Arcadia Formation from 200 feet bls to 330 feet bls. A thick sequence of carbonates from 77 feet bls to 200 feet bls creates the confining unit between the upper IAS permeable zones and this lower permeable zone. This highly transmissive unit is comprised of fossiliferous limestone of the Arcadia Formation. This zone is probably equivalent to the Permeable zone 3 described by Barr (1996). The potentiometric surface of this unit measured 5.6 feet above land surface (43.6 feet NGVD) in December 1997. Figures 14 and 15 present potentiometric maps of the intermediate aquifer for May and September 1997.

5.3 UPPER FLORIDAN AQUIFER

The Upper Floridan aquifer in the vicinity of ROMP 9.5 is approximately 1,300 feet thick (Metz, 1995). The top of the Upper Floridan aquifer occurs approximately 14 feet below the top of the Oligocene Age Suwannee Limestone at approximately 468 feet bls. A rise in the head level was noted at 468 feet bls during coring. Coring and data collection was terminated at 543 feet bls in the Suwannee Limestone. The potentiometric surface of the Upper Floridan aquifer at ROMP 9.5 measured 8.6 feet above land surface (46.6 feet NGVD) in December 1997. Figures 16 and 17 present potentiometric maps of the Upper Floridan aquifer for May and September 1997.

6.0 GROUND-WATER QUALITY

Ground-water samples were collected from the intermediate and Upper Floridan aquifers at 20 feet intervals while core drilling. All samples were collected with a 2-inch diameter submersible pump installed inside the core drill rods, with the off-bottom packer installed at a selected test interval. This packer/pump configuration is illustrated in Figure 8. The field analyses and laboratory analyses of the ground-water samples are presented in Tables 1 and 2, respectively. Figure 18 presents a graph of the chloride, sulfate, and total dissolved solids (TDS) concentrations of the ground-water samples collected.

6.1 SURFICIAL AQUIFER

Ground-water samples were not collected from the surficial aquifer at ROMP 9.5 during the core drilling phase. A ground-water sample was collected in 1997 from the completed shallow surficial monitor well MW-4 (screened interval 2 to 8 feet bls) at the well site. Water quality in the surficial aquifer for most parameters is within potable limits. Chloride, sulfate, and TDS concentrations were 58 mg/L, 5 mg/L, and 432 mg/L, respectively.

6.2 INTERMEDIATE AQUIFER SYSTEM

Ground-water samples were collected from several packer tests intervals while core drilling through the intermediate aquifer (38 feet bls to 468 ft bls) at ROMP 9.5.

Ground-water samples were collected from packer tests performed in the upper permeable zone (61 to 77 feet bls) and in the confining units above the lower permeable zone. The water quality samples collected from these intervals were within potable standards for most parameters. Chloride concentrations ranged from 75 mg/L at 61 feet bls to 78 mg/L at 148 feet bls. Sulfate concentrations ranged from 51 mg/L at 61 feet bls to 86 mg/L at 148 feet bls. TDS concentrations ranged from 374 mg/L at 61 feet bls to 483 mg/l at 148 feet bls.

Ground-water samples were collected from packer tests in the lower permeable zone (200 feet bls to 330 feet bls) and from the confining units above the Upper Floridan (330 feet bls to 468 feet bls). The water quality samples collected from these intervals were generally within potable standards for most parameters. Iron concentrations exceeded potable standards and ranged from 0.3 mg/L to 0.7 mg/L. Chloride concentrations ranged from 102 mg/L at 188 feet bls to 63 mg/L at 468 feet bls. Sulfate concentrations ranged from 29 mg/L at 188 feet bls to 196 mg/L at 468 feet bls. TDS concentrations ranged from 423 mg/l at 188 feet bls to 561 mg/l at 468 feet bls.

6.3 UPPER FLORIDAN AQUIFER

One ground-water sample was collected by packer testing in the Upper Floridan while core drilling at ROMP 9.5. The packer test interval was 493 feet bls to 513 feet bls for this sample. The water quality in this zone exceeds potable standards for several parameters. The chloride, sulfate, and TDS concentrations were 75 mg/L, 286 mg/L, and 748 mg/L, respectively.

7.0 HYDRAULIC DATA

Specific capacity measurements were collected during all packer tests. The measurements were made in the permeable and confining units of the intermediate and Upper Floridan aquifers. The specific capacity varied from 0.01 gallons per minute/foot (gpm/ft) for a confining zone in the Arcadia to 0.55 gpm/ft for a permeable zone in the Suwannee Limestone (Table 4).

Porosity and vertical hydraulic conductivity values were calculated for 10 core samples collected while drilling in the intermediate and Upper Floridan aquifers at ROMP 9.5. Core samples exhibiting low and high porosity features were selected, to determine relative confining properties between and within

permeable zones in the intermediate and Upper Floridan aquifers. The vertical hydraulic conductivity values ranged from 9.42×10^{-4} feet/day for a core sample collected in the upper permeable zone of the IAS to 2.47×10^{-2} feet/day for a confining zone in the IAS. Porosity values ranged from a low of 28% for a permeable zone core sample to a high of 52 % for a core sample collected in a confining zone. The results of the porosity and permeameter testing are presented in Table 5. The results of the testing indicate the variable nature of the sedimentary units. The vertical hydraulic values and porosity percentages are highest in the confining zones. The lowest values were measured in core samples collected from permeable units. Additional hydraulic data collected from aquifer performance tests will be presented in the ROMP 9.5 report: *Phase Two -Aquifer Performance Testing*.

8.0 SUMMARY

Core drilling and testing, the first phase of a hydrogeologic investigation was conducted at the ROMP 9.5 IAS monitor well site from November 1996 to March 1997. The wire-line coring method was used to collect continuous lithologic core from land surface to 546 ft bls for description and stratigraphic correlation. Ground-water samples were collected at 20 foot intervals during coring to characterize the water quality in the intermediate and Upper Floridan aquifers. Water levels were measured daily, while coring in the surficial, intermediate and Upper Floridan aquifers. Daily logs prepared by the site geologist are presented in Appendix C.

The results of the coring investigation indicate the ROMP 9.5 well site is underlain by an unconfined surficial aquifer (land surface to 38 feet bls), an artesian intermediate aquifer with two separate permeable zones (61 feet bls to 77 feet bls, and 200 feet bls to 330 feet bls) and the artesian Upper Floridan aquifer (468 feet bls to > 543 ft bls). Water quality in the surficial aquifer is generally good with most parameters within potable limits. Ground-water samples collected from the intermediate aquifer system were generally within potable limits. One ground-water sample collected from the Upper Floridan aquifer exceeded most parameters for drinking water standards.

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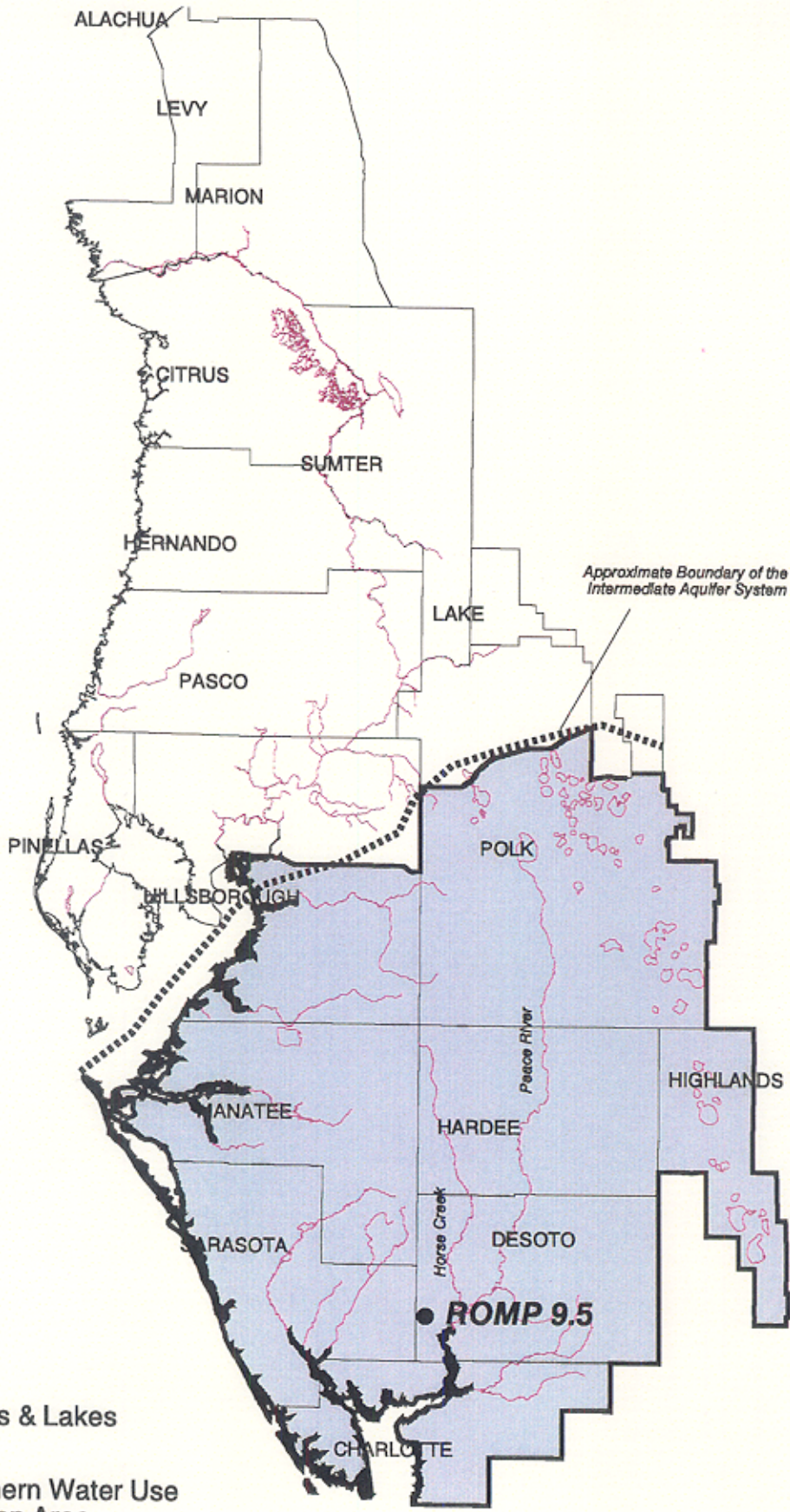
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FIGURES



 Rivers & Lakes

 Southern Water Use Caution Area

10 0 10 20 Miles



FIGURE 1. ROMP 9.5 IAS

General Location Map

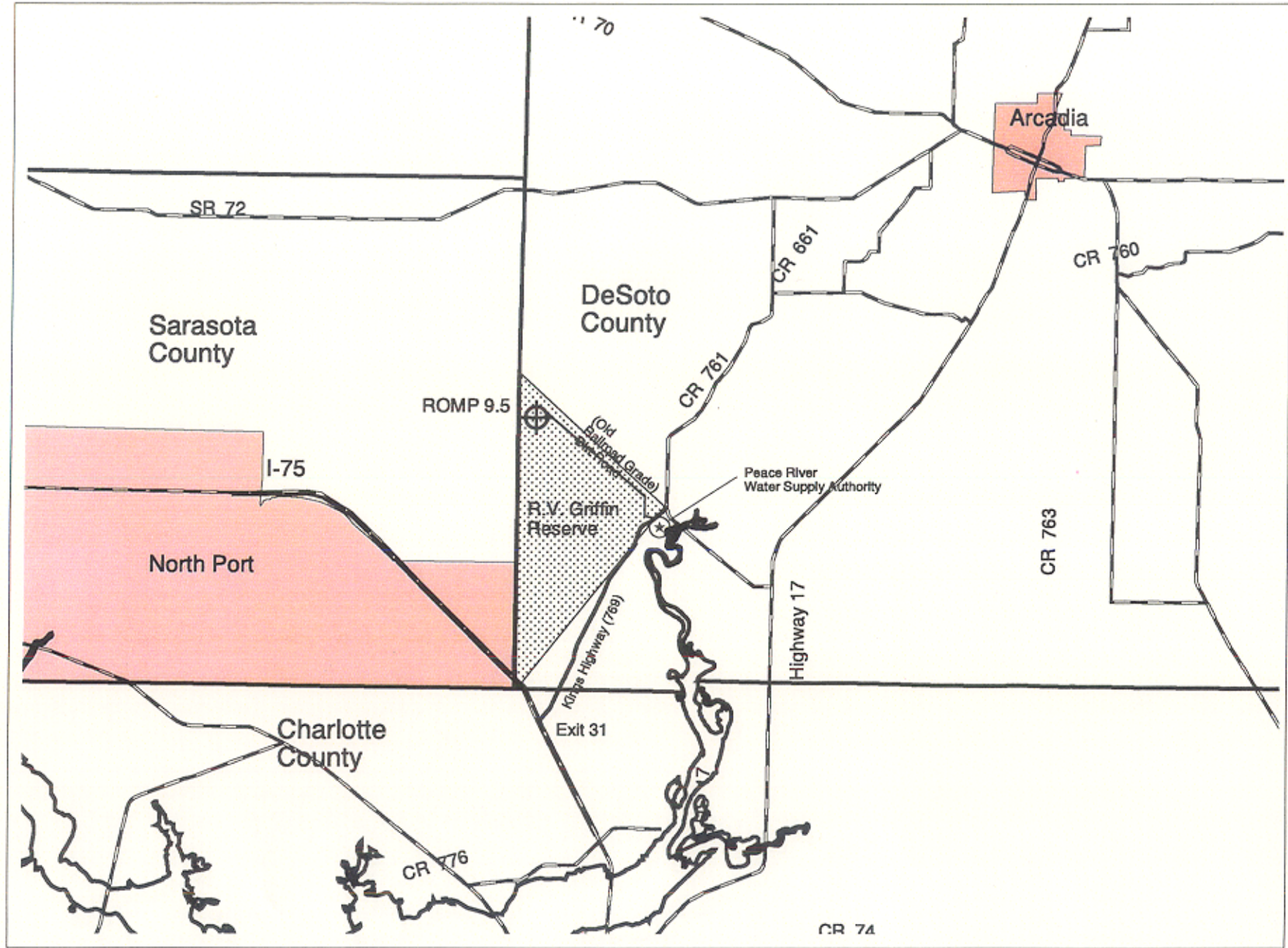
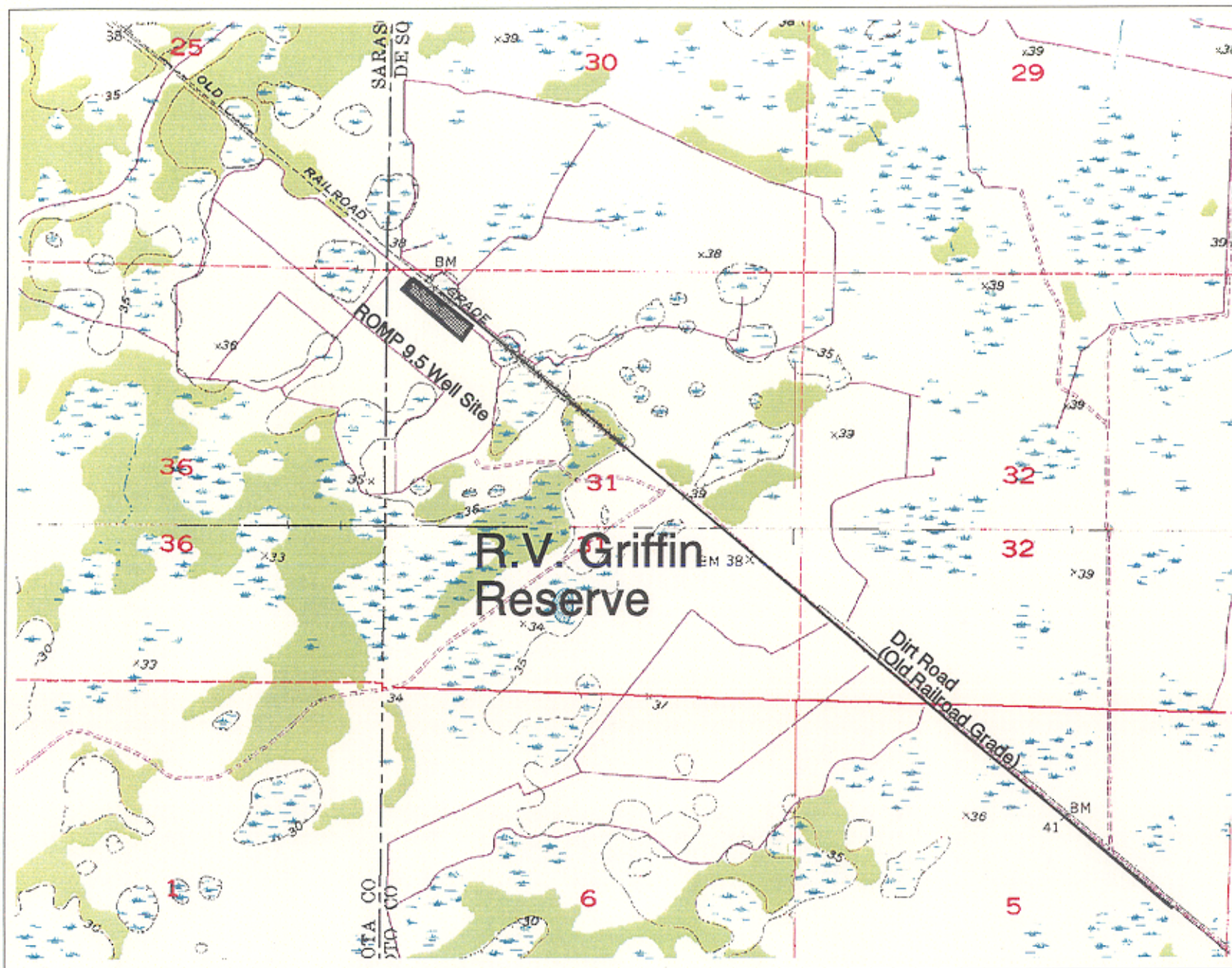


FIGURE 2. ROMP 9.5 IAS SITE

Project Location Map



DeSoto County
 Murdock NE Quad
 S31-T38-R23
 Latt: 27 7' 59"
 Long: 82 3' 20"
 Site Elev.
 ~38' NGVD

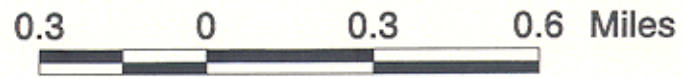
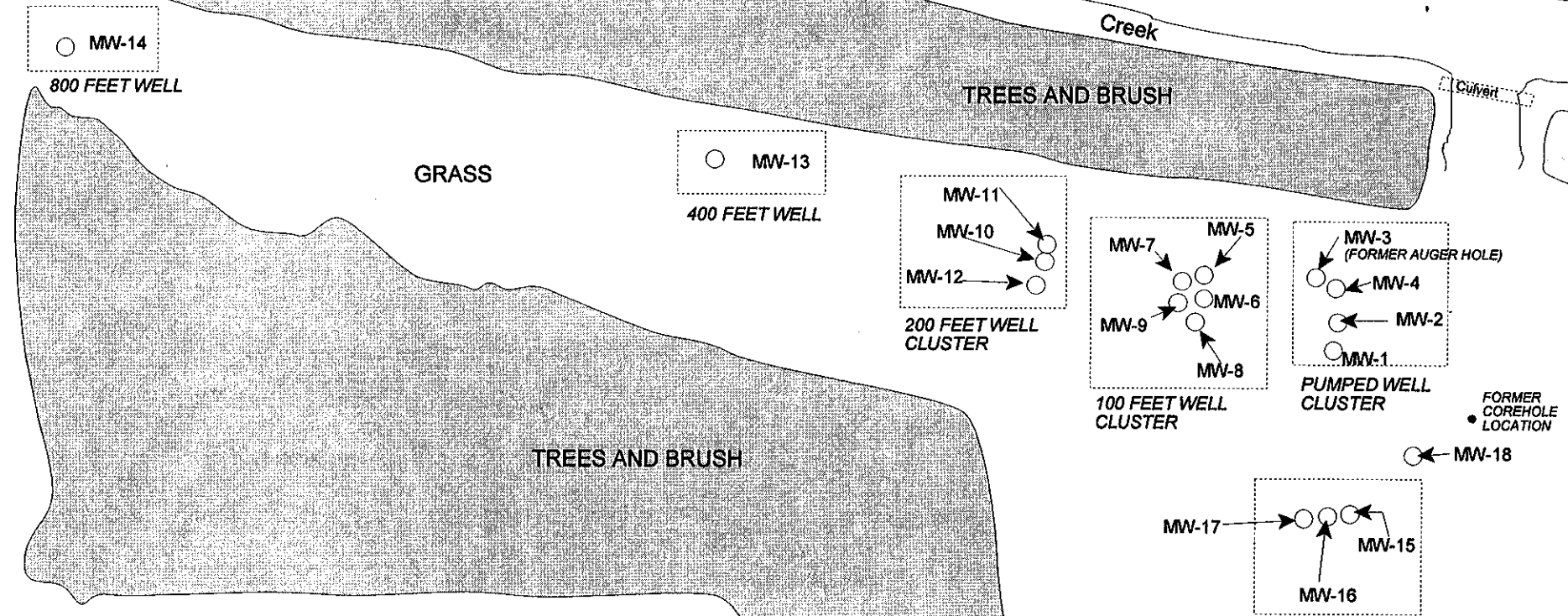


FIGURE 3. ROMP 9.5 IAS SITE
 Well Site Location

District Parcel #
 Quad Sheet: Murdock NE
 STR: 31-38S-23E
 Approx. Site Elev: 38.0 Feet

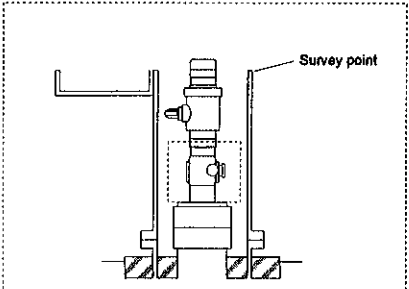


R. V. GRIFFIN RESERVE



NOTE: All wells are protected by locking steel covers and District combination locks.

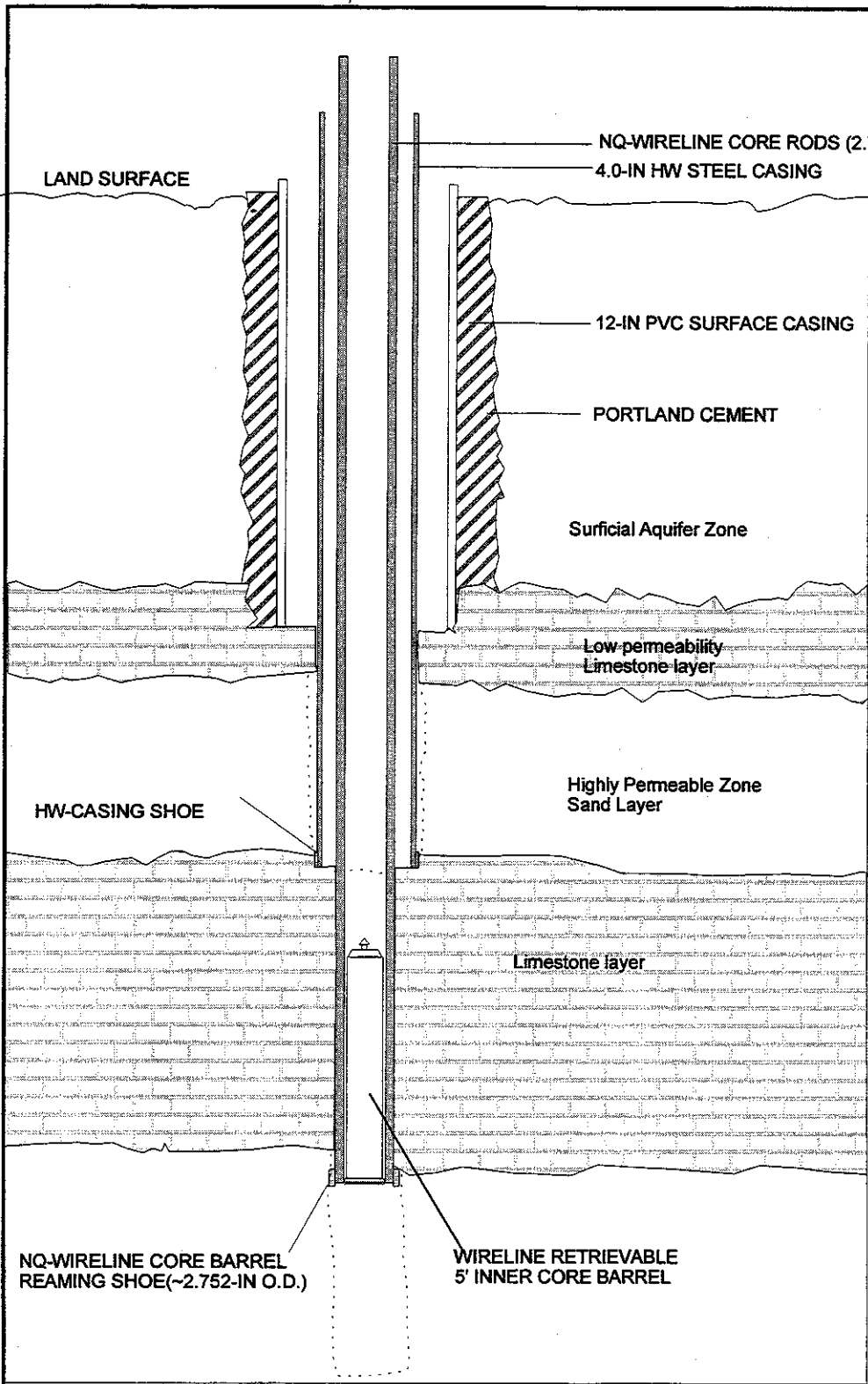
| Well Number | Well Cluster | Well Name | Monitored Interval (ft bis) | Well Elevation (eovd) |
|-------------|--------------|----------------------|-----------------------------|-----------------------|
| MW-18 | Core | #7 Coring H2O Supply | 61 - 77 | 40.63 |
| MW-3 | Pumped | 4" Lower aurical | 12 - 37 | 39.67 |
| MW-4 | Pumped | 4" Upper aurical | 2 - 8 | 40.39 |
| MW-2 | Pumped | 6" IAS pumped | 205 - 331 | 41.21 |
| MW-1 | Pumped | 12" UF pumped | 505 - 801 | 40.66 |
| MW-5 | 100' | 2" UF ob | 500 - 800 | 40.83 |
| MW-6 | 100' | 2" UF confiner | 470 - 475 | 41.05 |
| MW-8 | 100' | 2" IAS ob | 205 - 330 | 41.17 |
| MW-11 | 200' | 2" IAS ob | 205 - 330 | 40.73 |
| MW-10 | 200' | 2" Nocalite confiner | 340 - 350 | 40.64 |
| MW-12 | 200' | 2" Arcadia confiner | 180 - 180 | 40.42 |
| MW-13 | 400' | 2" IAS ob | 205 - 330 | 40.58 |
| MW-14 | 800' | 2" IAS ob | 205 - 331 | 38.68 |
| MW-7 | 100' | 2" Nocalite confiner | 340 - 350 | 41.14 |
| MW-9 | 100' | 2" Arcadia confiner | 180 - 180 | 41.06 |
| MW-15 | #2 100' | 2" Nocalite confiner | 340 - 350 | 38.84 |
| MW-16 | #2 100' | 2" IAS ob | 205 - 330 | 39.46 |
| MW-17 | #2 100' | 2" Arcadia confiner | 180 - 180 | 38.97 |



Note: MW-1 and MW-2 have flowing well head.



FIGURE 4. ROMP 9.5 IAS SITE
 Monitor Well Site Diagram



Typical Wire line Coring Installation

FIGURE 5. ROMP 9.5 IAS

Wire Line Coring Diagram

MW-3

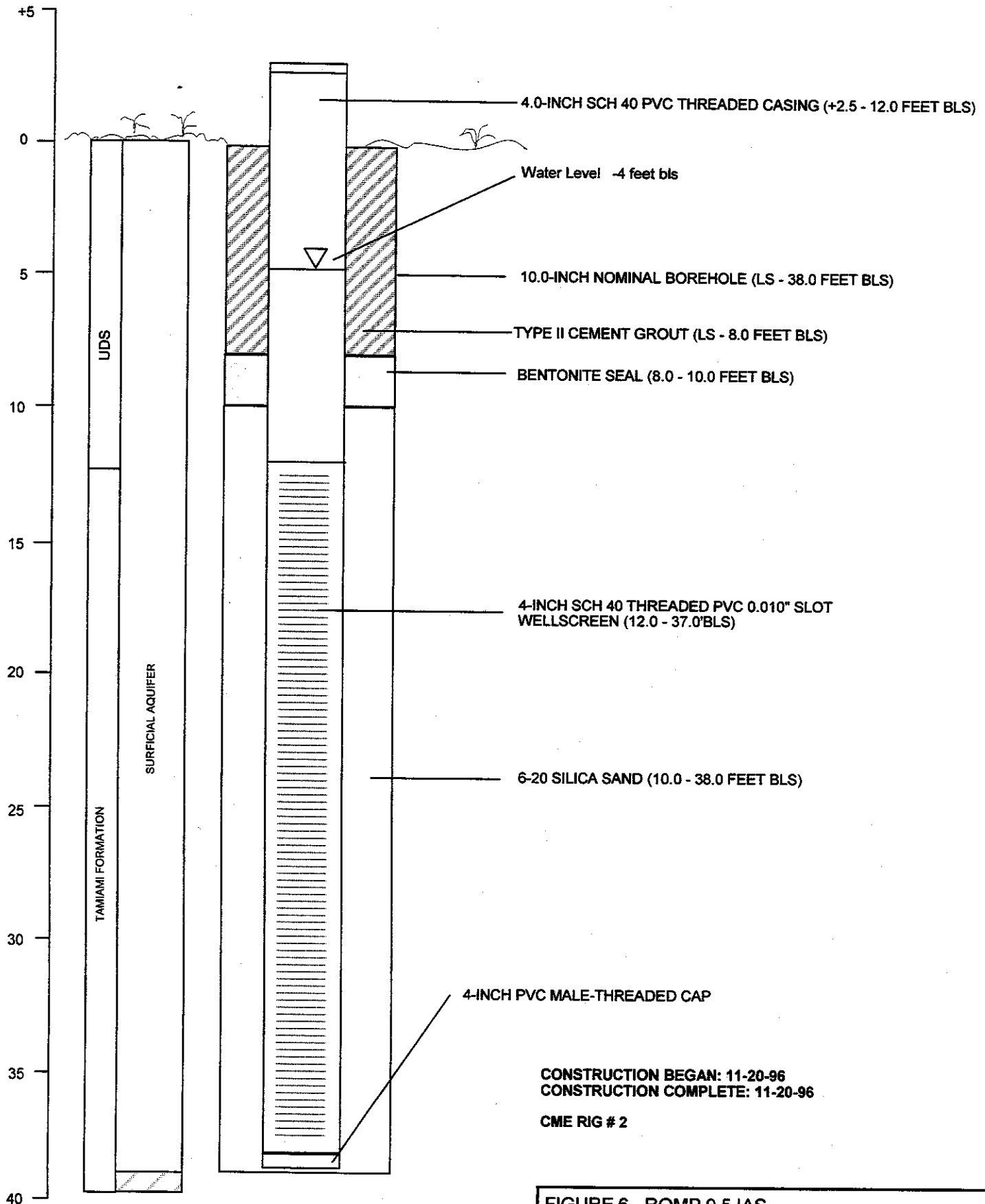


FIGURE 6. ROMP 9.5 IAS

Permanent Deep Surficial Well
(Former Auger Hole)

FEET

Corehole configuration
from 12-19-97 to 1-13-98

Corehole configuration
from 2-5-98 to 2-27-98

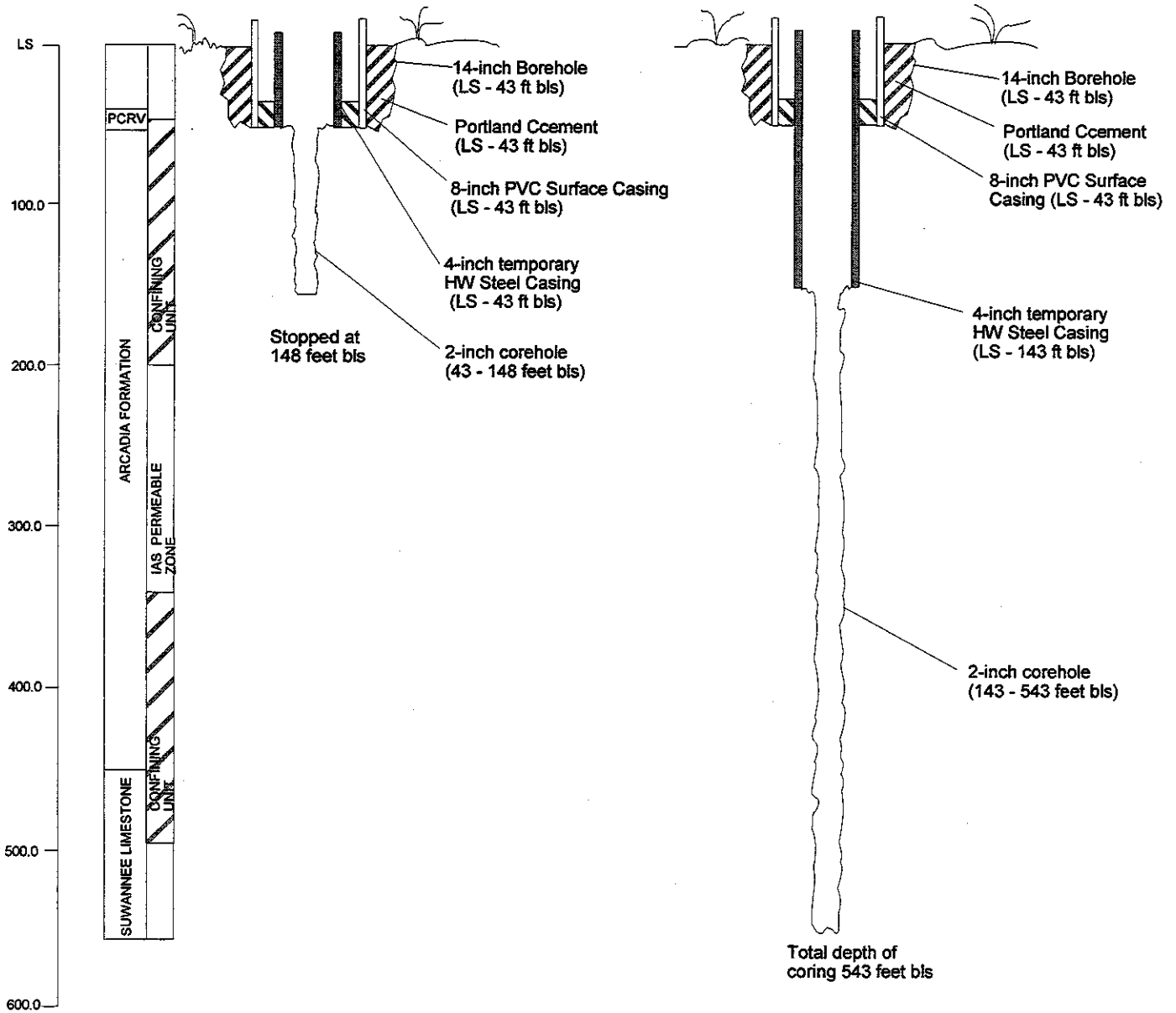


FIGURE 7. ROMP 9.5 IAS

Corehole Configuration During Coring

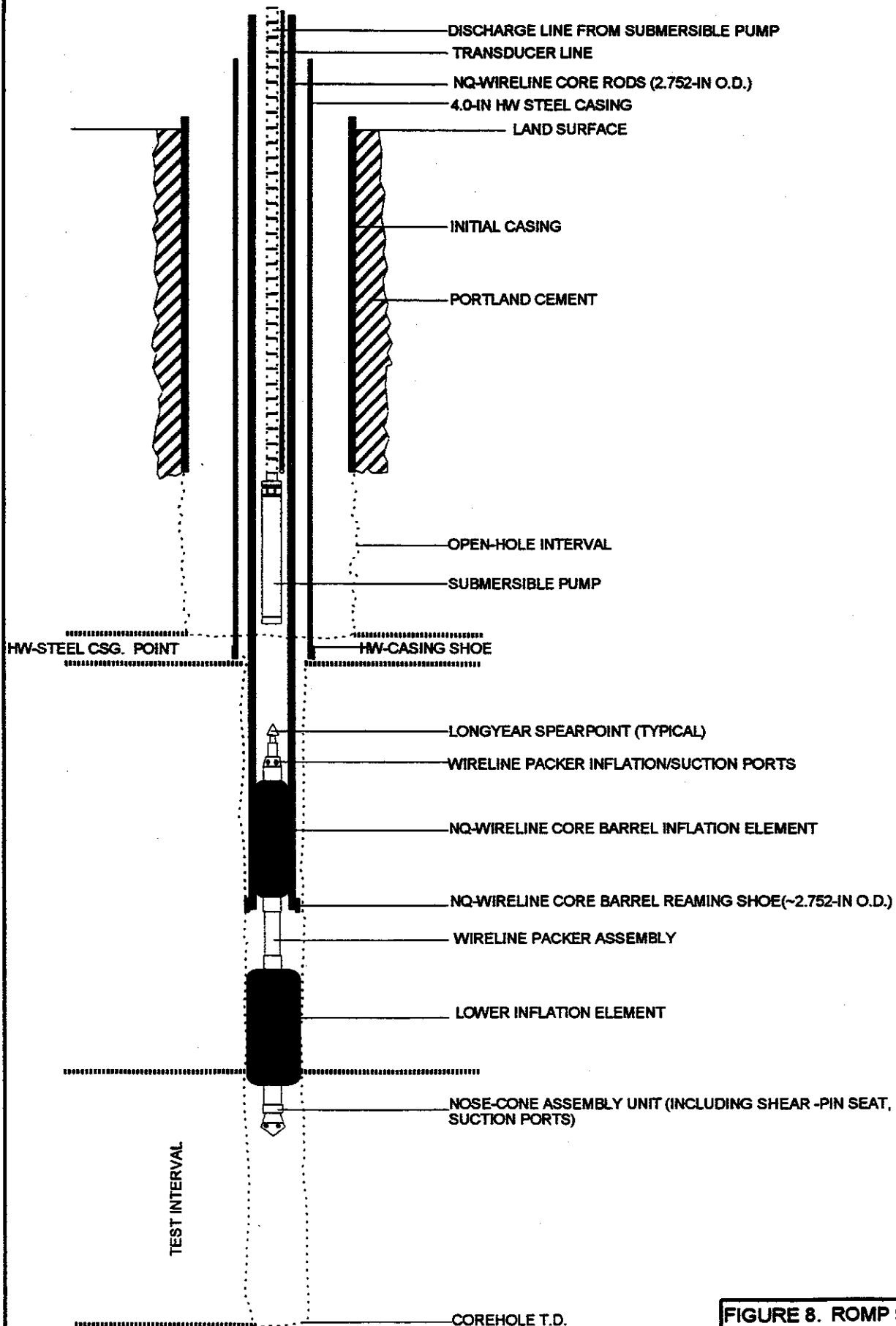


FIGURE 8. ROMP 9.5 IAS

Wire Line Packer Diagram

Land
Surface 85' NGVD

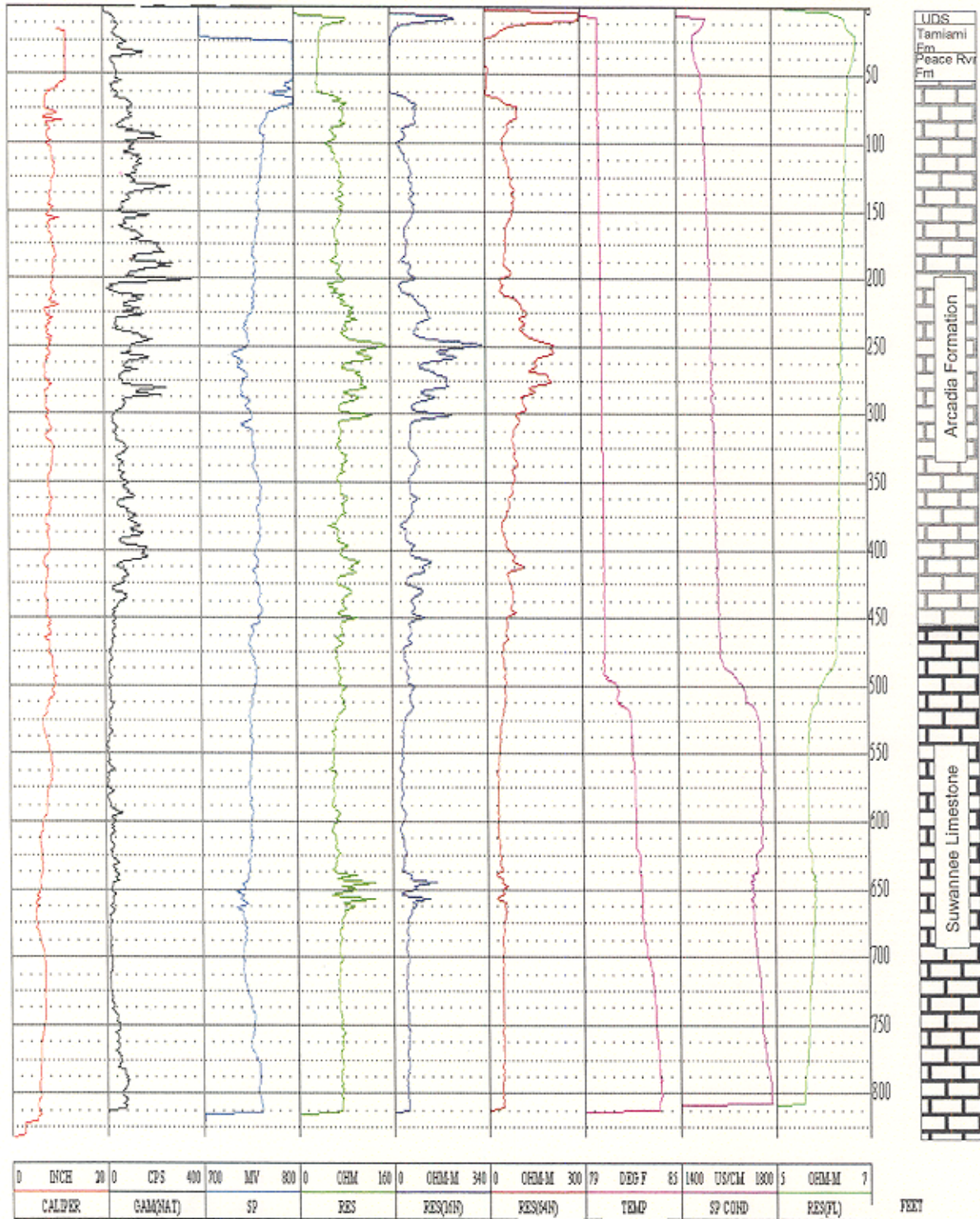


FIGURE 9. ROMP 9.5 IAS

Geophysical Logs Run During Coring

Elevation = 38' NGVD

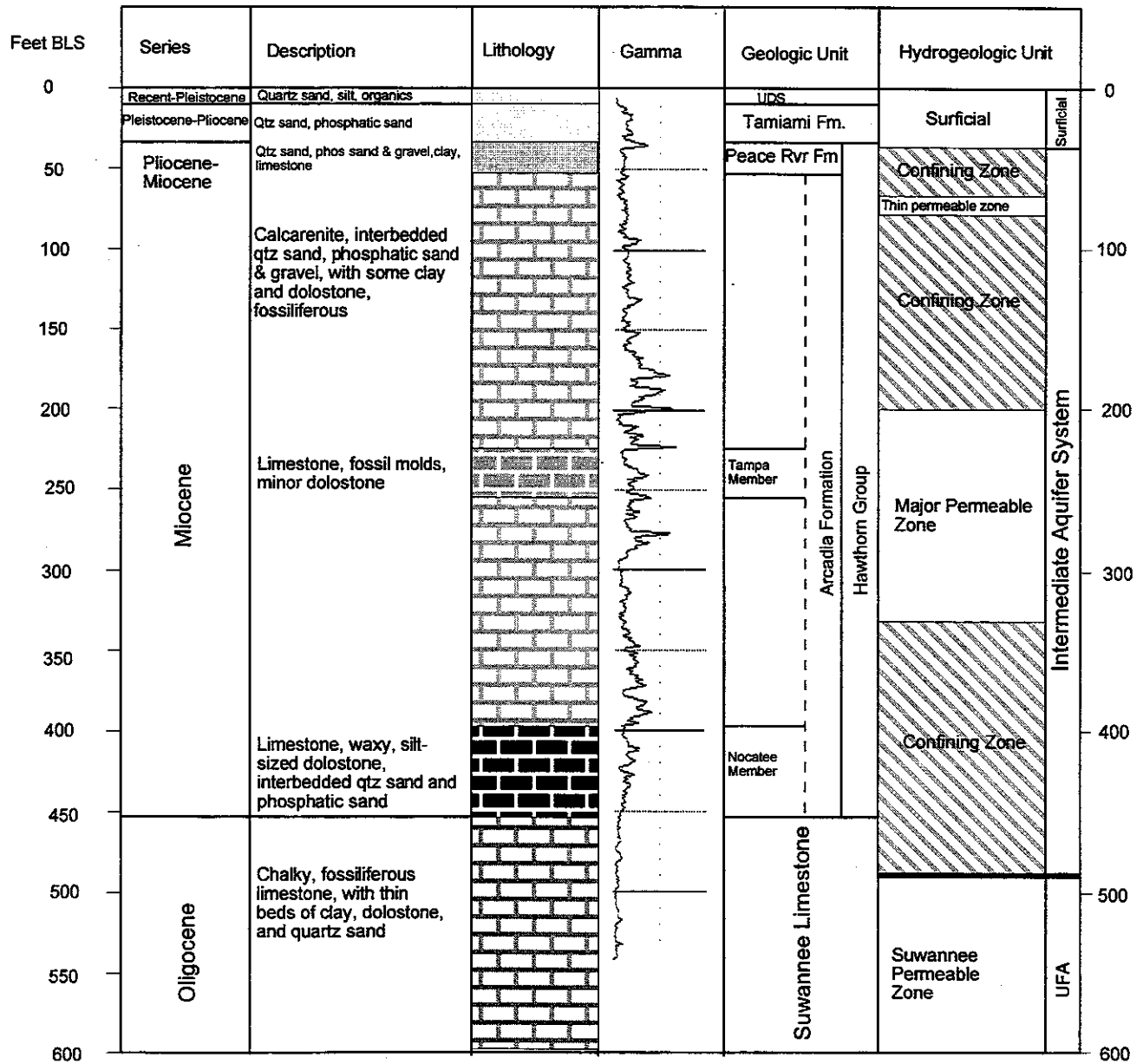


FIGURE 10. ROMP 9.5 IAS

ROMP 9.5 Hydrogeology

ROMP 9.5 Water Levels During Coring

November 1996 to March 1997

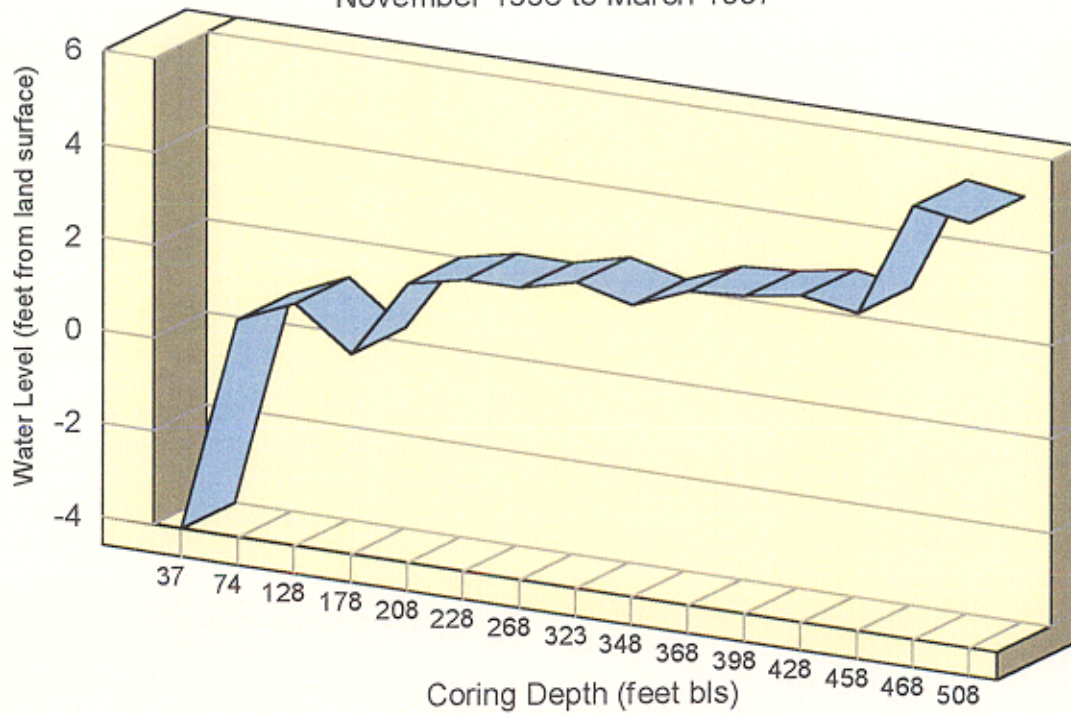
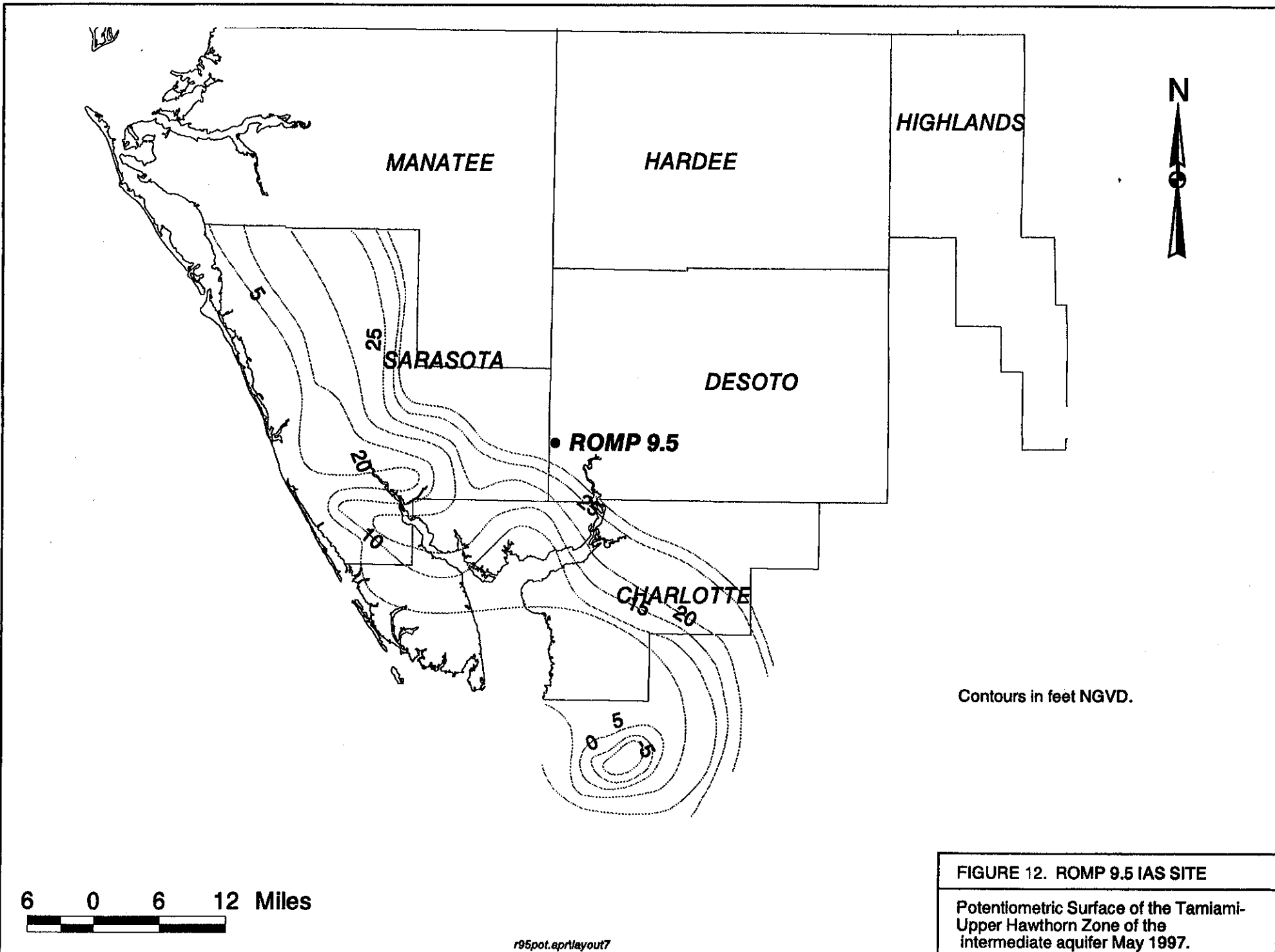
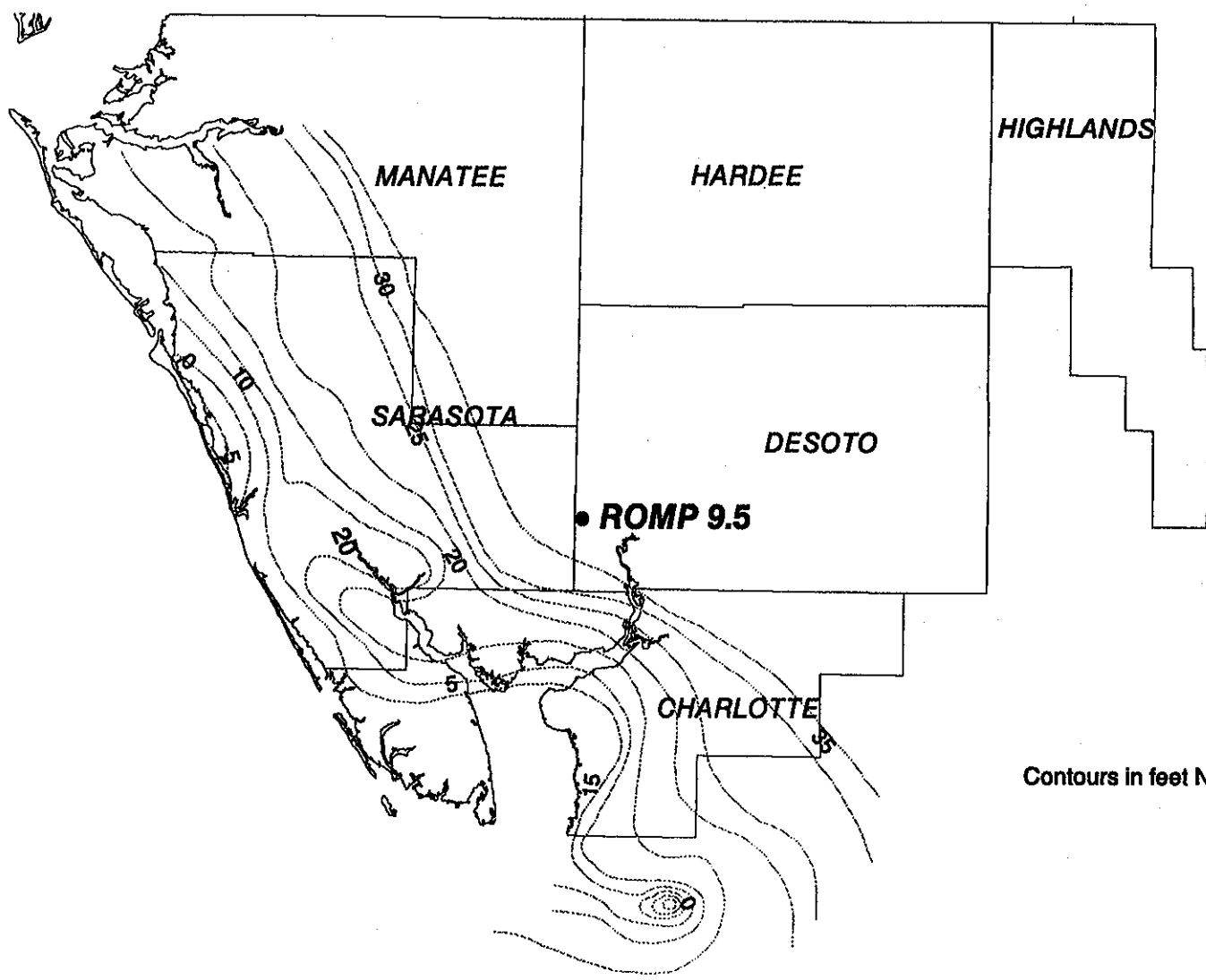


FIGURE 11. ROMP 9.5 IAS

Water Levels During Coring





Contours in feet NGVD.



FIGURE 13. ROMP 9.5 IAS
 Potentiometric Surface of the Tamiami-Upper Hawthorn Zone of the intermediate aquifer September 1997.

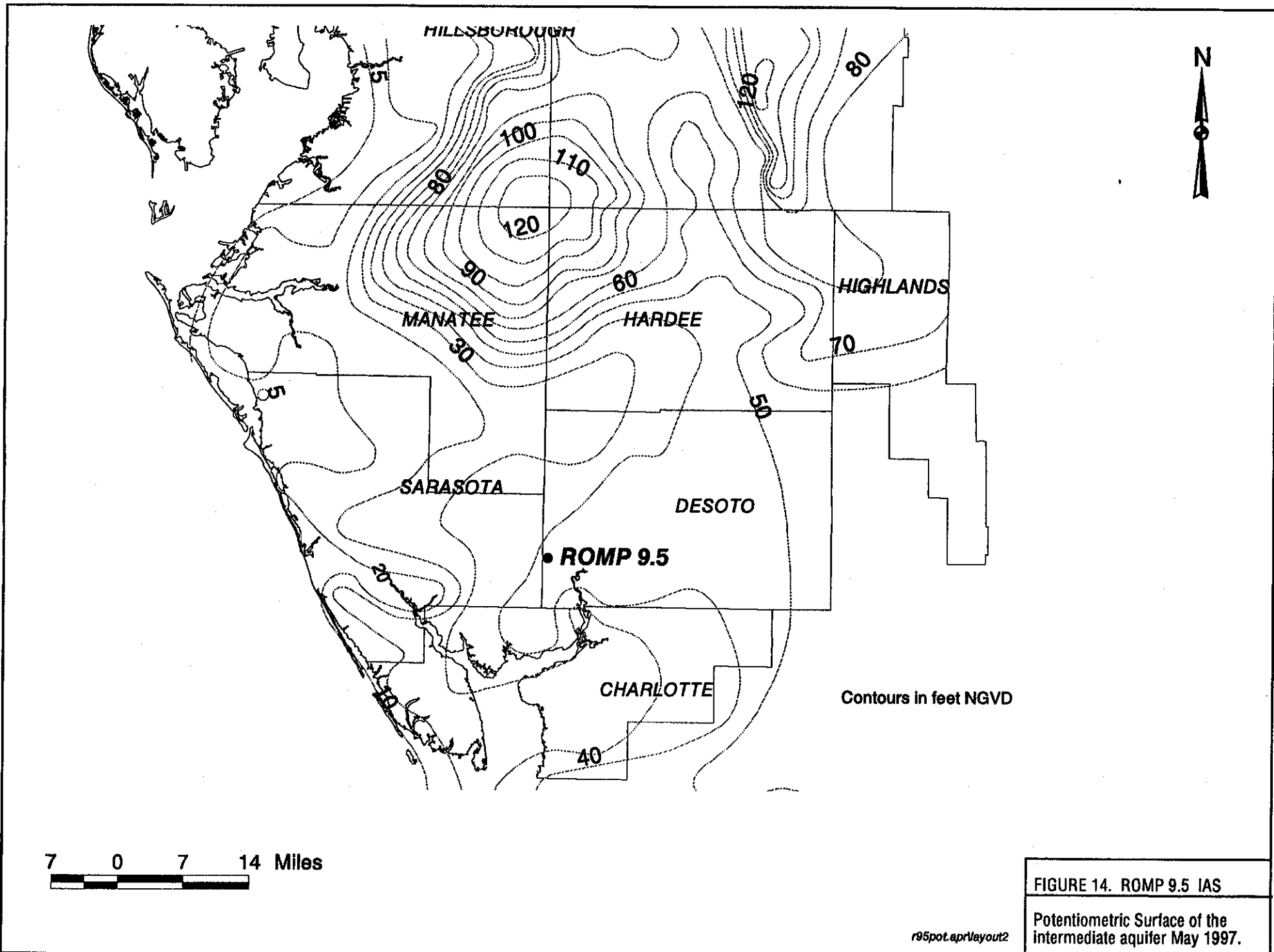
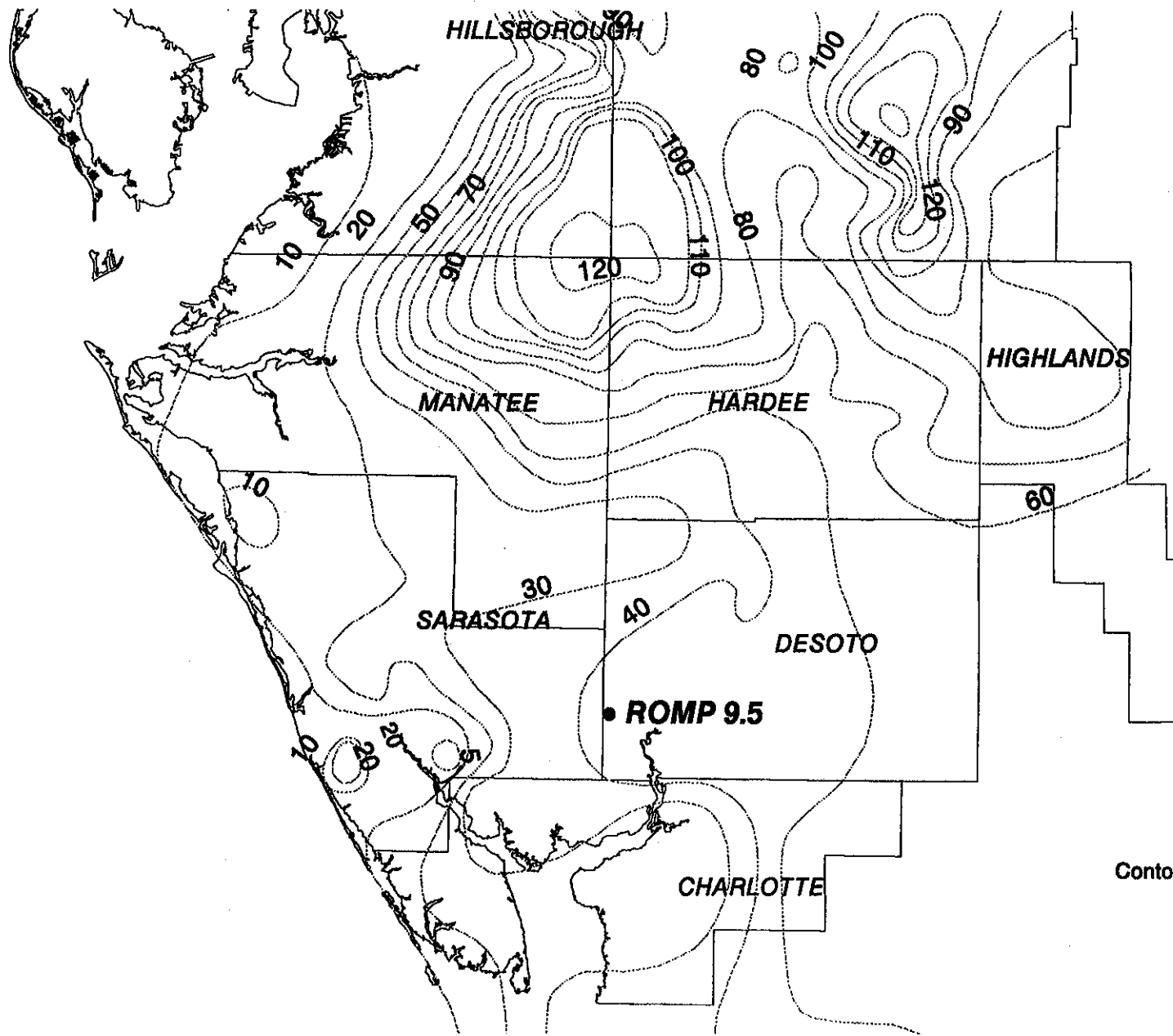


FIGURE 14. ROMP 9.5 IAS
Potentiometric Surface of the
intermediate aquifer May 1997.

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Contours in feet NGVD.

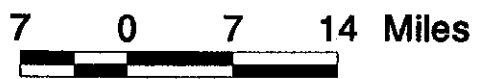
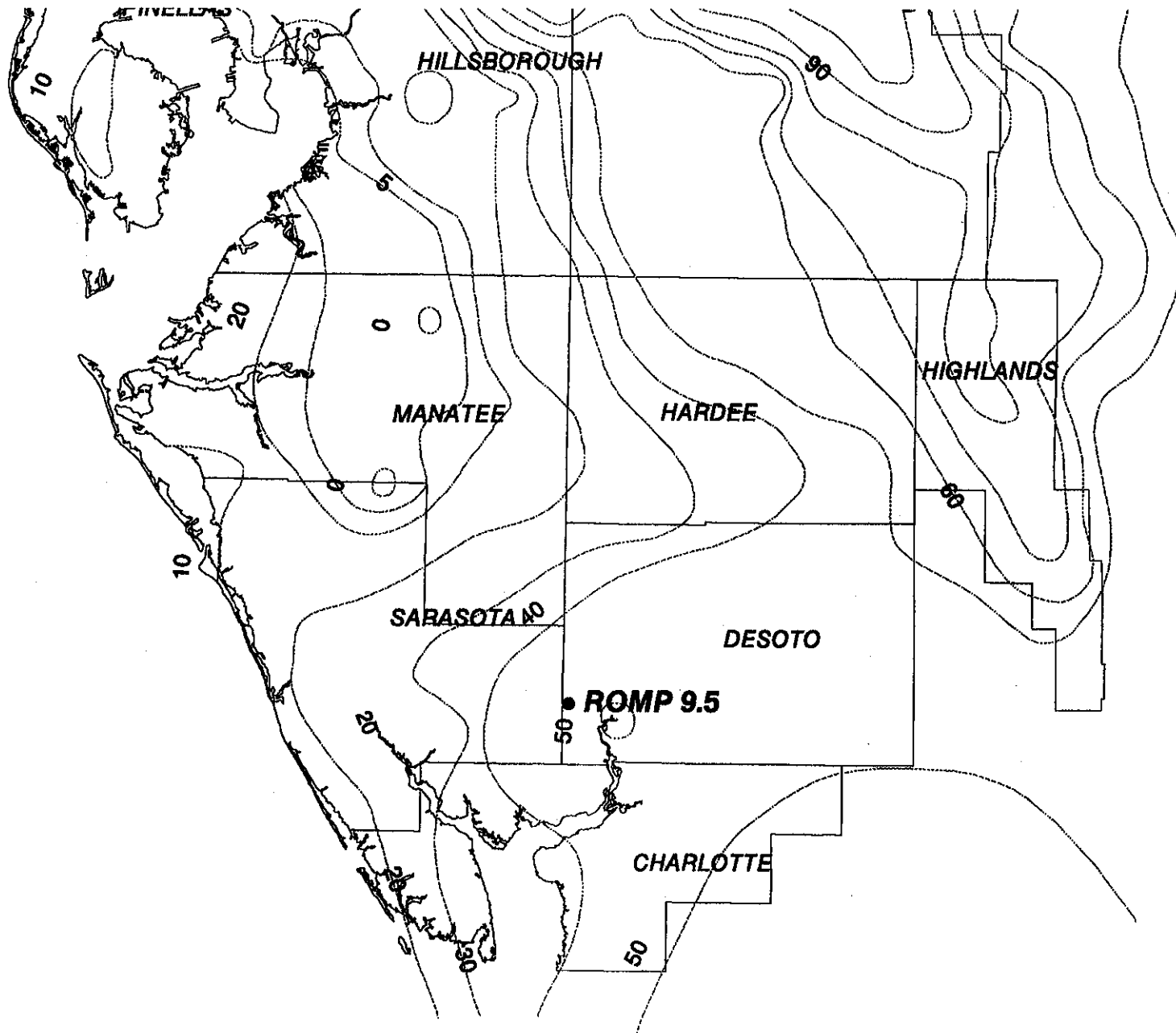


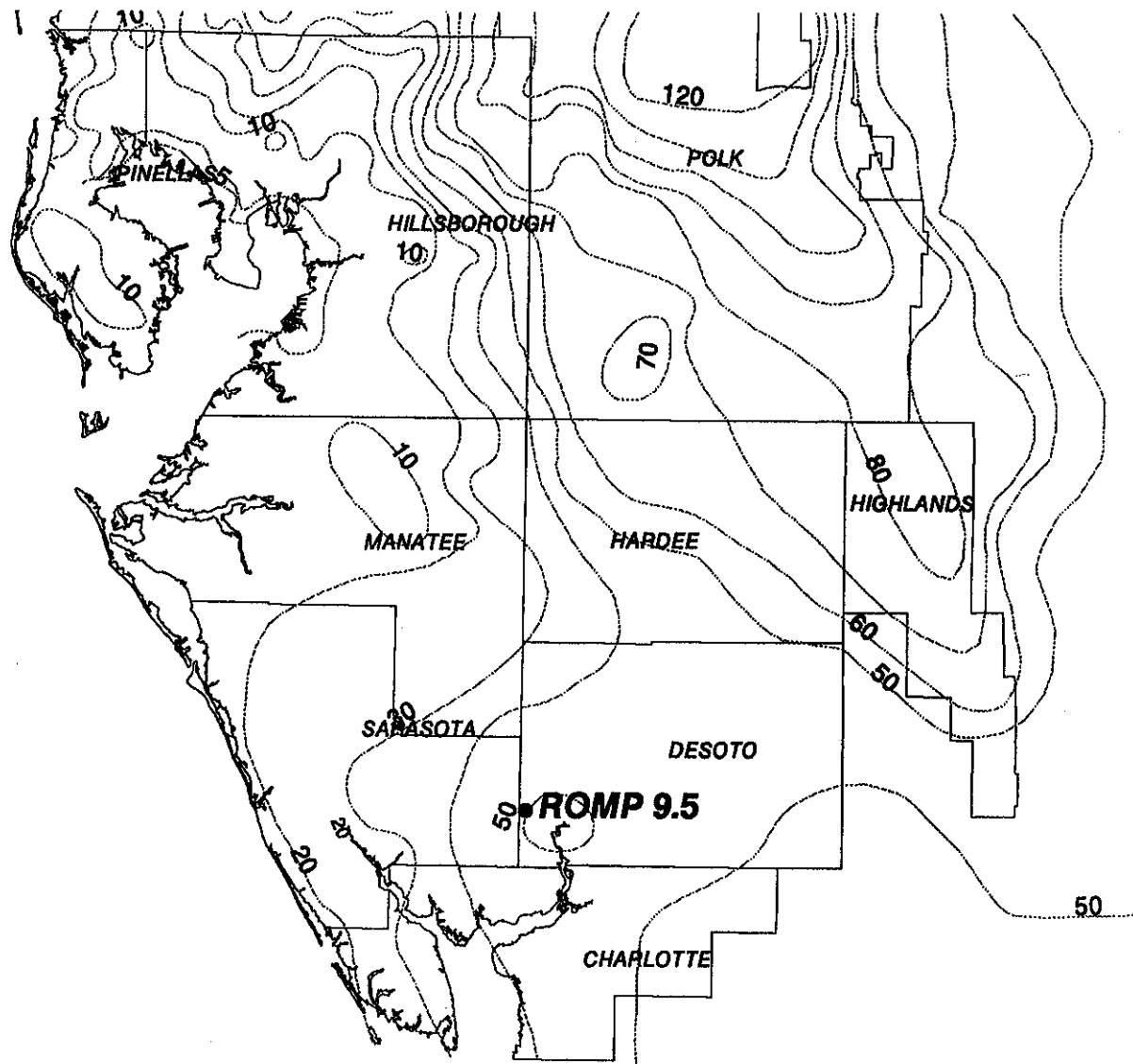
FIGURE 15. ROMP 9.5 IAS
 Potentiometric Surface of the intermediate aquifer September 1997.



Contours in feet NGVD.



FIGURE 16. ROMP 9.5 IAS
Potentiometric Surface of the
Upper Floridan Aquifer May 1997.



Contours in feet NGVD.

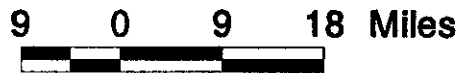


FIGURE 17. ROMP 9.5 IAS

Potentiometric Surface of the
Upper Floridan Aquifer September 1997.

ROMP 9.5 IAS SITE

Groundwater Samples Collected During Coring

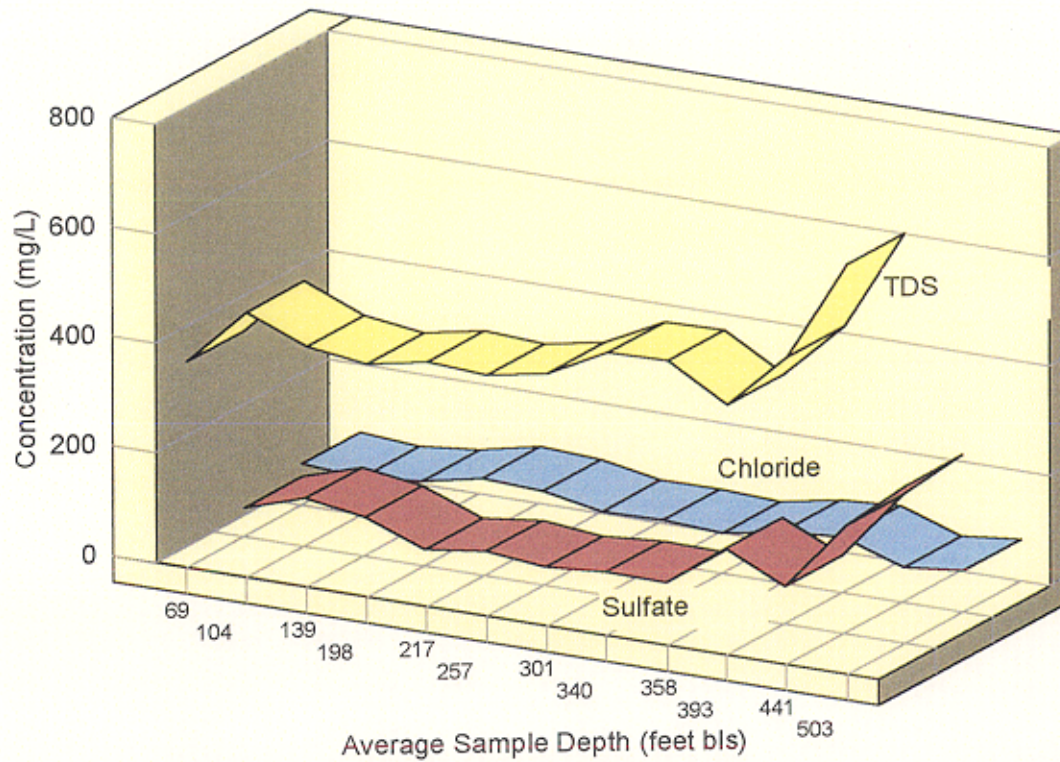


FIGURE 18. ROMP 9.5 IAS SITE

Chloride, Sulfate, and TDS Graph

TABLES

Table 1. Field Analyses of ROMP 9.5 Packer Samples Collected During Coring

| Date (M/D/Y) | Time | Depth | Water Level (~FT ALS) | Specific Cond (umohs) | H2O Temp (celcius) | H2O Density | CL (mg/l) (hach) | SO4 (mg/l) (hach) | pH | Notes |
|-----------------|------|-------|-----------------------------|-----------------------------|--------------------------|----------------|------------------------|-------------------------|----|-------|
|-----------------|------|-------|-----------------------------|-----------------------------|--------------------------|----------------|------------------------|-------------------------|----|-------|

| | | | | | | | | | | |
|----------|------|---------|----|-----|------|----|-----|-----|----|---|
| 12/19/96 | 1115 | 61-74 | NA | 682 | 23.5 | NA | 140 | 100 | NA | Collected from 2" pump discharge during packer test |
| 01/08/97 | 1445 | 80-128 | NA | 740 | 24.9 | NA | 120 | 200 | NA | Collected from 2" pump discharge during packer test |
| 01/13/97 | 1806 | 129-148 | NA | NA | NA | NA | NA | NA | NA | Collected from 2" pump discharge during packer test |

* All concentrations reported in mg/l unless otherwise noted

4" Steel casing 0-43' bis

NA - Not Analyzed

| | | | | | | | | | | |
|----------|------|---------|------|------|------|----|-----|-----|------|---|
| 02/05/97 | 1145 | 188-208 | NA | NA | 24.7 | NA | 160 | 55 | NA | Collected from 2" pump discharge during packer test |
| 02/05/97 | 1750 | 205-228 | 2.20 | NA | 25.6 | NA | 160 | 65 | NA | Collected from 2" pump discharge during packer test |
| 02/10/97 | 1545 | 245-268 | 2.82 | 762 | 24.7 | NA | 160 | 65 | 7.69 | Collected from 2" pump discharge during packer test |
| 02/11/97 | 1400 | 293-308 | 2.20 | 783 | 24.7 | NA | NA | NA | 7.64 | Collected from 2" pump discharge during packer test |
| 02/12/97 | 1510 | 331-348 | NA | 740 | 25.3 | NA | 160 | 70 | 7.57 | Collected from 2" pump discharge during packer test |
| 02/17/97 | 1510 | 348-368 | 2.60 | 780 | 26.5 | NA | 140 | 150 | 7.57 | Collected from 2" pump discharge during packer test |
| 02/18/97 | 1540 | 388-398 | 2.88 | 740 | 24.9 | NA | 160 | 80 | 7.63 | Collected from 2" pump discharge during packer test |
| 02/26/97 | 815 | 413-468 | 4.19 | 870 | 25.5 | NA | 140 | 200 | 7.75 | Collected from 2" pump discharge during packer test |
| 02/27/97 | 1100 | 493-513 | 5.20 | 1070 | 26.2 | NA | 160 | 300 | 8.05 | Collected from 2" pump discharge during packer test |

* All concentrations reported in mg/l unless otherwise noted

4" Steel casing 0-143' bis

NA - Not Analyzed

Table 2. Laboratory Analyses of ROMP 9.5 Packer Samples Collected During Coring

| Date (M/D/Y) | Time | Depth | Water Level (ft bls) | Specific Cond. (umohs) | Water Density | CL | SO4 | pH | Br | TDS | Ca | Mg | Bicarb as (CaCO3) | K | Na | SI | Fe (ug/l) | Total Hardness (CaCO3) | ION % |
|--------------|------|---------|----------------------|------------------------|---------------|----|-----|-----|-----|-----|-----|----|-------------------|------|----|-----|-----------|------------------------|-------|
| 12/19/96 | 1115 | 61-77 | NA | 664 | 1.0005 | 75 | 51 | 9.9 | 0.2 | 374 | 6.5 | 15 | 151 | 49.0 | 67 | 7.8 | 0 | 78 | -1.99 |
| 01/08/97 | 1445 | 80-128 | NA | 747 | 1.0005 | 68 | 86 | 7.6 | 0.0 | 483 | 86 | 22 | 232 | 1.5 | 40 | 10 | 118 | 305 | -2.77 |
| 01/13/97 | 1806 | 129-148 | NA | 750 | 1.0004 | 78 | 70 | 7.4 | 0.2 | 438 | 62 | 30 | 205 | 1.8 | 43 | 9.3 | 276 | 278 | -1.55 |

* All concentrations reported in mg/l unless otherwise noted

4" Steel casing 0-43' bls

NA - Not Analyzed

| | | | | | | | | | | | | | | | | | | | |
|----------|------|---------|------|------|--------|-----|-----|-----|-----|-----|----|----|-----|-----|----|------|-----|-----|-------|
| 02/05/97 | 1145 | 188-208 | NA | 717 | 1.0004 | 102 | 29 | 7.9 | 0.3 | 423 | 40 | 28 | 187 | 2.4 | 58 | 13.6 | 200 | 215 | -1.69 |
| 02/05/97 | 1750 | 205-228 | 2.20 | 740 | 1.0004 | 96 | 43 | 7.8 | 0.3 | 445 | 44 | 30 | 195 | 2.4 | 58 | 11.2 | 32 | 233 | -1.15 |
| 02/10/97 | 1545 | 245-268 | 2.82 | 753 | 1.0004 | 77 | 33 | 7.8 | 0.2 | 438 | 39 | 31 | 194 | 2.7 | 60 | 10.2 | 231 | 225 | 3.91 |
| 02/11/97 | 1400 | 293-308 | 2.2 | 777 | 1.0004 | 78 | 41 | 7.8 | 0.2 | 459 | 44 | 32 | 198 | 2.6 | 60 | 10 | 54 | 242 | 4 |
| 02/12/97 | 1510 | 331-348 | NA | 839 | 1.0005 | 73 | 40 | 7.8 | 0.2 | 515 | 41 | 35 | 250 | 3.5 | 76 | 10.8 | 458 | 247 | 3.52 |
| 02/17/97 | 1510 | 348-368 | 2.80 | 827 | 1.0005 | 93 | 119 | 8.0 | 0.3 | 518 | 47 | 34 | 185 | 3.7 | 69 | 7.5 | 722 | 257 | -2.34 |
| 02/18/97 | 1540 | 368-398 | 2.88 | 791 | 1.0005 | 101 | 68 | 7.8 | 0.4 | 454 | 48 | 32 | 197 | 3.0 | 59 | 9.4 | 603 | 252 | -2.62 |
| 02/26/97 | 815 | 413-468 | 4.19 | 903 | 1.0005 | 63 | 198 | 7.9 | 0.2 | 561 | 58 | 37 | 145 | 4.5 | 69 | 20.5 | 570 | 297 | 2.57 |
| 02/27/97 | 1100 | 483-513 | 5.2 | 1131 | 1.0007 | 75 | 286 | 7.8 | 0.2 | 748 | 96 | 48 | 181 | 4.8 | 61 | 13 | 674 | 437 | 1.98 |

* All concentrations reported in mg/l unless otherwise noted

4" Steel casing 0-143' bls

NA - Not Analyzed

Table 3. Daily Water Level Measurements During Coring

| Date | Time | Casing Depth (feet bls) | Core Hole Depth (feet bls) | Core Hole Water Level (feet above land surface) |
|-------------|------|----------------------------|-------------------------------|--|
| 20-Nov-1996 | 1450 | 43 | 37 | -4.00 bls |
| 6-Jan-1997 | 1058 | 43 | 74 | 0.66 |
| 7-Jan-1997 | 730 | 43 | 128 | 1.20 |
| 4-Feb-1997 | 1000 | 143 | 178 | 0.28 |
| 5-Feb-1997 | 930 | 143 | 208 | 1.99 |
| 6-Feb-1997 | 730 | 143 | 228 | 2.25 |
| 10-Feb-1997 | 810 | 143 | 268 | 2.25 |
| 12-Feb-1997 | 800 | 143 | 323 | 2.55 |
| 13-Feb-1997 | 715 | 143 | 348 | 2.25 |
| 18-Feb-1997 | 715 | 143 | 368 | 2.72 |
| 19-Feb-1997 | 750 | 143 | 398 | 2.80 |
| 20-Feb-1997 | 730 | 143 | 428 | 3.00 |
| 24-Feb-1997 | 1050 | 143 | 458 | 2.80 |
| 26-Feb-1997 | 1030 | 143 | 468 | 5.30 |
| 3-Mar-1997 | 945 | 143 | 508 | 5.11 |

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Table 4. Results of Core Hole Packer Testing at ROMP 9.5 IAS

| Test interval (feet below land surface) | Stratigraphic Unit | Hydrogeologic Unit | Discharge (gpm) | Drawdown (feet) | Specific Capacity (gpm/ft) | Time until pumping stabilized (min) | Comments |
|---|-------------------------|--------------------------|--------------------|--------------------|----------------------------------|---|------------------------------------|
| 61-74 | Arcadia Fm | IAS upper permeable zone | 5 | 67 | 0.07 | 20 | Open hole interval no packer. |
| 80-128 | Arcadia Fm | IAS confining unit | 5 | 31 | 0.16 | 60 | Annulus drawdown -1.6 ft. |
| 128-148 | Arcadia Fm | IAS confining unit | 5 | 50 | 0.10 | 10 | |
| 148-168 | Arcadia Fm | IAS confining unit | 1 | 90 | 0.01 | n/a | Low perm zone but data unreliable. |
| 183-188 | Arcadia Fm | IAS confining unit | 6 | n/a | n/a | n/a | Water level drew down to pump. |
| 188-208 | Arcadia Fm | IAS confining unit | 5 | 70 | 0.07 | 20 | Annulus drawdown -1.6 ft. |
| 205-228 | Arcadia/Tampa Mbr | IAS lower permeable zone | 5 | 15 | 0.33 | 10 | Permeable zone. |
| 245-268 | Tampa Mbr/Arcadia | IAS lower permeable zone | 4 | 14 | 0.28 | 10 | Permeable zone. |
| 293-308 | Arcadia Fm | IAS lower permeable zone | 5 | 10 | 0.50 | 8 | Permeable zone. |
| 331-348 | Arcadia Fm | IAS confining unit | 5 | 25 | 0.20 | 8 | |
| 348-368 | Arcadia Fm | IAS confining unit | 3 | 140 | 0.02 | 50 | |
| 388-398 | Arcadia Fm | IAS confining unit | 3 | 108 | 0.02 | 50 | |
| 413-468 | Nocatee Mbr/Suwannee Lm | IAS confining unit | 4 | 42 | 0.09 | 20 | |
| 448-468 | Suwannee Lm | IAS confining unit | 5 | 42 | 0.11 | 15 | |
| 493-513 | Suwannee Lm | UFA permeable zone | 5 | 9 | 0.55 | 5 | Permeable zone. |

permeameter.wb2

Table 5. ROMP 9.5 Falling Head Permeameter Results

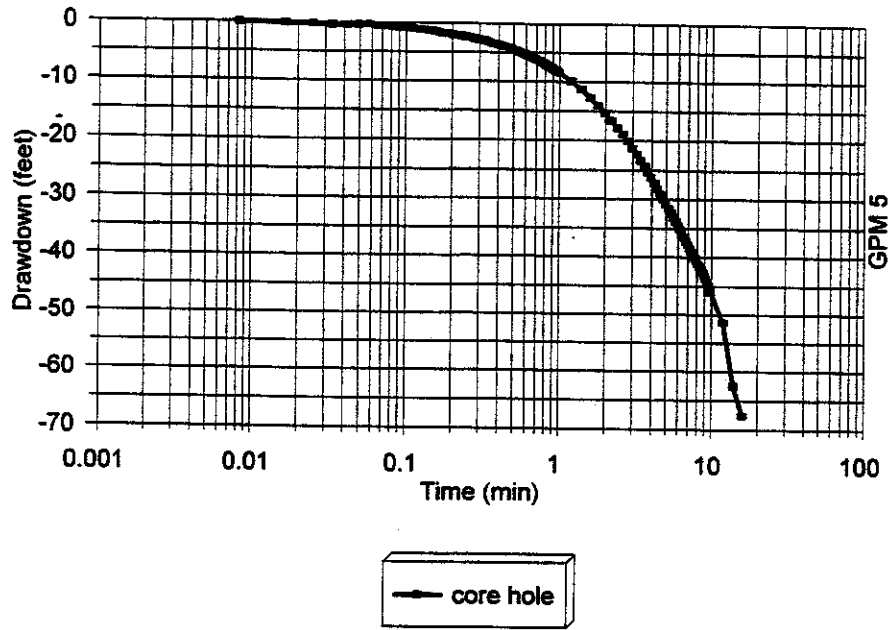
| Sample Depth (feet b/s) | Formation | Lithology | Aquifer | Vertical Hydraulic Conductivity Average (feet/day) | Porosity (%) |
|----------------------------|-----------|-------------------------|----------------------|---|-----------------|
| 64.0 | Arcadia | limestone | IAS (permeable zone) | 9.42×10^{-4} | 33 |
| 100.7 | Arcadia | limestone & dolostone | IAS (confining zone) | not run | 52 |
| 148.7 | Arcadia | dolostone | IAS (confining zone) | 1.67×10^{-4} | 40 |
| 197.5 | Arcadia | dolostone & phos sand | IAS (confining zone) | 1.68×10^{-4} | 29 |
| 257.6 | Arcadia | fossiliferous limestone | IAS (permeable zone) | 1.75×10^{-4} | 28 |
| 337.3 | Arcadia | sandy limestone | IAS (confining zone) | 2.47×10^{-2} | 34 |
| 361.5 | Arcadia | limestone | IAS (confining zone) | 3.09×10^{-2} | 39 |
| 388.3 | Arcadia | limestone | IAS (confining zone) | 1.12×10^{-4} | 33 |
| 464.2 | Suwannee | limestone | IAS (confining zone) | 3.81×10^{-2} | 38 |
| 500.8 | Suwannee | fossiliferous limestone | UFA (permeable zone) | 3.33×10^{-4} | 33 |

Testing performed by Florida Geological Survey

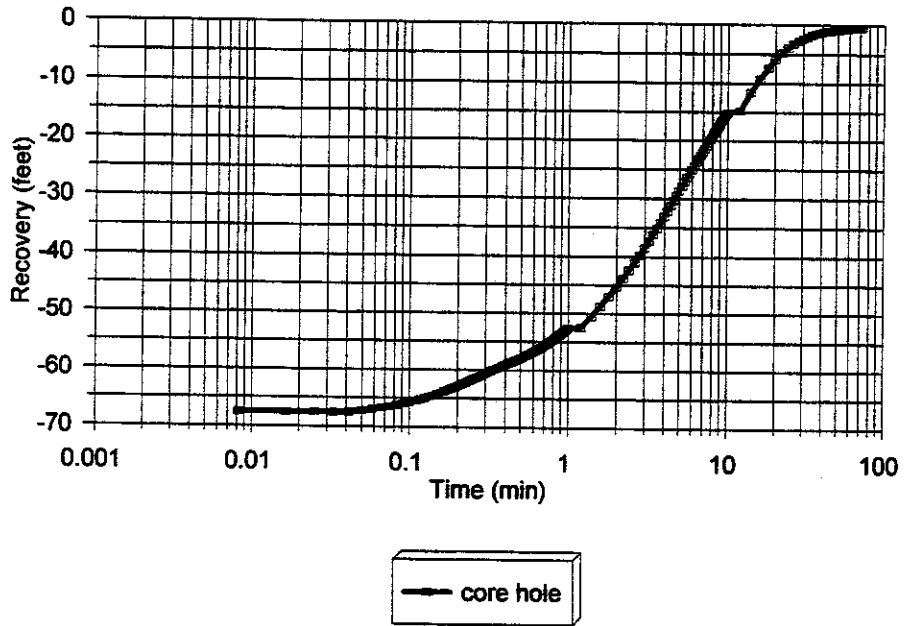
romp9.5\tables\permeameter.wb3

APPENDIX A

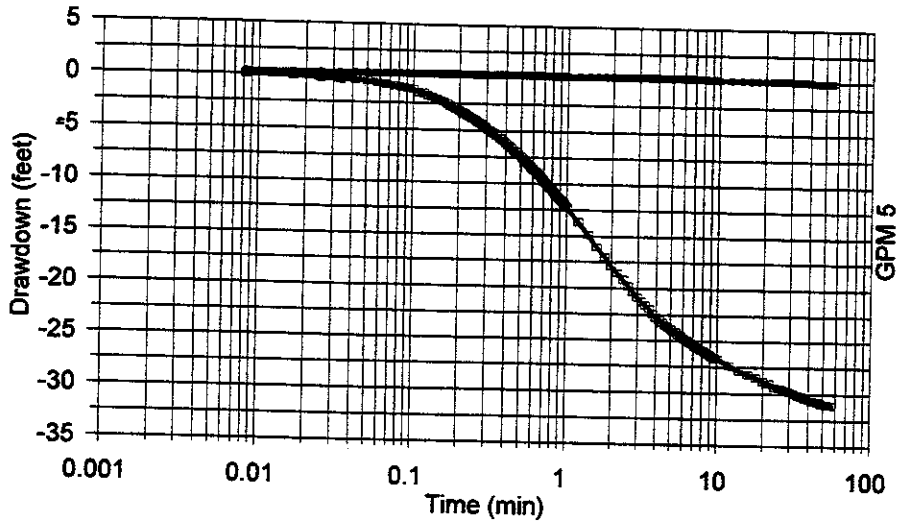
ROMP 9.5 Core Hole Test
Arcadia Fm (61-77 Ft Bls)



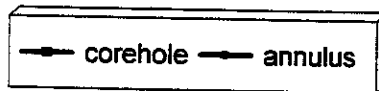
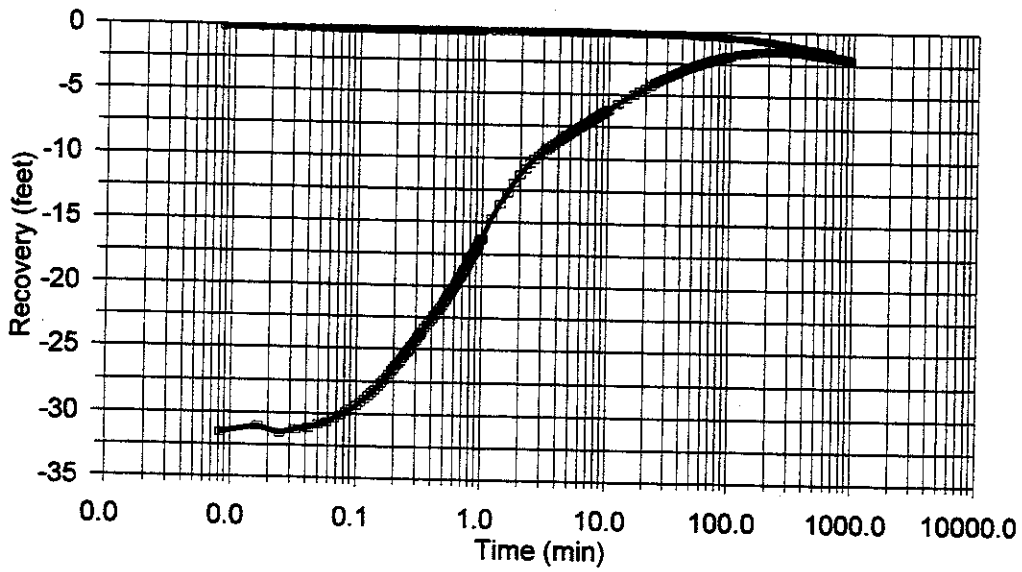
ROMP 9.5 Core Hole Test
Arcadia Fm (61-77 Ft Bls)



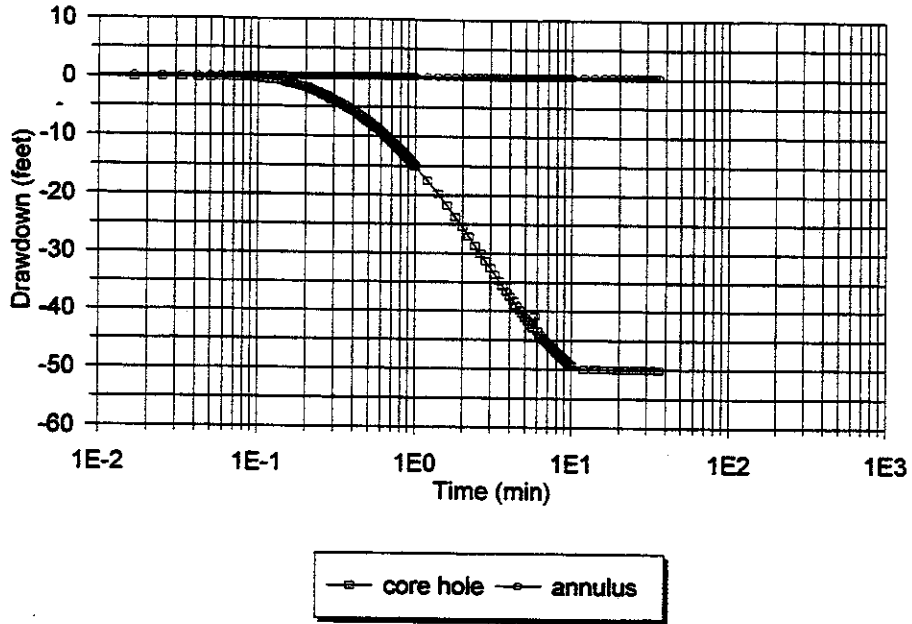
ROMP 9.5 Core Hole Packer Test
 Arcadia Fm (80-128 ft bls)



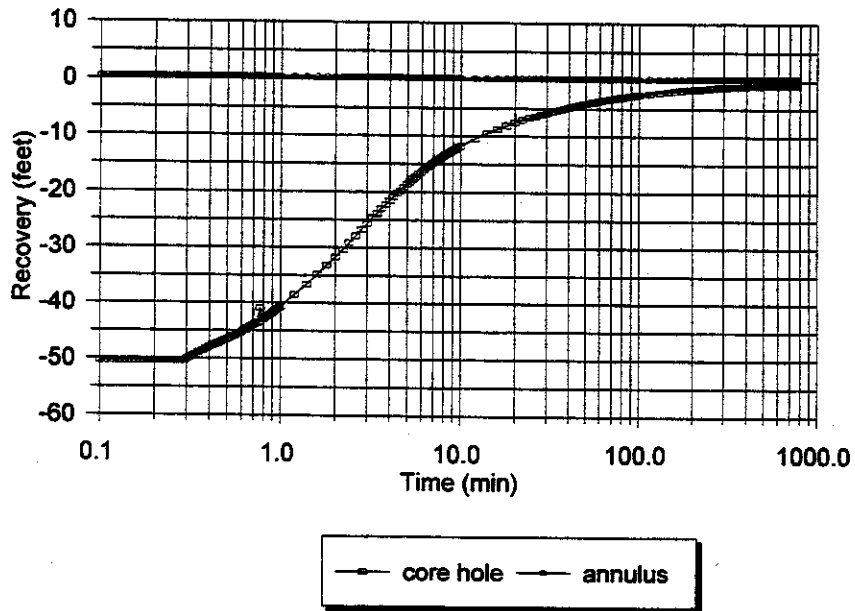
ROMP 9.5 Core Hole Packer Test
 Arcadia Fm (80-128 Ft Bls)



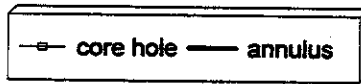
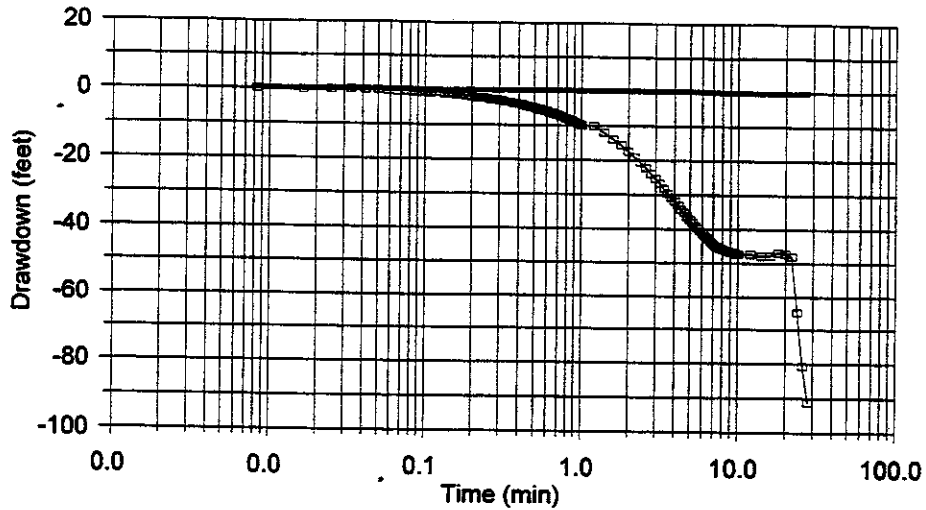
ROMP 9.5 Core Hole Packer Test
Arcadia Fm (128-148 Ft Bls)



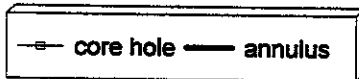
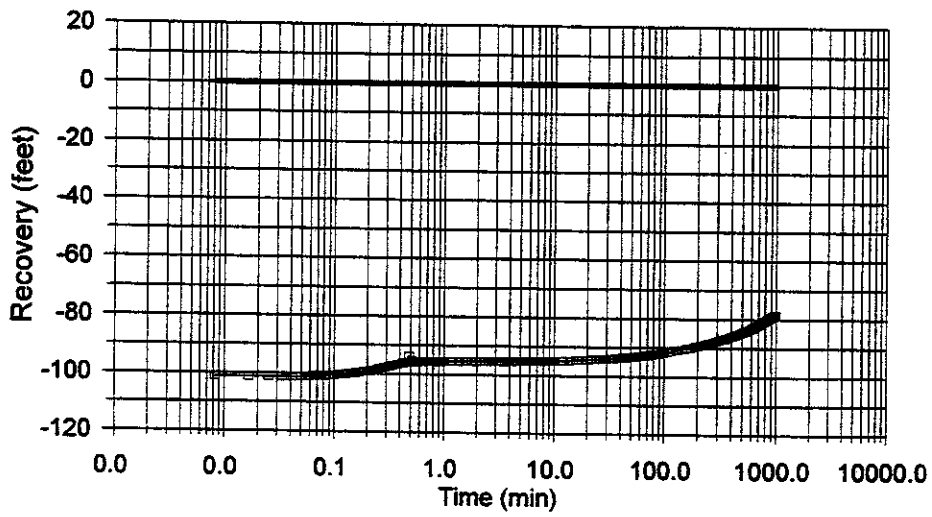
ROMP 9.5 Core Hole Packer Test
Arcadia Fm (128-148 ft bls)



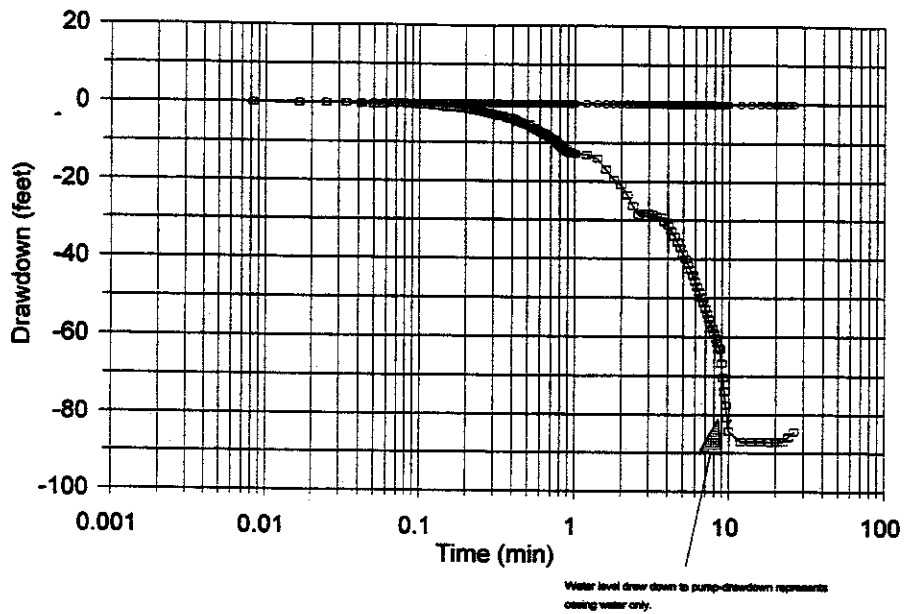
ROMP 9.5 Core Hole Packer Test
Arcadia Fm (148-168 ft bls)



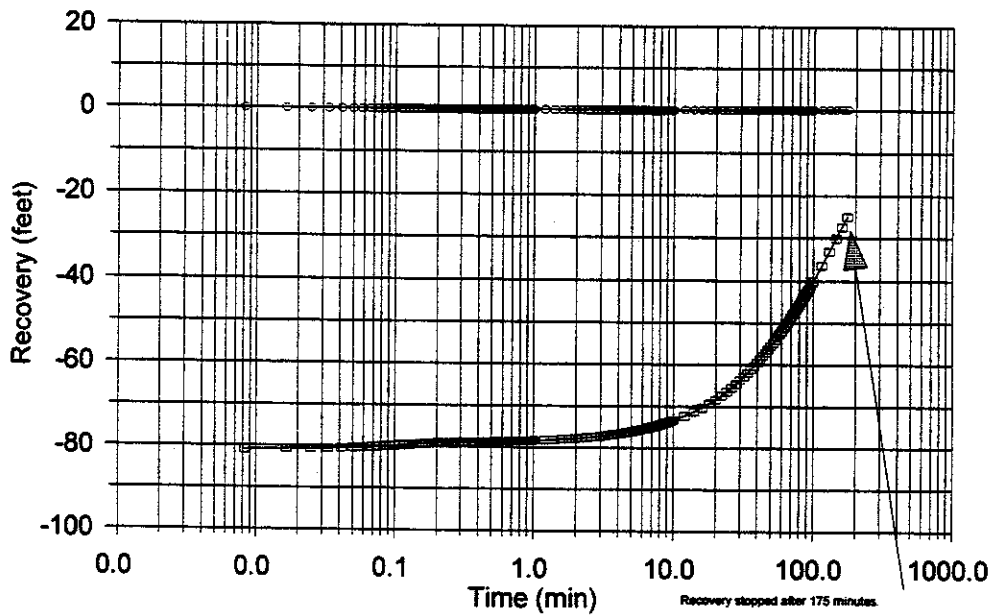
ROMP 9.5 Core Hole Packer Test
Arcadai Fm (148-168 ft bls)



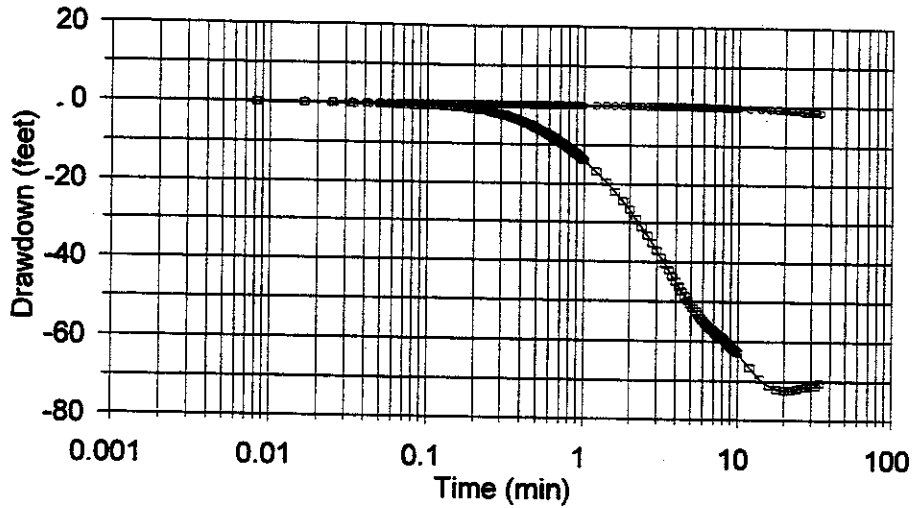
ROMP 9.5 Core Hole Test
Arcadia Fm (183-188 ft bls)



ROMP 9.5 Core Hole Test
Arcadia (183-188) ft bls

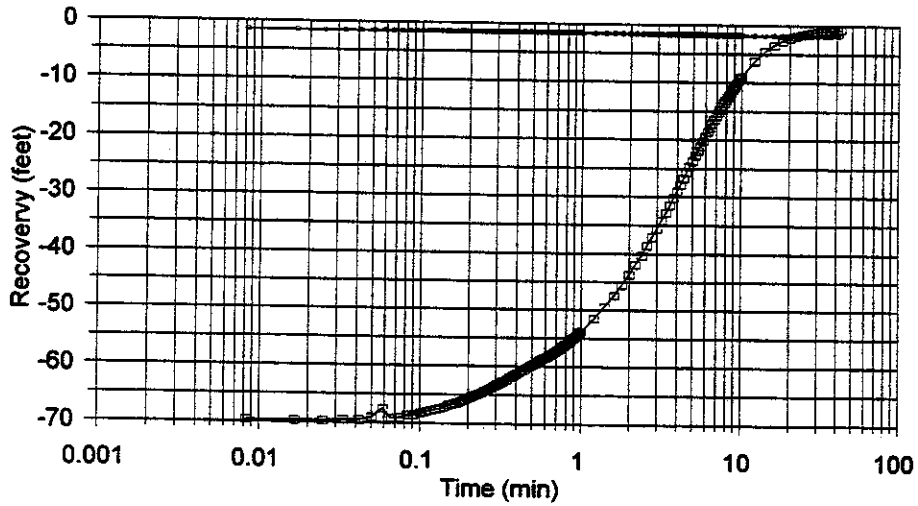


ROMP 9.5 Core Hole Packer Test
Arcadia Fm (188-208 ft bls)



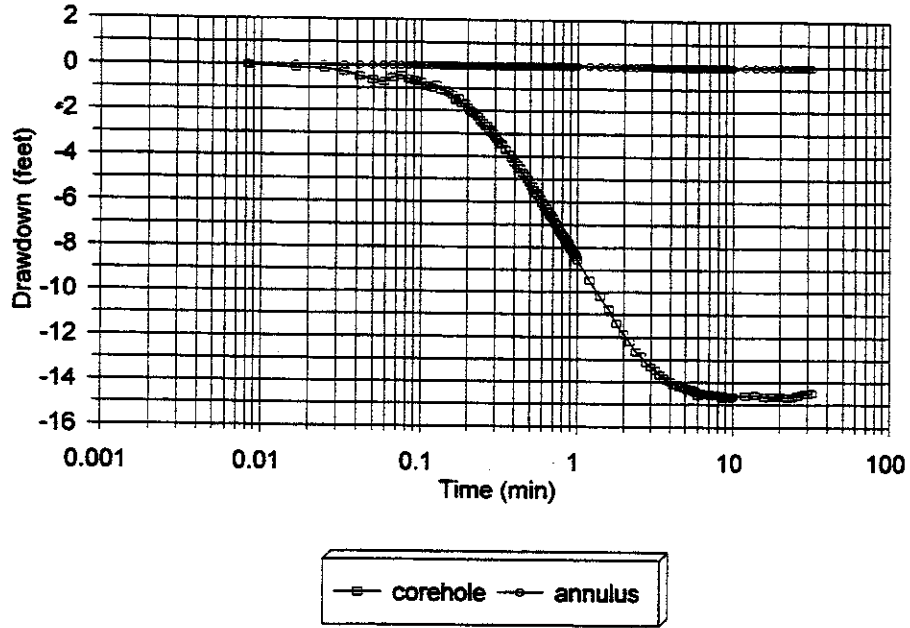
—□— Corehole —○— Annulus

ROMP 9.5 Core Hole Packer Test
Arcadia Fm (188-208 ft bls)

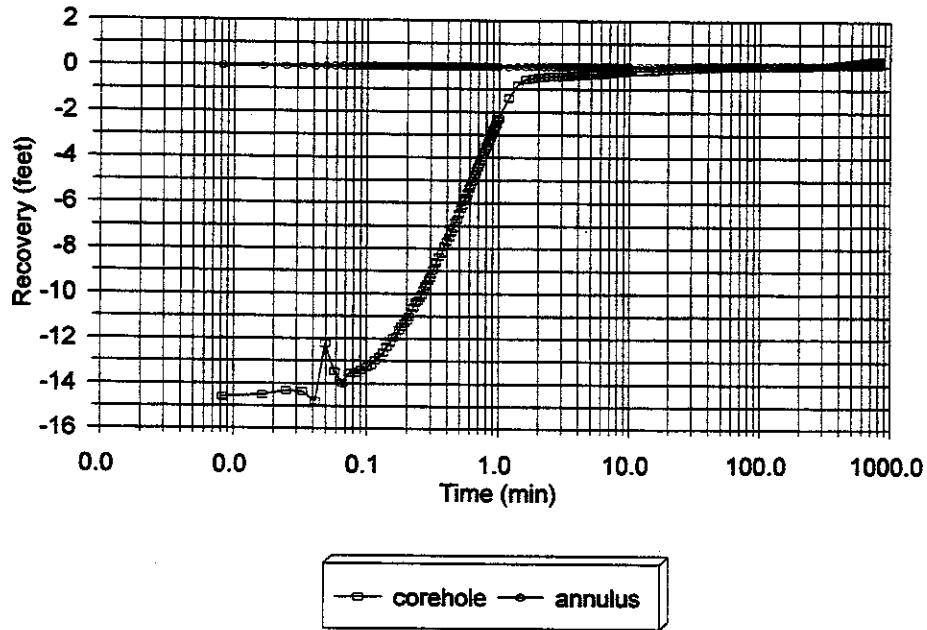


—□— Corehole —○— Annulus

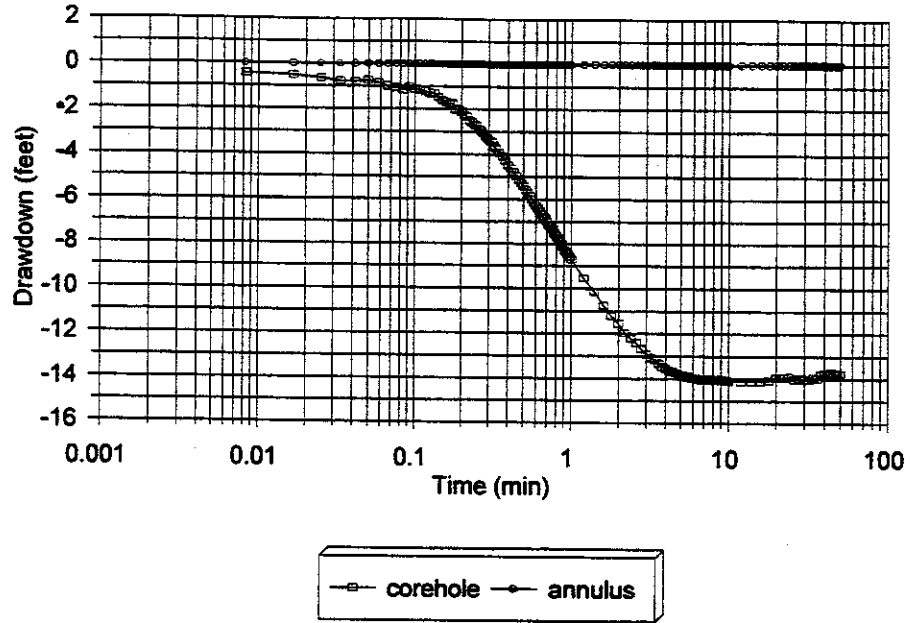
ROMP 9.5 Core Hole Packer Test
Arcadia Fm (205-228)



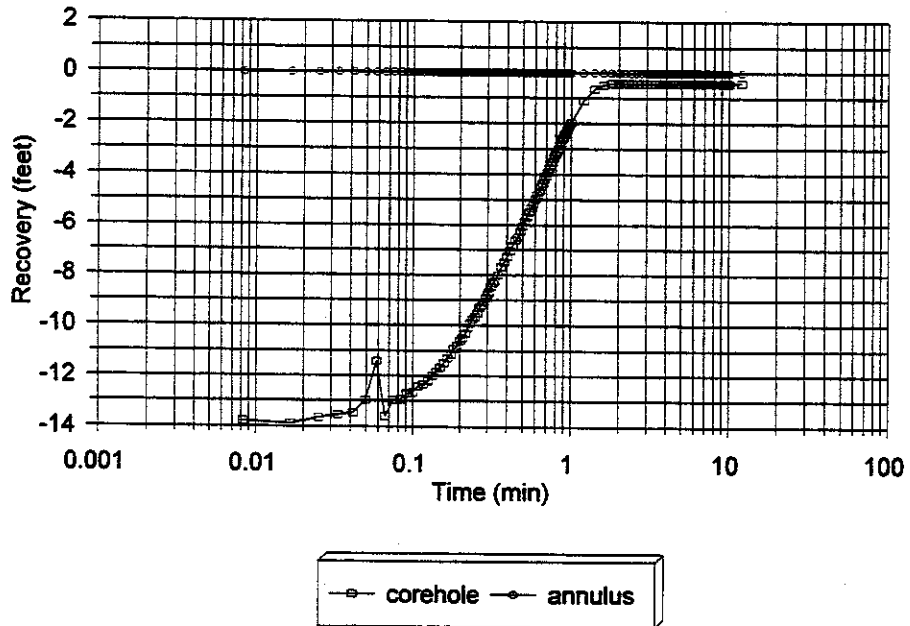
ROMP 9.5 Core Hole Packer Test
Arcadia Fm (205-228)



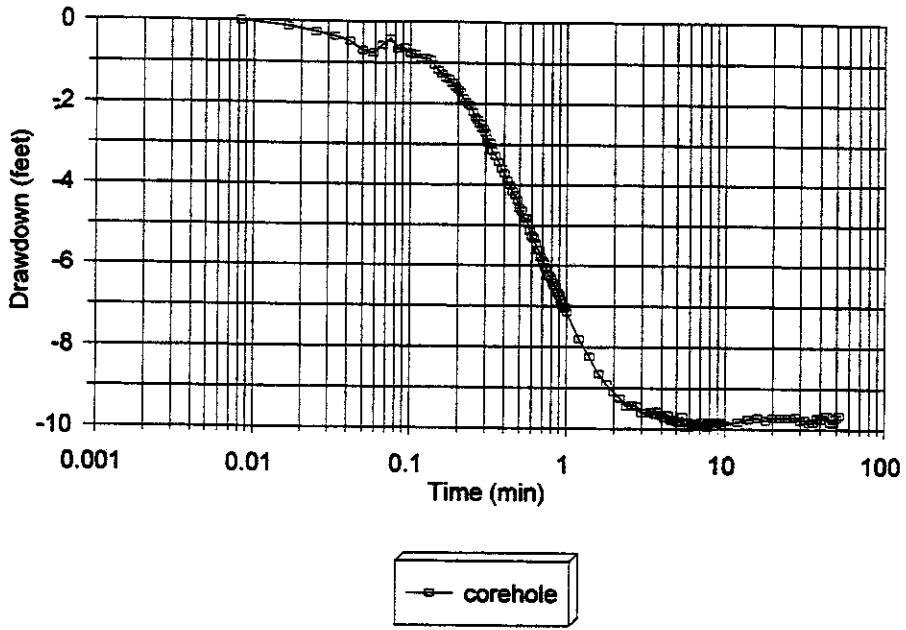
ROMP 9.5 Core Hole Packer Test
Arcadia Fm (245-268 ft bis)



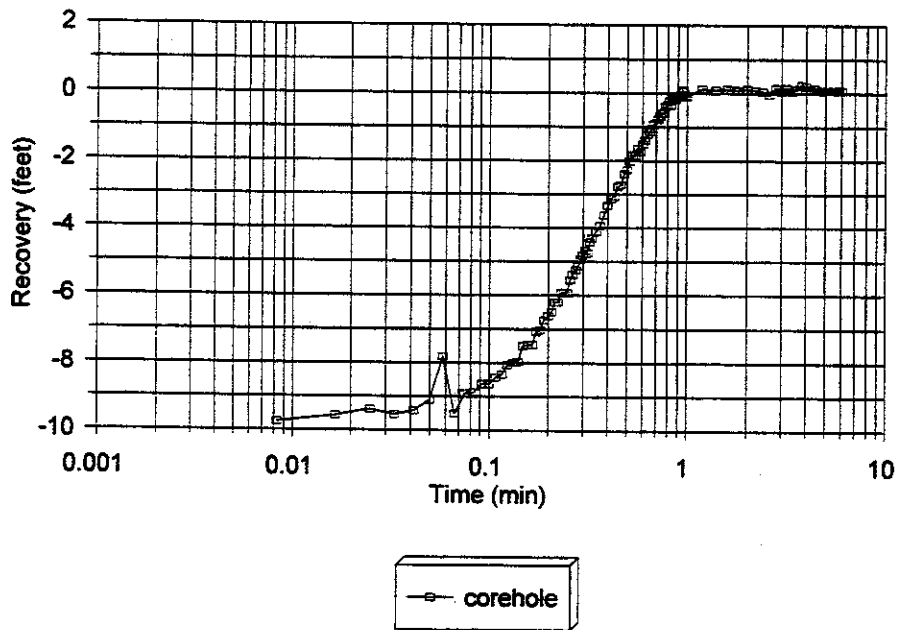
ROMP 9.5 Core Hole Packer Test
Arcadia Fm (245-268 ft bis)



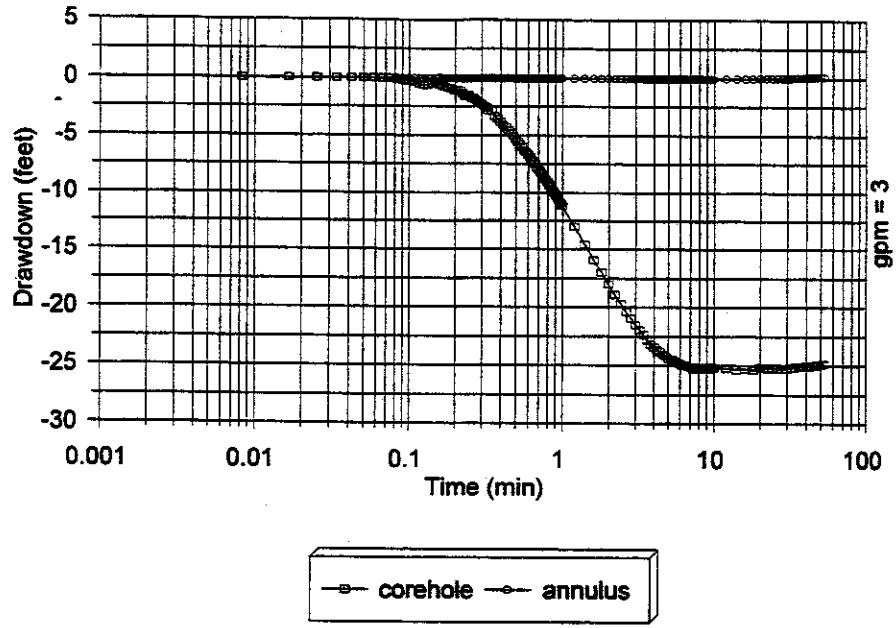
ROMP 9.5 Core Hole Packer Test
Arcadia Fm (293-308 ft bls)



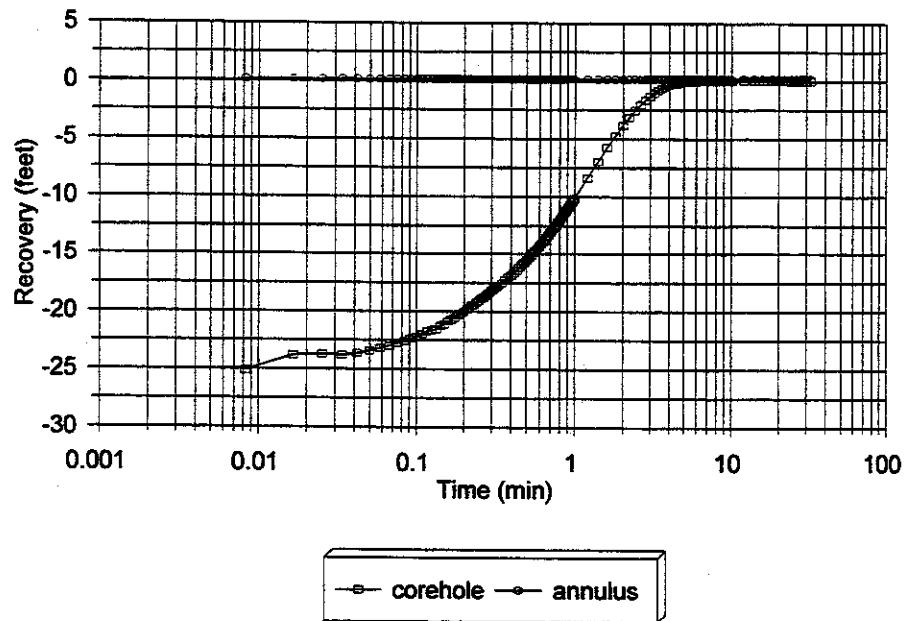
ROMP 9.5 Core Hole Packer Test
Arcadia Fm (293-308 ft bls)



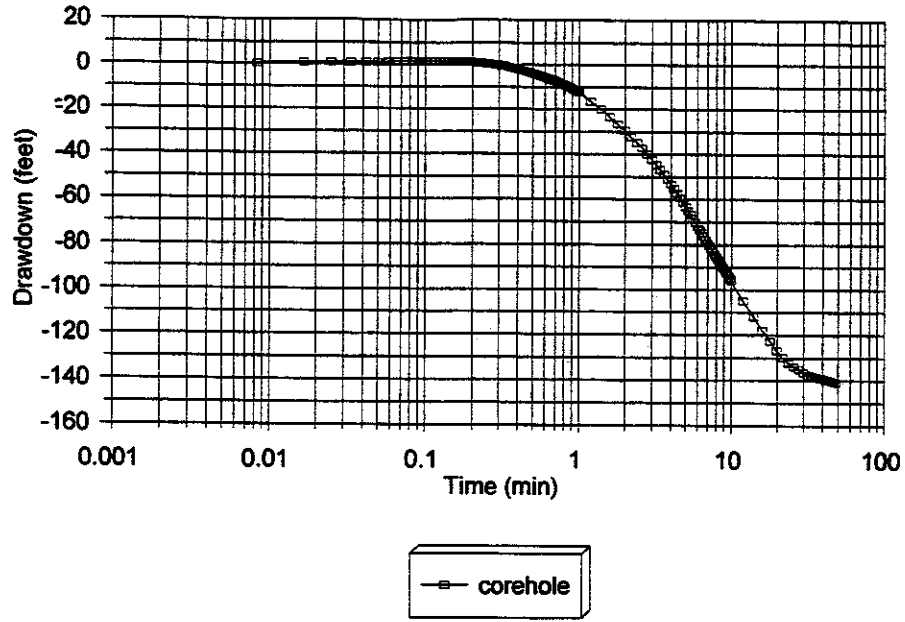
ROMP 9.5 Core Hole Packer Test
Arcadia Fm (331 - 348 ft bls)



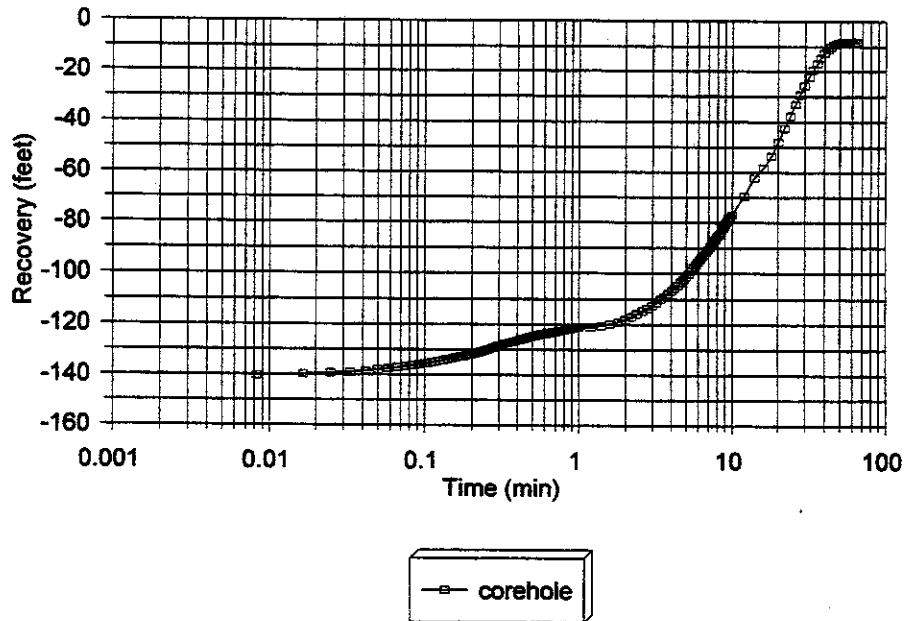
ROMP 9.5 Corehole Packer Test
Arcadia Fm (331 - 348 ft bls)



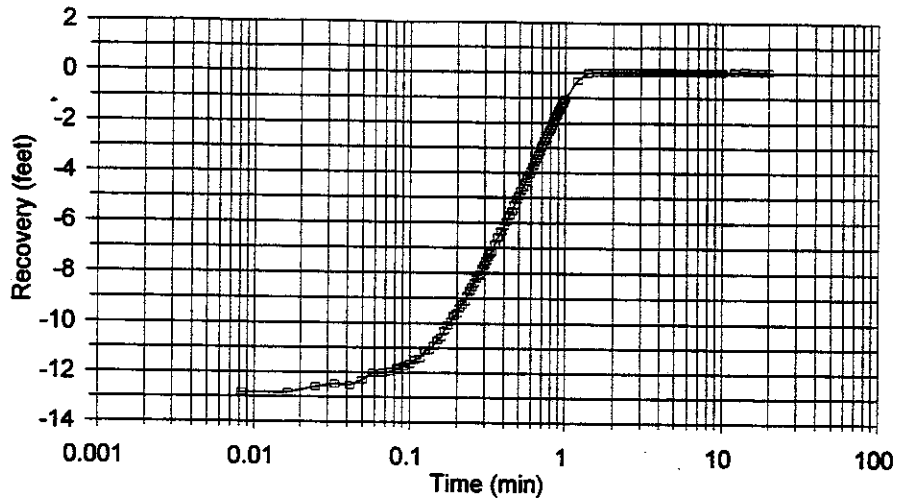
ROMP 9.5 Core Hole Packer Test
Arcadia Fm (348-368 ft bls)



ROMP 9.5 Core Hole Packer Test
Arcadia Fm (348-368 ft bls)

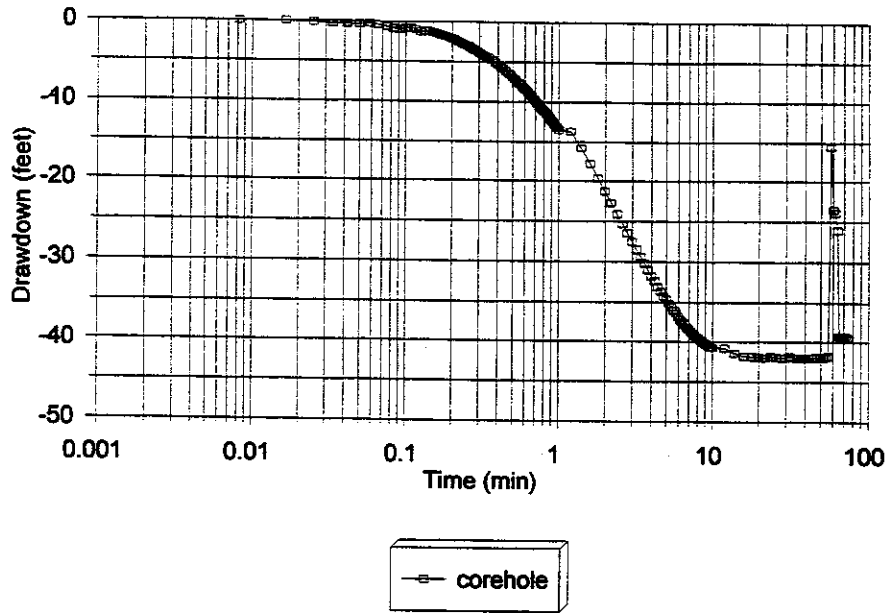


ROMP 9.5 Core Hole Packer Test
Arcadia Fm (388-398 ft bls)

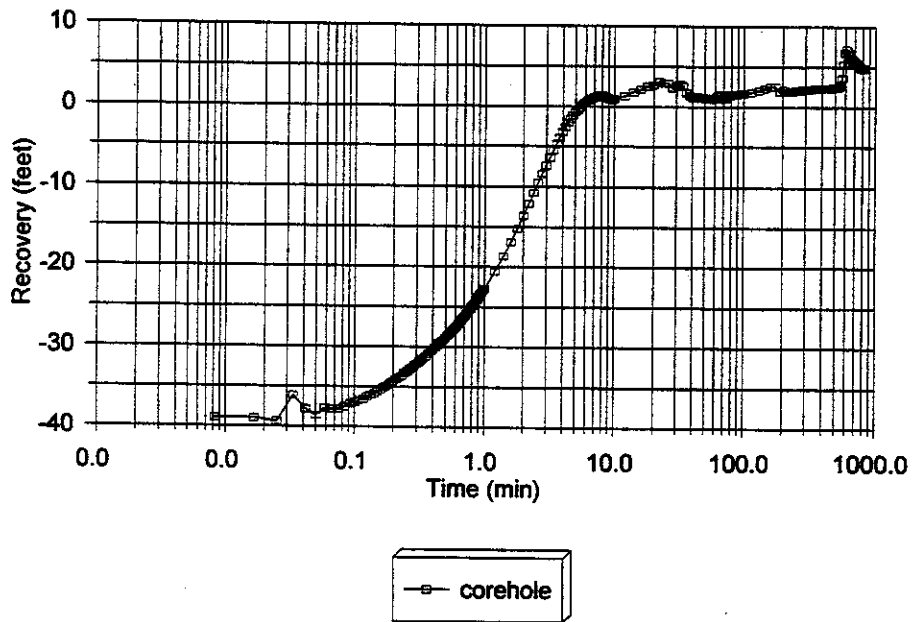


—●— corehole

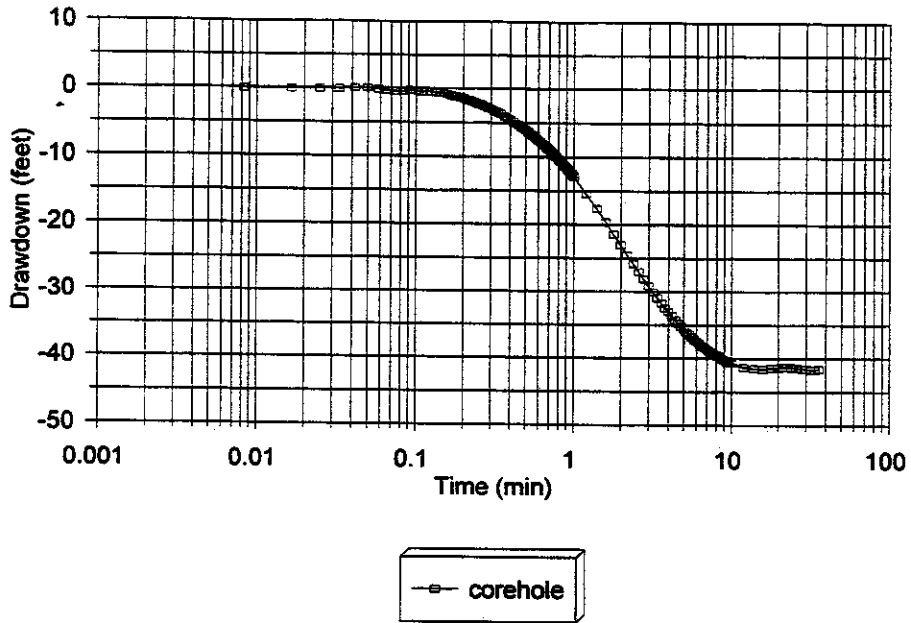
ROMP 9.5 Core Hole Packer Test
Arcadia Fm (413-468)



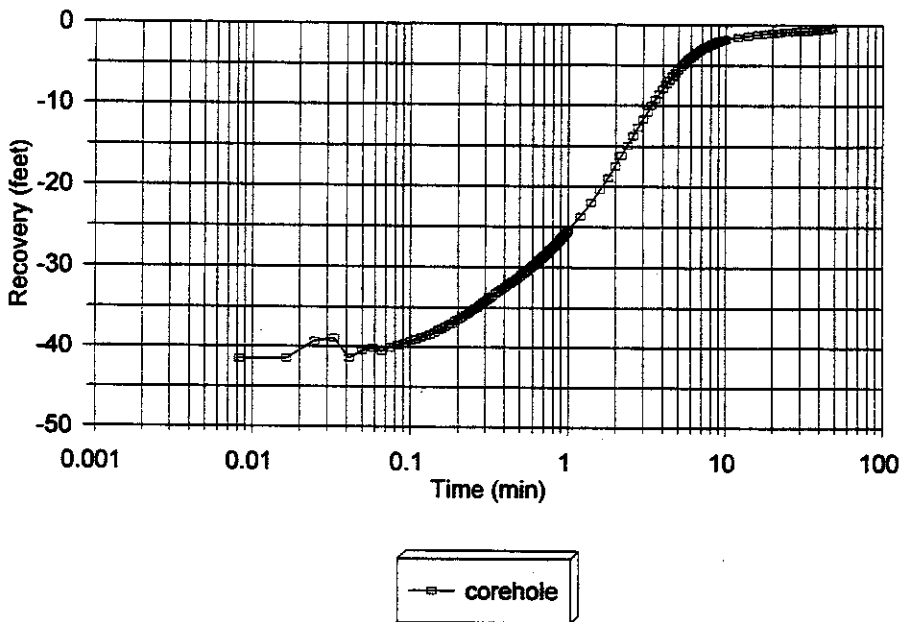
ROMP 9.5 Core Hole Packer Test
Arcadia Fm (413-468 ft bls)



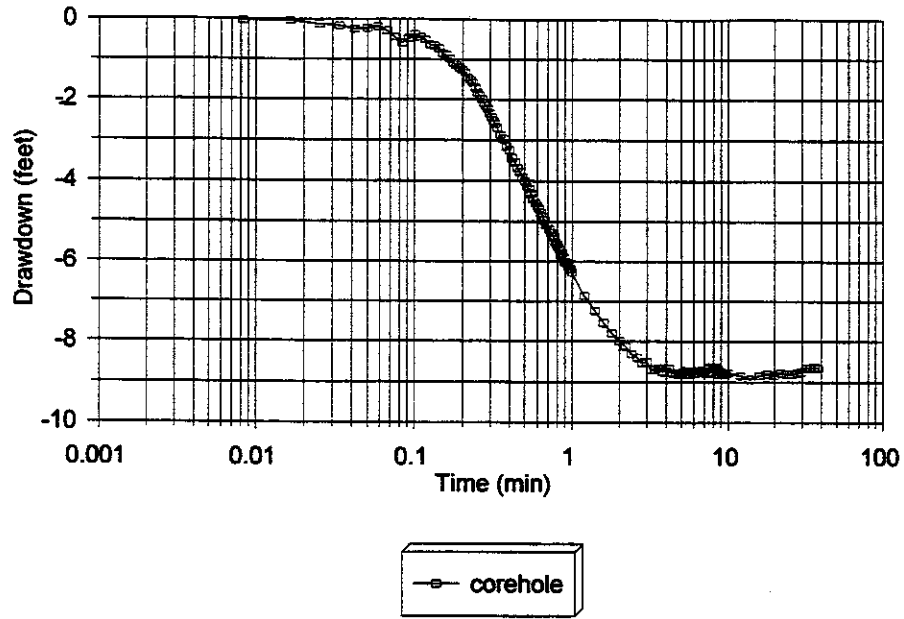
ROMP 9.5 Core Hole Packer Test
Arcadia Fm (448-468 ft bls)



ROMP 9.5 Core Hole Packer Test
Arcadia Fm (448-468 ft bls)



ROMP 9.5 Core Hole Packer Test
Suwannee Lm (493-513)



APPENDIX B

LITHOLOGIC WELL LOG PRINTOUT

SOURCE - FGS

WELL NUMBER: W-17597
 TOTAL DEPTH: 543 FT.
 SAMPLES - 2" CORE

COUNTY - DESOTO
 LOCATION: T.38S R.23E S.31
 LAT = 27D 07M 59S
 LON = 82D 03M 20S

COMPLETION DATE: 02/28/97

ELEVATION: 38 FT

OTHER TYPES OF LOGS AVAILABLE - GEOPHYSICAL WELL LOGS (0 - 800 FT BLS)

OWNER/DRILLER: SWFWMD ROMP 9.5 (IAS) /DRILLED BY PAT MEADORS (SWFWMD DRILLER)
 LOCATED WITHIN THE RV GRIFFIN RESERVE

WORKED BY: TED GATES (SWFWMD GEOLOGIST)

WIRE LINE ROTARY CORING FROM 0 FT. TO 543 FT. BLS

| | | | | |
|-------|---|-------|---------|--------------------------------|
| 0.0 | - | 11.5 | 090UDSC | UNDIFFERENTIATED SAND AND CLAY |
| 11.5 | - | 34.0 | 122TMIM | TAMIAMI FM. |
| 34.0 | - | 53.0 | 122PCRV | PEACE RIVER FM. |
| 53.0 | - | 224.0 | 122ARCA | ARCADIA FM. |
| 224.0 | - | 254.0 | 122TAMP | TAMPA MEMBER OF ARCADIA FM. |
| 254.0 | - | 398.0 | 122ARCA | ARCADIA FM. |
| 398.0 | - | 454.0 | 122NOCA | NOCATEE MEMBER OF ARCADIA FM. |
| 454.0 | - | T.D. | 123SWNN | SUWANNEE LIMESTONE |

0 - 3 SAND; MODERATE GRAY TO MODERATE DARK GRAY
 30% POROSITY; INTRAGANULAR
 GRAIN SIZE: VERY FINE; RANGE: MICROCRYSTALLINE TO FINE
 ROUNDNESS: SUB-ANGULAR TO SUB-ROUNDED; MEDIUM SPHERICITY
 UNCONSOLIDATED
 SEDIMENTARY STRUCTURES: INTERBEDDED
 ACCESSORY MINERALS: SILT-20%, PLANT REMAINS-01%
 FOSSILS: NO FOSSILS
 SAND QUARTZ, SOME SILT AND ORGANICS, DRY

3 - 4.3 SAND; MODERATE LIGHT GRAY TO BROWNISH GRAY
 30% POROSITY; INTRAGRANULAR
 GRAIN SIZE: MEDIUM; RANGE: FINE TO MEDIUM
 ROUNDNESS: SUB-ANGULAR TO SUB-ROUNDED; MEDIUM SPHERICITY
 UNCONSOLIDATED
 SEDIMENTARY STRUCTURES: INTERBEDDED
 ACCESSORY MINERALS: SILT-02%
 FOSSILS: NO

4.3 - 7.3 SAND; BLACK
 30% POROSITY; INTRAGRANULAR
 GRAIN SIZE: FINE; RANGE: VERY FINE TO MEDIUM
 ROUNDNESS: SUB-ANGULAR TO SUB-ROUNDED; MEDIUM SPHERICITY
 UNCONSOLIDATED
 SEDIMENTARY STRUCTURES: INTERBEDDED
 ACCESSORY MINERALS: SILT-05%
 FOSSILS: NO FOSSILS

- 7.3- 9.4 SAND; LIGHT OLIVE GRAY TO GREENISH GRAY
20% POROSITY: INTRAGRANULAR
GRAIN SIZE: MEDIUM; RANGE: FINE TO COARSE
ROUNDNESS: SUB-ANGULAR TO SUB-ROUNDED; MEDIUM SPHERICITY
POOR INDURATION
CEMENT TYPE(S): CLAY MATRIX
ACCESSORY MINERALS: CLAY-15%, IRON STAIN-20%, SILT-05%
PHOSPHATIC SAND-01%
FOSSILS: NO FOSSILS
SAND, QUARTZ, CLAYEY, IRON STAINED, SOME PHOSPHATIC SAND
- 9.4- 12.5 SAND; YELLOWISH GRAY TO LIGHT GREENISH GRAY
20% POROSITY: INTRAGRANULAR
GRAIN SIZE: MEDIUM; RANGE: FINE TO COARSE
ROUNDNESS: SUB-ANGULAR TO SUB-ROUNDED; MEDIUM SPHERICITY
UNCONSOLIDATED
SEDIMENTARY STRUCTURES: INTERBEDDED, MOTTLED
ACCESSORY MINERALS: PHOSPHATIC SAND-05%, SILT-04%
CLAY-01%
OTHER FEATURES: PLATY, CALCAREOUS
FOSSILS: ECHINOID, FOSSIL FRAGMENTS
SAND, QUARTZ, SHELL FRAGMENTS, ECHINOID
FRAGMENTS, INTERBEDDED PHOSPHATE
- 12.5- 29 SAND; MODERATE LIGHT GRAY TO MODERATE GRAY
30% POROSITY: INTRAGRANULAR
GRAIN SIZE: MEDIUM; RANGE: FINE TO COARSE
ROUNDNESS: ANGULAR TO SUB-ROUNDED; MEDIUM SPHERICITY
UNCONSOLIDATED
SEDIMENTARY STRUCTURES: INTERBEDDED, MOTTLED
ACCESSORY MINERALS: PHOSPHATIC SAND-10%, SILT-02%
OTHER FEATURES: FROSTED, SPECKLED
FOSSILS: MOLLUSKS, FOSSIL FRAGMENTS
QUARTZ SAND WITH PHOPHATIC SAND, FEW LARGE SHELL FRAGMENTS
- 29 - 34 SAND; OLIVE GRAY TO BLACK
30% POROSITY: INTRAGRANULAR
GRAIN SIZE: MEDIUM; RANGE: FINE TO COARSE
ROUNDNESS: SUB-ANGULAR TO SUB-ROUNDED; MEDIUM SPHERICITY
UNCONSOLIDATED
SEDIMENTARY STRUCTURES: INTERBEDDED
ACCESSORY MINERALS: PHOSPHATIC SAND-20%
PHOSPHATIC GRAVEL-02%, LIMESTONE-02%, CLAY-01%
OTHER FEATURES: FROSTED, GRANULAR, SPECKLED
FOSSILS: MOLLUSKS, FOSSIL FRAGMENTS
SAND, QUARTZ, PHOSPHATIC SAND, LARGE SOLIDIFIED MOLLUSK
SHELLS AND FRAGMENTS, PECTIN MOLDS

- 34 - 37.4 SAND; MODERATE GRAY TO BLACK
 20% POROSITY: INTRAGRANULAR
 GRAIN SIZE: MEDIUM; RANGE: FINE TO COARSE
 ROUNDNESS: SUB-ANGULAR TO SUB-ROUNDED; MEDIUM SPHERICITY
 POOR INDURATION
 CEMENT TYPE(S): CLAY MATRIX
 SEDIMENTARY STRUCTURES: INTERBEDDED
 ACCESSORY MINERALS: PHOSPHATIC SAND-25%, CLAY-05%
 PHOSPHATIC GRAVEL-03%
 OTHER FEATURES: FROSTED, SPECKLED
 SAND, QUARTZ, PHOSPHATIC SAND AND GRAVEL, INTERBEDDED WITH
 BLUE-GREEN CLAY; AROUND 35.0' LARGE CLAYSTONE FRAGMENTS
 HARD.
- 37.4- 48 CLAY; LIGHT OLIVE GRAY TO DARK GREENISH GRAY
 05% POROSITY: LOW PERMEABILITY; MODERATE INDURATION
 CEMENT TYPE(S): CLAY MATRIX
 SEDIMENTARY STRUCTURES: INTERBEDDED
 ACCESSORY MINERALS: QUARTZ SAND-20%, PHOSPHATIC SAND-05%
 OTHER FEATURES: GRANULAR, SPECKLED
 FOSSILS: FOSSIL FRAGMENTS
 CLAY, SANDY, LOW PERMEABILITY
- 48 - 53 LIMESTONE; YELLOWISH GRAY TO YELLOWISH GRAY
 10% POROSITY: FRACTURE, MOLDIC
 GRAIN TYPE: BIOGENIC, CALCILUTITE
 GRAIN SIZE: MICROCRYSTALLINE
 RANGE: MICROCRYSTALLINE TO CRYPTOCRYSTALLINE
 GOOD INDURATION
 CEMENT TYPE(S): CALCILUTITE MATRIX
 SEDIMENTARY STRUCTURES: INTERBEDDED
 ACCESSORY MINERALS: QUARTZ SAND-03%, PHOSPHATIC SAND-01%
 OTHER FEATURES: GRANULAR
 FOSSILS: FOSSIL FRAGMENTS
- 53 - 58 LIMESTONE; WHITE TO YELLOWISH GRAY
 10% POROSITY: FRACTURE, MOLDIC
 GRAIN TYPE: BIOGENIC, CALCILUTITE
 GRAIN SIZE: MICROCRYSTALLINE
 RANGE: MICROCRYSTALLINE TO CRYPTOCRYSTALLINE
 GOOD INDURATION
 CEMENT TYPE(S): CALCILUTITE MATRIX
 SEDIMENTARY STRUCTURES: INTERBEDDED
 ACCESSORY MINERALS: QUARTZ SAND-03%, PHOSPHATIC SAND-02%
 OTHER FEATURES: GRANULAR
 FOSSILS: FOSSIL FRAGMENTS, BENTHIC FORAMINIFERA, MOLLUSKS

- 58 - 68 CALCILUTITE; YELLOWISH GRAY TO LIGHT OLIVE GRAY
 03% POROSITY: FRACTURE
 GRAIN TYPE: CALCILUTITE, SKELETAL
 GRAIN SIZE: MICROCRYSTALLINE
 RANGE: MICROCRYSTALLINE TO VERY FINE; GOOD INDURATION
 CEMENT TYPE(S): CALCILUTITE MATRIX, DOLOMITE CEMENT
 SEDIMENTARY STRUCTURES: INTERBEDDED
 ACCESSORY MINERALS: PHOSPHATIC SAND-25%, QUARTZ SAND-03%
 SILT-03%, DOLOMITE-01%
 OTHER FEATURES: FROSTED, SPECKLED, FOSSILIFEROUS
 FOSSILS: FOSSIL FRAGMENTS
 CALCILUTITE, VERY LOW POROSITY, SANDY, FEW FOSSILS
- 68 - 70 SANDSTONE; LIGHT OLIVE GRAY TO OLIVE GRAY
 08% POROSITY: INTERGRANULAR, FRACTURE
 GRAIN SIZE: MEDIUM; RANGE: FINE TO COARSE
 ROUNDNESS: ANGULAR TO SUB-ANGULAR; MEDIUM SPHERICITY
 POOR INDURATION
 CEMENT TYPE(S): CALCILUTITE MATRIX
 SEDIMENTARY STRUCTURES: INTERBEDDED
 ACCESSORY MINERALS: CALCILUTITE-40%, QUARTZ SAND-15%
 OTHER FEATURES: CALCAREOUS, GRANULAR, SPECKLED
 PHOSPHATIC SANDSTONE, CALCILUTITE CEMENT MATRIX
- 70 - 73 CALCILUTITE; YELLOWISH GRAY TO LIGHT OLIVE GRAY
 03% POROSITY: FRACTURE, INTERGRANULAR
 GRAIN TYPE: CALCILUTITE, BIOGENIC, SKELETAL
 GRAIN SIZE: MICROCRYSTALLINE
 RANGE: CRYPTOCRYSTALLINE TO VERY FINE; GOOD INDURATION
 CEMENT TYPE(S): CALCILUTITE MATRIX, DOLOMITE CEMENT
 SEDIMENTARY STRUCTURES: INTERBEDDED, MOTTLED
 ACCESSORY MINERALS: PHOSPHATIC SAND-25%, QUARTZ SAND-05%
 OTHER FEATURES: PARTINGS, SPECKLED, FOSSILIFEROUS
 FOSSILS: MOLLUSKS
- 73 - 79 CALCILUTITE; LIGHT OLIVE GRAY TO OLIVE GRAY
 10% POROSITY: INTERGRANULAR, FRACTURE
 GRAIN TYPE: CALCILUTITE, BIOGENIC
 GRAIN SIZE: MICROCRYSTALLINE
 RANGE: CRYPTOCRYSTALLINE TO VERY FINE; MODERATE INDURATION
 CEMENT TYPE(S): CALCILUTITE MATRIX
 SEDIMENTARY STRUCTURES: INTERBEDDED
 ACCESSORY MINERALS: PHOSPHATIC SAND-40%, QUARTZ SAND-05%
 OTHER FEATURES: FROSTED, GRANULAR, SPECKLED
 FOSSILS: NO FOSSILS
 CALCILUTITE MATRIX WITH HIGH PERCENTAGE OF PHOSPHATIC SAND

- 79 - 79.7 PHOSPHATE; OLIVE GRAY TO PINKISH GRAY
20% POROSITY: INTERGRANULAR, FRACTURE
POSSIBLY HIGH PERMEABILITY; UNCONSOLIDATED
CEMENT TYPE(S): CALCILUTITE MATRIX, CLAY MATRIX
SEDIMENTARY STRUCTURES: INTERBEDDED
ACCESSORY MINERALS: CALCILUTITE-30%, QUARTZ SAND-05%
CHERT-02%
OTHER FEATURES: CALCAREOUS, FROSTED, GRANULAR, SPECKLED
PHOSPHATIC SAND, INTERBEDDED SILT SIZED LIMESTONE
- 79.7- 83.1 CALCILUTITE; LIGHT OLIVE GRAY TO OLIVE GRAY
03% POROSITY: FRACTURE
GRAIN TYPE: CALCILUTITE, BIOGENIC
GRAIN SIZE: MICROCRYSTALLINE
RANGE: CRYPTOCRYSTALLINE TO VERY FINE; GOOD INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX, DOLOMITE CEMENT
SEDIMENTARY STRUCTURES: INTERBEDDED
ACCESSORY MINERALS: PHOSPHATIC SAND-25%, QUARTZ SAND-05%
CHERT-02%
OTHER FEATURES: FROSTED, GRANULAR, SPECKLED
FOSSILS: BENTHIC FORAMINIFERA, MOLLUSKS
CALCILUTITE WITH PHOSPHATIC SAND INTERBEDDED
- 83.1- 88.7 CALCILUTITE; WHITE TO YELLOWISH GRAY
10% POROSITY: FRACTURE, MOLDIC, POSSIBLY HIGH PERMEABILITY
GRAIN TYPE: CALCILUTITE, BIOGENIC, SKELETAL
GRAIN SIZE: MICROCRYSTALLINE
RANGE: CRYPTOCRYSTALLINE TO VERY FINE; GOOD INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX, DOLOMITE CEMENT
SEDIMENTARY STRUCTURES: INTERBEDDED
ACCESSORY MINERALS: PHOSPHATIC SAND-05%
PHOSPHATIC GRAVEL-02%, DOLOMITE-03%, CLAY-02%
OTHER FEATURES: CHALKY, FOSSILIFEROUS
FOSSILS: MOLLUSKS, BENTHIC FORAMINIFERA, FOSSIL MOLDS
CALCILUTITE, HARD, MOLDIC, MOLDS FILLED WITH PHOSPHATIC
SAND
- 88.7- 90.7 CLAY; LIGHT OLIVE GRAY TO OLIVE GRAY
N % POROSITY, MODERATE INDURATION
CEMENT TYPE(S): CLAY MATRIX
ACCESSORY MINERALS: PHOSPHATIC SAND-02%, LIMESTONE-01%
CLAY, LOW PERMEABILITY, VERY LITTLE INTERBEDDED ACCESSORY
MINERALS

- 90.7- 93 CALCILUTITE; LIGHT OLIVE GRAY TO OLIVE GRAY
 03% POROSITY: FRACTURE, MOLDIC, POSSIBLY HIGH PERMEABILITY
 GRAIN TYPE: CALCILUTITE
 GRAIN SIZE: CRYPTOCRYSTALLINE; MODERATE INDURATION
 CEMENT TYPE(S): CALCILUTITE MATRIX
 SEDIMENTARY STRUCTURES: INTERBEDDED
 ACCESSORY MINERALS: PHOSPHATIC SAND-13%, QUARTZ SAND-01%
 PHOSPHATIC GRAVEL-01%
 CALCILUTITE MATRIX, INTERBEDDED SILT-SIZED LIMESTONE AND
 PHOSPHATIC SAND, SOME GRAVEL
- 93 - 98.6 CALCILUTITE; YELLOWISH GRAY TO LIGHT OLIVE GRAY
 10% POROSITY: MOLDIC, FRACTURE
 GRAIN TYPE: CALCILUTITE, BIOGENIC, SKELETAL
 GRAIN SIZE: MICROCRYSTALLINE
 RANGE: CRYPTOCRYSTALLINE TO MEDIUM; GOOD INDURATION
 CEMENT TYPE(S): CALCILUTITE MATRIX, DOLOMITE CEMENT
 SEDIMENTARY STRUCTURES: INTERBEDDED
 ACCESSORY MINERALS: PHOSPHATIC SAND-05%, DOLOMITE-02%
 QUARTZ SAND-01%, PHOSPHATIC GRAVEL-01%
 OTHER FEATURES: DOLOMITIC, CHALKY, HIGH RECRYSTALLIZATION
 FOSSILIFEROUS
 FOSSILS: ECHINOID, BENTHIC FORAMINIFERA, MOLLUSKS
 CALCILUTITE, MOLDIC, SOME MOLDS FILLED WITH DOLOSTONE AND
 PHOSPHATIC SAND
- 98.6- 102.2 CLAY; GREENISH GRAY TO DARK GREENISH GRAY
 01% POROSITY: INTERGRANULAR; MODERATE INDURATION
 CEMENT TYPE(S): CLAY MATRIX
 SEDIMENTARY STRUCTURES: INTERBEDDED
 ACCESSORY MINERALS: PHOSPHATIC SAND-02%
 PHOSPHATIC GRAVEL-01%, QUARTZ SAND-01%, GLAUCONITE-01%
 CLAY, LITTLE INTERBEDDED MINERALS, LOW PERMEABILITY GRADES
 TO CALCARENITE BELOW 101.6' 35-40% QUARTZ AND PHOSPHATIC
 SAND TO 103.4' VERY LOW PERMEABILITY
- 102.2- 103.4 CLAY; LIGHT OLIVE GRAY TO OLIVE GRAY
 11% POROSITY, POOR INDURATION
 CEMENT TYPE(S): CLAY MATRIX
 SEDIMENTARY STRUCTURES: INTERBEDDED
 ACCESSORY MINERALS: PHOSPHATIC SAND-15%, QUARTZ-15%
 OTHER FEATURES: CALCAREOUS
 VERY LOW PERMEABILITY, QUARTZ AND PHOSPHATIC SAND WITH
 VARIABLE PERCENTAGE, INDURATION VARIABLE: MEDIUM TO POOR

- 103.4- 109.4 CALCARENITE; YELLOWISH GRAY TO LIGHT OLIVE GRAY
 02% POROSITY: PIN POINT VUGS, LOW PERMEABILITY
 GRAIN TYPE: CALCILUTITE
 GRAIN SIZE: MICROCRYSTALLINE
 RANGE: MICROCRYSTALLINE TO CRYPTOCRYSTALLINE
 MODERATE INDURATION
 CEMENT TYPE(S): CALCILUTITE MATRIX
 SEDIMENTARY STRUCTURES: INTERBEDDED
 ACCESSORY MINERALS: PHOSPHATIC SAND-20%, QUARTZ-20%
 OTHER FEATURES: FOSSILIFEROUS, SPECKLED
 VERY LOW TO LOW PERMEABILITY, VARYING PERCENTAGES OF QUARTZ
 AND PHOSPHATIC SAND, PIN HOLE TO 1/2" VUGS 110' IS CONTACT
 BETWEEN PEACE RIVER FORMATION AND UNDIFFERENTIATED ARCADIA
- 109.4- 128 CALCARENITE; WHITE TO YELLOWISH GRAY
 02% POROSITY: PIN POINT VUGS, LOW PERMEABILITY
 GRAIN TYPE: CALCILUTITE
 GRAIN SIZE: MICROCRYSTALLINE
 RANGE: MICROCRYSTALLINE TO CRYPTOCRYSTALLINE
 MODERATE INDURATION
 CEMENT TYPE(S): CALCILUTITE MATRIX
 SEDIMENTARY STRUCTURES: INTERBEDDED
 ACCESSORY MINERALS: PHOSPHATIC SAND-02%, QUARTZ- %
 OTHER FEATURES: FOSSILIFEROUS
 FOSSILS: ECHINOID, FOSSIL FRAGMENTS, FOSSIL MOLDS
 VERY LOW TO MODERATE PERMEABILITY, PIN HOLE TO 2" VUGS
 VARYING PERCENTAGES OF QUARTZ AND PHOSPHATIC SAND
 PHOPHATIC SAND IS LESS COMMON
- 128 - 140 CALCARENITE; WHITE TO YELLOWISH GRAY
 03% POROSITY: PIN POINT VUGS, FRACTURE
 GRAIN TYPE: CALCILUTITE, SKELETAL, SKELTAL CAST
 GRAIN SIZE: MICROCRYSTALLINE
 RANGE: MICROCRYSTALLINE TO FINE; MODERATE INDURATION
 CEMENT TYPE(S): CALCILUTITE MATRIX
 SEDIMENTARY STRUCTURES: INTERBEDDED
 ACCESSORY MINERALS: PHOSPHATIC SAND-01%, QUARTZ- %
 OTHER FEATURES: FOSSILIFEROUS
 FOSSILS: ECHINOID, FOSSIL FRAGMENTS, FOSSIL MOLDS
 VERY LOW TO LOW PERMEABILITY (VERY LOW 144.5'-153') PIN
 HOLE TO 1" VUGS TO 144.5', VARYING PERCENTAGES OF QUARTZ
 AND PHOSPHATIC SAND LIMESTONE IS MUCH CLEANER, VERY FEW
 INTERBEDDED ACCESSORY MINERALS
- 140 - 153 CALCARENITE; WHITE TO YELLOWISH GRAY
 03% POROSITY: FRACTURE, PIN POINT VUGS
 GRAIN TYPE: BIOGENIC, PELLET, CALCILUTITE
 GRAIN SIZE: VERY FINE
 RANGE: MICROCRYSTALLINE TO VERY FINE; MODERATE INDURATION
 CEMENT TYPE(S): CALCILUTITE MATRIX
 ACCESSORY MINERALS: PHOSPHATIC SAND-01%, QUARTZ SAND-02%
 OTHER FEATURES: FOSSILIFEROUS
 FOSSILS: NO FOSSILS

- 153 - 160.8 CLAY; YELLOWISH GRAY TO LIGHT OLIVE GRAY
01% POROSITY: LOW PERMEABILITY; MODERATE INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX, CLAY MATRIX
SEDIMENTARY STRUCTURES: INTERBEDDED
ACCESSORY MINERALS: PHOSPHATIC SAND-01%, QUARTZ SAND-01%
LIMESTONE-20%, CLAY-03%
OTHER FEATURES: FOSSILIFEROUS
VERY LOW PERMEABILITY
- 160.8- 163.8 CALCARENITE; YELLOWISH GRAY TO LIGHT OLIVE GRAY
03% POROSITY: INTERGRANULAR, PIN POINT VUGS
LOW PERMEABILITY
GRAIN TYPE: CALCILUTITE, PELLET
GRAIN SIZE: MICROCRYSTALLINE
RANGE: CRYPTOCRYSTALLINE TO MICROCRYSTALLINE
POOR INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
SEDIMENTARY STRUCTURES: INTERBEDDED
ACCESSORY MINERALS: PHOSPHATIC SAND-10%, QUARTZ SAND-07%
CLAY-02%
OTHER FEATURES: FOSSILIFEROUS
FOSSILS: FOSSIL FRAGMENTS, WORM TRACES
LOW PERMEABILITY, EFFERVECES WITH ACID
- 163.8- 187.2 CALCARENITE; YELLOWISH GRAY TO LIGHT OLIVE GRAY
05% POROSITY: MOLDIC, FRACTURE
GRAIN TYPE: BIOGENIC, CALCILUTITE, SKELETAL
GRAIN SIZE: MICROCRYSTALLINE
RANGE: CRYPTOCRYSTALLINE TO VERY FINE; GOOD INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
SEDIMENTARY STRUCTURES: INTERBEDDED
ACCESSORY MINERALS: PHOSPHATIC SAND-02%, QUARTZ SAND-02%
PHOSPHATIC GRAVEL-01%
OTHER FEATURES: PARTINGS, FOSSILIFEROUS
FOSSILS: ECHINOID, MOLLUSKS, FOSSIL FRAGMENTS
LIMESTONE, MOLDIC, APPEARS PERMEABLE, NUMEROUS MOLLUSK
MOLDS
- 187.2- 189.7 CLAY; LIGHT OLIVE GRAY TO GREENISH GRAY
02% POROSITY: LOW PERMEABILITY; POOR INDURATION
CEMENT TYPE(S): CLAY MATRIX, CALCILUTITE MATRIX
SEDIMENTARY STRUCTURES: INTERBEDDED
ACCESSORY MINERALS: LIMESTONE-40%, DOLOMITE-05%
PHOSPHATIC SAND-03%, QUARTZ SAND-02%
OTHER FEATURES: CALCAREOUS
CLAY, INTERBEDDED WITH LIMESTONE MATRIX

- 189.7- 196 CALCARENITE; LIGHT OLIVE GRAY TO GREENISH GRAY
 03% POROSITY: INTERGRANULAR, PIN POINT VUGS
 GRAIN TYPE: BIOGENIC, CRYSTALS, PELLET
 GRAIN SIZE: VERY FINE; RANGE: CRYPTOCRYSTALLINE TO FINE
 POOR INDURATION
 CEMENT TYPE(S): CALCILUTITE MATRIX, CLAY MATRIX
 SEDIMENTARY STRUCTURES: INTERBEDDED
 ACCESSORY MINERALS: PHOSPHATIC SAND-15%, QUARTZ SAND-10%
 CLAY-02%
 OTHER FEATURES: GRANULAR, SPECKLED, CRYSTALLINE
 CALCARENITE, INTERBEDDED PHOSPHATIC AND QUARTZ SAND LOW
 PERMEABILITY
- 196 - 198.3 CALCARENITE; WHITE TO YELLOWISH GRAY
 03% POROSITY: INTERGRANULAR, MOLDIC
 GRAIN TYPE: BIOGENIC, PELLET, SKELETAL
 GRAIN SIZE: VERY FINE; RANGE: CRYPTOCRYSTALLINE TO FINE
 MODERATE INDURATION
 CEMENT TYPE(S): CALCILUTITE MATRIX
 OTHER FEATURES: FOSSILIFEROUS
 FOSSILS: ECHINOID, BENTHIC FORAMINIFERA, MOLLUSKS
- 198.3- 202.6 CALCARENITE; LIGHT OLIVE GRAY TO OLIVE GRAY
 05% POROSITY: INTERGRANULAR, MOLDIC
 GRAIN TYPE: BIOGENIC, SKELETAL, PELLET CAST
 GRAIN SIZE: VERY FINE; RANGE: CRYPTOCRYSTALLINE TO FINE
 MODERATE INDURATION
 CEMENT TYPE(S): CALCILUTITE MATRIX, CLAY MATRIX
 SEDIMENTARY STRUCTURES: INTERBEDDED
 ACCESSORY MINERALS: CLAY-10%, ORGANICS-02%
 FOSSILS: ECHINOID, BENTHIC FORAMINIFERA, MOLLUSKS
- 202.6- 203.4 CALCILUTITE; WHITE TO YELLOWISH GRAY
 01% POROSITY: LOW PERMEABILITY
 GRAIN SIZE: MICROCRYSTALLINE
 RANGE: CRYPTOCRYSTALLINE TO MICROCRYSTALLINE
 GOOD INDURATION
 CEMENT TYPE(S): CALCILUTITE MATRIX
 ACCESSORY MINERALS: ORGANICS-01%, CLAY-01%
 CALCILUTE, HARD, LOW PERMEABILITY
- 203.4- 205.9 CLAY; LIGHT OLIVE GRAY TO GREENISH GRAY
 01% POROSITY: LOW PERMEABILITY; MODERATE INDURATION
 CEMENT TYPE(S): CLAY MATRIX
 SEDIMENTARY STRUCTURES: INTERBEDDED
 ACCESSORY MINERALS: LIMESTONE-03%
 OTHER FEATURES: CALCAREOUS

- 205.9- 207.7 DOLOSTONE; LIGHT OLIVE GRAY TO OLIVE GRAY
20% POROSITY: FRACTURE, MOLDIC, POSSIBLY HIGH PERMEABILITY
10-50% ALTERED; SUBHEDRAL
GRAIN SIZE: MICROCRYSTALLINE
RANGE: CRYPTOCRYSTALLINE TO VERY FINE; GOOD INDURATION
CEMENT TYPE(S): DOLOMITE CEMENT, CALCILUTITE MATRIX
SEDIMENTARY STRUCTURES: INTERBEDDED
ACCESSORY MINERALS: LIMESTONE-02%
FOSSILS: MOLLUSKS, ECHINOID, BENTHIC FORAMINIFERA
FOSSIL MOLDS, CORAL
DOLOSTONE, PERMEABLE, MOLDIC, FRACTURES, GRADES INTO MOLDIC
LIMESTONE
- 207.7- 211.2 CALCARENITE; YELLOWISH GRAY TO LIGHT OLIVE GRAY
15% POROSITY: FRACTURE, MOLDIC, POSSIBLY HIGH PERMEABILITY
GRAIN TYPE: BIOGENIC, SKELETAL, SKELTAL CAST
GRAIN SIZE: MICROCRYSTALLINE
RANGE: CRYPTOCRYSTALLINE TO VERY FINE; MODERATE INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX, DOLOMITE CEMENT
CLAY MATRIX
SEDIMENTARY STRUCTURES: INTERBEDDED
ACCESSORY MINERALS: CLAY-15%, DOLOMITE-05%
OTHER FEATURES: FOSSILIFEROUS
- 211.2- 212.6 CLAY; WHITE TO YELLOWISH GRAY
02% POROSITY: LOW PERMEABILITY; POOR INDURATION
CEMENT TYPE(S): CLAY MATRIX, CALCILUTITE MATRIX
SEDIMENTARY STRUCTURES: INTERBEDDED
ACCESSORY MINERALS: LIMESTONE-20%, PHOSPHATIC GRAVEL-01%
OTHER FEATURES: CALCAREOUS
CLAY, WHITE, LIMY
- 212.6- 215 CALCARENITE; YELLOWISH GRAY TO LIGHT OLIVE GRAY
10% POROSITY: MOLDIC, FRACTURE, PIN POINT VUGS
GRAIN TYPE: BIOGENIC, SKELETAL, SKELTAL CAST
GRAIN SIZE: MICROCRYSTALLINE
RANGE: CRYPTOCRYSTALLINE TO MICROCRYSTALLINE
GOOD INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
ACCESSORY MINERALS: DOLOMITE-05%
OTHER FEATURES: CHALKY, DOLOMITIC, FOSSILIFEROUS
FOSSILS: MOLLUSKS, FOSSIL MOLDS

- 215 - 219 DOLOSTONE; YELLOWISH GRAY TO OLIVE GRAY
 10% POROSITY: MOLDIC, FRACTURE, PIN POINT VUGS
 10-50% ALTERED; SUBHEDRAL
 GRAIN SIZE: MICROCRYSTALLINE
 RANGE: MICROCRYSTALLINE TO CRYPTOCRYSTALLINE
 GOOD INDURATION
 CEMENT TYPE(S): DOLOMITE CEMENT, CALCILUTITE MATRIX
 SEDIMENTARY STRUCTURES: INTERBEDDED
 ACCESSORY MINERALS: LIMESTONE-20%, PHOSPHATIC SAND-02%
 QUARTZ SAND-01%
 OTHER FEATURES: CALCAREOUS
 FOSSILS: MOLLUSKS, BENTHIC FORAMINIFERA, FOSSIL MOLDS
 FOSSIL FRAGMENTS
- 219 - 223.6 CALCARENITE; YELLOWISH GRAY TO LIGHT OLIVE GRAY
 10% POROSITY: MOLDIC, FRACTURE, INTERCRYSTALLINE
 GRAIN TYPE: BIOGENIC, SKELETAL, SKELTAL CAST
 GRAIN SIZE: MICROCRYSTALLINE
 RANGE: CRYPTOCRYSTALLINE TO VERY FINE; GOOD INDURATION
 CEMENT TYPE(S): CALCILUTITE MATRIX
 ACCESSORY MINERALS: CALCITE-01%, DOLOMITE-01%
 FOSSILS: ECHINOID, MOLLUSKS, BENTHIC FORAMINIFERA
 FOSSIL FRAGMENTS
- 223.6- 242 CALCILUTITE; WHITE TO YELLOWISH GRAY
 10% POROSITY: FRACTURE, MOLDIC, VUGULAR
 GRAIN TYPE: BIOGENIC, SKELETAL, SKELTAL CAST
 GRAIN SIZE: MICROCRYSTALLINE
 RANGE: MICROCRYSTALLINE TO CRYPTOCRYSTALLINE
 GOOD INDURATION
 CEMENT TYPE(S): CALCILUTITE MATRIX
 ACCESSORY MINERALS: DOLOMITE-02%
 FOSSILS: MOLLUSKS, BENTHIC FORAMINIFERA
 CALCILUTITE, HARD, FEW MOLDS - NOT VERY PERMEABLE
- 242 - 247.7 CALCARENITE; WHITE TO YELLOWISH GRAY
 10% POROSITY: FRACTURE, MOLDIC, VUGULAR
 GRAIN TYPE: BIOGENIC, SKELETAL, SKELTAL CAST
 GRAIN SIZE: VERY FINE
 RANGE: MICROCRYSTALLINE TO CRYPTOCRYSTALLINE
 GOOD INDURATION
 CEMENT TYPE(S): CALCILUTITE MATRIX
 ACCESSORY MINERALS: PHOSPHATIC SAND-01%, DOLOMITE-01%
 FOSSILS: MOLLUSKS, BENTHIC FORAMINIFERA, ECHINOID
 CALCARENITE, MOLDIC, FRACTURED, HIGH POROSITY

- 247.7- 256.6 CALCARENITE; WHITE TO YELLOWISH GRAY
 15% POROSITY: FRACTURE, MOLDIC, INTERCRYSTALLINE
 GRAIN TYPE: BIOGENIC, SKELETAL, SKELTAL CAST
 GRAIN SIZE: VERY FINE; RANGE: MICROCRYSTALLINE TO FINE
 GOOD INDURATION
 CEMENT TYPE(S): CALCILUTITE MATRIX
 ACCESSORY MINERALS: CALCITE-01%
 OTHER FEATURES: FOSSILIFEROUS
 FOSSILS: CORAL, MOLLUSKS, BENTHIC FORAMINIFERA
 FOSSIL FRAGMENTS
 CALCARENITE, MADE-UP ALMOST ENTIRELY OF FORAM TESTS
 (SORITES)
- 256.6- 263 CALCARENITE; WHITE TO YELLOWISH GRAY
 10% POROSITY: FRACTURE, MOLDIC, POSSIBLY HIGH PERMEABILITY
 GRAIN TYPE: BIOGENIC, SKELETAL, SKELTAL CAST
 GRAIN SIZE: VERY FINE; RANGE: MICROCRYSTALLINE TO FINE
 GOOD INDURATION
 CEMENT TYPE(S): CALCILUTITE MATRIX
 ACCESSORY MINERALS: CALCITE-01%
 OTHER FEATURES: FOSSILIFEROUS
 FOSSILS: CORAL, MOLLUSKS, ECHINOID, BENTHIC FORAMINIFERA
 FOSSIL FRAGMENTS
 CALCARENITE FOSSILIFEROUS, CORALS, ECHINOIDS, FORAMS
- 263 - 296.8 CALCARENITE; WHITE TO YELLOWISH GRAY
 15% POROSITY: INTERGRANULAR, MOLDIC
 POSSIBLY HIGH PERMEABILITY
 GRAIN TYPE: BIOGENIC, SKELETAL, SKELTAL CAST
 GRAIN SIZE: FINE; RANGE: MICROCRYSTALLINE TO MEDIUM
 GOOD INDURATION
 CEMENT TYPE(S): CALCILUTITE MATRIX
 OTHER FEATURES: FOSSILIFEROUS
 FOSSILS: ECHINOID, MOLLUSKS, BENTHIC FORAMINIFERA, CORAL
- 296.8- 331 CALCARENITE; VERY LIGHT ORANGE TO YELLOWISH GRAY
 .05% POROSITY: INTERGRANULAR, MOLDIC, PIN POINT VOUGS
 GRAIN TYPE: BIOGENIC, PELLET, SKELETAL
 GRAIN SIZE: VERY FINE; RANGE: MICROCRYSTALLINE TO FINE
 MODERATE INDURATION
 CEMENT TYPE(S): CALCILUTITE MATRIX
 SEDIMENTARY STRUCTURES: INTERBEDDED
 ACCESSORY MINERALS: PHOSPHATIC SAND-01%, QUARTZ SAND-01%
 OTHER FEATURES: GRANULAR, WEATHERED, CRYSTALLINE
 FOSSILS: ECHINOID, MOLLUSKS, BENTHIC FORAMINIFERA
 CALCARENITE, LESS PERMEABLE, TRACE QUARTZ AND PHOSPHATIC
 SAND

- 331 - 343.5 CLAY; WHITE TO YELLOWISH GRAY
01‡ POROSITY: LOW PERMEABILITY; MODERATE INDURATION
CEMENT TYPE(S): CLAY MATRIX, CALCILUTITE MATRIX
ACCESSORY MINERALS: PHOSPHATIC SAND-01‡, QUARTZ SAND-01‡
LIMESTONE-03‡
OTHER FEATURES: CALCAREOUS
- 343.5- 345.5 CALCARENITE; YELLOWISH GRAY TO LIGHT OLIVE GRAY
02‡ POROSITY: INTERGRANULAR, LOW PERMEABILITY
GRAIN TYPE: BIOGENIC, CALCILUTITE
GRAIN SIZE: VERY FINE; RANGE: MICROCRYSTALLINE TO MEDIUM
GOOD INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
SEDIMENTARY STRUCTURES: INTERBEDDED
ACCESSORY MINERALS: PHOSPHATIC SAND-03‡, QUARTZ SAND-02‡
CLAY-01‡
OTHER FEATURES: GRANULAR, SPECKLED, HIGH RECRYSTALLIZATION
CALCARENITE, LOW PERMEABILITY, INTERBEDDED QUARTZ AND
PHOSPHATIC SAND SAND, SOME MOLDS FILLED WITH QUARTZ AND
PHOSPHATIC SAND, HIGH RECRYSTALLIZATION
- 345.5- 352 CALCARENITE; WHITE TO YELLOWISH GRAY
03‡ POROSITY: INTERGRANULAR, LOW PERMEABILITY
GRAIN TYPE: BIOGENIC, CALCILUTITE, PELLET
GRAIN SIZE: VERY FINE; RANGE: MICROCRYSTALLINE TO MEDIUM
MODERATE INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
SEDIMENTARY STRUCTURES: INTERBEDDED
ACCESSORY MINERALS: PHOSPHATIC SAND-02‡, CLAY-01‡
QUARTZ SAND-01‡
FOSSILS: BENTHIC FORAMINIFERA, FOSSIL FRAGMENTS
- 352 - 368.5 LIMESTONE; LIGHT GRAY TO LIGHT OLIVE GRAY
03‡ POROSITY: INTERGRANULAR, LOW PERMEABILITY
GRAIN TYPE: BIOGENIC
GRAIN SIZE: CRYPTOCRYSTALLINE
RANGE: CRYPTOCRYSTALLINE TO MICROCRYSTALLINE
POOR INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
SEDIMENTARY STRUCTURES: INTERBEDDED
ACCESSORY MINERALS: PHOSPHATIC SAND-03‡, QUARTZ SAND-02‡
CLAY-02‡
OTHER FEATURES: CALCAREOUS, WEATHERED
FOSSILS: ECHINOID, BENTHIC FORAMINIFERA, FOSSIL FRAGMENTS
LIMESTONE, POORLY CONSOLIDATED, INTERBEDDED PHOSPHATIC AND
QTZ SAND, LITTLE CLAY, LOW PERMEABILITY

- 368.5- 373 CALCILUTITE; YELLOWISH GRAY TO LIGHT OLIVE GRAY
 02% POROSITY: LOW PERMEABILITY
 GRAIN TYPE: BIOGENIC, CRYSTALS
 GRAIN SIZE: CRYPTOCRYSTALLINE
 RANGE: CRYPTOCRYSTALLINE TO MICROCRYSTALLINE
 GOOD INDURATION
 CEMENT TYPE(S): CALCILUTITE MATRIX
 ACCESSORY MINERALS: PHOSPHATIC SAND-02%, QUARTZ SAND-02%
 FOSSILS: FOSSIL FRAGMENTS
 CALCILUTITE, HARD, FEW ACCESSORY MINERALS, VERY LOW
 PERMEABILITY
- 373 - 381.3 CLAY; YELLOWISH GRAY TO LIGHT OLIVE GRAY
 02% POROSITY: LOW PERMEABILITY; GOOD INDURATION
 CEMENT TYPE(S): CALCILUTITE MATRIX
 ACCESSORY MINERALS: LIMESTONE-40%, PHOSPHATIC SAND-08%
 QUARTZ SAND-05%
 OTHER FEATURES: CALCAREOUS
 CLAY, CALCAREOUS, INTERBEDDED
- 381.3- 383 CALCARENITE; YELLOWISH GRAY TO LIGHT OLIVE GRAY
 05% POROSITY: INTERGRANULAR, LOW PERMEABILITY
 GRAIN TYPE: BIOGENIC, CRYSTALS, SKELETAL CAST
 GRAIN SIZE: MICROCRYSTALLINE
 RANGE: CRYPTOCRYSTALLINE TO VERY FINE; MODERATE INDURATION
 CEMENT TYPE(S): CALCILUTITE MATRIX
 SEDIMENTARY STRUCTURES: INTERBEDDED
 ACCESSORY MINERALS: PHOSPHATIC SAND-02%, QUARTZ SAND-01%
- 383 - 385 LIMESTONE; YELLOWISH GRAY TO LIGHT OLIVE GRAY
 02% POROSITY: INTERGRANULAR, LOW PERMEABILITY
 GRAIN TYPE: BIOGENIC, CRYSTALS
 GRAIN SIZE: CRYPTOCRYSTALLINE
 RANGE: CRYPTOCRYSTALLINE TO MICROCRYSTALLINE
 MODERATE INDURATION
 CEMENT TYPE(S): CALCILUTITE MATRIX
 SEDIMENTARY STRUCTURES: INTERBEDDED
 ACCESSORY MINERALS: PHOSPHATIC GRAVEL-02%, QUARTZ SAND-01%
 FOSSILS: FOSSIL FRAGMENTS
- 385 - 389 LIMESTONE; YELLOWISH GRAY TO LIGHT OLIVE GRAY
 10% POROSITY: INTERGRANULAR, MOLDIC
 POSSIBLY HIGH PERMEABILITY
 GRAIN TYPE: BIOGENIC, SKELETAL, SKELETAL CAST
 GRAIN SIZE: MICROCRYSTALLINE
 RANGE: CRYPTOCRYSTALLINE TO VERY FINE; MODERATE INDURATION
 CEMENT TYPE(S): CALCILUTITE MATRIX
 SEDIMENTARY STRUCTURES: INTERBEDDED
 ACCESSORY MINERALS: PHOSPHATIC GRAVEL-01%, QUARTZ SAND-01%
 OTHER FEATURES: FOSSILIFEROUS
 FOSSILS: CORAL, ECHINOID, BENTHIC FORAMINIFERA, MOLLUSKS
 FOSSIL FRAGMENTS
 LIMESTONE, MOLDIC, FOSSILIFEROUS, APPEARS PERMEABLE

- 389 - 398.5 LIMESTONE; YELLOWISH GRAY TO LIGHT OLIVE GRAY
05% POROSITY: INTERGRANULAR, MOLDIC
GRAIN TYPE: BIOGENIC, SKELETAL, SKELETAL CAST
GRAIN SIZE: MICROCRYSTALLINE
RANGE: CRYPTOCRYSTALLINE TO VERY FINE; MODERATE INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
SEDIMENTARY STRUCTURES: INTERBEDDED
ACCESSORY MINERALS: PHOSPHATIC SAND-02%, QUARTZ SAND-03%
CLAY-01%
FOSSILS: CORAL, ECHINOID, BENTHIC FORAMINIFERA, MOLLUSKS
FOSSIL FRAGMENTS
- 398.5- 404.8 LIMESTONE; GREENISH GRAY TO GREENISH GRAY
01% POROSITY: LOW PERMEABILITY
GRAIN TYPE: BIOGENIC
GRAIN SIZE: CRYPTOCRYSTALLINE
RANGE: CRYPTOCRYSTALLINE TO CRYPTOCRYSTALLINE
POOR INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX, CLAY MATRIX
ACCESSORY MINERALS: CLAY-10%, QUARTZ SAND-05%
LIMESTONE, WAXY, CLAYEY, POORLY CONSOLIDATED
- 404.8- 407.5 LIMESTONE; YELLOWISH GRAY TO GREENISH GRAY
02% POROSITY: LOW PERMEABILITY
GRAIN TYPE: BIOGENIC, CALCILUTITE
GRAIN SIZE: MICROCRYSTALLINE
RANGE: CRYPTOCRYSTALLINE TO MICROCRYSTALLINE
GOOD INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
SEDIMENTARY STRUCTURES: INTERBEDDED
ACCESSORY MINERALS: PHOSPHATIC SAND-03%, QUARTZ SAND-02%
CLAY-05%
OTHER FEATURES: CALCAREOUS
FOSSILS: ECHINOID, BENTHIC FORAMINIFERA, FOSSIL FRAGMENTS
LIMESTONE, INTERBEDDED WITH BEDS OF WAXY, CLAYEY LIMESTONE
VERY LOW PERMEABILITY
- 407.5- 422.5 LIMESTONE; WHITE TO YELLOWISH GRAY
02% POROSITY: INTERGRANULAR, LOW PERMEABILITY
GRAIN TYPE: CRYSTALS, CALCILUTITE
GRAIN SIZE: MICROCRYSTALLINE
RANGE: CRYPTOCRYSTALLINE TO MICROCRYSTALLINE
GOOD INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
SEDIMENTARY STRUCTURES: INTERBEDDED
ACCESSORY MINERALS: QUARTZ SAND-06%, PHOSPHATIC SAND-01%
FOSSILS: FOSSIL FRAGMENTS

- 422.5- 431 MUDSTONE; YELLOWISH GRAY TO LIGHT OLIVE GRAY
 01% POROSITY: LOW PERMEABILITY
 GOOD INDURATION
 CEMENT TYPE(S): CALCILUTITE MATRIX, CLAY MATRIX
 SEDIMENTARY STRUCTURES: INTERBEDDED
 ACCESSORY MINERALS: QUARTZ SAND-03%, PHOSPHATIC SAND-01%
 PHOSPHATIC GRAVEL-01%, CLAY-02%
 FOSSILS: FOSSIL FRAGMENTS
 MUDSTONE, WAXY, LOW PERMEABILITY
- 431 - 436 LIMESTONE; WHITE TO YELLOWISH GRAY
 01% POROSITY: LOW PERMEABILITY
 GRAIN TYPE: CRYSTALS, CALCILUTITE
 GRAIN SIZE: MICROCRYSTALLINE
 RANGE: CRYPTOCRYSTALLINE TO MICROCRYSTALLINE
 GOOD INDURATION
 CEMENT TYPE(S): CALCILUTITE MATRIX
 SEDIMENTARY STRUCTURES: INTERBEDDED
 ACCESSORY MINERALS: QUARTZ SAND-03%, PHOSPHATIC GRAVEL-01%
 FOSSILS: BENTHIC FORAMINIFERA, FOSSIL FRAGMENTS
- 436 - 438.3 MUDSTONE; YELLOWISH GRAY TO LIGHT OLIVE GRAY
 01% POROSITY: LOW PERMEABILITY
 POOR INDURATION
 CEMENT TYPE(S): CALCILUTITE MATRIX, CLAY MATRIX
 SEDIMENTARY STRUCTURES: INTERBEDDED
 ACCESSORY MINERALS: QUARTZ SAND-05%, PHOSPHATIC GRAVEL-01%
- 438.3- 440 LIMESTONE; WHITE TO YELLOWISH GRAY
 02% POROSITY: INTERGRANULAR, LOW PERMEABILITY
 GRAIN TYPE: CRYSTALS, CALCILUTITE
 GRAIN SIZE: MICROCRYSTALLINE
 RANGE: CRYPTOCRYSTALLINE TO MICROCRYSTALLINE
 GOOD INDURATION
 CEMENT TYPE(S): CALCILUTITE MATRIX
 SEDIMENTARY STRUCTURES: INTERBEDDED
 ACCESSORY MINERALS: QUARTZ SAND-03%, PHOSPHATIC GRAVEL-01%
 FOSSILS: FOSSIL FRAGMENTS
- 440 - 452 LIMESTONE; VERY LIGHT ORANGE TO YELLOWISH GRAY
 02% POROSITY: INTERGRANULAR, LOW PERMEABILITY
 GRAIN TYPE: CRYSTALS, CALCILUTITE
 GRAIN SIZE: MICROCRYSTALLINE
 RANGE: CRYPTOCRYSTALLINE TO MICROCRYSTALLINE
 MODERATE INDURATION
 CEMENT TYPE(S): CALCILUTITE MATRIX
 SEDIMENTARY STRUCTURES: INTERBEDDED
 ACCESSORY MINERALS: QUARTZ SAND-01%
 FOSSILS: FOSSIL FRAGMENTS
 LIMESTONE-POSSIBLE SUWANNEE CONTACT-VERY CLEAN, PHOSPHATE
 NEARLY ABSENT, VERY LITTLE QUARTZ SAND

452 - 463 LIMESTONE; VERY LIGHT ORANGE TO YELLOWISH GRAY
01% POROSITY: LOW PERMEABILITY
GRAIN TYPE: BIOGENIC, CALCILUTITE
GRAIN SIZE: MICROCRYSTALLINE
RANGE: CRYPTOCRYSTALLINE TO MICROCRYSTALLINE
POOR INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX, CLAY MATRIX
ACCESSORY MINERALS: CLAY-02%
FOSSILS: BENTHIC FORAMINIFERA
LIMESTONE, VERY SOFT CLAYEY, VERY LOW PERMEABILITY

463 - 483 LIMESTONE; VERY LIGHT ORANGE TO YELLOWISH GRAY
05% POROSITY: FRACTURE, INTERGRANULAR, PIN POINT VUGS
POOR INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
FOSSILS: BENTHIC FORAMINIFERA

483 - 498 LIMESTONE; VERY LIGHT ORANGE TO YELLOWISH GRAY
15% POROSITY: INTERGRANULAR, MOLDIC
POSSIBLY HIGH PERMEABILITY
GRAIN TYPE: BIOGENIC, SKELETAL, SKELETAL CAST
GRAIN SIZE: MICROCRYSTALLINE
RANGE: CRYPTOCRYSTALLINE TO VERY FINE; GOOD INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX
OTHER FEATURES: MUDDY

498 - 523 LIMESTONE; WHITE TO YELLOWISH GRAY
01% POROSITY: PIN POINT VUGS
GRAIN TYPE: CALCILUTITE
GRAIN SIZE: CRYPTOCRYSTALLINE
RANGE: CRYPTOCRYSTALLINE TO CRYPTOCRYSTALLINE
POOR INDURATION
CEMENT TYPE(S): CALCILUTITE MATRIX, CLAY MATRIX
ACCESSORY MINERALS: CLAY-01%
FOSSILS: BENTHIC FORAMINIFERA

523 - 543 END OF CORING

543 TOTAL DEPTH

APPENDIX C

Point 174 IAS Site DeSoto Co. TSP

Tues. 11-17-74

- 1230 TSP GAMES on-site @ 2000 136 in DeSoto County
 Meet with Lynn Barr (USGS), Pat Menden, Robert
 Peck (Richard)
- 1300 new Case 75 to be pumped well cluster located
 sitting up to edge in the first sand well
 will be the permanent surface aquifer monitor; the water
 supply will be the casing hole.
- 1455 Space shuttle 21st flight goes off - barely visible
 from site (discovery).
- 1500 Spinning in 1st angle flight (10" angle, 6" inside span)
- 1730 Stop angling @ 19' in same sandy & shell fragment
 looks like good water producer for H₂O supply well
- 1740 leaving site for the day

m.l. ~~hall~~
 11-15-76

PUMP 136 IAS Desoto Co.
Wed. 11-20-94

TED CARTER

- 0700 Driving to PUMP 25 City to help S Murphy get Hydro trailer and save to PUMP 136.
- 1200 On-site @ Pump 136 setting up trailer.
- 1300 Augering @ 34' b/s encounter ^{hard layer} ~~auger~~ probably limestone.
- 1340 Large shell layer - solidified @ 34' - continuing with another auger.
- 1420 Reach clay's phosphatic sand layer. Clay appears to be Venice clay w/ interbedded phosphatic sand & gravel.
- 1450 Installing 4" screen ~~37.5'-12.5'~~ ^{37.5'-12.5'} 12', 4" blank from 10'-12.5'-2.5' above land surface. There is a semi-consolidated clay zone @ 9' b/s 10-20 sand PAK 37.5-12'. Bentonite 10-8'.
- 1700 4" PVC water supply is installed - left 10' of gasgas in the hole - will grout from 8' to surface tomorrow A.M.
- 1720 Leaving site for the day
*note: water level in auger = 4.0' b/s

m. 7. ^{sto}

Road 136 IAS S. 1/2
Thurs. 11-21-94

TED GATES

0715 Arrive on-site, P. Meador picks up backhoe at
entrance gate. Will dig mud pit to core
today

7.85 4.70
1.52
3.15

E' 20
-2.22
5.78

3.85
3.23
4.62

ES
POD 131 IAS Site
Mon 12-16-91
TED (TNS)

1230 Arr on-site P. Menden, R. P. Ke, L. Johnson on-site
Pit sitting up to drill 12" hole to install 8"
Surface casing for eye hole

1250 Discuss drilling plans for contract sig w/ Lloyd
Work on Operator's work order

1330 L. Johnson on-site

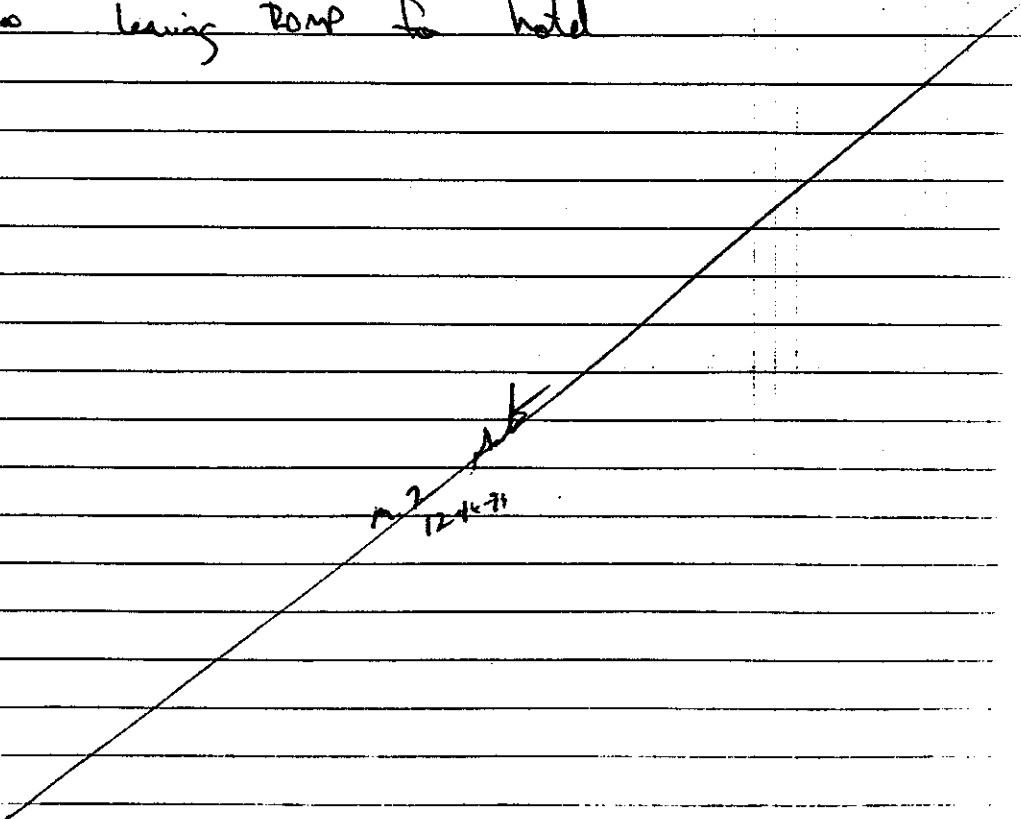
1405 Mess work in 1st zone intermediate well = 6.20 - (2.20)
= 3.98' b/s

1430 leaving site for POMP 5

1530 POMP 5 well in upper Int. 7.85 - (3.23) = 4.62' b/s
well in 12" Surf. 4.70 - (1.52) = 3.15' b/s

well in 2" U.T. OS well 7.20 - (3.00) = ~ 4.20' b/s. Top of
well is > 200' well construct is ok.

1700 leaving POMP for hotel



12-16-91

90 1st Zone Ind. 4" well casing = 2.22' als.
2nd Zone Ind. 4" water supply = 3.51 als

Ramp 136 IAS 5.6
Tues. 12-17-94

TED Gator

0700 on-site @ Ramp 136

0730 Put drill 13" hole to ~40' yesterday - will be drilling to 50' today and install 8" surface casing for borehole

Water supply well: 61 4" casing, open hole 57'

0940 U.C. = 1.93' b/s. Top casing = 3.3' and 6'

0940 U.C. in 4" 1st zone = $(2.27' - (2.22)) = 4.05' \text{ s/s}$

1000 Cindy Gator (Land Resource) on-site - discuss well construction plans & cement installation.

Lynn Barr (USGS) on-site

1130 Lunch

1300 8" casing is installed in borehole to 57.5' b/s. C is ~~at~~ 57' mtr

1330 Begin trench grouting borehole

1430 Finish 1st batch of grouting in casing and

1500 Leaving site for Ramp 25 Lily

1000 on-site @ Ramp 25 Lily - Doug Ruppah @ Ramp 13

1430 leaving Ramp 13 for well

Add total of 300 gal. of cement ← casing line

1st stage 24 bags / 100 gal

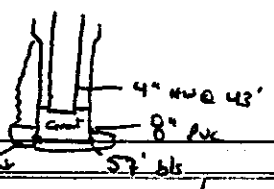
2nd stage 32 bags / 1 gal / 200 gal

#

12-17-94

3.51
4

3.51



3.51
4

TED GIBBS

Pump 136

Wed 12-18-79

57' b/s

- 0700 On-site @ Pump 136 Pat Meadors & R Parker also on-site
- 0730 W.L. = VPZ well = 6.27 - (2.22) = 4.05' b/s
W.L. = Water supply = 4.27 - (3.51) = 0.76' b/s
- 0800 Pd adding gant for annulus of casing - 4' of gant (3 bgs)
- 0900 L Johnson on-site picking up paperwork
- 0930 Installing 4" HW casing @ 43' b/s on top of gant.
- 1200 Lunch on-site [Lynn Barr USGS on-site @ 0800]
- 1330 Begin casing into cement @ bottom of 4" PVC @ 43' b/s
- 1500 Complete 3rd case run @ 58' b/s - All cement - hard
- 1530 Install water meter = 1637355 @ start of 63-68' case run. Encountered limestone on the 58-63' case run. Cement contact w/ limestone @ 59.5'. Calcite w/ interbedded sand: phosphatic sand (Peace River Fm.) - doesn't appear very permeable
- 1600 Collect #4 permeability sample for FGS testing @ 64-64.8' for Peace River Fm. calcite
- 1615 Case Run 68-73' @ 71.5 sandy zone in the limestone probably permeable (lost circulation during casing). Also sandy phosphate zone @ 72' b/s
- 1630 Stopped casing @ 74.5 to do a pump test with the submersible. Setting up equipment.
- 1730 Finish installing equipment - will run test tomorrow.
- 1735 leaving site to rd

12-18-79

Road 134
Thurs. 12-19-96

Teal Gates

- 0700 Arrive on-site (Gates Barr, Meador, Parker).
Setting up XO's and data logger equipment.
- 0800 One XO (Blue 100 psi) not working.
- 0920 Start ^{to} dewater test in core rods. Open int
61-74 in the Peace River Fm. The observation
well (water supply) open in to well 61-77.
Pumped @ 5 gpm w/ 2" submersible. ~~on~~ water
in core rods draw down past XO @ 70' b/c after
15 min
- 0953 Start Recovery phase.
- 1105 Stop Recovery phase (-0.4) lift to recover.
- 1115 Collected SD sample from 61-74 w/ 2" submersible
Volume of core rods = 17 gal
Temp: 23.5 pH - Cond: 0.682
Cl: $7 \times (20?) = 140$ mg/L SO₄: 100 mg/L
- 1145 George Willich on-site (retired USGS) to observe
sub activities.

PUMP 134
Tues. 1-7-96

TED CARTER

- 0745 T Carter on-site with Lyon Barr (USGS) current @ 128' ds
- 0800 -Reviewing data and conferencing with Lyon about packer placement and
- 1000 Trouble-shooting new 50 psi XD and rental data logger.
- 1100 Pk A and A1 - rebuilding packer - installing new seals and
- 1200 Lunch - leaving site
- 1300 Back on-site Call ROPS UInd APT - speak to Rick Lee. Everything seems to be going &
- 1330 Pk going in with the packer about
- 1415 2" pump set @ 70' (3.3' ds) = 66.7' ds. w.c. rise top of drill stem (3.3' ds). XD set @ 60-3.3 = 56.7'
- 1430 w.c. in annulus = 3.1' below top of 4" casing. 30 psi XD is set @ 40' below top of 4" casing. Log # 1474 Seal 1493 $\rho_{set} = .0116$
- 1435 Started test pumping @ 5 gpm for 80-128' interval
- 1438 Water level drew down to pump = 66.7' ds. Stopped drawdown - initial recovery phase - packer appears to have clogged intake ports.
- 1501 Going back in with the 2" pump, after checking packer and installing new seals & cleaning.
- 1530 w.c. in annulus is @ 300' ds T.O.C. All other depths are the same. Re-adjusting.
- 1655 w.c. in core rod set below T.O.C. Annulus = 3.2' below 4" casing. Core Rod depth was off trying again.
- 1710 Top pin stored on packer - stopping for the day.
- 1730 Going to ROPS UInd APT.
- 1830 Leaving ROPS for hotel.

S.S S.4

PUMP 136 & PUMPS

TWO COLUMNS

WED 1-8-96

- 11:00 On-site @ Pump 5 Upper. Int. APT. Mike Beach
Darcen Chen on-site. B. Darcen still going
down slowly - curve has not yet flattened out.
Myself & Rick Lee on-site, Lloyd Johnson
on-site.
- 11:30 T. Gates heading to TMS site
- 11:40 On-site @ TMS. Pat: All things here on 2" pump
- 11:30 Called in to Brad Pitt - Surface Test is scheduled
for next week @ Pump 5 (Greg).
- 11:40 Packer is again installed @ 80' interval for test 80-128'
- 11:41 W.L. in Cas Rods = 5.2' below T.O.C. Annulus =
3.3' below T.O.C. Pump is @ $70' - (3.3)' = 67' \text{ Sls.}$
Pump is 62' below water level. XD in Rods is
60' below (T.O.C. 3.3') = 57' or 52' below W.L.
- 12:00 Start packer test
- 12:05 Call to Pump 5 speak to Rick Lee. Rick
will stop pump and initiate Recovery phase
of test.
- 12:10 Annulus of HW Rods had w.c. drawdown. Stopping
packer test, will inspect packer.
- 14:30 Packer is set again - saw depth for every thing
Interval 80-128' Sls. W.L. in rods = 5.5' Annulus = 5.6'
- 14:31 Started test again Pumping @ 5 gpm.
Rods ~~flow~~ $0.23 \text{ gal/hr} = 13 \text{ gal} + \text{Hole} = 14 \text{ gal} = 3.2 \text{ gal}$
- 14:45 Collect STO. COMPLETE SAMPLE @ 80-128' Sls.
Temp: 24.9°C Cond. 274 umhos pH: —
Cl: 120 SO₄: 200
- 15:45 Begin Recovery.

Pump 136

THURS 1-9-97

TED GATE

- 0720 Arrive on-site @ Pump 136 INS Side
- 0730 Remove rods ~ 2' prop from core hole (covering) Bore
for 80-120' test

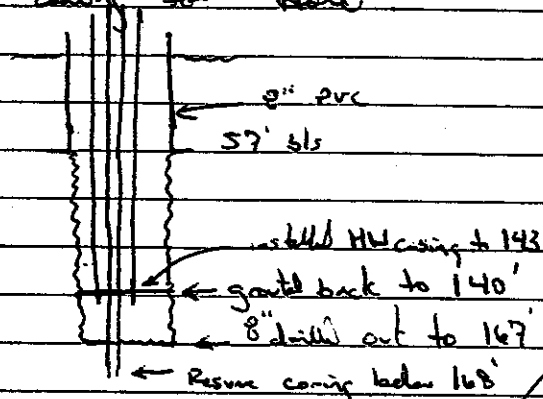
Romp 124
MON. 2-3-97

HW casing reset @ 141' b/s

TED Gatz

GATE
right Boony

- 1200 Arrive on-site @ Romp 136. Put pressure drill to 168' - then install grout (SS pipe) from 168 to ~148' b/s. will install 4" HW and begin casing through grout.
- 1230 Water supply well (7.78') below can bell.
- 1235 UP2 well (7.06') below top of casing.
- 1520 4" HW casing is reset @ 141' b/s. Begin casing through the cement (141-').
- 1710 Stop casing @ 158' b/s - still in cement.
- 1715 leaving for Hotel



M. 2
23 97

3.62 4.98 $\frac{4.8}{8.72}$
 $\frac{4.72}{.44}$

Top Cases
8.71

PUMP 134
TUES. 2-4-97

- 0745 water level in 4" U.S. 8.71
- 0750 water level in 4" VP2 well - 7.20
- 0815 Core rods - begin to core to the side of the core - formation is present along w/cased @ 163'
- 0940 Stop casing @ 178' b/s for a water level
- 0950 Water level = $(4.98) - (5.72) =$
- 1000 Water level = $(5.14) - (5.72) = +0.28'$ above level
- 1005 Reach 188' b/s. Stopping for test.
- 1150 Water level in core rods = $(3.62) - (4.95) = +1.33$
- 1200 XD#1 is set @ 90' - $(3.7' \text{als}) = 86.7' \text{ b/s}$
- 1205 XD#2 is set @ 30' - $(0.7' \text{als}) = 28.3' \text{ b/s}$
- 210 XD#1 needs 86.738' of water.
XD#2 needs 23.697' of water.
- 1215 ~~Begin test~~ Core rods are set @ 183' b/s.
 @ Bottom of hole is 188' U.S. 4" HW casing is @ 143'. 8" PVC is @ 57' b/s.
- 1216 Begin test: $188' \times (0.23 \text{ gal}) = 43 \text{ gal}$ (core rod)
 4" HW casing $143' \times (0.23 \text{ gal}) = 33 \text{ gal}$ 40.7 gal
 Total to be removed @ 130' gal (gpm = 6) = 83 minutes
- 1245 Collect sample STD core. 14
- 1241 Water level draw down to pump - stop test & recovery phases
- 1400 Pump was installed @ 95' b/s. Water draw down to the pump after 10 minutes. The formation produced no water.
 $\frac{134}{1} \times 0.23 \text{ gal} = 27 \text{ gal} - 22 \text{ gal} = 49 \text{ gal}$
 49 gal = 6 gpm = 8 minutes.
- 1550 Stop recovery test after 175 minutes well still @ 28' b/s.
- 1600 Resume casing =
- 1720 Stop casing @ 208' b/s - still appears low permeability.
- 1730 Casing for hole. n.w.s.c.

2.9

3.04
- 0.50
2.54
7.5
1.99

PUMP 136

0.75

TEST GATES

Wed 2-5-97

0720 Arrive @ site U.L. in 4" HW annulus is approximately ~~1.5'~~ 1.5' als. (Annulus is same as core rods)

0740 Water Supply well = 5.15' ~~1.65~~ T.O.C. (-1.55' als)

0741 1st U#2 well = 7.04 T.O.C. → (-4.82 als)

0745 Pat & Al taking off 20' of core rods 208-20-188'
Setting up for 20' packer test interval

0920 Measure U.L. in core rods = 1.99' als.

1010 ~~Core~~ Packer is set @ 18' Packer installed @ 188' als. Pump set @ -180' als X0#1 set @ 167' als. X0#2 set @ ~ 29' als.

1015 X0#1 reads 167.40' of H₂O above X0.

X0#2 reads 29.054' of H₂O above X0.

1040 X0#1 reads 166.811 ←

X0#2 reads 28.710

208 x 0.253 = 52.6 gal

4" HW = 143 x 0.285 = 40.75 = 93 gal

1045 X0#1 = 166.829

X0#2 = 28.638

1047 Begin pumping Test Zone 188-208 ← stopped

1050 Pump control - shut off - stop test, letting water levels equilibrate again.

1120 X0#1 = 166.861

X0#2 = 28.404

1124 Start pumping, GPM = 5 Test zone 188-208

1125 Drawdown X0#1 = -33.46

1200 Drawdown ~ 70' X0#1

1145 Collect STO. COMP @ 188-208' w/ 2" pump.

Temp = 24.7°C COMP: both dual pH both dual

Cl: 140 mg/L SO₄: 55 mg/L

1200 Begin recovery phase.

1230 Viewing packer test graphs - water level in B annulus draw down ~ 1.7'.

Rogel 136 IAS site
Wed. 2-5-97 continued

Ted Gets

1430 Call into office speak to Greg - update him on site activities - he says gives suggestions to check for leakage during packer tests.

1555 Messing W.L. in core rods = 2,20' b/s.

1600 Going in w/ packer. Core ^{logs} is @ 228' b/s.

1650 Start drawdown test for PT 205-228' b/s. This zone appears permeable. GPM = 5.5

1700 $XD^2_1 = -14.435$ of drawdown

$XD^2_2 = -0.02$

$228 \times 0.253 = 57 \text{ gal} = 5 \text{ gpm} = 11 \text{ minutes}$

1715 Collect STD comp @ 205-228' b/s.

1720 Stop pumping begin recovery phase

Temp: 25.6

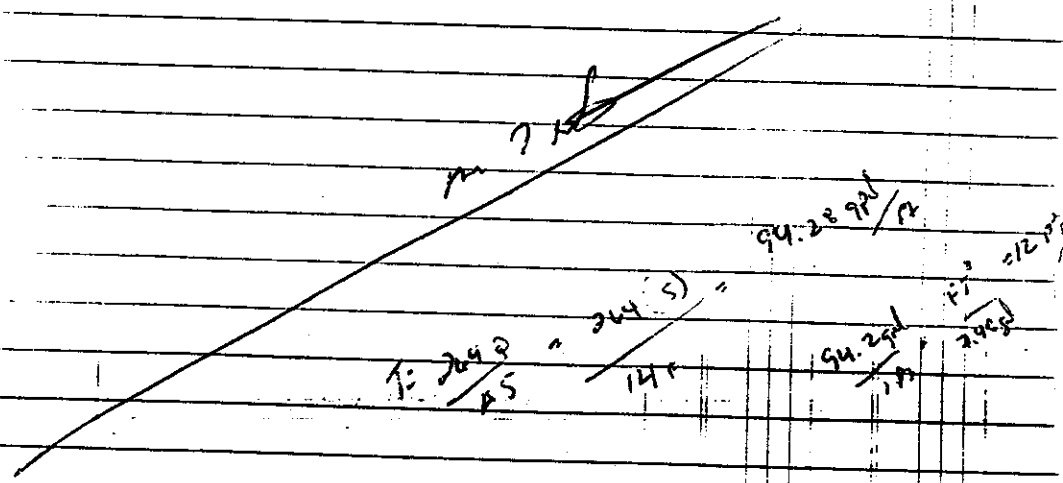
Cond -

pH -

Cl: 160 mg/l

Sol: 65 mg/l

1740 Leaving site for hotel.



RAMP 134 JAS Site

MON. 2-10-97

of Gates

- 1430 7. Gates arrives on-site. Pt. U in on-site
 Packer is set @ 245' bls. Pump is @ 200' bls
 Open Interval 245-200' bls
 Pt collected u.c. in 1st zone $-7.13 - (2.22) = 4.91$
 Coe hole = $+2.82$ with supply = $-4.72 - (3.3)$
- 1445 x0[#] is set @ ~ 170' bls
 x0[#] 2 is set @ ~ 30' bls
- 1500 245' x 0.233 = 57 gal + 23 x 0.38 = 9 gal
 66 gal total to run
- 1505 Start drawdown phase of test. GPM = 4.3
- 1545 Collect 570. complete sample @ 245-200' bls.
 Max of 14' of drawdown.
- 1555 Begin recovery phase of test.
- 1610 Fully Recovered stop test.
- 17:00 Packer is out of hole
- 1715 leaving site for the day

M. Z. Smith
 2-10-97

at Gates
 on-site
 0' Hs
 = 4.91
 22-(3.3) = 1.42
 1' Hs
 = 4.3
 20' Hs

Pump 134 IAS site
 Tues. 2-11-92
 0730 4" 1st zone well W.C. = 7.25 (T.C.) -
 Water supply well W.C. = -9.60 (T.C.) =
 Core rods W.C. = 3.05 - (0.9) = 2.25
 1200 Reach 304' Hs Stop casing
 1:20 3 Packer is set @ 293' Hs Bottomal holes @ 308'
 1325 Begin pumping phase of test 293-308'
 $293 \times 0.23 \text{ gal} = 67 \text{ gal} + 16 \text{ gal} = 73 \text{ gal}$
 15 minutes of pumping to 1 volume.
 [Using permeability to annulus = 2.25' Hs]
 1400 Collect STD COMP @ 293-308' Hs
 1415 Stop pumping - begin recovery phase. Drawdown
 was -9.5 ft in a permeable zone of the Tampa
 1421 Stop recovery phase - fully recovered.
 1700 Stop casing @ 323' Hs Getting close
 to the Nocatee Mbr.
 1715 Leaving site for the day

m? sub
 2-11-92

106

4" HW casing (annulus) is open from 143 to the bottom of Core Rods.

Pump 130

Wed 2-12-93

TED COMEY

- 0715 6llc ... 1st zone 4" = 7.21 (TUC)
 W.C. in water supply well = 5.22 (TUC)
- 1200 Core to 348' bls in Nacatac Mbr. of Anacostia.
 4" HW casing is not flowing.
- 1305 Install packer @ 333' w/ HW head seal installed. Core
 measure HW annulus with bit w/ seal in place.
 Measure W.C. in core rods 333-348' zone W.C. = +2.4
- 1315 Resetting packer - will reuse 4" head seal
- 1400 x0#1 (200 psi) set @ ~ 170' bls
 x0#2 (30 psi) set @ ~ 20' bls.
- 1405 x0#1 reads = 168.528
 x0#2 reads = 29.193
 Packer set @ 331-348' bls (appears less permeable)
- 1420 Start pump begin pumping phase. GPM =
 $331 \times 0.23 = 77 \text{ gal} + 7 \text{ gal} = 84 \text{ gal}$
- 1500 Stop recovery phase. Leaving packer in
 place for water level measurement.

n. 2. net
 2-12-93

143 to

3.95

1.20
2.25

POMP 134

GATES, BAZA MEADOWS, Vince P.
TUS GATES

GATEJ

Thurs. 2-17-97

0715 Core Rols WL = $3.95 - (0.5) - (1.20) = 2.25$

Annulus ~~was~~ is flowing again. Yesterday saw
cuttings was flowing in the casing.

books

0830

Collect Peen samples from peen test zone.

Carl

1015

Stop casing @ 36 1/2' hls in a low permeability
calcareous (Nocard).

be

WL = +2.43

Heading back to Trucksville

mid)

in
meadow

1.7
2-13-97

POAP 134
Mon. 2-17-97

TER Gates

1300 T. Gates arrives on-site P. Meaders,
R. Parker already on-site Temp 80°F
Sunny wind NE @ 15-20 mph

1335 Packer is installed @ 348' b/s. Open hole to 368'

1340 Annulus HW = 2.675 Core rods = 2.60' b/s

1345 Installing 2" pump = xps

1425 40# 200 psi will not return to 0

Installed @ 2170' b/s. Packer 0.345' diam x 0.

1422 Start drawdown phase for 348-368' b/s

$$348 \times 0.23 \text{ gal} = 80 \text{ gal} + 0.38 \text{ gal} \times 20' = 7 \text{ gal}$$

$$1 \text{ vol} = 87 \text{ gallons} \quad GP = 3.75$$

1450 Annulus HW = 3.65 GP = 2.0

$$\text{Drawdown} = -134.042'$$

1510 Collect 50 Comp sample @ 348-368' Drawdown 140' b/s

1515 Stop pump begin recovery phase

$$T = \frac{264(3)}{100'} \cdot 7.52 \text{ gal/hr} \cdot \frac{1 \text{ hr}}{7.40 \text{ gal}} = 1.05 \text{ hr/dk}$$

1645 Packed pump out of well. w.c. had returned to well ~ 8 A

1710 Leaving site for the day

m. z. h. k.
2-17-97

-1.43
5 ³4.25
-1.93 Test Gals
2.72

2 Gates
 POM 134
 Tues. 2-18-97

0710 GATES, Mechanics casing on-site @ Pump 136
 0720 W.C. in 4" HU = 2.50' ds
 W.C. in core rods = 2.72' ds
 W.C. in 4" 1st zone well = 7.14 - (2.22) =

0730 Resume casing @ 348' bls
 0830 1 Barr (VSGS) on-site
 1030 T. Gates leaving site to Pump 5

1200 T. Gates back on-site.
 1300 Reach 398' bls. The last 5 ft. appears permeable. Stopping here for pack test and head level measurement.

1330 G. M. Quann on-site. Setting up packer!
 xo's ok

1445 xoth set @ 170' bls. Pump install @ 200' bls.
 Packer set @ 388' open hole to 398'
 Annulus of HU = 2.87 Rods = 2.80' ds

1500 Begin drawdown phase
 1505 Drawdown = 12.30 in side rods Annulus = 2.90' ds
 $388 \times 0.23 = 90 \text{ gal} + 10 \times 0.38 = 4 \text{ gal}$
 Volume = 94 gal. GPM = 4.6
 $T = 17 \text{ ft}^2/\text{day}$

1529 Q = 4.0 gpm
 1607 Stopped test @ for recovery.
 1710 Leaving site for day

m. J. [unclear]
 2-18-97

4.63

3.30

1.33

3.30

.50

TED GAFER

Damp 134

Wed. 2-19-97

- 0715 Arrive @ well site, Meadows Gate, Brn, Parke
- 0720 H.W. Annulus = ^{2.80} ~~3.70~~ ' c/s Rods = 2.80 c/s
- 0730 Compared measurements between the H.W. remainder of fl
con rods - difference of 0.03'
- 0752 W.L. in 1st zone 4" = 7.20 - (2.22) = 4.98
- 0800 Resetting packer @ 348' again - packer was drilled
yesterday when Pat retrieved it.
- 0900 Pump installed x2's installed @ 388-398'
- 0913 Annulus = 2.80 GPM = 4.1 START PUMPING
- 0916 drawdown = 47' Load = 94 gal.
- 0945 GPM = 2.6 Load = 770
- 1005 Stop drawdown phase - begin recovery.
Annulus = 2.80 Max drawdown = 107' Load = 70
- 1045 Lynn stopped test instead of stop - so we
don't have recovery data - o.k. drawdown curve looks good.
- 1046 letting W.L. recover to measure head inside rods.
- 1130 W.L. still recovering - decide to resume coring.
- 1140 Stop coring @ 428' - still in tight formation
appears to still be Noctette, will set
packer @ 408' for a water level measurement.
- 1730 Leaving site for the day.

m. J. Gafar
2-19-97

1.33

2.78

3.09

111

ED GATES

PLANT 126 73.238
Thurs 2-20-77

168.96

TED GATES

Packer
80 dls
sh- & fl
-(2.22) = 498
no more deflct
@ 358'
Pumping

0715 Gates Barr Meadows Packer on-site
0720 Called w/c Packer apparently looked down - overnight -
Pct stated that is was partially sat. W-C in the
4" HW annulus and inside the core rods were equal
300' dls. Will continue coring
1345 Stop coring @ 458' dls. Appear to be near the
Surface contact - still tight - color looks like
Succinea
1400 T. Gates leaving site for Brallsville

0717
so we
can look good.
& rls.
in coring
tight formation
ill set
succ out.

~~2.78~~
2-20-77

Monday 2-24-97

Toad

134

1st Cor

- 1200 Gates arrives on-site P. Meador, L. B., A.
Morris already on-site.
- 1500 Setting up to packer testing from 403-408' SLs
- 1600 Start test pumping @ 4.5 gpm
- 1610 Max drawdown - 7.2 feet
- 1612 Stop test - begin recovery
- 1700 Wireline broke, trying to remove packer.
- 1730 Packer out - did not tip core rods out of hole. Packer did not set @ 403'.
- 1800 Leaving site for hotel.

~~1730~~
2-24-97

Florida
 1612 $(2.12) - 7.54 = 66$
 1614 5.20
 POMP 136 $\text{sum} = 2.24 \text{ added } 2.31$

8.54 - 2.54 113
 $\frac{.50}{7.54} - \frac{2.12}{5.42}$
 1.60 GPM

Tues. 2-25-97

at
 Bar, A.
 468' bls

- 0700 Pat & Al putting new valves on the rig.
- 0800 I begin report memo to Greg - detailing the current status and estimated completion date for all phases of work @ my projects.
- 1230 Randy Hinkle & Tim Bailey on-site - discuss work order for preparing site for the drilling contractor.
- 1330 Pat & Al have all rods back in the lab - resetting the pecker @ 403 again.
- 1400 Had problem with pecker - would set @ 403. Moved pecker @ 403 to 413 and its set.
- 1405 Change in water level !! For rods water level = +5.42 above land surface. HWL rods water level = +2. above land surf.
- 1410 Begin Pumping 413-468' bls GPM = 4.35
 $413 \times 0.23 = 95 \text{ gal} + 55 \times 0.38 = 21 = 116 \text{ gal}$
 29 minutes for sample. NO change in numbers.
- 1730 Still raining on-site. Begin recovery phase - will collect parcel tomorrow.
- 1750 Leaving site for night.

n. 7 hts
 2-25-97

114

PUMP Annulus 2.8
136
Wed - 2-26-97

3.35 2.54
- 3.35

J.F.D. GRATES

- 0715 Grates, Meads, Morris, Tom on-site
W.C. in core rods (packer in annulus 413-468) is
+4.19 Annulus = +2.80
- 0940 Begin pumping - with pump. 1 water blue sample
570 core from 413-468 bl.
- 1030 Pulling pump & packer. Resulting packer @
448' bls.
- 1030 Packer is reset @ 448-468. W.C. in core rods =
+5.30, annulus = 2.50.
- 1200 Complete test
- 1230 Resume coring @ 468
- 1600 Reach relatively hard section of rock. Swimmer
@ 498' bls.
- 1715 Stop @ 508' bls.
- 1720 Leaving site for hotel

7.7.101
2-26-97

GATES

200P 136

Thurs. 2-27-92

5.7

5.70

3.60

5
3.10

TED GATES

- 0715 GATES, Ben, Madras, Morris @ Drill Site
- 0720 Resume coring @ 50' SLS in permeable section of Sumner
- 0830 Cord to S13'
- 1000 Installing packer @ 493-513'
 $493 \times 0.23 = 114 \text{ gal} + 20 \times 0.38 = 8$
 $122 \text{ gal} = 3 \text{ minutes}$
- 1100 Collect STD. core @ 493-513'
- 1115 Stop test recovery complete
- 1240 T. Gates leaving site for Brooksville

Line Samples

ack @

on site:

Sumner

~~7. 100
 2-27-92~~

in Case

ROMP 134 IAS
MONDAY 3-3-97

THE CASE

guard
pound

0900 Arrive @ ROMP 134 Site

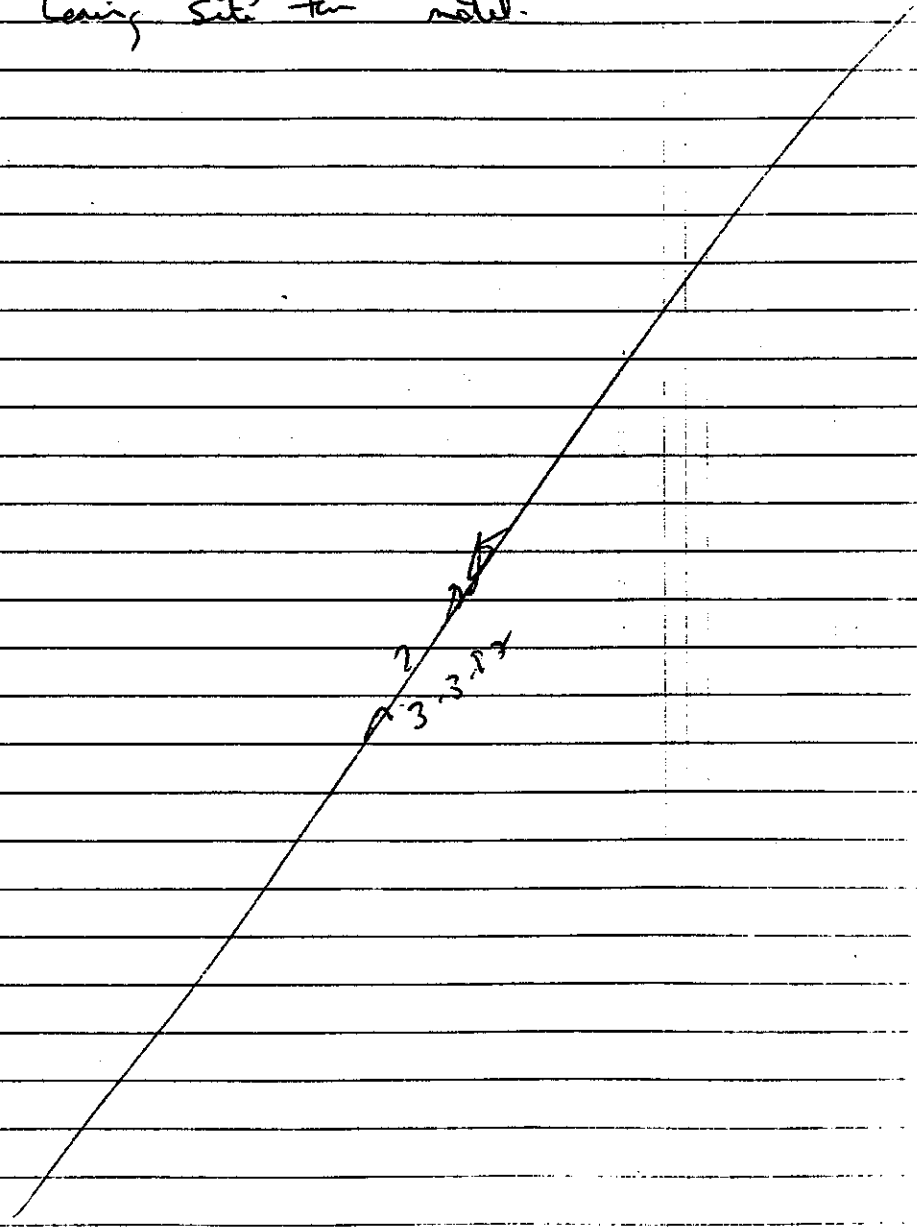
1230 Resume coring @ 513' bls

1700 Stop coring @ 543' bls

Port Weiss
widon
haul for

1730 Leaving site for motel.

Motel



Pump 134
 Tuesday 3-4-97

TED GATES

- 0700 Gates, Pelham, Meadors Barn on-site.
- 0715 Water levels: Core Rods (543') = 5.32' als
 Annulus: 4.07' als
- 0730 Call into Brooksville - speak to G. McQuinn -
 about site plans. Will grant hole up
 after getting a final water level & water sample.
 End of coring @ 543' b/s. in the
 Suwannee L.S.
- 1100 Collect final permeability samples - for a total
 of 10.
- 1200 Packer Set @ 513' for water level & water
 sample in the Floridan.
 $513 \times 0.23 \text{ gal/ft} = 118 \text{ gal}$ $40' \times 0.38 = 16 \text{ gal}$
 134 gal Approx 34 minutes.
- 1300 Annulus: 4.12' als Core Rods = 5.05' als.
- 1305 Packer appears not to be set. Annulus
 water level fluctuates with flow restrictions in
 core rods.