Engineering Report—Volume 1

DRILLING AND TESTING OF THE DEEP INJECTION WELL SYSTEM

General Development Utilities, Inc.

North Port St. Lucie
Wastewater Treatment Plant
Port St. Lucie, Florida

CH2M HILL

October 1987
SE15807.T2

Florida Department of Environmental Regulation

Southeast District • 1900 S. Congress Ave., Suite A • West Palm Beach, Florida 33406 • 407-964-9668

Bob Martinez, Governor
Dale Twachtmann, Secretary
John Shearer, Assistant Secretary
Scott Benyon, Deputy Assistant Secretary

NOV 10 1988

NOTICE OF PERMIT

St. Lucie County
UC - North Port St. Lucie WWTP IW-1

Mr. Gregory A. Kisela
General Development Utilities, Inc.
1111 S. Bayshore Drive
Miami, FL 33131

Dear Mr. Kisela:

Enclosed is Permit Number UO56-148337, to operate the North Port St. Lucie WWTP Class I Injection Well, issued pursuant to Section(s) 403.087, Florida Statutes and Florida Administrative Codes 17-3, 17-4, 17-6, 17-22 & 17-28.

Persons whose substantial interests are affected by this permit have a right, pursuant to Section 120.57, Florida Statutes, to petition for an administrative determination (hearing) on it. The petition must conform to the requirements of Chapters 17-103 and 28-5.201, FAC, and must be filed (received) in the Department's Office of General Counsel, 2600 Blair Stone Road, Tallahassee 32301, within fourteen (14) days of receipt of this notice. Failure to file a petition within the fourteen (14) days constitutes a waiver of any right such person has to an administrative determination (hearing) pursuant to Section 120.57, Florida Statutes. This permit is final and effective on the date filed with the Clerk of the Department unless a petition is filed in accordance with this paragraph or unless a request for extension of time in which to file a petition is filed within the time specified for filing a petition and conforms to Rule 17-103.070, FAC. Upon timely filing of a petition or a request for an extension of time this permit will not be effective until further Order of the Department.

When the Order (Permit) is final, any party to the Order has the right to seek judicial review of the Order pursuant to Section 120.168, Florida Statutes, by the filing of a Notice of Appeal pursuant to Rule 9.110, Florida Rules of Appellate Procedure, with the Clerk of the Department in the Office of General Counsel, 2600 Blair Stone Road, Tallahassee, Florida 32301; and by filing a copy of the Notice of Appeal accompanied by the applicable filing fees with the appropriate District Court of Appeal. The Notice of Appeal must be filed within 30 Days from the date the Final Order is filed with the Clerk of the Department.

Executed in West Palm Beach, Florida.

STATE OF FLORIDA
DEPARTMENT OF ENVIRONMENTAL REGULATION

Margaret F. Highsmith

Margaret F. Highsmith
UIC Permitting
1900 South Congress Avenue, Suite A
West Palm Beach, FL 33406
407/964-9668

MFH:rh:30

Copies furnished to:

Mark Elsner, DER - WPB
Richard Deuerling, DER -Tallahassee
David Butler, SFWMD
John Mason, EPA - Atlanta
Mike Merritt, USGS - Miami
Jeff Lehnen CH_2M Hill - Gainesville
Michael Yates, GDU

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PERMITTEE:
Mr. Gregory A. Kisela
General Development Utilities
1111 S. Bayshore Drive
Miami, FL 33131

I.D. NUMBER: 5156P03278
PERMIT/CERTIFICATION NUMBER: UO 56-148337
DATE OF ISSUE: November 10, 1988
EXPIRATION DATE: November 10, 1993
COUNTY: St. Lucie
LATITUDE/LONGITUDE: 27°20'09"N/80°21'03"W
SECTION/TOWNSHIP/RANGE: 20/T36S/R40E
PROJECT: North Port St. Lucie WWTP IW-1

This permit is issued under the provisions of Chapter 403, Florida Statutes, and Florida Administrative Code Rule 17-3, 17-4, 17-6, 17-22 and 17-28. The above named permittee is hereby authorized to perform the work or operate the facility shown on the application and approved drawing(s), plans, and other documents attached hereto or on file with the Department and made a part hereof and specifically described as follows:

TO OPERATE: A 12-inch injection well for disposal of 3.4 million gallons per day (maximum design capacity) of non-hazardous, secondarily-treated domestic wastewater through an open-hole interval between 2750 feet and the total depth of the well at 3324 feet (Exhibit I). The confinement of the injection zone from overlying USDW aquifers is monitored through two intervals (lower-1730 feet to 1800 feet; upper-950 feet to 1175 feet) in an offset 6-inch monitor well located 80 feet west of the injection well (Exhibits I & II).

IN ACCORDANCE WITH: Applications to operate a Class I Injection Well received April 20, 1988; letters with attachments from Michael Yates with General Development Utilities received June 20, 1988 and June 22, 1988; Certification of Completion of Construction for the injection and monitor wells received June 16, 1988; and Certificate of Demonstration of Financial Responsibility received August 17, 1988.

LOCATED AT: St. James Drive and Airoso Blvd..

TO SERVE: Port St. Lucie.

SUBJECT TO: General Conditions 1-16 and Specific Conditions 1-4.

CERTIFICATE OF SERVICE

This is to certify that this NOTICE OF PERMIT and all copies were mailed before the close of business on NOV 10 1988 to the listed persons.

Clerk Stamp

FILING AND ACKNOWLEDGEMENT FILED, on this date, pursuant to the §120.52(10), Florida Statutes, with the designated Department Clerk, receipt of which is hereby acknowledged.

Ann E Carris 11/10/88
Clerk Date

GENERAL CONDITIONS:

1. The terms, conditions, requirements, limitations, and restrictions set forth herein are "Permit Conditions" and as such are binding upon the permittee and enforceable pursuant to the authority of Sections 403.161, Florida Statutes. The permittee is hereby placed on notice that the Department will review this permit periodically and may initiate enforcement action for any violation of the "Permit Conditions" by the permittee, its agents, employees, servants or representatives.

2. This permit is valid only for the specific processes and operations applied for and indicated in the approved drawings or exhibits. Any unauthorized deviation from the approved drawings, exhibits, specifications, or conditions of this permit may constitute grounds for revocation and enforcement action by the Department.

3. As provided in Subsections 403.087(6), Florida Statutes, the issuance of this permit does not convey any vested rights or any exclusive privileges. Nor does it authorize any injury to public or private property or any invasion of personal rights, nor any infringement of federal, state, or local laws or regulations. This permit does not constitute a waiver of or approval of any other Department permit that may be required for other aspects of the total project which are not addressed in the permit.

4. This permit conveys no title to land or water, does not constitute state recognition or acknowledgement of title, and does not constitute authority for the use of submerged lands unless herein provided and the necessary title or leasehold interests have been obtained from the state. Only the Trustees of the Internal Improvement Trust Fund may express state opinion as to title.

5. This permit does not relieve the permittee from liability for harm or injury to human health or welfare, animal, plant or aquatic life or property and penalties therefor caused by the construction or operation of this permitted source, nor does it allow the permittee to cause pollution in contravention of Florida Statutes and Department rules, unless specifically authorized by an order from the Department.

6. The permittee shall at all times properly operate and maintain the facility and systems of treatment and control (and related appurtenances) that are installed or used by the permittee to achieve compliance with the conditions of this permit, as required by Department rules.

7. The permittee, by accepting this permit, specifically agrees to allow authorized Department personnel, upon presentation of credentials or other documents as may be required by law, access to the premises, at reasonable times, where the permitted activity is located or conducted for the purpose of:

   a. Having access to and copying any records that must be kept under the conditions of the permit;
   b. Inspecting the facility, equipment, practices, or operations regulated or required under this permit; and
   c. Sampling or monitoring any substances or parameters at any location reasonably necessary to assure compliance with this permit or Department rules.

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

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

   a. a description of and cause of non-compliance; and

GENERAL CONDITIONS:

b. the period of non-compliance, including exact dates and times; or, if not corrected, the anticipated time the non-compliance is expected to continue, and steps being taken to reduce, eliminate, and prevent recurrence of the non-compliance.

The permittee shall be responsible for any and all damages which may result and may be subject to enforcement action by the Department for penalties or revocation of this permit.

9. In accepting this permit, the permittee understands and agrees that all records, notes, monitoring data and other information relating to the construction or operation of this permitted source, which are submitted to the Department, may be used by the Department as evidence in any enforcement case arising under the Florida Statutes or Department rules, except where such use in proscribed by Sections 403.73 and 403.111, Florida Statutes.

10. The permittee agrees to comply with changes in Department rules and Florida Statutes after a reasonable time for compliance, provided however, the permittee does not waive any other rights granted by Florida Statutes or Department rules.

11. This permit is transferable only upon Department approval in accordance with Florida Administrative Code Rules 17-4.12 and 17-30.30, as applicable. The permittee shall be liable for any non-compliance of the permitted activity until the transfer is approved by the Department.

12. This permit is required to be kept at the work site of the permitted activity during the entire period of construction or operation.

13. This permit also constitutes:

( ) Determination of Best Available Control Technology (BACT)
( ) Determination of Prevention of Significant Deterioration (PSD)
( ) Certification of Compliance with State Water Quality Standards (Section 401, PL 92-500)
( ) Compliance with New Source Performance Standards

14. The permittee shall comply with the following monitoring and record keeping requirements:

a. Upon request, the permittee shall furnish all records and plans required under Department rules. The retention period for all records will be extended automatically, unless otherwise stipulated by the Department, during the course of any unresolved enforcement action.

b. The permittee shall retain at the facility or other location designated by this permit records of all monitoring information (including all calibration and maintenance records and all original strip chart recordings for continuous monitoring instrumentation), copies of all reports required by this permit, and records of all data used to complete the application for this permit. The time period of retention shall be at least three years from the date of the sample, measurement, report or application unless otherwise specified by Department rule.

c. Records of monitoring information shall include:

- the date, exact place, and time of sampling or measurements;
- the person responsible for performing the sampling or measurements
- the date(s) analyses were performed;
- the person responsible for performing the analyses;
- analytical techniques or methods used; and
- results of such analyses.

15. When requested by the Department, the permittee shall within a reasonable time furnish any information required by law which is needed to determine compliance with the permit. If the permittee becomes aware that relevant facts were not submitted or were incorrect in the permit application or in any report to the Department, such facts or information shall be submitted or corrected promptly.

GENERAL CONDITIONS:

16. In the case of an underground injection control permit, the following permit conditions shall also apply:

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

    b. Reports of compliance or noncompliance with, or any progress reports on, requirements contained in any compliance schedule of this permit shall be submitted no later than 14 days following each schedule date.

    c. Notification of any noncompliance which may endanger health or the environment shall be verbally submitted to the department within 24 hours and again within 72 hours and a final report provided within two weeks.

        1. The verbal reports shall contain any monitoring or other information which indicate that any contaminant endanger an underground source of drinking water and any noncompliance with a permit condition or malfunction of the injection system which may cause fluid migration into or between underground sources of drinking water.

        2. The written submission shall contain a description of and a discussion of the noncompliance and if not corrected, the anticipated time the noncompliance is expected to continue, the steps being taken to reduce, eliminate, and prevent recurrence of the noncompliance and all information required by Florida Administrative Code Rule 17-28.230(4)(b).

    d. The Department shall be notified at least 180 days before conversion or abandonment of an injection well, unless abandonment within a lesser period of time is necessary to protect waters of the state.

SPECIFIC CONDITIONS:

1. Operating Requirements

    a. The flow to the injection well, IW-1, will be monitored and controlled at all times to ensure the maximum pressure at the wellhead does not exceed 66% of the tested pressure (66 psig) on the final casing and the velocity down the well does not exceed 8.0 feet per second (2704 gpm).

    b. The injection well system will be monitored by continuous indicating, recording and totalizing devices for effluent flow rate and volume, injection pressure and monitor well pressures. All gauges and recording devices must be maintained in good operating condition and calibrated semi-annually at a minimum.

2. Testing and Reporting Requirements

    a. Any failure of injection well monitoring and recording equipment for a period of more than forty-eight (48) hours will be reported immediately to the Department.

    b. The following injection well performance and monitor zone data will be recorded as indicated and reported monthly:

        1. Injection well performance:

            - total daily flow (mgd)
            - daily maximum flow (mgd)
            - daily maximum injection pressure (psig)
            - daily average injection pressure (psig)
            - monthly averages for the above

SPECIFIC CONDITIONS CONTINUED:

b. 2. Chemical characteristics of upper and lower monitoring zones:

- total dissolved solids-measured (mg/l)
- chlorides (mg/l)
- fecal coliform (# colonies/100 ml)
- conductivity (umho/cm)
- BOD5
- pH
- temperature
- ammonia (mg/l)

c. A minimum of three (3) well volumes of fluid will be pumped from each monitor system prior to sampling for chemical parameters listed.

d. A controlled quarterly test of well injectivity will be conducted at two specified injection flow rates. The high rate should approach maximum design flow. The following data will be recorded and reported at each injection rate:

- Injection flow rate (mgd)
- Injection pressure (psig)
- Well head pressure with no flow (shut-in pressure in psig).

All readings should be taken after a minimum five minute period of stabilized flow.

e. All injection well data submissions will be clearly identified on each page with facility name, I.D. Number, date of sampling/recording and type of data shown. The lead plant operator or higher official must sign and date each submittal.

f. The permittee will demonstrate mechanical integrity for the injection well prior to February 2, 1993 in compliance with the criteria established in 17-28.250(1)(c) and 17-28.130(6)(c)1 and 2 FAC. The testing procedure and schedule shall be submitted to the Department for approval at least thirty days prior to testing.

g. The evaluation and interpretation of the mechanical integrity test data will be certified by the engineer of record and submitted with the operating permit renewal application at least sixty days prior to the expiration of this permit.

3. Surface Equipment

a. The integrity of the monitor zone sampling systems will be maintained at all times. Sampling lines and equipment shall be kept free of contamination with independent discharges and no interconnections with any other lines.

b. The surface equipment for the injection well system must maintain compliance with 17-6.080(4)(d) FAC for water hammer control, screening, access for logging and testing, reliability and flexibility in the event of damage to the well and effluent piping.

4. Financial Responsibility

a. The permittee must maintain financial responsibility and resources to plug and abandon the injection well system throughout the term of this permit.

b. The Certificate of Demonstration of Financial Responsibility expires March 31, 1989. The permittee must renew this certification by the Department prior to its expiration.

Issued this 10th day of November, 1988

STATE OF FLORIDA
DEPARTMENT OF ENVIRONMENTAL REGULATION

J Scott Benyon
J. Scott Benyon
Deputy Assistant Secretary

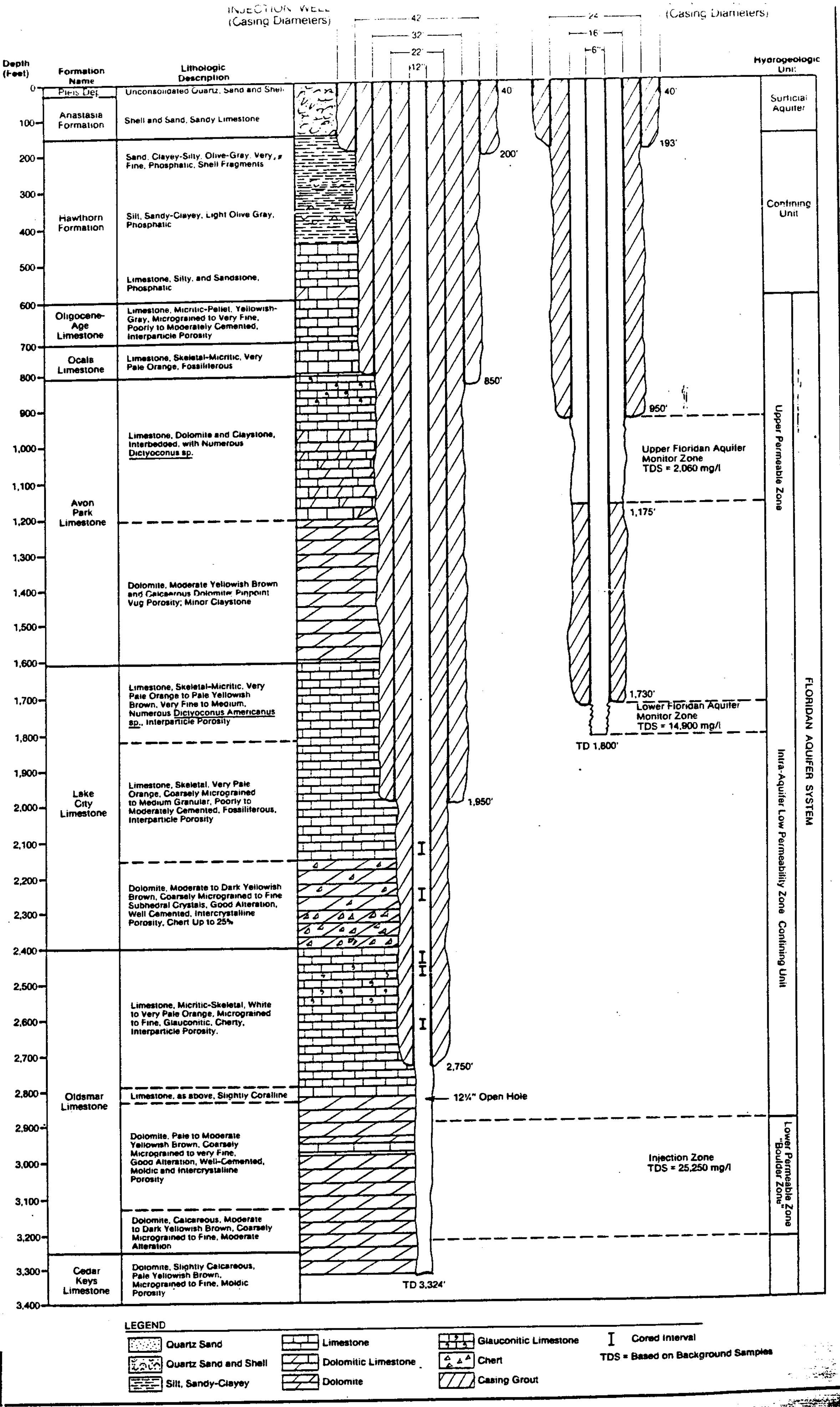

EXHIBIT I

FIGURE 2 GDU North .t St. Lucie WWTP—Summary of Well Construction and Hydrogeologic Di
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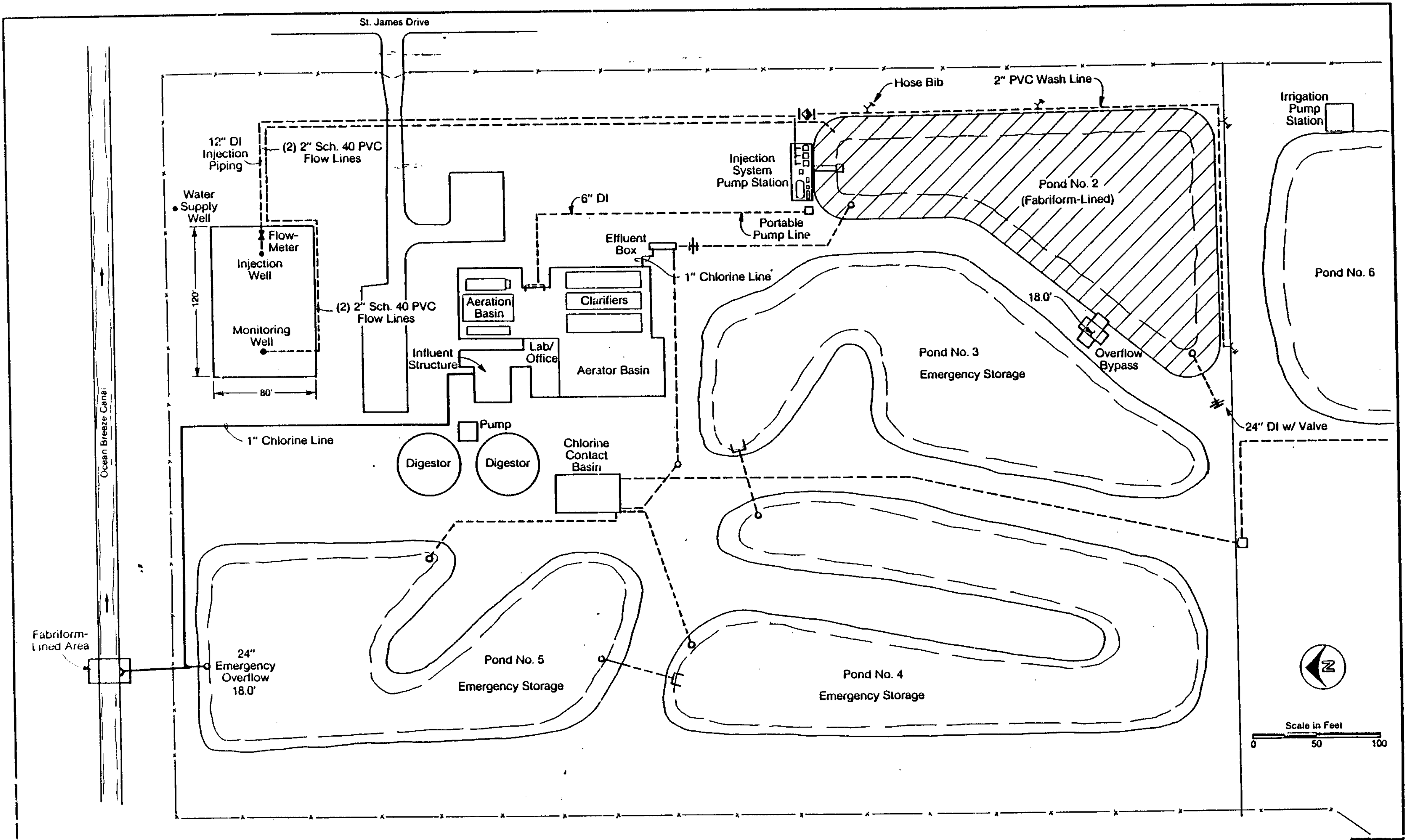
EXHIBIT II



Section 20, T36S, R4
U.S.G.S. Ankona Quadrangle Map

FIGU 1-1.
GDU North Port St. Lucie WWTP Injection System S an.

MEMORANDUM

CH2M HILL

TO:
Scott Benyon, DER/West Palm Beach
Paul Phillips, DER/West Palm Beach
Cathy Conrardy, DER/Tallahassee
Mike Merritt, USGS/Miami
David Butler, SFWMD/West Palm Beach
Gene Coker, EPA/Atlanta
Michael Yates, GDU/Miami
Pete Walch, GDU/Port St. Lucie
Jimmy Brantley, Youngquist Bros./Ft. Myers
J. I. Garcia-Bengochea, CH2M HILL/Gainesville
John Curtiss, CH2M HILL/Deerfield Beach

FROM:
Leslie Shannon, CH2M HILL
Jeffrey Lehnen, CH2M HILL

DATE: November 17, 1987

SUBJECT:
General Development Utilities
North Port St. Lucie Injection System Final Report

PROJECT: SE15807.T2

We are pleased to transmit the report on the construction and testing of the GDU North Port St. Lucie injection well entitled "Engineering Report--Drilling and Testing of the Deep Injection Well System." The report is in two volumes, with Volume I containing the text and appendices A through F, and Volume II containing appendices G and H.

The pump station will be completed and the system will be operational by approximately the first week of December. In accordance with Specific Condition 12, we would like to receive written authorization to proceed with operational testing as soon as possible after the system is operational.

An operating permit application will be made after a period of operational testing. This report will become part of that application by reference.

We appreciate your past support and cooperation and look forward to timely receipt of the written authorization. Please call with any questions (904/377-2442).

gnCR43/049

ENGINEERING REPORT

DRILLING AND TESTING OF THE DEEP INJECTION WELL SYSTEM

Prepared for

GENERAL DEVELOPMENT UTILITIES
NORTH PORT ST. LUCIE WASTEWATER TREATMENT PLANT
PORT ST. LUCIE, FLORIDA

Prepared by

CH2M HILL, SOUTHEAST, INC.
7201 N.W. 11th Place
Gainesville, Florida 32605

October 1987
SE15807.T2

CONTENTS

CONTENTS--Continued

TABLES

FIGURES

ACKNOWLEDGEMENTS

The timely completion of the injection well system was made possible through the close cooperation of the many agencies and individuals involved. The Florida Department of Environmental Regulation (FDER) Technical Advisory Committee (TAC), comprised of representatives of the FDER, EPA, SFWMD, and the United States Geological Survey (USGS), under the chair of Mr. Paul Phillips, provided invaluable agency support and response throughout the planning, design, and construction phase of the project.

Those who played key roles in the execution of this project are as follows:

General Development Utilities (GDU)--Mr. Leighton Hew, Mr. Michael Yates, Mr. Peter Walch

Department of environmental Regulation, State of Florida--Mr. Scott Benyon, District Manager, Ms. Cathy Conrardy, Mr. Richard Deuerling, Mr. Mark Elsner, Dr. Alex Padva, Assistant District Manager, Mr. Paul Phillips, and Mr. Don White

Environmental Protection Agency (EPA)--Mr. Gene Coker

South Florida Water Management District (SFWMD)--Mr. David Butler

U.S. Geologic Survey (USGS)--Mr. Michael Merritt

Youngquist Brothers, Inc.--Mr. Tim Youngquist, Mr. Jimmy Brantley

Elkins Industrial Contractors, Inc.--Mr. Matthew D. Welch

CH2M HILL--Ms. Laura G. Cesare, Mr. John Curtiss, Mr. James C. Dwyer, Dr. J. I. Garcia-Bengochea, Mr. Jeffrey D. Lehnen, Ms. Leslie B. Shannon, and Mr. Bruce Spiller

Section 1
SCOPE

PROJECT DESCRIPTION

This report describes the drilling, construction, and testing of the deep injection and monitoring well system at the General Development Utilities (GDU) North Port Wastewater Treatment Plant (WWTP) in Port St. Lucie, Florida.

The injection and monitoring well system was constructed in accordance with the "Contract Documents for the Deep Injection and Monitoring Wells--North Port St. Lucie Wastewater Treatment Plant" of General Development Utilities, Inc., which CH2M HILL prepared in December, 1986.

The Florida Department of Environmental Regulation (FDER) issued Permit No. UC 56-097497 to construct a Class I Test/Injection Well and associated monitor well on April 10, 1985. The permit was revised and extended on May 8, 1987. Copies of the FDER permits and related correspondence are included in Appendix A.

Youngquist Brothers, Inc. was the drilling contractor for the construction of the injection and monitoring well system. Construction of the drilling pad and wells began in April 1987 and was completed in September 1987.

The injection system consists of the injection well, an effluent pumping station, a multi-zoned monitoring well, and control and monitoring instrumentation. The injection well is 3,324 feet deep with a 12-inch-diameter casing set at 2,750 feet below pad. The injection zone is a highly permeable, cavernous dolomite occurring between approximately 2,900 feet and 3,200 feet below pad.

The well is capable of accepting effluent flows up to 4 mgd from the pump station. Current (1987) flow from the plant is approximately 0.4 mgd. The pump station, constructed under a separate contract by Elkins Industrial Constructors, Inc., consists of two constant speed vertical turbine pumps in a lined pond, both rated at 2.65 mgd (1,840 gpm) at 115 feet of field head. Their combined capacity is approximately 4.0 mgd.

The current (1987) flows are spray irrigated on a wooded site west of the plant. General Development Corporation (GDC) has scheduled to convert that site to a golf course in early 1988. The injection well system will function as a backup disposal system to pump the excess effluent that cannot be reused by spray irrigation on the golf course, once the course is completed.

The aquifer overlying the injection zone is monitored by means of the two-zone monitoring well. The lower zone, extending from 1,730 to 1,800 feet, is monitored by the 6-5/8-inch casing, and the upper zone, extending from 950 to 1,175 feet, is monitored by the annulus between the 6-5/8- and 16-inch casings. Monitoring of these two zones is designed to detect any vertical migration of the injected fluid should it occur.

The data collected during the drilling, construction, and testing of the wells are included in the appendices of this report. The daily field reports and weekly progress summaries are contained in Appendix G.

Section 2
PROJECT CONSTRUCTION

LOCATION

The injection well system, consisting of an injection well, separate monitor well, and a pump station, is part of the General Development Utilities (GDU) North Port St. Lucie Wastewater Treatment Plant (WWTP). The WWTP is located off St. James Drive near Bayshore Boulevard in Port St. Lucie, St. Lucie County, Florida (Figure 2-1). The map location is N.E. ¼, Section 20, Township 36S, Range 40E; latitude 27°20'~~09~~16", longitude 80°21'03". The site plan, showing the location of the injection and monitor wells, the pump station, and the emergency overflow, is depicted in Figure 2-2.

SITE PREPARATION

Prior to the well drilling operation, existing sludge drying beds were demolished and removed, and the area was cleared and graded level. The final drilling pad elevation at the injection well is 14.50 feet mean sea level (msl), and 15.50 feet msl at the monitor well. A concrete drilling pad measuring 80 feet by 120 feet with a continuous 8-inch curb around its perimeter was constructed. The pad drains to a shallow sump around the injection wellhead. During system operation, a 6-inch PVC pad drain line will transport rainwater off the pad to an existing culvert to the Ocean Breeze Canal.

An 8-inch water supply well was drilled off the northeast corner of the pad for use during drilling operations. This well was drilled to a total depth of 120 feet, with 80 feet of PVC casing and forty feet of 8-inch, 0.030-inch slot PVC screen, and gravel packed to 40 feet below land surface.

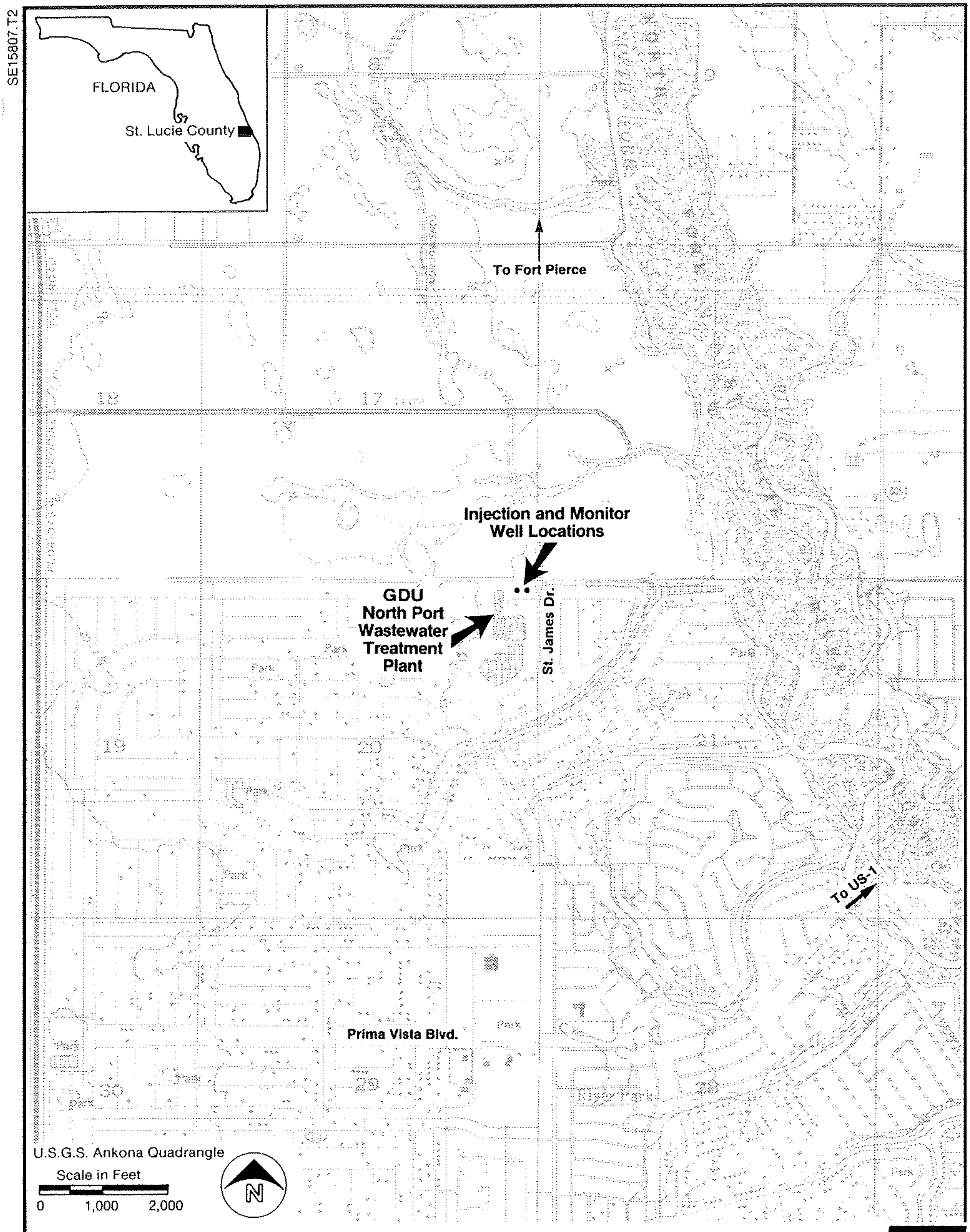
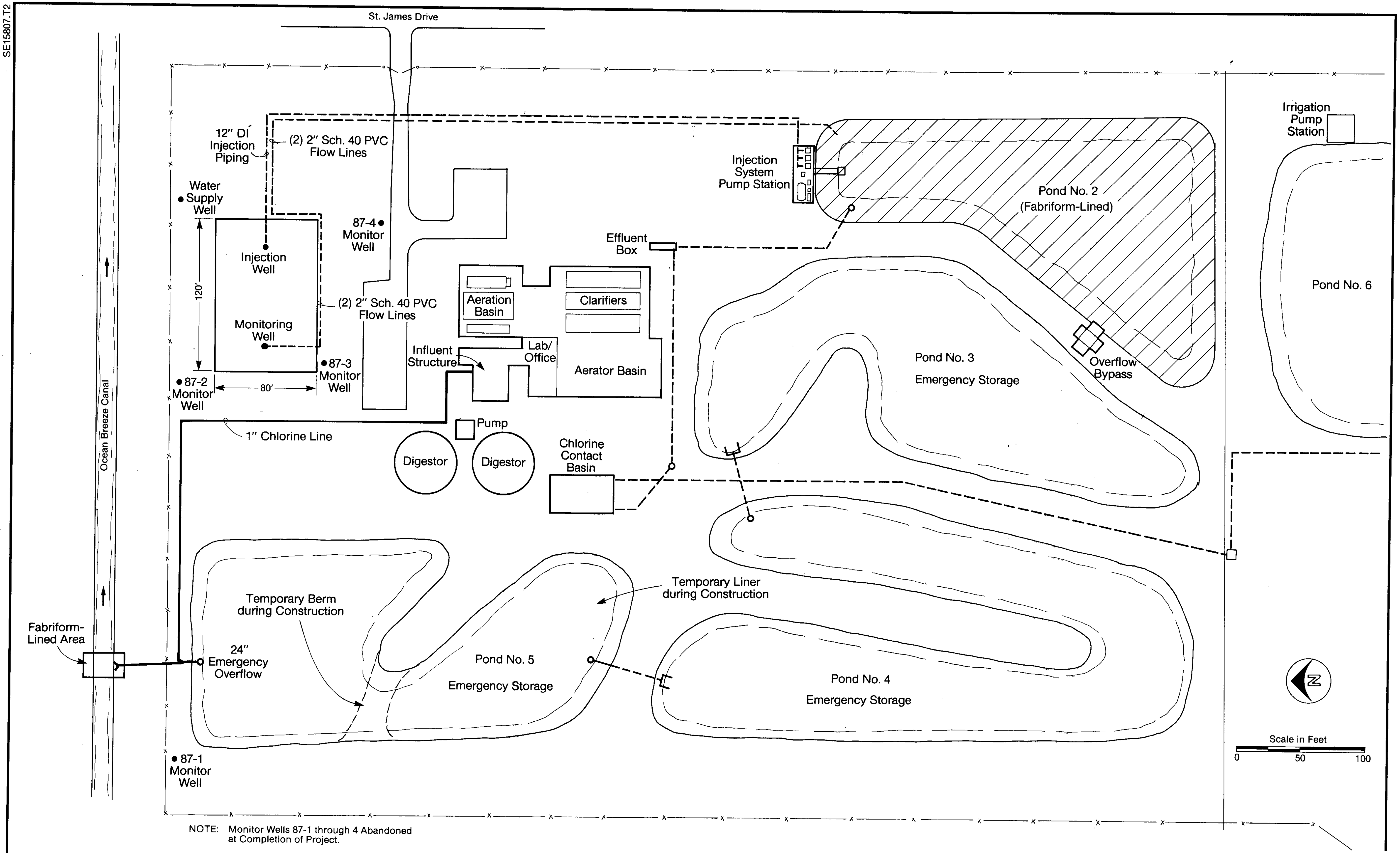


FIGURE 2-1.
Location of the GDU North Port St. Lucie WWTP, Port St. Lucie, Florida.



NOTE: Monitor Wells 87-1 through 4 Abandoned at Completion of Project.

Section 20, T36S, R40E on
U.S.G.S. Ankona Quadrangle Map

FIGURE 2-2.
Site Plan of the North Port St. Lucie WWTP Injection Well System.

CH2M HILL

The annulus from 40 feet to the surface was filled with neat cement.

Four shallow monitor wells, the 87-1 through 87-4 series, whose locations are shown in Figure 2-2, were drilled around the pad to monitor for possible contamination from drilling activities. These wells were constructed with 23 to 28 feet of 2-inch PVC casing and 5 feet of PVC, slot size 40 screen. Weekly sampling for chlorides and conductivity was conducted, with the results presented in Appendix D. A separate sample was also sent to the CH2M HILL laboratory to establish a good baseline to compare against the field measurements (Appendix D). Laboratory results and field measurements are reasonably close. Field measurements did not vary significantly from week to week, indicating no contamination from construction activities occurred. These wells were plugged and abandoned at the completion of the drilling project.

METHODOLOGY AND DATA COLLECTION

Drilling began on the injection well in April 1987 and on the monitor well in July 1987. The drilling rig used for the injection well was a Citation A1000 with a rated hook load of 500,000 pounds. A 360 Challenger was used for the monitor well, with a rated hook load of 200,000 pounds. The wells were rotary drilled with conventional mud circulation into the underlying Eocene limestones at approximately 900 feet. The remaining portions of the injection well and the monitor well to a depth of 1,580 feet were drilled and reamed utilizing reverse air circulation with Baroid drilling mud to prevent artesian flow of brackish water. The lower 190 feet of the monitor well were drilled by reverse air open circulation.

During the pilot hole drilling, two sets of formation samples from both wells were collected every 10 feet from land surface to total depth. One sample set was washed and described, and the other was sent to the Florida Bureau of Geology in Tallahassee. The lithologic sample descriptions from the injection well and the monitor well are in Appendix B.

Water samples were collected every 30 feet from 850 feet to 3,324 feet while the injection well pilot hole was being drilled, and from 950 to 1,770 feet while drilling the monitor well pilot hole. These samples were collected from the air-lifted water from the bit depth at each drilling rod change. Additional water samples were taken in the injection well with a depth sampler in the transitional area from less than to greater than 10,000 mg/l total dissolved solids (TDS). Water quality results from pilot hole drilling and the depth sampling are contained in Appendix D.

During reverse air drilling, the fluid column in the borehole was weighted with bentonite mud to maintain a hydrostatic pressure equal to the artesian pressure of the Floridan aquifer. This "wafer" of heavy fluid acted as a piston in the casing, which prevented the well from flowing. A blowout preventer was also kept on the well. No salt needed to be added during drilling to maintain sufficient hydrostatic pressure. Drilling was greatly facilitated by the 23 feet between the rig floor and the pad level, which provided extra height in which the artesian flow could rise without having to weight it down.

Drift indicators were also run during drilling of the pilot and reamed holes on both wells. A Totco drift indicator was used to measure the hole inclination from plumb. These surveys are required to be run from ground surface to total depth (TD) every 90 feet in the injection and monitor wells.

By regulation, the inclination of the hole must be maintained at less than 1 degree, but the Contractor generally maintained the inclination of this hole at less than 1/2 degree. The drift records for both wells are summarized in Appendix G.

Geophysical logs and surveys were run on various stages of the pilot and reamed holes on the injection and monitor wells from land surface to total depth. The geophysical logs were run to evaluate the types of formations encountered, to identify transmissive and confining strata, and to determine cement tops and bonding. CH2M HILL, Southern Resource Exploration, and Schlumberger ran the geophysical logs, and Deep Venture Diving Service performed the television surveys. A summary of the final television survey and copies of all geophysical logs are contained in Appendix H.

INJECTION WELL CONSTRUCTION

Drilling of the injection well began in April 1987 and was completed in August 1987. Drilling of the pilot hole, geophysical logging, reaming, and casing installation progressed as follows:

1. Drilled a 60-inch hole to 40 feet and set 40 feet of 54-inch casing.

2. Cemented the casing back to the surface with 38 sacks of ASTM Type II neat cement and 69 sacks of Type II neat with 12 percent bentonite.

3. Drilled a 12 ¼-inch pilot hole to 201 feet in depth through the surficial aquifer and into the underlying clay, and ran geophysical logs.

4. Reamed with a 48-inch bit assembly to 200 feet in depth.

5. Installed the 42-inch steel casing to 195 feet and cemented with 672 sacks of Type II cement with 4 percent bentonite.

6. Drilled the 12 ¼-inch pilot hole to 894 feet in depth into the consolidated limestone, and ran geophysical logs.

7. Reamed with a 40-inch bit assembly and stabilizer to 854 feet in depth.

8. Installed the 32-inch steel casing to 850 feet and cemented with 2,356 sacks of Type II cement with 2 percent bentonite and 295 sacks of neat cement.

9. Drilled the 12 ¼-inch pilot hole to 2,005 feet and ran geophysical logs. Schlumberger ran an induction electric log.

10. Reamed the pilot hole with a 31-inch bit assembly and stabilizer to a total depth of 1,950 feet.

11. Installed the 22-inch steel casing to 1,950 feet and cemented it with 4,769 sacks of ASTM Type II cement with 4 percent bentonite and 468 sacks of neat cement.

12. Drilled the 12 ¼-inch pilot hole to 3,324 feet in depth, obtained 5 cores in the interval 2,100 to 2,635 feet in depth, and ran geophysical logs.

13. Ran a color TV survey of the pilot hole to visually evaluate the confining and injection zones.

14. Set a bridge plug from 2,875 to 2,805 feet in depth.

15. Reamed the pilot hole with a 21-inch bit assembly to 2,765 feet in depth.

16. Installed the 12-inch seamless steel casing to 2,750 feet.

17. Installed 620-silica sand up to 2,771 feet to plug the open hole and capped with 18 sacks of Type II cement with calcium chloride.

18. Cemented the 12-inch casing with 1,550 sacks of Type II cement with 4 percent bentonite, 1,684 sacks of 2 percent bentonite, and 290 sacks of neat cement. Left the top 299 feet of casing temporarily uncemented.

19. Ran a temperature log inside the 12-inch casing after the first stage of cement to pick the top of that stage, and ran a second temperature log after all but the last stage was cemented.

20. Ran a pressure test on the 12-inch casing at 98.4 psi with 1.1 psi drop after one hour.

21. Ran a cement bond log on the 12-inch casing.

22. Cemented the 12-inch casing from 299 feet to surface with 281 sacks of Type II cement with 4 percent bentonite.

23. Drilled out the plug and cleaned out the hole to a final total depth of 3,324 feet, and ran geophysical logs.

24. Ran a pumping test of the completed well at 2,000 gpm for 2 hours, filling the lined pond.

25. Ran a 16-hour step injection test at rates of 700, 1,000, 1,400, 2,000, and 2,940 gpm.

26. Ran a black and white TV survey and caliper and temperature logs of the completed well to total depth.

27. Pumped the injection zone to obtain background water quality sample.

28. Completed the wellhead.

WELL CASINGS

The intermediate casings are black carbon steel conforming to the latest revision of ASTM A139 Grade B. The final casing string on the injection well conforms to ASTM A53, Grade B, seamless. All the intermediate casings were manufactured using the automatic submerged arc welding process and all casings were butt-welded when installed.

The casings were welded by certified welders using the wire-feed welding technique. The joints were welded with a root pass and two or more filler passes as needed. Centralizers were fabricated from bands cut from steel casing. They were approximately 2 inches wide and 16 inches long and when welded to the casing, bowed out 3 to 4 inches to hold the casing away from the formation.

Centralizers are located 5 feet from the bottom of each casing string, 20, 40 and 100 feet above the casing string bottom and every 100 feet thereafter to ground surface. They were placed 90° apart around the casing and were aligned so as to allow the grout pipes to pass easily. A summary of the injection well casings is presented in Table 2-1.

The first casing (42-inch) is set through the surficial freshwater aquifer and into the underlying silty clays of the Hawthorn Formation. The second casing (32-inch) was set through the Hawthorn Formation into the consolidated limestones of the Avon Park Limestone. The third casing (22-inch) was set to isolate the artesian aquifer from the borehole and the injection zone. Based on the geophysical logs of the pilot hole to 1,950 feet, and the water quality data from the pilot hole and depth samples, the 10,000 mg/l TDS interface occurs in the interval 1,700 to 1,730 feet in depth. The 22-inch casing is set through the Avon Park Limestone and into the Lake City Limestone at 1,950 feet.

After the pilot hole was drilled to a depth of 3,324 feet and the Boulder Zone of the Oldsmar Limestone was penetrated, the hole was reamed and the 12-inch final casing string was set at 2,750 feet and cemented. The 12-inch casing was set well above the large cavities of the injection zone and within a hard, well-cemented limestone. The borehole diameter was close to gauge size around the casing bottom, providing a good surface for cement bonding.

CEMENTING

After each steel casing was positioned at the setting depth, 1.9-inch grout pipe was lowered inside the casing to within approximately 10 feet of bottom and the casing was sealed at the surface. The first stage of cement was then pumped through the grout pipe and out the bottom of the casing. After allowing time for the cement to set, the top of the cement was tagged with both grout pipes outside of the casing, and subsequent cement stages were tremied through the two grout pipes in the annulus. Cement was circulated

Table 2-1
INJECTION WELL CASING SUMMARY

Diameter (inches)	Wall Thickness (inch)	Depth (feet below pad)		Cemented Interval (feet)	
		From	To	From	To
54	0.375	0	40	0	40
42	0.500	0	200	0	200
32	0.500	0	850	0	850
22	0.500	0	1,950	0	1,950
12	0.500	0	2,750	0	2,750

to ground surface on all injection well casings. Dowell Schlumberger Inc. performed the cementing using ASTM C 150 Type II cement. Table 2-2 is a summary of the cement type and volumes used on all injection well casings.

During cementing of the fourth stage of the final casing, tremie line broke off about 200 feet below the pad. Cement was pumped through two 2-inch tremie pipes, 180 degrees apart, set within 10 feet of the previous stage which was tagged at 2,064 feet. Thirty-three barrels (136 sacks) of Type II cement with 2 percent bentonite were pumped at four barrels per minute before pumping was ceased to allow 1½ joints (45 feet) of tremie to be removed from both strings. The lines were left full of cement while pulling the joints.

The pipe was pulled using the rig's draw works. Cementing was resumed and 52 more barrels were pumped for a total of 85 barrels.

After completion of the stage, it was discovered that the south tremie line had broken approximately 200 feet below the pad, leaving approximately 1,800 feet of 2-inch pipe in the annulus between the 12-inch and the 22-inch casings. Fresh water was immediately pumped down the north tremie line at approximately 1,900 feet until the return water ran clear. This was done to evacuate any cement that had escaped at 200 feet from the broken tremie pipe.

Upon inspection of the break the following day, it was apparent that the pipe had failed approximately 1 foot below the connection with the next higher piece of pipe at a repair weld.

Since the tremie pipe was full of cement when it parted, the pipe is not considered a conduit or a pathway for fluid movement. It was also decided that fishing for the pipe may

Table 2-2
INJECTION WELL CEMENT SUMMARY

Date	Casing Cemented (inch)	Type of Cement (API)	Number of Sacks	Cemented Interval (feet) From	Cemented Interval (feet) To
5/1/87	54	Lead: Type II with 12% Bentonite	69	40	Surface
		Tail: Type II Neat	38		
5/4/87	42	Type II with 4% Bentonite	672	200	Surface
5/15/87	32	Lead: Type II with 2% Bentonite	1,684	850	261
		Tail: Type II Neat	295		
5/15/87	32	Type II with 2% Bentonite	672	261	Surface
6/8/87	22	Lead: Type II with 4% Bentonite	941	1,950	1,553
		Tail: Type II Neat	468		
6/9/87	22	Type II with 4% Bentonite	513	1,553	1,440
6/10/87	22	Type II with 4% Bentonite	510	1,440	1,262
6/10/87	22	Type II with 4% Bentonite	606	1,178	1,001
6/11/87	22	Type II with 4% Bentonite	509	1,001	750
6/11/87	22	Type II with 4% Bentonite	517	750	452
6/12/87	22	Type II with 4% Bentonite	720	452	Surface
7/6/87	Plug	Type II Neat with Calcium Chloride	18	2,771	2,761
7/6/87	12	Lead: Type II with 2% Bentonite	220	2,750	2,490
		Tail: Type II Neat	290		
7/8/87	12	Type II with 4% Bentonite	472	2,490	2,276
7/8/87	12	Type II with 4% Bentonite	430	2,276	2,064
7/8/87	12	Type II with 4% Bentonite	354	2,064	1,988
7/9/87	12	Type II with 4% Bentonite	208	1,988	1,809
7/10/87	12	Type II with 4% Bentonite	700	1,809	1,114
7/10/87	12	Type II with 4% Bentonite	850	1,114	299
7/16/87	12	Type II with 4% Bentonite	281	299	Surface

result in leaving more pipe and fittings in the annulus which would not be desirable.

The cementing operation was continued using two tremie pipes. No difficulties were encountered in running the tremie pipes or in completing the cementing of the 12-inch casing up to surface.

After cementing the final string of casing (the 12-inch on the injection well) a pressure test was performed on July 13, 1987. The casing was pressure tested at 98.4 psi, and dropped to 97.3 psi after one hour. This is well within the 5 percent pressure change that DER allows.

GEOPHYSICAL LOGS

Geophysical logs were run in each stage of the pilot hole before the hole was reamed. These logs were used to evaluate the hydrogeology of the strata penetrated by the exploratory hole. The casing setting depths were established and cement calculations were prepared from these logs. Logs were also run while pumping the pilot hole to identify the producing zones in the open hole interval between 1,950 and 3,324 feet.

TV surveys were used to visually evaluate the pilot hole and the final condition of the completed well. The first color survey showed excellent cavities in the Boulder Zone. The second black and white survey showed the casing joints to be in good condition and that the hole was clear and unobstructed to a total depth of 3,324 feet (after clearing out an obstruction at 3,008 feet).

A cement bond log with a wave train display was run in the completed well to evaluate the bonding of the cement outside the 12-inch casing. The cement bond between the casing, cement and formation appears to be acceptable throughout the casing.

A summary of the geophysical logs and surveys run in the injection well is presented in Table 2-3. Copies of the geophysical logs are contained in Appendix H, and a summary of the final TV survey run in the completed well is also included in Appendix H.

MONITORING WELL CONSTRUCTION

Drilling of the monitoring well began in late June 1987 and was completed in September 1987. The purpose of this well is to detect any upward migration of the injected fluid into portions of the Floridan aquifer containing water with less than 10,000 mg/l total dissolved solids and into the first permeable zone above the confining zone.

The monitoring well is a two-zone well which monitors the intervals between 950 and 1,175 feet and between 1,730 and 1,800 feet. Drilling of the pilot hole, geophysical logging, reaming and casing installation progressed in stages as follows:

1. Drilled a 41-inch hole and set 40 feet of 36-inch casing.

2. Cemented the casing with 52 sacks of ASTM Type II neat cement.

3. Drilled a 9-7/8-inch pilot hole to 205 feet, and ran geophysical logs.

4. Reamed a 29-inch hole to 205 feet in depth through the surficial aquifer and into the underlying clay.

Table 2-3
INJECTION WELL GEOPHYSICAL LOGGING SUMMARY

Date	Well Progress and Casing Depth	or Surveys Run[a]	Purpose
5/2/87	54" pit casing to 40' 12-1/4" pilot hole to 200'	C,G,E	1. Evaluate the shallow freshwater aquifer. 2. Establish the top of the clay and the 42" casing setting depth.
5/8/87	42" casing to 195' 12-1/4" pilot hole to 894'	C,G,LSN	1. Hydrogeologic definition of the Florida aquifer. 2. Establish the 32" casing setting depth.
5/23/87	32" casing to 850' 12-1/4 pilot hole to 2,005'	C,G,LSN,T_s,FR DI	1. Hydrogeologic definition of the Floridan aquifer. 2. Identify monitoring intervals. 3. Establish the brackish/saltwater interface. 4. Qualitative evaluation of the upper confining beds above the injection zone. 5. Establish the 22" casing setting depth.
6/25/87	22" casing to 1950' 12¼" pilot hole to 3,324'	C,G,LSN,T_s,FR FR_p,T_p,FV_p	1. Hydrogeologic definition of the injection zone. 2. Qualitative evaluation of the confining beds above the injection zone. 3. Identification of transmissive zones in this interval. 4. Establish the 12" casing setting depth.
6/26/87	22" casing to 1,950' 12¼" pilot hole to 3,324'	TV	1. To visually evaluate the confining and injection zones.
7/7/87	12" casing to 2,750'	T_s	1. Identify the top of the first stage of cement outside the 12" casing.
7/11/87	12" casing to 2,750'	T_s	1. To verify integrity of cement on final casing.
7/14/87	12" casing to 2,750' 7 stages of cement pumped	CBL,WTD	1. To verify integrity of cement on final casing.

Table 2-3 (continued)

Date	Well Progress and Casing Depth	or Surveys Run[a]	Purpose
7/30/87	Well completed	TV	1. To provide visual background record of casing, confining and injection zones.
8/5/87	Well completed	T_s, C	1. Background static temperature and caliper logs.

---

[a] Abbrevations for logs and surveys are as follows:

E = Single point electric and SP

LSN = Long and short normal electric and SP

C = Three-arm mechanical caliper

T_s = Temperature - static

T_p = Temperature - pumped

FV_p = Fluid velocity (propeller flowmeter) pumped

FR_s = Fluid resistivity, static

FR_p = Fluid resistivity, pumped

TV = Television survey

CBL = Cement bond, variable density

WTD = Wave train display

DI = Dual induction

5. Installed a 24-inch steel casing to 193 feet and cemented with 281 sacks of Type II cement with 4-percent bentonite.

6. Drilled a 9-7/8-inch hole to 1,000 feet in depth into the upper producing zone of the Floridan aquifer, and ran geophysical logs.

7. Reamed with a 22-inch bit assembly to 958 feet.

8. Installed 950 feet of 16-inch steel casing and cemented with 911 sacks of ASTM Type II cement with 2 percent bentonite, and 105 sacks of Type II neat cement.

9. Drilled a 14-3/4-inch hole to 1,418 feet and developed the well at 2,000 gpm for 1 hour.

10. Pumped the partially completed monitor well for a water source for injection testing.

11. Resumed drilling a 14-3/4-inch hole to 1,760 feet, with the interval from 1,580 to 1,760 feet drilled by reverse air open circulation, and ran geophysical logs.

12. Installed 1,730 feet of 6-5/8-inch steel casing and cemented with 851 sacks of ASTM Type II cement with 2-percent bentonite, and 86 sacks of Type II neat cement.

13. Ran a pressure test on the 6-5/8-inch casing at 100 psi with no pressure drop after one hour.

14. Drilled out the plug and cleaned out the hole to a final total depth of 1,800 feet, and ran geophysical logs.

15. Developed the lower zone by airlifting and the upper zone by flowing for 48 hours, and took background water quality samples.

16. Completed the wellhead.

Figure 2-3 shows a diagram of the injection and monitor wells with the casing depths and cemented and monitoring intervals.

CASINGS AND CEMENTING

The surface casing in the monitoring well is black steel conforming to ASTM 139, Grade B, manufactured by the automatic submerged arc welding process, and butt-welded. All other casings conformed to ASTM A53 Grade B, furnished with plain beveled ends. The casings were installed, centralized, and cemented using the same methods used on the injection well casings. A summary of the monitoring well casings is presented in Table 2-4, and a summary of the cement used is presented in Table 2-5.

Selection of the final casing setting depth was reached after numerous discussions and meetings with the Technical Advisory Committee (TAC). The permitted design anticipated the lower monitoring interval to be between 1,650 to 1,800 feet. The final setting depth of the 6-5/8-inch casing was 1,730 feet, with an open hole interval to 1,800 feet. Pertinent correspondence related to this issue is found in Appendices A and F.

GEOPHYSICAL LOGS

The geophysical logs run in the hole to 1,800 feet confirmed the depths of the producing zones indicated on the injection well logs. Table 2-6 summarizes the monitor well logs.

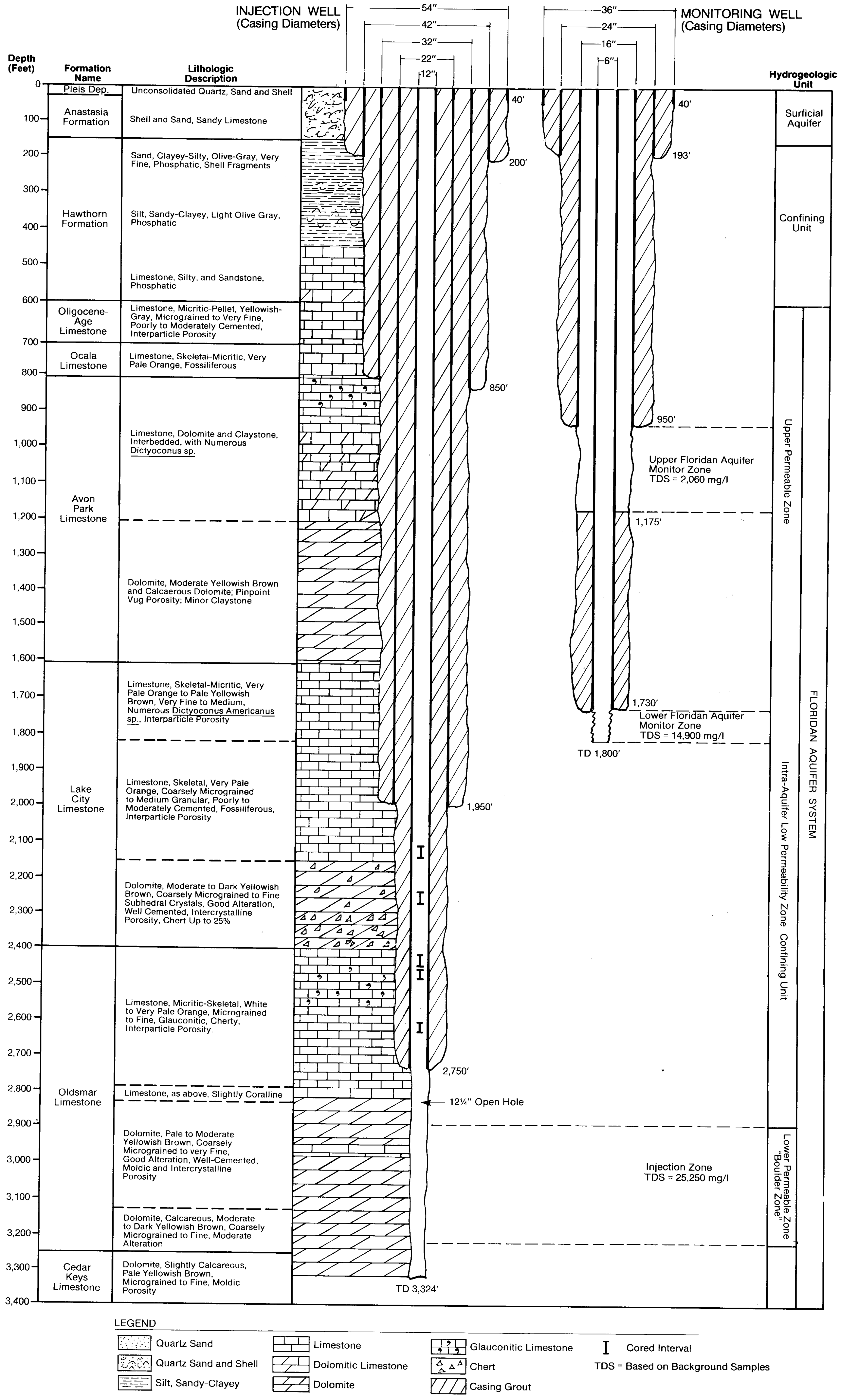


FIGURE 2-3.
GDU North Port St. Lucie WWTP—Summary of Well Construction and Hydrogeologic Data.

Table 2-4
MONITORING WELL CASING SUMMARY

Diameter (inches)	Wall Thickness (inch)	Depth (feet below pad)		Cemented Interval (feet)	
		From	To	From	To
36	0.375	0	40	0	40
24	0.500	0	193	0	193
16	0.500	0	950	0	950
6-5/8	0.562	0	1,730	1,175	1,730

Table 2-5
MONITOR WELL CEMENT SUMMARY

Date	Casing Cemented (inch)	Type of Cement (API)	Number of Sacks	Cemented Interval (feet)	
				From	To
6/30/87	36	Type II Neat	52	40	0
7/5/87	24	Type II with 4% Bentonite	222	200	50
7/6/87	24	Type II with 4% Bentonite	59	50	0
7/17/87	16	Lead: Type II with 2% Bentonite	786	950	135
		Tail: Type II Neat	105		
7/18/87	16	Type II with 2% Bentonite	125	135	Surface
8/8/87	6-5/8	Lead: Type II with 2% Bentonite	395	1,730	1,475
		Tail: Type II	86		
8/8/87	6-5/8	Type II with 2% Bentonite	310	1,475	1,331
8/9/87	6-5/8	Type II with 2% Bentonite	146	1,331	1,175

Table 2-6
MONITORING WELL GEOPHYSICAL LOGGING SUMMARY

Date	Well Progress and Casing Depth	Types of Logs or Surveys Run[a]	Purpose
7/2/87	36" casing to 40' 9-7/8" hole to 205'	G,LSN	1. Establish the 24" casing setting depth.
7/11/87	24" casing to 193' 9-7/8" hole to 1,000'	C,G,LSN	1. Identify the top of the Floridan aquifer 2. Establish the 16" casing setting depth.
8/6/87	16" casing to 950" 14-3/4" pilot hole to 1760'	C,G,LSN,T_s FR_s,FV_p	1. Identify transmissive zones for monitoring intervals. 2. Establish the 6-5/8" casing setting depth.
8/18/87	6-5/8" casing to 1,730' cement to 1,175'	CBL,WTD	1. Confirm the adequacy of cement outside the 6-5/8" casing.
8/18/87	5" hole to 1,800'	C,T_s	1. Characterize lower monitoring interval.

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[a] Abbreviations for logs and surveys are as follows:

LSN = Long and short normal electric and SP

G = Natural gamma ray

C = Three-arm mechanical caliper

T_s = Temperature, static

FV_p = Fluid velocity (propeller flowmeter), flowing

FR_s = Fluid resistivity, static

CBL = Cement bond, variable density

WTD = Wave train display

At least two producing zones were identified from the geophysical logs run in both the injection and monitor wells. The upper zone is monitored through the uncemented annulus around the 6-5/8-inch casing from the top of the cement at 1,175 feet to the bottom of the 16-inch casing at 950 feet. The lower monitoring zone is penetrated by the open hole below the 6-5/8-inch casing from 1,730 to 1,800 feet.

Section 4 of this report contains a discussion of water quality in the monitoring zones.

GEOLOGY

BACKGROUND

Stratigraphic information is available from other injection wells drilled in St. Lucie and neighboring counties, and from nearby oil test wells drilled in the 1950's. The GDU South Port WWTP injection well, drilled in 1982, is the closest injection well for which data were available, at 6.6 miles south-southeast of the site. The City of Stuart injection well is approximately 10 miles southeast of the site, east of U.S. 1 in the City of Stuart, and the Hercules, Inc. well in Vero Beach is approximately 20 miles north of the site. Two Amerada Petroleum Company wells, Cowles Magazine, Inc. #1 and #2, were drilled one section (Sec. 19, T36S, R40E) west of the North Port St. Lucie well. Data from all these wells indicate that a thick sequence of dolomites, limestones and clays exist in the region and at the GDU North Port St. Lucie WWTP injection well site. The recently completed well at Jensen Beach was not included in this review since the drilling data were not readily available.

Figure 2-3 depicts in part the major stratigraphic units encountered while drilling the injection well to a total depth of 3,324 feet. Strata encountered at this site range in age from Paleocene to Pleistocene, with the Paleocene Cedar Keys Formation being the oldest formation penetrated. Stratigraphic units of Eocene age include the Oldsmar Limestone, the Lake City and Avon Park Limestones, and the Ocala Group. Oligocene-age limestones, the Hawthorn Formation of Miocene age, and the Pleistocene Anastasia Formation and Pamlico Sand are also present.

A generalized northwest-southeast geologic section from the Hercules well in Indian River County to the City of Stuart well in Martin County was constructed using data from the oil test wells and injection wells (Figure 2-4 and 2-5). The regional extent of the formation, their relatively uniform thickness, and the general dip to the southeast is illustrated in these figures.

LITHOSTRATIGRAPHIC DESCRIPTIONS

Paleocene Series

Cedar Keys Limestone. The Cedar Keys Limestone is the oldest formation encountered, at an approximate depth of 3,260 feet. Cole (1944) originated the term "to cover the rocks encountered in wells in peninsula and northern Florida from the first appearance of the Borelis fauna to the top of the Upper Cretaceous" (p. 28). Chen (1965) later characterized the Cedar Keys Limestone as conformable with the overlying Oldsmar Limestone, with a distinct change in lithology marking the top of the bed. The formation top is identified by a gray, slightly calcitic, microcrystalline dolomite that is not usually fossiliferous. The top is slightly to commonly gypsiferous and is indicated by a

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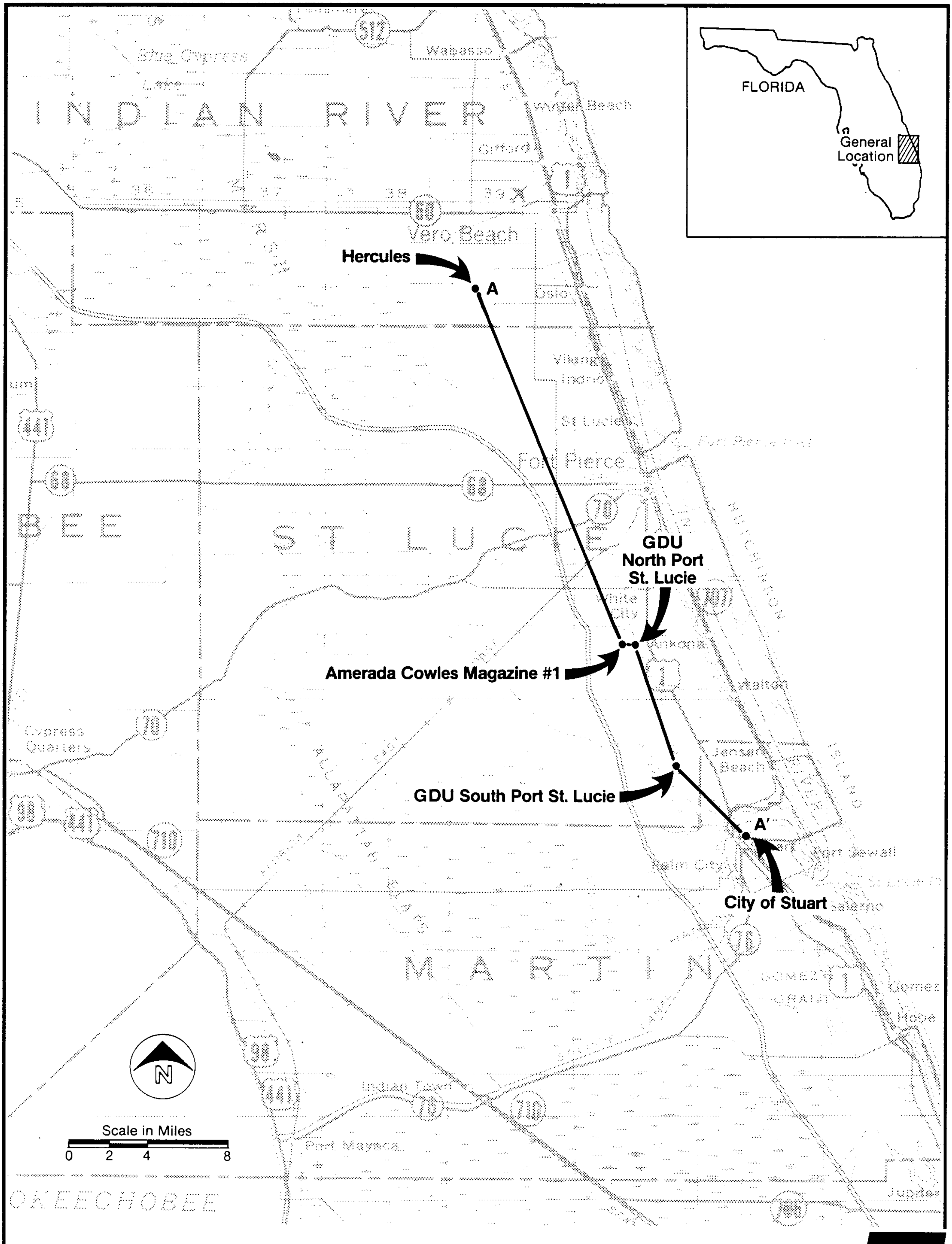
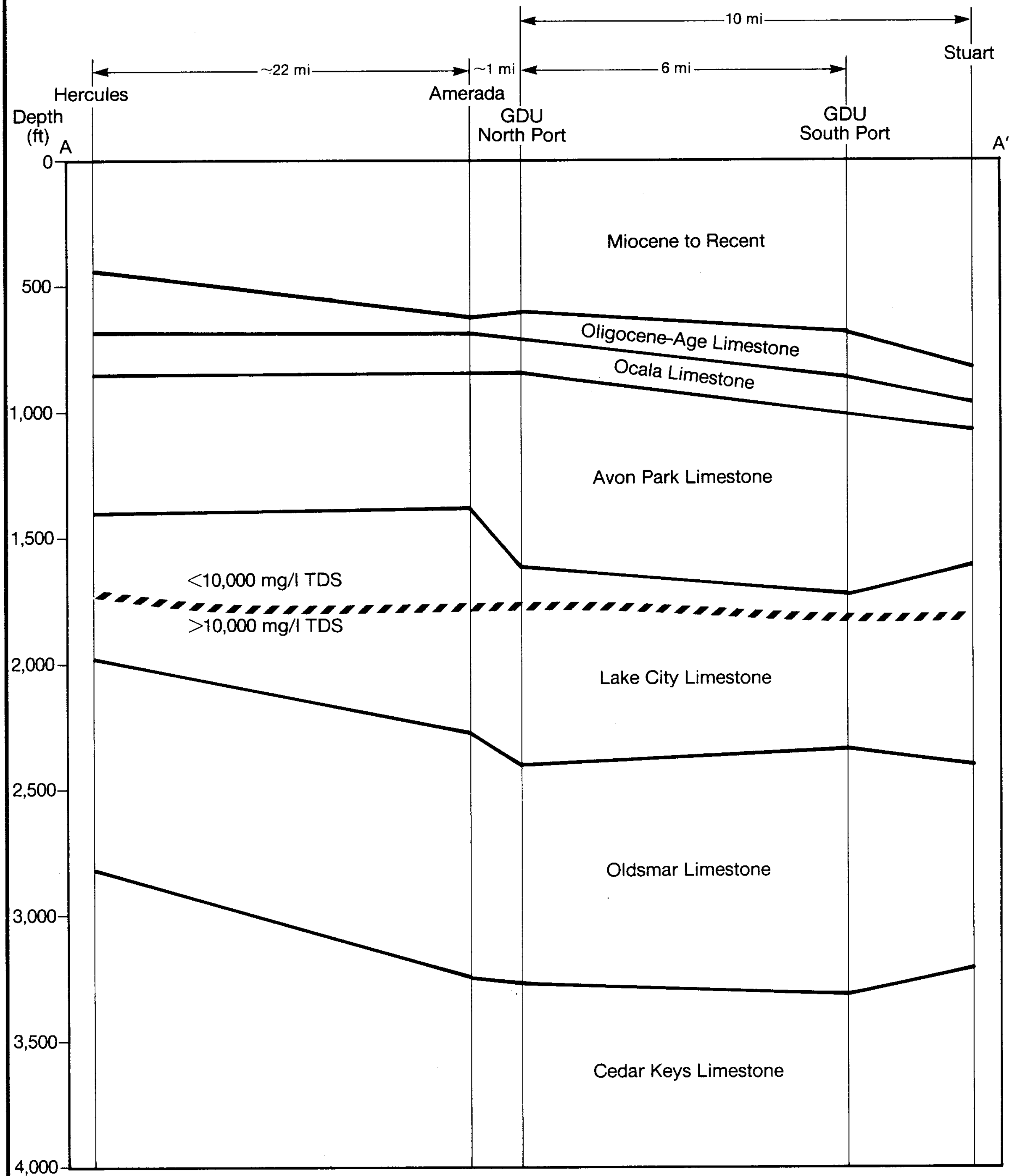


FIGURE 2-4.
GDU North Port St. Lucie WWTP—Location of Geologic Cross-Section.



Source: Florida Geologic Survey and CH2M HILL Files.

FIGURE 2-5.
GDU North Port St. Lucie WWTP—Generalized North-South Geologic Section from Indian River to Martin County.

relatively low resistivity curve on electric logs (Chen, 1965). Guide fossils for the Cedar Keys Limestone are <u>Borelis</u> <u>gunteri</u> and <u>Borelis</u> <u>floridanus</u>, the top of whose range occurs near the top of the Cedar Keys Limestone. Chen (1965) also describes the formation as grading to interbedded dolomite and anhydrite beds in its lower part.

Puri and Winston (1974) indicate that thick anhydrite strata usually occur in the Cedar Keys Limestone about 200 feet below the formation top, and that in some wells, dolomitized grainstone skeletal limestones occur immediately below the formation contact. Along the east coast, they note that the Cedar Keys lithology consists of tan to brown anhedral to porous euhedral dolostone. Puri and Winston picked the top of the Cedar Keys Limestone in Amerada Cowles Magazine #2 well, approximately one mile west of the injection well, at 3,060 feet below land surface based on the typical Cedar Keys electric log marker.

A lithologic log of the Amerada Cowles Magazine Inc. #1 well was obtained from the Florida Geological Survey files (Reference #W-4086). Chen used this well, which is located approximately 1½ miles west of the site, in making cross sections for Florida Geologic Survey Bulletin 45. He picked the top of the Cedar Keys Limestone at 3,230 feet in depth, based on grain size and color of the dolomite, and provided these remarks:

> "1. No evaporites present in this well (at least at 0-5300')
>
> 2. The Cedar Keys Limestone composed entirely of dolomite with a better degree of crystallinity than other wells in the region studied."

No anhydrites were found at the GDU North Port St. Lucie well. The natural gamma ray log shows no strong deflections to the left that would be indicative of anhydrite (Keys and MacCary, 1971). No evidence of the guide fossils was noted. However, a sharp deflection to the right occurs on the electric log at a depth of 3,270 feet. The caliper log clearly shows the highly cavernous portion of the hole ending at a depth of 3,220 feet, where it returns to gauge-hole size. Puri and Winston (1974) indicated that highly transmissive zones occur primarily in Eocene-age strata, with a few cavities occurring in the middle sections of the Cedar Keys Limestone. The first light gray dolomite occurs at 3,220 feet in depth, and calcareous dolomites still showing evidence of skeletal-pellet limestones are noted below that depth in the lithologic log (Appendix B). Consequently the contact between the Cedar Keys Limestone and Eocene-age formations is placed in the interval 3,220 to 3,270 feet in depth. This contact occurs at a depth of 3,300 feet at the GDU South Port well, and at approximately 3,200 feet deep at the City of Stuart's well.

Eocene Series

Oldsmar Limestone. The Oldsmar Limestone may be characterized as predominantly limestone and dolomite, with minor components of chert, gypsum, and peat. The formation was initially described as a biostratigraphic unit with four distinct faunal zones. Disagreement exists in the literature as to whether the formation is conformable with the underlying and overlying formations.

Chen (1965) describes the limestone as "usually light brown to chalky white, rather pure, porous, and fossilferous," with some reef-like beds in northern Florida, while the interbedded dolomites are typically "brown to dark brown, rather porous, fine to coarse crystalline, commonly saccharoidal textured." At the Amerada Cowles Magazine #1 well, the Oldsmar Limestone occurs at a depth between 2,270 and 3,230 feet, and consists of interbedded, highly fossiliferous limestone and fine crystalline dolomite. Puri and Winston (1974) show the top of the Oldsmar Limestone in the Amerada Cowles Magazine #2 occurring at approximately 2,180 feet in depth. The top of the Oldsmar Limestone occurred at 2,330 feet at the GDU South Port St. Lucie site, and at 2,400 feet in depth at the City of Stuart well.

The top of the Oldsmar Limestone occurs at 2,400 feet in depth at the GDU North Port St. Lucie site. A sharp lithologic break occurs between the 2,400 to 2,410 foot depth, where the dolomite and chert of the lower Lake City Limestone are underlain by white to very pale orange, glauconitic, friable limestone. The natural gamma ray and caliper logs of the pilot hole in this interval clearly indicate the transition from dolomite to a soft limestone. The white limestone is a predominantly homogeneous unit with minor amounts of chert and few Pseudophragmina sp. until approximately 2,620 feet in depth. The peak on the natural gamma ray log at a depth of 2,500 feet is believed to result from the glauconite content of this limestone. The natural gamma ray log shows low counts indicating limestone throughout the 2,400 to 2,620 foot depth interval except for this peak. Between 2,620 to 2,880 feet, the limestone is a very pale orange, micritic-pellet, well-cemented limestone that has been somewhat dolomitized. Increasing gamma ray counts over this interval reflect that dolomitization has occurred, and the straight line seen on the caliper log over portions of this interval reflects the high degree of cementation. The limestone is also coralline in parts.

Another distinguishable break occurs at 2,890 feet in depth, when the dolomitized portion of the lower Oldsmar Limestone is encountered. A gauge hole with cavities is indicated on the caliper log, and the lithologic log indicates a sharp change to dolomite, which persists for the total depth of the hole. The Boulder Zone portion of the Oldsmar thus occurs from 2,890 to 3,220 feet deep at this site (330 feet thick), while at the GDU South Port site it only occurs in the lower 200 feet of the Oldsmar Limestone, from 3,100 to 3,300 feet deep. The Boulder Zone at this site is most clearly indicated on the caliper log of the pilot hole.

Lake City Limestone. Chen (1965) characterizes the Lake City Limestone, of middle Eocene age, as a formation of interbedded, highly fossiliferous limestone and brown to dark brown dolomite. The existence of an unconformity between the overlying Avon Park and the Lake City is uncertain, while the base is conformable with the Oldsmar (Chen, 1965). The first appearance of the foraminifera Dictyoconus americanus has commonly been used to mark the top of the Lake City Limestone. Thin laminae of peat and anhydrite and gypsum impregnation are also common (Stringfield, 1966). The base of the Lake City Limestone is characterized by a thick sequence of dark brown, finely crystalline dolomite (Chen, 1965).

Johnson (1984) logged 938 wells in 32 counties in peninsular Florida, and has characterized the Paleocene-age to Pliocene-age geologic formations according to their natural gamma ray and electric log signatures. He reports that the Lake City Limestone is divided into an upper gamma ray zone, and a lower gamma ray zone of somewhat higher intensity that correlates with the basal dolomite section. The formation top in southeast Florida is easily detected from the natural gamma ray log by an abrupt shift to a lower-intensity trace immediately below the higher trace of the lower Avon Park dolomitic zone.

At the Amerada Cowles Magazine #1 well, the Lake City Limestone occurs between the interval from 1,370 to 2,270 feet in depth, and consists mostly of fossiliferous limestone with interbedded fine crystalline dolomite. Near the base of the formation, the limestone becomes cherty. The characteristic basal dolomites of the Lake City Limestone occur in this well as cherty, dark brown, fine crystalline dolomite. The basal dolomites were not noted at the GDU South Port well site, but were found at the Hercules well site in the approximate interval from 1,960 to 2,120 feet deep.

The Lake City Limestone at the GDU North Port WWTP site occurs between the intervals 1,620 and 2,400 feet in depth. The formation has lithologically distinctive upper and lower portions, and has almost no interbedding. The upper portion is predominantly a very pale orange, skeletal to skeletal-micritic, poor to moderately well-cemented, highly fossiliferous limestone. Numerous foraminifera species occurs in the Lake City including Operculinoides jennyi, Dictyoconus americanus, Lepidocyclina sp., and Pseudophragmina sp. In the interval from 1,710 to 1,810 feet deep, the D. americanus were so numerous that the individual specimens (averaging 2 - 3 mm in diameter across their base) comprised from 20 to 80 percent of the sample at that depth.

The lower portion of the Lake City Limestone begins at 2,160 feet, when an abrupt change to dolomite occurs. The dolomite is moderate to dark yellowish brown, with very fine subhedral crystals, slightly sucrosic, and with good alteration and well-developed intercrystalline porosity. The chert content in this lower interval ranges from 5 to 25 percent. A core taken in the interval 2,245 to 2,255 feet deep shows that the chert occurs as discrete nodules embedded in the dolomite.

The natural gamma ray and caliper logs clearly indicate the lithologic divisions of the Lake City Limestone. A low gamma ray count and a washed-out hole correlate with the homogeneous, moderately cemented limestones of the upper Lake City. A slightly higher gamma ray count and a gauge-size hole with cavities in the interval 2,120 to 2,400 feet correlates with the basal cherty dolomites. The characteristic trace of the upper contact with the Avon Park (Johnson, 1984) is well illustrated on the natural gamma ray log, and a slight increase in gamma ray intensity is noted in the lower portion of the formation.

Avon Park Limestone. Chen (1965) described the Avon Park Limestone of late Middle Eocene as a light brown to brown, porous, finely fragmental limestone with abundant *Coskinolina* *sp*., *Lituonella* *sp*., *Dictyoconus* *sp*. and other diagnostic foraminifers, and a brown to dark brown, rather porous, very fine to medium crystalline, saccharoidal dolomite (p. 59 - 60). A basal unit of thick, dark brown, nonfossiliferous, crystalline dolomite also exists. Lichtler (1960) describes the Avon Park in Martin County as a "cream to tan, hard to medium soft, rather pure, chalky to finely crystalline limestone," but he also reports that wells have not penetrated it completely, and may not have encountered the basal dolomites. Lichtler also reports that the index fossil echinoid *Peronella* *dalli* was recovered from a few deep wells in Martin County.

Johnson (1984) divides the Avon Park into two zones based on characteristic natural gamma ray patterns. The upper Avon Park, usually unconformably underlying the Ocala Group, is recognized by a distinguishable increase in gamma ray intensity from the low-intensity Ocala. The increase may be a single sharp peak marking the contact or several low to medium intensity peaks. The lower gamma ray zone, corresponding to the basal dolomitic zone, is characterized by several peaks of slightly higher intensity or a continuous trace of higher intensity without peaks (Johnson, 1984).

The Avon Park at the Amerada Cowles #1 well occurs from 830 to 1,370 feet deep, with fossiliferous limestone in the upper portion and the brown to dark brown, fine crystalline dolomite occurring in the lower 380 feet of the formation. At the GDU South Port well, the Avon Park Limestone is a soft, homogenous limestone in the upper part of the formation (1,000 to 1,200 feet) and has a relatively thin basal dolomitic unit from 1,660 to 1,720 feet deep.

The reported top of the Avon Park Limestone at the GDU North Port site is based on the first appearance of *Dictyoconus cookei*, which occurs at a depth of 860 feet in the injection well and 830 feet in the monitor well. Other characteristic foraminifera noted from this formation include *Lepidocyclina sp.*, *Operculinoides sp.*, *Textularia sp.*, *Coskinolina floridana sp.*, *Globigerina sp.*, and a few small echinoids tentatively identified as *Peronella dalli*. The formation is a homogeneous fossiliferous limestone only in the upper few tens of feet, and grades into an interbedded limestone and dolomite sequence with traces of claystone. The interbedding is best shown on the caliper log, and the high percent of dolomite (as compared to the gamma ray trace in the upper Lake City Limestone) is shown by the higher counts on the natural gamma ray log.

The formation top is also selected based on the criteria Johnson (1984) developed. The natural gamma ray logs run on the pilot hole from 0 to 990 feet and from 750 to 2,000 feet on May 8 and 23, 1987 respectively, demonstrate the characteristic trace Johnson described. After the low-intensity trace of the Ocala Group, two strong peaks are shown at approximately 840 and 870 feet. The lithologic log also indicates some minor glauconite through this interval, which provides further support for the presence of an unconformity. Natural gamma ray peaks on the monitor well log are noted at 832 and 870 feet in depth.

The basal dolomites begin at approximately 1,450 feet deep and persist until the contact with the Lake City. The caliper log shows a gauge hole with spikes, typical of a fractured cavernous dolomite. The induction electric log most clearly shows this unit by a sharp increase in resistivity in the interval from 1,450 to 1,600 feet deep, indicating the increasing dolomite in the lower 150 feet of this formation. The lower gamma ray zone Johnson (1984) described is also detectable on the North Port St. Lucie natural gamma ray log over the interval from approximately 1,490 to 1,600 feet deep.

The monitor well penetrated a much more dolomitized portion of this formation, especially in its upper half.

Ocala Group. The Ocala Group of Upper Eocene age rests unconformably on the Avon Park Limestone, and is overlain unconformably by Oligocene or post-Oligocene-age strata (Chen, 1965). The group has been divided into two or three formations by various authors, but will be treated as a group in this report. Chen (1965) described the group in peninsular Florida as consisting of "chalky white to very light brown, porous and not well consolidated, finely fragmental to microcoquinoid....[with] the fossils and fossil fragments loosely cemented by a sparry calcite matrix." Large foraminifera characteristic of the Ocala Group include *Lepidocyclina ocalana*, *Operculinoides sp.*, and *Heterostegina ocalana*. Bryozoan and echinoid fragments are also common.

Thickness of the Ocala Group in Indian River County ranges from 50 to 200 feet (Crain, et al., 1975). The approximate interval of the Ocala Group at the Hercules site ranges from 680 to 850 feet in depth. In Martin County the Ocala Group is generally less than 100 feet thick (Lichtler, 1960), and thins south of St. Lucie County to approximately 30 feet in southwest Martin County (Johnson, 1984). The Ocala Group occurs between 690 and 830 feet in the Amerada Cowles Magazine #1 well. A Florida Power and Light core (AG-106), located at 27°20'15"/80°18'50", penetrated the top of the Ocala at a depth of 680 feet (Armstrong, et al., 1985). The North Port St. Lucie site is located at 27°20'09"/80°21'03", less than 2 miles to the northwest.

Johnson (1984) reports that the Ocala Group typically has the lowest natural gamma ray trace run on water wells in his study area, and that the formation can be divided into an upper gamma ray zone of low intensity and a lower zone showing slightly higher intensity. In St. Lucie and Indian River Counties the upper zone of the Ocala Group is a pure, recrystallized limestone with a very low intensity natural gamma ray signature.

The Ocala Group occurs between 720 and 830 feet at the GDU North Port St. Lucie site. The formation top is based on the first appearance of Lepidocyclina sp. and on the drop in natural gamma ray intensity from the basal peaks of the overlying Oligocene-age limestone. The upper and lower gamma ray units are distinguishable on the gamma ray log, and correlate with a lithologic break. The upper unit occurs between 720 and 760 feet deep, while the lower unit occurs from 760 to 830 feet deep. The break is represented lithologically by an increase in grain size and abundance of foraminifera, and the presence of glauconite.

Oligocene Series

Oligocene-age Limestones. Oligocene-age limestones exist at the GDU North Port St. Lucie site from a depth of 578 feet to 720 feet. Disagreement exists in the literature as to whether these limestones may be assigned to the Suwannee Limestone. Suwannee Limestone is identified in Martin County (Lichtler, 1960), with variable thickness across a northwest-southeast trending fault. Crain, et al. (1975) identified up to 200 feet of undifferentiated Oligocene limestones in the eastern part of Indian River County, apparently only on the downthrown side of a fault.

Armstrong, et al., (1985) studied the post-Eocene deposits in eastern Martin and St. Lucie counties in great detail, and identified two unnamed limestones (U-A and U-B) of Oligocene age. Of particular interest is the Florida Power and Light Core AG-106, which is less than two miles to the southeast of the GDU North Port St. Lucie injection well site. Comparison of the natural gamma ray log from Core AG-106 (Figure 3 from Armstrong, et al.) with the same log from the injection well reveals a close match of the log signatures. The natural gamma ray peaks of Unit U-A and the basal gamma ray marker in unit U-B are easily correlated with the natural gamma ray signature of the North Port St. Lucie well. Lithologic descriptions of Units U-A and U-B may be matched with the GDU North Port St. Lucie lithologic log, so that a yellowish-gray limestone with sandstone and phosphate grains, equivalent to Armstrong's Unit U-A, occurs in the interval from 578 to 610 feet in depth. The underlying very pale orange limestones equivalent to Unit U-B occur from 610 to 720 feet deep. The marker gamma ray peak in the lower portion of Unit U-B occurs at North Port St. Lucie at 695 feet deep.

Armstrong, et al. (1985) indicated that a sharp erosional contact exists between the Hawthorn Formation and the underlying limestones. In Core AG-106, he noted that the coarse sands of the lower Hawthorn Formation had washed into solution cavities of the underlying limestones. Evidence of this erosional contact is also found at the GDU North Port St. Lucie site. A sharp drop from the large natural gamma ray peaks characteristic of the basal Hawthorn Formation is noted at 578 feet deep. A sharp deflection to the right on the long and short normal electric log of both the injection and monitor wells at this depth is also indicative of an erosional boundary. The lithologic log also shows a break, with up to 40 percent sandstone in the interval between 570 to 580 feet deep.

Miocene Series

Hawthorn Formation. The Hawthorn Formation is present at the North Port St. Lucie site in the interval from 150 to 578 feet in depth. It consists of a grayish-olive, clayey, silty sand; sandstone; or silty limestone, with variable amounts of phosphate grains, quartz grains, and shell fragments. The natural gamma ray trace through the Hawthorn Formation matches the signature from Core AG-106 exceptionally well in the lower portion of the formation. The higher natural gamma ray activity of the Hawthorn Formation relative to the overlying Anastasia Formation is clearly shown on the natural gamma ray log of the monitor well.

Pleistocene Series

Anastasia Formation. The Anastasia Formation of Pleistocene age is a principal source of groundwater in Indian River, St. Lucie, and Martin Counties. It occurs to depths of 100 to 170 feet below land surface, and lies unconformably on the older formations in Martin County (Lichtler, 1960). In St. Lucie County, it consists of sand, shell beds, and interlayered sandy limestone or sandstone, with consolidated coquina occurring in the central part of the county (Bearden, 1972). In eastern St. Lucie County, permeable coarse sand and shell, and consolidated sand and shell occur in the interval between 60 and 130 feet deep. The Anastasia is overlain unconformably by the Pamlico Sand (Bearden, 1972).

The Anastasia Formation occurs between 20 and approximately 150 feet at the GDU North Port St. Lucie site. It is characterized by a poorly sorted, unconsolidated shell hash, with some slightly phosphatic sandstone in its upper portion. The lower portion of the Anastasia Formation also consists of sandy limestone.

Pamlico Sand. St. Lucie County lies in the Atlantic Coastal Lowlands physiographic province, and is covered by a veneer of Pleistocene Pamlico Sand where the elevation is less than 25 feet above present sea level (Bearden, 1972). The sand occurs from land surface to 20 feet below land surface, and consists of an unconsolidated, very fine to coarse, subangular quartz sand with some organic matter and shell.

Section 3
HYDRAULIC TESTING

Several testing methods were used to characterize the confining and injection zones. The testing program developed for this site consisted of rock core analyses through the confining zone, a short duration well development, and a 16-hour step injection test. Two limitations existed on the testing: the storage capacity of the lined pond and the producing capacity of the monitor well.

INJECTION WELL ROCK CORES

Coring was conducted to characterize the confining beds above the injection zone. Five coring operations were made while drilling the 12-1/4-inch pilot hole. Table 3-1 summarizes the coring program, and provides a lithologic description of the cores.

Cores were taken from 2,100 to 2,634 feet, with recovery varying from 8 feet to over the full 10 feet. All cores were drilled using a 10-foot core barrel and a tungsten carbide-tipped core bit.

Portions of the cores at least 6 inches in length were selected and sent to Ardaman and Associates, Inc. for determination of the vertical and horizontal coefficient of permeability and porosity. The results of the vertical and horizontal permeability, and the porosity, from the core samples are shown in Table 3-2. Appendix B contains the actual laboratory reports.

Table 3-1
SUMMARY OF LITHOLOGIC CORE INTERVALS AND DESCRIPTIONS

Interval Cored (ft)	Recovery (ft)	Interval Sent to Lab	Lithology
2100-2110	10	2101-2101.8 2108.2-2109	Limestone, micritic-skeletal, white to very pale orange, coarsely micrograined to very fine, chalky, moderately well-cemented, interparticle porosity.
2245-2255	8	2249-2250 2253.5-2254	Dolomite, moderate yellowish brown, very fine to fine subhedral crystals, moderate to good alteration, well-cemented, slightly sucrosic, moldic and intercrystalline porosity; chert nodules.
2425-2435	10	2425-2426.2 2430-2431	Limestone, skeletal-pellet-micritic, very pale orange, coarsely micrograined to fine, granular appearance, chalky, poorly cemented, slightly glauconitic, interparticle porosity.
2445-2455	10+	2449-2450 2451-2451.75	Limestone, skeletal-pellet-micritic, white to very pale orange, coarsely micrograined to fine, poorly cemented, chalky, chert in lower 5 feet replacing Dictyoconus sp., interparticle porosity.
2624-2634	9.5	2628-2629 2632.5-2633.2	Limestone, micritic-pellet-skeletal, very pale orange, micrograined to very fine, very well cemented, granular appearance, interparticle porosity.

Table 3-2
CORE ANALYSIS SUMMARY
GDU NORTH PORT ST. LUCIE INJECTION WELL

Depth (ft)	Orientation (Horizontal or Vertical)	Coefficient of Permeability (cm/sec)	Porosity (Gs=2.70) (%)	Dry Density (pcf)
2101.0-2101.8	V	$4.5\text{x}10^{-5}$	35	109.2
2101.0-2101.8	H	$5.4\text{x}10^{-5}$	35	108.7
2108.2-2109.0	V	$4.4\text{x}10^{-5}$	32	114.6
2108.2-2109.0	H	$3.3\text{x}10^{-5}$	31	115.7
2249.0-2250.0	V	$3.5\text{x}10^{-7}$	13	147.0
2249.0-2250.0	H	$1.4\text{x}10^{-7}$	9	152.8
2253.5-2254.0	V	$2.8\text{x}10^{-3}$	37	105.8
2253.5-2254.0	H	$1.2\text{x}10^{-3}$	32	114.5
2425.0-2426.2	V	$6.7\text{x}10^{-4}$	35	109.5
2425.0-2426.2	H	$5.7\text{x}10^{-4}$	35	109.1
2430.0-2431.0	V	$1.6\text{x}10^{-5}$	34	111.6
2430.0-2431.0	H	$3.4\text{x}10^{-4}$	36	108.5
2449.0-2450.0	V	$3.5\text{x}10^{-6}$	35	109.8
2449.0-2450.0	H	$8.9\text{x}10^{-5}$	38	104.0
2451.0-2451.8	V	$2.3\text{x}10^{-5}$	31	116.5
2451.0-2451.8	H	$1.1\text{x}10^{-5}$	30	117.2
2628.0-2629.0	V	$4.1\text{x}10^{-5}$	25	125.7
2628.0-2629.0	H	$1.9\text{x}10^{-4}$	30	117.6
2632.5-2633.0	V	$5.0\text{x}10^{-4}$	31	116.3
2632.5-2633.0	H	$1.5\text{x}10^{-4}$	32	115.1

Note: Core analyses performed by Ardaman and Associates, Orlando, Florida.

Further evidence supporting the confining nature of the cored intervals is found by comparing the fluid velocity, caliper, and natural gamma ray logs of the pilot hole. Within the 1,650- to 2,300-foot interval above the 2,300 to 2,400-foot flow zone, a sharp reduction in fluid velocity, an overgauge-sized hole, and a low intensity natural gamma ray count (indicating a clean limestone) all indicate confinement.

The upper Oldsmar Limestone, whose top occurs at 2,400 feet, is the lowermost confining sequence above the injection zone. Confinement from 2,400 to 2,890 feet is indicated by the same pattern of a sharp reduction in fluid velocity, an oversized hole, and a low natural gamma ray count. Straight-line overgauge traces on the caliper log may be due to the impregnated chert noted in the cores taken from this interval. This confining sequence persists until approximately 2,890 feet, when the top of the "Boulder Zone" portion of the Oldsmar Formation is encountered.

INJECTION TEST OF 12-INCH CASING

After completing the injection well to a total depth of 3,324 feet, the well was developed for 2 hours at approximately 2,000 gpm, and the monitor well was drilled to a depth of 1,418 feet. A 16-hour step rate injection test was run to evaluate the hydraulic characteristics of the injection well and to finalize the injection pump design.

Brackish water from the monitoring well was used for the injection test. Chloride values of monitor well fluid from the 1,400-foot depth were approximately 1,065 to 1,315 mg/l (Appendix D). The monitor well was cased to 950 feet with a 16-inch casing, and open with a 15-inch hole to 1,418 feet for the test.

A vertical turbine pump was installed in the monitor well and discharged into a 12-inch pipe connected to the injection well. A Flow Research Corporation Series 1,000 flow meter, an inline propeller type with a totalizer, measured the flowrate. A Helicoid 10-inch pressure gauge placed between the flowmeter and the wellhead, reading from 0-100 psi, measured the injection pressure.

The test was originally designed to be 16 hours in duration, with step rates between 500 and 2,800 gpm. The injection test began on July 25, 1987, but due to several interruptions, was not completed until July 28, 1987. The total duration of the test was 17 hours, with the last 12 hours continuing uninterrupted. A second 1 hour injection test was run on July 30, 1987. The major reason the injection test had to be interrupted was that inadequate diesel motors and pump bowls were initially available. Once pumps and motors that could sustain the 2,800 gpm rate were supplied, the test proceeded without interruption.

After stepping up the injection rates from 700, 1,000, 1,400, and 2,000 gpm, the test was run at 2,940 gpm for 12 hours, reaching a maximum head of 121 feet (52.5 psi) of water after 30 minutes of pumping. Using a Hazen-Williams friction coefficient of 140, an average value for good, clean seamless steel pipe, the friction loss in the 12-inch casing is 51.8 feet (22.4 psi) of water. After the test, a static head of 50.8 feet (22 psi) of water was measured. The hydraulic loss (friction plus static) thus accounts for 103 feet of the 121 feet of head, which indicates that 18 feet or 7.8 psi of injection pressure is due to the formation.

After 12 hours of injecting at 2,940 gpm, the test was terminated. A second, 1 hour injection test was run on July 30, 1987. Both tests are summarized in Table 3-3 and the data from the tests are found in Appendix C.

Table 3-3
STEP INJECTION TEST SUMMARY-COMPLETED INJECTION WELL[a]

Injection Rate (gpm)	Duration (hours)	Maximum Injection Head (feet above pad)
0	--	50.8 Static
700	0.5	57.5
1,000	9.25	65.7
1,400	0.5	71.5
2,000	0.5	80.7
2,940	12	121.1
2,800	1	113

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[a] Injection testing occurred from July 23-30, 1987.

Section 4

OPERATING AND MONITORING SYSTEMS

GENERAL SYSTEM DESCRIPTION

The present effluent disposal system at the North Port St. Lucie WWTP is limited to spray irrigation on a pine flat woods site to the northeast of the WWTP. The new Class I injection well system will inject excess effluent into a cavernous dolomite formation containing saltwater at a depth of over 2,900 feet below ground surface.

The new injection system includes the effluent pump station, hydraulic surge protection appurtenances, injection and multizone monitoring wells, and instrumentation and controls. The existing north ponds will be utilized for emergency storage of effluent should the pump station be out of service. An overflow to the adjacent canal north of the site is provided should the emergency storage ponds be filled before the pump station can be restored to service.

SPRAY IRRIGATION SYSTEM

The existing spray irrigation system will remain in place once the injection system is online. Following the construction of the planned golf course on the existing spray site, the spray system will continue to provide effluent reuse through golf course irrigation. Since the spray irrigation pumps are located in Pond No. 6, that system will be operated independently of the injection system. The injection system will serve as a backup system to handle the flows exceeding the golf course's capacity.

INJECTED EFFLUENT FLOW AND PUMPS

When operating normally, the effluent flows through the existing chlorine contact basin, through the existing 24-inch piping to the south and into Pond No. 2 (Figure 2-2). This pond is lined with Fabriform and is the wet well for the pump station. The pond is normally operated in the fill and draw mode between elevations 14.5 and 16.5, which is approximately 450,000 gallons.

The two pumps are 3-stage vertical turbines rated at 1,840 gpm at 115 feet of head. Piping to accommodate a third pump is included. The pumps are constant speed, controlled by float switches at the pump intake structure. The pumps are mounted in pump cans and discharge into a common 12-inch header. From this header, piping connects to the 12-inch injection well and to the hydraulic surge protection system.

HYDRAULIC SURGE PROTECTION

The surge protection system is a 2,000 gallon capacity tank with level control switches to maintain the water level in the tank within the design operating range. Should the water level in the tank rise or fall beyond the operating range, an alarm will sound at the pump station and in the lab building.

SYSTEM MONITORING AND CONTROLS

Pump operation is controlled by the float switches in the pump intake structure. The water elevation and function of each float switch and of the critical elevations of the system are as follows:

Elevation (Ft. MSL)	Description
19.0	Top of pond berm
18.0	Overflow into adjacent pond Nos: 3, 4, and 5 from Pond No. 2
17.0 (float switch)	High water level alarm
16.5 (float switch)	Call lag pump to run
15.5 (float switch)	Call lead pump to run
14.5 (float switch)	All pumps off
13.5	Bottom of screened opening in intake structure
12.0 to 13.0	Pond No. 2 bottom elevation

Standby power is supplied by the existing generator to operate the system during power outages.

The flow rate and pressure are monitored via a venturi tube flow insert located in the above ground piping at the injection well. The flow rate and injection pressure are indicated and recorded in the lab building. The multizone monitoring well located on the drilling pad with the injection well is sampled on a monthly basis. The water levels in the the two artesian monitoring zones are indicated at the wellhead and will be indicated and recorded in the lab building. Two sample flow lines run from the monitoring well to the pump station basin for discharge of purge water during water sampling.

The surge system controls are located at the pump station and level switches in the surge tank add air and vent air into/from the tank to maintain the water level, between 1'4" and 2'2" below the top of the tank.

An alarm sounds if the water level rises above or below these levels following an adjustable time delay. Air can be manually added or vented, if necessary. A rupture disk on the tank will rupture at pressures over 125 psi. Surge system trouble alarm and light annunciation are displayed in the lab building.

EMERGENCY STORAGE AND DISCHARGE

Should the pump station be out of service, the effluent will fill the lined Pond No. 2 up to elevation 17.0 and the high level alarm will sound. The plant operator will attempt to return the pumps to operation, but if he is unsuccessful, he will activate the chlorination system at the effluent splitter box to chlorinate the flow into Pond No. 2.

Ponds Nos. 3, 4, and 5 are connected and will provide an additional 4.1 million gallons of storage to the 1.1 million gallons in Pond No. 2. If the pumps are not back in service when the ponds reach elevation 18.0, the operator will activate the overflow chlorinator and chlorinated effluent will overflow into the adjacent canal. The ponds will provide approximately 6 days of storage at present day flows and over 24 hours of storage at the injection well capacity flow rate of 4.0 mgd. Additional storage may be available in the southern ponds currently used for spray irrigation effluent storage.

When the pump station is back in service, the stored effluent will be pumped back into Pond No. 2 for injection into the well.

BACKGROUND MONITORING

VIDEO TELEVISION SURVEY

A color survey of the pilot hole was run to 3,294 feet on June 26, 1987. After the well was completed, a final color survey was attempted, but a clear picture could not be obtained due to black suspended particles. A black and white survey was then run to a total depth of 3,318 feet, followed by a 1-hour injection test, and another black and white survey was run to a total depth of 3,317 feet. The results of the final survey are summarized in Appendix H.

BACKGROUND WATER QUALITY

Water quality samples were taken at various stages during and after construction to establish the background water quality of the injection and monitoring zones.

One of the most important water quality determinations is the depth at which the total dissolved solids (TDS) of the formation fluids exceed 10,000 mg/l. Data obtained to determine the 10,000 mg/l interface include:

- geophysical logs on the injection and monitor wells,
- water quality samples from reverse air drilling of the injection well,
- depth samples from the injection well,
- water quality samples from reverse air open circulation drilling of the monitor well, and

- water quality samples from the monitor well during and after development.

Geophysical logs run on the injection well pilot hole to 2,005 feet include a Schlumberger induction electric log, and CH2M HILL single point, long and short normal (LSN) electric logs, and fluid resistivity logs. The medium and deep induction log traces on the induction electric log begin to separate at 1,700 feet in depth, and gradually shift to the left (lower resistivity). The deep induction log is also reading more conductive fluid in the formation than in the borehole. The long and short normal traces converge at approximately 1,700 feet, and below 1,720 feet both the borehole and formation fluids are salty. Below 1,806 feet, the LSN log reads very low resistivities of the salty water. The fluid resistivity log shows a gradual shift to the left (lower resistivity beginning at 1,720 feet in depth, and a more abrupt shift to the left beginning at 1,800 feet). The lowest resistivity value of 0.5 ohm-meters occurred at 1,840 to 1,850 feet in depth on this log.

Geophysical logs were run on the monitor well pilot hole to 1,746 feet in depth. The LSN log is similar to the LSN of the injection well, in that the long and short normal curves converge between 1,700 to 1,710 feet. The fluid resistivity log is quite different from the injection well fluid resistivity log, showing a much lower overall resistivity and a less erratic, more gradual decline in resistivity with depth. These differences may be due to different borehole sizes, and different drilling methods. Despite these differences, the Schlumberger induction electric log, both LSN logs and the injection well fluid resistivity log all indicate that a change in water quality occurs at approximately 1,700 feet.

Water quality samples were taken while drilling the injection well pilot hole by reverse air closed circulation. Water quality fresher than anticipated occurred to a depth of 2,000 feet (Appendix D) which is due to the recirculation of fresher drilling make-up water, and from the contribution of fresh water from flow zones in the 1,500-1,600 foot interval. Water samples were also taken with the CH2M HILL logger's depth sampler, with the results shown in Table 4-1. These values indicate that a large shift in water quality occurs between 1,680 and 1,850 feet.

Reverse air open circulation was used to drill the monitor well pilot hole below 1,580 feet in an effort to obtain more representative water quality samples. Water quality values reported over the 1,580 foot to total depth interval (Appendix D) are not significantly different from those obtained from the injection well.

After the monitor well was completed, the upper zone was developed by natural flow, and the lower zone by air lifting for approximately 48 hours. The purpose of the well development was to ensure that natural background was being sampled when the complete background water quality sampling was performed. Field water quality sampling was performed during the well development, with the results shown in Tables 4-2 and 4-3. The lower zone, which monitors the interval from 1,730 to 1,800 feet, is monitoring beneath the 10,000 mg/l interface. The transition to greater than 10,000 mg/l TDS waters occurs at approximately 1,700 feet at this site. The depth of that interface at other sites from Martin to Indian River Counties is depicted in Figure 2-5.

Water quality sampling to establish background water quality of the monitoring zones was conducted on August 30, 1987 in accordance with the parameter list provided by the South

Table 4-1
WATER QUALITY FROM INJECTION WELL PILOT HOLE DEPTH SAMPLES (1670 to 1980 FEET)[a]

	Depth (Feet)		
Parameter	1670	1850	1980
Chloride (mg/l)	1425	7523	7323
Conductivity (μmhos/cm)	4400	19,400	19,400
Temperature (°C)	27.5	24.5	27.0

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[a] Test conducted on May 23, 1987. Water quality analyses performed in the field.

Table 4-2
UPPER MONITOR ZONE (950-1,175 FEET IN DEPTH) WATER QUALITY DURING WELL DEVELOPMENT

Date	Time	Specific Conductance (μmhos/cm)	Total Dissolved Solids[1] (mg/l)	Temperature (°C)	Chloride (mg/l)
8/28/87	3:15 p.m.	3060	1867	28.5	--
	4:30 p.m.	3000	1830	28.5	--
	8:00 p.m.	3090	1885	27.0	--
8/29/87	1:30 a.m.	3020	1842	23.0	--
	6:30 a.m.	3080	1879	26.5	--
	10:00 a.m.	3030	1848	29.5	--
	11:15 a.m.	3080	1879	30.5	1300
	12:45 p.m.	3070	1873	32.0	--
	2:15 p.m.	3020	1842	31.0	--
	3:30 p.m.	3010	1836	28.0	--
	5:00 p.m.	3010	1836	28.0	1200

Note: Field pH of August 29, 1987, 5:00 p.m. sample = 7.86.

[1] Total Dissolved Solids (TDS) values were calculated from the relationship TDS = Specific Conductance X 0.61.

Table 4-3
LOWER MONITOR ZONE (1730-1800 FEET IN DEPTH) WATER QUALITY DURING WELL DEVELOPMENT

Date	Time	Specific Conductance (µmhos/cm)	Total Dissolved Solids[1] (mg/l)	Temperature (°C)	Chloride (mg/l)
8/28/87	3:15 p.m.	19,500	11,895	28.5	--
	4:30 p.m.	20,000	12,200	28.0	--
	8:00 p.m.	19,000	11,590	27.0	--
8/29/87	1:30 a.m.	22,000	13,420	23.0	--
	6:00 a.m.	20,000	12,200	27.00	--
	10:00 a.m.	20,500	12,505	28.0	--
	11:15 a.m.	22,000	13,420	28.5	--
	12:45 p.m.	19,300	11,773	28.5	11,147
	2:15 p.m.	20,000	12,200	20.5	9,997
	3:30 p.m.	20,000	12,200	28.0	--
	5:00 p.m.	20,000	12,200	28.00	--
	8:00 p.m.	20,000	12,200	32.0	--
	11:00 p.m.	21,000	12,810	31.5	--
8/30/87	2:00 a.m.	21,000	12,810	31.5	--
	6:00 a.m.	21,800	13,298	31.5	--
	9:30 a.m.	21,800	13,298	28.0	10,047
	12:30 p.m.	20,000	12,200	28.0	10,297

Note: Field pH of August 30, 1987, 12:30 p.m. sample = 7.63.

[1] Total Dissolved Solids (TDS) values were calculated according to the relationship TDS = Specific Conductance X 0.61.

Florida District FDER office. That parameter list and the actual laboratory reports are contained in Appendix D.

Two final samples were taken from the injection well after it was completed. Between 58,000 and 78,000 gallons were pumped prior to sampling. Results of that sampling are found in Table 4-4. A five gallon unacidized sample representative of the native injection zone fluid was collected after well development, and shipped to Dr. James B. Cowart, Florida State University. Copies of the laboratory reports and the transmittal letter are found in Appendix D.

Laboratory and field results from all water samples taken in the injection zone interval indicate that water quality in that interval more than satisfies the requirements for a suitable injection zone. Chloride values from the completed well were 19,400 mg/l, while total dissolved solids from the completed well were 25,250 mg/l.

Background and weekly water samples taken from the 87-7 series shallow monitor wells, located around the injection pad, were discussed in Section 2. Appendix D contains the laboratory and field results from these wells.

OPERATIONAL MONITORING

INJECTION WELL INSTRUMENTATION

The monitoring system includes recording and indicating instruments for flows and pressures, and periodic water quality sampling to detect any deviation from background values. The flow is recorded on a 24-hour circular chart with a 0-5 mgd range, and a totalizer records the total flow in thousands of gallons.

Table 4-4
WATER QUALITY OF COMPLETED INJECTION WELL (2750 to 3324 Feet)[a]

Parameter	Value
GENERAL	
pH (Units)	7.45
Stability Index (2 pHs - pH)	8.77
Total Alkalinity (as CaCO3)	100
Phenolphthalein Alkalinity	0.0
Carbon Dioxide (free)	7.0
Bicarbonates (as HCO3-)	<0.1
Hydroxides (OH-)	<0.1
Color (APHA)	20
Conductivity (μmhos/cm)	41,400
Field Conductivity (μmhos/cm)	50,000
Calcium Hardness (as CaCO3)	5,880
Magnesium Hardness (as CaCO3)	320
Total Hardness (as CaCO3)	6,200
Carbonate Hardness (as CaCO3)	100
Non Carbonate Hardness, as CaCO3	6100
Turbidity (NTU)	3.5
Odor (TON)	N.O.D.
Saturation Index (pH - pHs)	1.32
Carbonate (as CO3=)	<0.1
ANIONS	
Chloride	19,400
Fluoride	0.50
Sulfate	3,400

Note: Values are mg/l unless otherwise stated
N.O.D. = No odor observed.
Field Chloride = 22,100 mg/l.

[a] Sample collected on August 18, 1987. Water quality analyses performed by CH2M HILL laboratory, Gainesville, Florida.

The injection pressure, measured and indicated with a pressure gauge near the wellhead, is indicated and recorded in the lab room on another 24-hour circular chart with a range of 0-100 psi.

Figure 4-1 shows the injection wellhead detail and the flow tube location in the injection line.

MONITOR WELL INSTRUMENTATION

The Floridan aquifer is monitored with the two-zone monitor well located 80 feet west of the injection well. The upper zone, monitored through the annulus between the 16- and 6-5/8-inch casings, is open from 950 to 1,175 feet to the upper Floridan aquifer. This zone is artesian, and flows at a rate of approximately 400 gpm through the 4-inch valve on the 16-inch casing.

The lower monitoring zone is the open hole below the 6-5/8-inch casing, which extends from 1,730 feet to 1,800 feet in depth. This monitoring zone flows under natural artesian conditions at about 25 gpm.

Continuous water level monitoring of the two monitoring intervals is provided by two circular chart recorders reading 0 to 30 feet of water. These recorders are housed in the lab building. Figure 4-2 shows the monitoring wellhead details and instrumentation.

The injected effluent and the two monitoring zones' water quality will be monitored periodically, in accordance with the requirements of Section 17-28.250 F.A.C. The operational monitoring plan will be developed with the Technical Advisory Committee during the course of the operating permit application process.

SE15807.T2

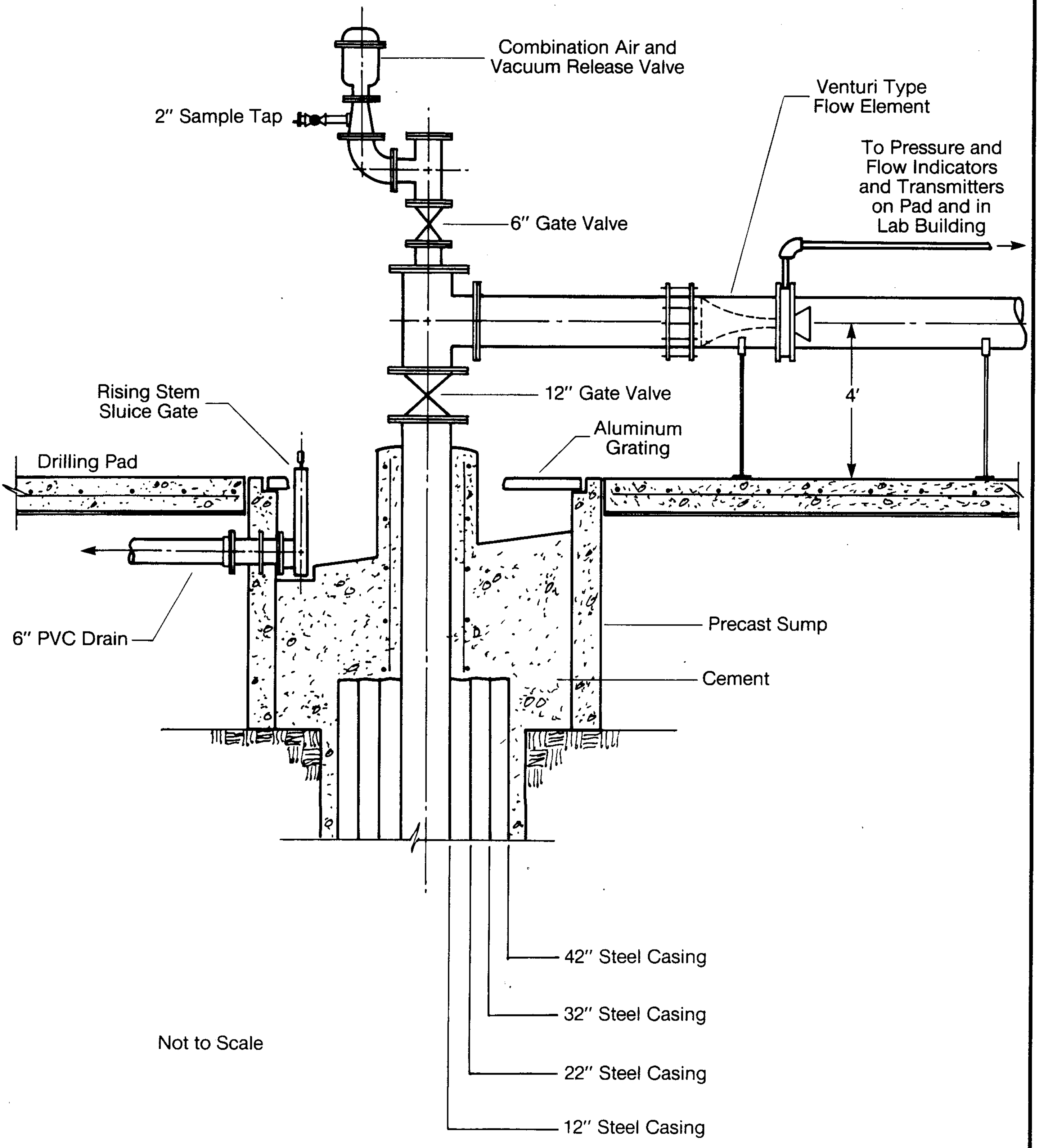

FIGURE 4-1.
GDU North Port St. Lucie WWTP—Injection Wellhead Detail.

CH2M HILL

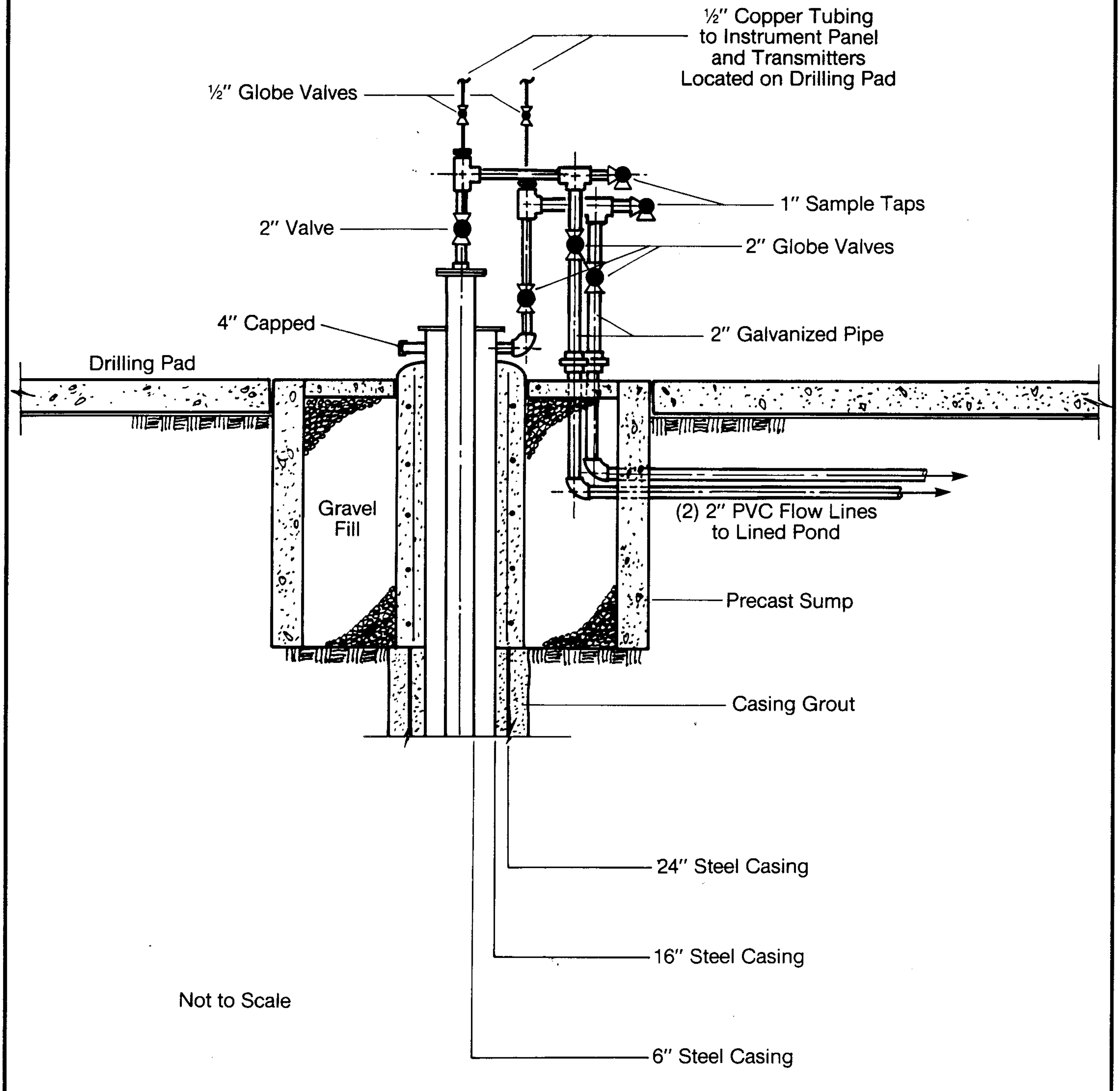

FIGURE 4-2.
GDU North Port St. Lucie WWTP—Monitor Wellhead Detail.

SUMMARY AND CONCLUSIONS

The deep injection well system at the GDU North Port St. Lucie WWTP in Port St. Lucie, Florida consists of a 3,324-foot deep, 12-inch diameter injection well, a surge protection system, and an injection pump station with control and monitoring instrumentation. A separate monitor well is open to two zones above the injection zone.

The injection well has a design capacity of 4 mgd, and is constructed of four concentric steel casings designed to protect the underground sources of drinking water (USDW) from possible upward migration of fluid. Four casings (plus a 40-foot surface casing) which are fully cemented from their bottoms to land surface, protect the surficial freshwater aquifer. The 42-inch outer casing was installed to protect the water quality of the surficial aquifer, which serves as a principal domestic and municipal supply in St. Lucie County. The 42-inch casing is set to 195 feet and is fully cemented from its bottom to land surface.The surficial aquifer extends to a depth of approximately 150 feet at the site.

The underground source of drinking water (USDW) portion of the upper Floridan aquifer, which occurs above 1700 feet in depth, is protected by 850 feet of 32-inch casing and 1,950 feet of 22-inch casing. The confining beds between the base of the USDW and the injection zone are further protected by the 12-inch seamless casing set to 2,750 feet and cemented to land surface. Confinement is provided by the lower Lake City Limestone and the upper Oldsmar Limestone, in the interval from 1,700 feet to the top of the injection zone.

The open hole injection zone extends from a depth of 2,750 feet to 3,324 feet. The injection zone, known as the Boulder Zone, occurs in the Lower Eocene Oldsmar Formation, and is composed of highly fractured, cavernous dolomite. The major zone through which the effluent exits the borehole is in the interval from 2,890 to 3,220 feet. The effluent will migrate radially away from the well through this zone. Natural water quality in the lower Oldsmar Formation is essentially that of sea water, with a total dissolved solids value of 25,250 mg/l.

Continuous pressure monitoring and periodic water samples in the two monitoring zones of the monitor well are designed to detect any vertical migration of the injected fluid. The upper zone extends from 950 to 1,175 feel in depth, and monitors in the USDW. The lower zone is completed from 1,730 to 1,800 feet, and monitors the Floridan aquifer below the USDW.

The hydraulic testing of the injection well demonstrated that most of the wellhead injection pressure is attributable to friction losses in the well and buoyancy of the fresher injected fluid on the native saltwater. At the maximum test rate of 2,940 gpm, the hydraulic loss (friction plus static) accounted for 103 feet of the 121 feet of head measured at the wellhead.

The deep injection well system provides the GDU North Port St. Lucie WWTP with an environmentally safe backup alternative to spray irrigation of effluent on the surrounding pine flatwoods and new golf course. In the unlikely event that emergency disposal procedures are necessary, the effluent will flow into the lined Pond No. 2, then into Ponds 3, 4, and 5, and ultimately into the Ocean Breeze Canal. During emergency disposal to the pond(s) or canal, the effluent from the wastewater treatment plant will be chlorinated in accordance with Chapter 17-6, F.A.C.

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Appendix A
FDER CLASS I--TEST/INJECTION WELL CONSTRUCTION AND TESTING PERMIT AND RELATED CORRESPONDENCE

STATE OF FLORIDA
DEPARTMENT OF ENVIRONMENTAL REGULATION

SOUTHEAST FLORIDA DISTRICT
1900 SOUTH CONGRESS AVENUE
WEST PALM BEACH, FLORIDA 33406

BOB MARTINEZ
GOVERNOR
DALE TWACHTMANN
SECRETARY
J. SCOTT BENYON
DISTRICT MANAGER

MAY 08 1987

NOTICE OF PERMIT

St. Lucie County
UIC - Class I Injection
Well Construction and
Testing Permit

Mr. Charles Fancher, Vice President
General Development Utilities
1111 S. Bayshore Dr.
Miami, FL 33470

Dear Mr. Fancher:

Enclosed is revised and extended Permit Number UC 56-097497 to construct one 12 inch (I.D.) Test/Injection Well, and one 6" satellite monitoring well, issued pursuant to Section(s) 403.087, Florida Statutes.

Any party to this Order (permit) has the right to seek judicial review of the permit pursuant to Section 120.68, Florida Statutes, by the filing of a Notice of Appeal pursuant to Rule 9.110, Florida Rules of Appellate Procedure, with the Clerk of the Department in the Office of General Counsel, 2600 Blair Stone Road, Tallahassee, Florida 32301; and by filing a copy of the Notice of Appeal accompanied by the applicable filing fees with the appropriate District Court of Appeal. The Notice of Appeal must be filed within 30 days from the date this Notice is filed with the Clerk of the Department.

Executed in West Palm Beach, Florida

STATE OF FLORIDA DEPARTMENT OF
ENVIRONMENTAL REGULATION

Donald B. White
Permitting Section Head
1900 South Congress Avenue, Suite A
West Palm Beach, FL 33406
305/964-9668

DW:s/222

Copies furnished to:
- Richard Deuerling, DER, Tallahassee
- Al Mueller, Jr., DER/West Palm Beach
- Paul Phillips, " "
- Ron Lane, " "
- David Butler, South Florida Water Management District
- Mike Merritt, USGS - Miami
- Gene Coker, USEPA - Atlanta
- Jim Moses, SLCHU - Pt. St. Lucie
- Brian Hurley, SLCBD - Pt. St. Lucie
- Michael Yates, GDU - Miami
- J. I. Garcia - Bengochea, CH2M Hill - GNV
- Jeff Lehnen, CH2M Hill - GNV

CERTIFICATE OF SERVICE

This is to certify that this NOTICE OF PERMIT and all copies were mailed before the close of business on May 8 1987 to the listed persons.

Clerk Stamp

FILING AND ACKNOWLEDGEMENT FILED, on this date, pursuant to §120.52(10), Florida Statutes, with the designated Department Clerk, receipt of which is hereby acknowledged.

Carmella Burgess 5-8-87
Clerk Date

STATE OF FLORIDA
DEPARTMENT OF ENVIRONMENTAL REGULATION

SOUTHEAST FLORIDA DISTRICT
1900 SOUTH CONGRESS AVENUE
WEST PALM BEACH, FLORIDA 33406

BOB MARTINEZ
GOVERNOR
DALE TWACHTMANN
SECRETARY
J. SCOTT BENYON
DISTRICT MANAGER

PERMITTEE:
Mr. Charles E. Fancher
Vice President
General Development
Utilities
1111 South Bayshore Dr.
Miami, Florida 33131

I.D. NUMBER: 5156P60236
PERMIT/CERTIFICATION NUMBER: UC 56-097497
DATE OF ISSUE: MAY 0 7 1987
EXPIRATION DATE: May 1, 1988
COUNTY: St. Lucie
LATITUDE/LONGITUDE: 27°20'09"N/80°21'03"E
SECTION/TOWNSHIP/RANGE:
PROJECT: Class I Injection Well Construction Permit (North Port St. Lucie)

This permit is issued under the provisions of Chapter 403, Florida Statutes, and Florida Administrative Code Rule 17-28. The above named permittee is hereby authorized to perform the work or operate the facility shown on the application and approved drawing(s), plans, and other documents attached hereto or on file with Department and made a part hereof and specifically described as follows:

CONSTRUCT: One 12-inch Class I Test/Injection well, 3300 feet deep with a satellite monitor well. Also including a duplex pump station and a 450,000 gallon lined pond. The well will be used for testing and future disposal of treated wastewater effluent and will have a maximum injection capacity limited to 8 FPS velocity.

IN ACCORDANCE WITH: Application for Permit to Construct a Class I Injection Well System submitted to this agency on Department of Environmental Regulation Form 17-1.209(9) dated December 18, 1984, contract documents prepared by CH_2M Hill dated December, 1984 as amended, permit extension request of March 11, 1987, current contract documents dated December, 1986 received April 10, 1987 showing minor modifications for the injection well, monitor well and pump station.

NOTE: This permit is a second extension (revised) of UC 56-097497.

SUBJECT TO: General Conditions 1-16 and Specific Conditions 1-21.

DER Form 17-1.201(5)
Effective November 30, 1982

PERMITTEE:
Mr. Charles E. Fancher
Vice President

I.D. Number: 5156P60236
PERMIT/CERTIFICATION NUMBER: UC 56-097497
DATE OF ISSUE: MAY 0 7 1987
EXPIRATION DATE: MAY 0 1 1989

GENERAL CONDITIONS:

7. The permittee, by accepting this permit, specifically agrees to allow authorized Department personnel, upon presentation of credentials or other documents as may be required by law, access to the premises, at reasonable times, where the permitted activity is located or conducted for the purpose of:

   a. Having access to and copying any records that must be kept under the conditions of the permit;
   b. Inspecting the facility, equipment, practices, or operations regulated or required under this permit; and
   c. Sampling or monitoring any substances or parameters at any location reasonably necessary to assure compliance with this permit or Department rules.

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

8. If, for any reason, the permittee does not comply with or will be unable to comply with any condition or limitation specified in the permit, the permittee shall immediately notify and provide the Department with the following information:
   a. a description of and cause of non-compliance; and

   b. the period of non-compliance, including exact dates and times; or, if not corrected, the anticipated time the non-compliance is expected to continue, and steps being taken to reduce, eliminate, and prevent recurrence of the non-compliance.

      The permittee shall be responsible for any and all damages which may result and may be subject to enforcement action by the Department for penalties or revocation of this permit.

9. In accepting this permit, the permittee understands and agrees that all records, notes, monitoring data and other information relating to the construction or operation of this permitted source, which are submitted to the Department, may be used by the Department as evidence in any enforcement case arising under the Florida Statutes or Department rules, except where such use in proscribed by Sections 403.73 and 403.111, Florida Statutes.

10. The permittee agrees to comply with changes in Department rules and Florida Statutes after a reasonable time for compliance, provided however, the permittee does not waive any other rights granted by Florida Statutes or Department rules.

11. This permit is transferable only upon Department approval in accordance with Florida Administrative Code Rules 17-4.12 and

GENERAL CONDITIONS:

15. When requested by the Department, the permittee shall within a reasonable time furnish any information required by law which is needed to determine compliance with the permit. If the permittee becomes aware that relevant facts were not submitted or were incorrect in the permit application or in any report to the Department, such facts or information shall be submitted or corrected promptly.

16. In the case of an underground injection control permit, the following permit conditions shall also apply:

    a. All reports or information required to be submitted to the department shall be certified as being true, accurate and complete.

    b. Reports of compliance or noncompliance with, or any progress reports on, requirements contained in any compliance schedule of this permit shall be submitted no later than 14 days following each schedule date.

    c. Notification of any noncompliance which may endanger health or the environment shall be verbally submitted to the department within 24 hours and again in writing within 72 hours and a final report provided within two weeks.

        1. The verbal reports shall contain any monitoring or other information which indicates that any contaminant may cause an endangerment to an underground source of drinking water and any noncompliance with a permit condition or malfunction of the injection system which may cause fluid migration into or between underground sources of drinking water.

        2. The written submission shall contain a description of and cause of noncompliance and if not corrected, the anticipated time the noncompliance is expected to continue, steps being taken to reduce, eliminate, and prevent recurrence of the noncompliance and all information required in accordance with Florida Administrative Code Rule 17-28.23(4)(b).

    d. The department shall be notified at least 180 days before conversion or abandonment of an injection well, unless abandonment within a lesser period of time is necessary to protect waters of the state.

SPECIFIC CONDITIONS:

F. Description of any construction problems that develop and their status;
G. Xeroxed copies of the driller's log are to be submitted with weekly summary;
H. Detailed description of the standard deviation survey when performed;
I. Accurate records of the amount of any material such as salt (NaCl) used during construction to kill the flow of the well;
J. Weekly summaries shall include a cover page summarizing critical event occurrences such as lost equipment, blowouts, last circulation, etc. as well as normal milestone events;

4. The cementing program shall be submitted by the engineer at least fifteen (15) days prior to the date the cementing is scheduled and approval must be received before cementing begins. The format for the estimate shall be submitted at the first scheduled meeting with the TAC. The cementing program shall be designed with the use of ASTM Type II cement.

5. The permittee and/or the engineer shall schedule progress review meetings with the TAC for the purpose of reviewing the results of tests, geophysical logging, drilling records, and construction problems. The initial meeting will be held prior to construction start-up but after the contractor has been selected. Scheduling of future meetings shall be scheduled for the purpose of selecting final setting depths for the 22" and 12" casings.

6. A professional engineer, registered pursuant to Chapter 471, Florida Statutes (F.S.) must be retained throughout the construction period to be responsible for the construction operation and to certify the application, specifications, completion report and other related documents. On-site monitoring of the construction operation shall be provided by a professional engineer or a qualified geologist. The Department must be notified immediately of any change in engineer.

7. Issuance of this construction permit does not obligate the permitting authority to authorize operation of the well, unless the well and surface appurtenances qualified for an operation permit.

8. If any problems develop that may seriously hinder compliance with this permit, construction progress or good construction practice the Department shall be notified immediately. The Department may require a written report describing in detail what

SPECIFIC CONDITIONS:

and that the well be shut in after the following have been completed:

A. TV Survey.
B. All geophysical logging. (Including mechanical integrity temperature log and/or radioactive tracer survey run after the initial injection test).
C. Mechanical integrity pressure test if not completed during well construction.
D. Initial injection test (not with effluent).
E. Background water quality analysis from the upper and lower monitor zones to include:
    1. Primary standards as described in Chapter 17-22.104(1) F.A.C., but excluding radionuclides (subparagraph (e)).

    2. Secondary standards as described in Chapter 17-22.104(2) F.A.C. - NOTE: Chapter 17-22.105 describes sampling and analytical methods.

    3. Minimum criteria described in Chapter 17-3.402 but limited to the following parameters (not described above) normally found in domestic wastewater secondarily treated recovered water:

        a. Inorganics
            Sulfide (field measurement)
            Soluble orthophosphate
            Ammonium
            Organic nitrogen

        b. Metals
            Antimony

        c. Biological
            Fecal coliform

        d. Volatile organics
            Toluene
            1,2 dichloroethylene
            chloroethane
            chloroform
            1,2 dichlorobenzene

SPECIFIC CONDITIONS:

17. Prior to drill penetration of the confining beds of the Hawthorne Formation and tapping the Floridan Aquifer System, a casing shall be set and cemented such that the casing is securely seated into the top of the Hawthorne confining beds.

18. The 22" casing shall be set into a zone of water quality of greater than 10,000 TDS into a formation adequate to restrict vertical movement of fluids.

19. Permittee shall submit final shop drawings of selected pumps and pump cans for concurrence with intended performance design. Department shall respond within 3 days of receipt of same.

20. Permittee shall notify the department at least 72 hours prior to conducting the following tests:

a. Pressure test of the inner casing in order to satisfy the requirements of rule 17-28.13(6)(b), F.A.C.

b. Temperature, noise, radioactive tracer surveys used to satisfy the requirements of 17-28.13(6)(c) F.A.C.

These tests may be witnessed by a representative of the department.

21. Every attempt shall be made to stabilize the temperatures in the well before running the mechanical integrity test.

Issued this 7th day of May, 1987

STATE OF FLORIDA
DEPARTMENT OF ENVIRONMENTAL REGULATION

Scott Benyon
J. Scott Benyon
District Manager

JSB:dws/222

CH2M HILL
Engineers
Planners
Economists
Scientists

July 20, 1987

SE15807.T2

Mr. J. Scott Benyon
District Manager
Department of Environmental Regulation
1900 South Congress Avenue
West Palm Beach, Florida 333406

Dear Mr. Benyon:

Subject: General Development Utilities, Inc.
North Port St. Lucie - WWTP Injection System
UC-56-097497

This letter is to present CH2M HILL's recommendation concerning the lower monitoring interval for the referenced project, as requested by you after the TAC meeting held in your offices on July 15, 1987.

During that TAC meeting, our letter to you dated July 8th, 1987 and the TAC recommendations for setting the lower monitoring interval were discussed at length. CH2M HILL recommends that the lower monitoring interval in the monitor well be set at between 1,570 and 1,620 feet in depth. This interval is near the base of the USDW and is the first permeable strata above the 10,000 mg/l TDS line. This zone should be able to monitor long-term effectiveness of the confining zone, as well as any possible fluid movement into the USDW. Both requirements being set forth in Chapter 17-28, FAC.

The upper monitoring zone would be between 950 and 1,200 feet. Both the upper and lower monitoring zones would then be very close to those depths shown on the project drawings approved by the TAC and your office last May as part of the construction permit.

The well is currently cased to 950 feet and cementing is being completed on the 16-inch casing. The pilot hole will be advanced below 1,000 feet, early this week.

CH2M HILL Gainesville Office 7201 N.W. 11th Place., P.O. Box 1647, Gainesville, Florida 32602 904.377.2442
EasyLink 62508220
Telex 756070

Thank you for your attention in this matter, and should you have any questions please contact me at (904)377-2442 or (305)426-4008.

Respectfully submitted,

J. I. Garcia-Bengochea

J. I. Garcia-Bengochea, P. E., Ph.D.
Director of Groundwater Resources

tl/gnCR9/056
cc: Nancy Roen/GDU/Miami
Ane Deister/GDU/Miami
Michael Yates/GDU/Miami
Leighton Hew/GDU/Miami
Alex Padva/DER/West Palm Beach
Don White/DER/West Palm Beach
Paul Phillips/DER/Port St. Lucie
Mark Elsner/DER/Port St. Lucie
Richard Deuerling/DER/Tallahassee
Gene Coker/EPA/Atlanta
Mike Merritt/USGS/Miami
Dave Butler/SFWMD/West Palm Beach
Dick Bedard/CH2M HILL/DFB
John Curtiss/CH2M HILL/DFB
Leslie Shannon/CH2M HILL/GNV
James Dwyer/CH2M HILL/TPA
Jeff Lehnen/CH2M HILL/GNV

STATE OF FLORIDA

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BOB MARTINEZ
GOVERNOR
DALE TWACHTMANN
SECRETARY
J. SCOTT BENYON
DISTRICT MANAGER

July 24, 1987

Dr. J.I. Garcia-Bengochea, P.E.
CH$_2$M Hill
7201 N.W. 11 Place
Gainesville, Fl. 32602

RE: GDU Pt. St. Lucie UC56-097497

Dear Dr. Garcia:

This is in response to your letter dated July 20, 1987, concerning the lower monitoring interval for the North Port St. Lucie injection well.

Your recommendation to set the lower monitoring zone at a depth between 1570 and 1620 feet and above the 10,000 mg/l TDS line is not desireable. Monitoring the interval between 1710 and 1770 ft. is, however, consistent with the permit granted to General Development Utilities on May 7, 1987, and is hereby approved.

The 1710 to 1770 ft. monitoring interval was identified by you during a July 22, 1987 meeting in my office between you, Dr. Alexander Padva and myself during which a review of the lithological log was conducted in cooperation with Ms. Leslie Shannon, the geologist on site. This alternative will provide for monitoring below the base of the U.S.D.W. as recommended by the TAC. At the same time it will not require penetration through the confining strata which was a subject of concern in your letter to me dated July 8, 1987.

The upper monitoring remains unchanged between 950 and 1200 feet.

Sincerely,

J. Scott Benyon
District Manager

JSB:apb122

cc: Nancy Roen/GDU/Miami
Ane Deister/GDU/Miami
Michael Yates/GDU/Miami
Leighton Hew/GDU/Miami
Don White/DER/West Palm Beach
Paul Phillips/DER/West Palm Beach
Mark Elsner/DER/West Palm Beach
Richard Deurling/DER/Tallahassee
Gene Coker/EPA/Atlanta
Mike Merritt/USGS/Miami
Dave Butler/SFWMD/West Palm Beach
Dick Bedard/Ch2M Hill/DFB
John ~~Curtiss/CH2M Hill/DFB~~
[redacted]
James Dwyer/CH2M Hill/TPA
Jeff Lehnen/CH2M Hill/GNV

CH2M HILL
Engineers
Planners
Economists
Scientists

July 31, 1987

SE15807.T2

Mr. J. Scott Benyon
District Manager
Department of Environmental Regulation
1900 South Congress Avenue
West Palm Beach, Florida 33406

Dear Mr. Benyon:

Subject: General Development Utilities, Inc.
North Port St. Lucie WWTP Injection System
UC-56-097497

Many thanks for your letter of July 24 on the referenced subject with the approval for the depth of the lower monitoring interval (1710 - 1770 feet). Although it is not our recommended depth interval (1570 - 1620 feet), we feel that such interval will be closer to the requirements of Chapter 17-28, FAC, than the depth of 2300 - 2400 feet previously suggested by TAC.

We wish to call to your attention that the approved depth is very close to the 10,000 mg/1 TDS interface, which is not static. We therefore anticipate wide fluctuation in the TDS concentration of the samples to be collected during the monitoring process. We also hope that those in your department reviewing such data will understand such conditions.

CH2M HILL INC. Gainesville Office 7201 N.W. 11th Place., P.O. Box 1647, Gainesville, Florida 32602 904.377.2442
EasyLink 62508220
Telex 756070

We wish to thank you for your personal involvement in this timely decision which we believe is in the best interest of all concerned parties.

Sincerely,

J. I. Garcia-Bengochea

J. I. Garcia-Bengochea, P.E., Ph.D.
Director of Groundwater Resources

JIGB/kah

xc: Nancy Roen/GDU/Miami
Ane Deister/GDU/Miami
Michael Yates/GDU/Miami
Leighton Hew/GDU/Miami
Alex Padva/DER/West Palm Beach
Don White/DER/West Palm Beach
Paul Phillips/DER/Port St. Lucie
Mark Elsner/DER/Port St. Lucie
Richard Deuerling/DER/Tallahassee
Gene Coker/EPA/Atlanta
Mike Merritt/USGS/Miami
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Leslie Shannon/CH2M HILL/GNV
James Dwyer/CH2M HILL/TPA
Jeff Lehnen/CH2M HILL/GNV

Appendix B
INJECTION WELL GEOLOGIC LOG
MONITOR WELL GEOLOGIC LOG
ROCK CORE ANALYSES

1981

Ardaman & Associates, Inc.

Consultants in Soils, Hydrogeology,
Foundations and Materials Testing

September 11, 1987
File Number 87-105

CH2M Hill
7201 N.W. 11th Place
Gainesville, FL 32602

Attention: Ms. Leslee Shannon

Subject: Permeability Testing of Rock Cores

Gentlemen:

As requested, the cores provided to us were subsampled to obtain samples for determination of the vertical and horizontal coefficient of permeability and porosity.

The samples were subcored to obtain 2-inch diameter permeability test specimens. The samples were encased in latex membranes and mounted in triaxial-type permeability cells for testing. An effective confining stress of about 7 lb/in^2 was used and a backpressure of about 95 lb/in^2 was applied to achieve saturation during flow measurement. The hydraulic gradients applied to the samples varied between 1 and 10 depending upon the sample coefficient of permeability. Each sample was permeated with water and the inflow and outflow monitored until a relatively constant value of the coefficient of permeability was obtained. The porosity of each sample was determined using final volumetric and dry weight measurements, and an assumed specific gravity of 2.70. The results are shown in the attached table.

If you have any questions or when you require additional testing, please contact us.

Very truly yours,
ARDAMAN & ASSOCIATES, INC.

Jan C. Wildman

Jan C. Wildman
Manager of Technical Services

Nadim F. Fuleihan, Sc.D., P.E.
Principal
Florida Registration No. 31953

JCW:ed
Encl.

8008 S. Orange Avenue, P.O. Box 13003, Orlando, Florida 32859-3003 305, 855-3860

RESULTS OF PERMEABILITY TESTING

Depth (feet)	Orientation (Horizontal or Vertical)	Coefficient of Permeability (cm/sec)	Porosity (G_s=2.70) (%)	Dry Density (pcf)
2101.0-2101.8	V	$4.5x10^{-5}$	35	109.2
2101.0-2101.8	H	$5.4x10^{-5}$	35	108.7
2108.2-2109.0	V	$4.4x10^{-5}$	32	114.6
2108.2-2109.0	H	$3.3x10^{-5}$	31	115.7
2249.0-2250.0	V	$3.5x10^{-7}$	13	147.0
2249.0-2250.0	H	$1.4x10^{-7}$	9	152.8
2253.5-2254.0	V	$2.8x10^{-3}$	37	105.8
2253.5-2254.0	H	$1.2x10^{-3}$	32	114.5
2425.0-2426.2	V	$6.7x10^{-4}$	35	109.5
2425.0-2426.2	H	$5.7x10^{-4}$	35	109.1
2430.0-2431.0	V	$1.6x10^{-5}$	34	111.6
2430.0-2431.0	H	$3.4x10^{-4}$	36	108.5
2449.0-2450.0	V	$3.5x10^{-6}$	35	109.8
2449.0-2450.0	H	$8.9x10^{-5}$	38	104.0
2451.0-2451.8	V	$2.3x10^{-5}$	31	116.5
2451.0-2451.8	H	$1.1x10^{-5}$	30	117.2
2628.0-2629.0	V	$4.1x10^{-5}$	25	125.7
2628.0-2629.0	H	$1.9x10^{-4}$	30	117.6
2632.5-2633.0	V	$5.0x10^{-4}$	31	116.3
2632.5-2633.0	H	$1.5x10^{-4}$	32	115.1

GDU NORTH PORT ST. LUCIE
INJECTION WELL SAMPLE LOG

Depth	Description
0-40	No sample.
40-50	Sand and shell, unconsolidated, white (N9) to medium light gray (N6), shell hash <10 mm average; Sandstone, calcareous, medium gray (N5), v. fine, slightly phosphatic, intergranular porosity.
50-70	Sand and shell, same as above; Sandstone, calcareous, medium light gray (N6), v. fine to medium, moderately well-cemented with calcareous cement, slightly phosphatic; Quartz grains, clear, coarse, subangular.
70-100	Sand and shell, unconsolidated, same as above; Shell hash 10-15 mm average, numerous whole mollusks; Sandstone, same as above; Quartz grains, clear, coarse.
100-110	Sand and shell, unconsolidated, white (N9) to medium light gray (N6), shell hash consisting of shell fragments, angular, to 30 mm, and whole gastropods and mollusks <10 mm; Sand, v. fine and slightly phosphatic; Sandstone, same as above, slightly phosphatic.
110-120	Same as above, whole gastropod 20 mm.
120-130	Limestone, sandy, micritic, v. light gray (N8), well-cemented with calcitic cement, quartz and phosphate grains, intergranular porosity; Sand, medium light gray (N6), v. fine, poorly cemented; Shell fragments, 10%, angular, ∿ 10 mm.
130-140	Limestone, sandy, same as above; Sand, same as above; Shell fragments, <10%, angular, ∿ 15 mm; Quartz grains, <5%, clear, coarse, subangular; Phosphate grains, <5%, brown to black, fine to medium, rounded; Silt, light olive gray (5 Y 6/1), <5%.
140-150	Sand, silty, 80%, olive gray (5 Y 4/1), v. fine, subrounded, poorly cemented, v. fine to fine phosphate grains, intergranular (low) porosity; Limestone, sandy, 10%, same as

Depth	Description
	above; Shell, mollusks, 10%, whole and fragments ∿ 20 mm.
150-160	Same as above, Shell fragments (angular) to 50 mm.
160-170	Sand, silty, 80%, same as above; Limestone, sandy, 10%, same as above; Shell fragments, 10%, angular, ∿ 30 mm.
170-180	Sand, clayey-silty, olive gray (5 Y 6/1), v. fine, subrounded, poorly cemented, phosphate grains, brown to black, v. fine, subrounded, low porosity; Shell hash, 20%, v. coarse; Minor shell fragments.
180-190	Same as above, stiff.
190-200	Sand, clayey-silty, 90%, same as above; Limestone, skeletal, 10%, white, v. fine grained.
200-300	Sand, clayey-silty, 95%, grayish olive (10 Y 4/2), v. fine, subangular, poorly cemented, phosphate grains, brown to black, v. fine, subrounded, benthic forams (*Textularia sp*.?), low porosity; Shell fragments, 5%, ∿ 5 mm.
300-360	Same as above, with phosphate grains, v. fine to fine.
360-380	Sand, clayey-silty, olive-gray (5 Y 3/2), v. fine, subrounded, poorly cemented, phosphate grains, brown to black, v. fine to fine, subrounded, benthic forams, quartz grains, clear, coarse, subrounded, low porosity.
380-390	Sandstone, silty, yellowish-gray (5 Y 3/2), coarsely micrograined to v. fine, poorly to moderately cemented, some calcitic cement, phosphate grains, v. fine, brown to black, quartz grains, clear, coarse, subangular, intergranular porosity; Shell fragments, <5 mm, shark's tooth.
390-410	Sandstone, 80%, same as above; Shell fragments, 20%, up to 10 mm, subangular.

Depth	Description
410-420	Sand, clayey-silty, olive-gray (5 Y 3/2), v. fine, subrounded, poorly cemented, phosphate grains, brown to black, v. fine to fine, subrounded, benthic forams, low porosity.
420-430	Sand, silty, same as above; Shell fragments, <10%, ∿ 5 mm, subangular.
430-450	Sand, silty, 50%, same as above; Shell fragments, 50%, white (N9), 5-10 mm, subangular.
450-460	Shell fragments, 60%, white (N9), 5-10 mm, subangular; Sand, 30%, silty, white (N9) to light olive gray (5 Y 5/2), coarsely micrograined to v. fine, subrounded to subangular, some calcitic cement; Phosphate grains, 10%, coarsely micrograined to fine, subrounded, intergranular and interparticle porosity.
460-490	Sand, clayey-silty, white to light olive gray (5 Y 5/2).
460-470	Silt, sandy-clayey, 80%, white to light olive gray (5 Y 5/2), coarsely micrograined, poorly cemented, calcareous cement, plastic; Phosphate grains, 20%, brown to black, v. fine to fine, subrounded, benthic forams, low porosity.
490-530	Silt, sandy-clayey, 80%, light olive gray (5 Y 5/2), coarsely micrograined to v. fine, poorly cemented, calcitic cement, plastic; Phosphate grains, 20%, brown to black, v. fine to medium, subrounded, low porosity.
530-540	Same as above, with v. minor shell fragments (∿ 1 mm) and shark's teeth.
540-560	Silt, sandy, 70%, light olive gray (5 Y 5/2), same as above, with 30% phosphate grains, v. fine to medium, rounded, plastic, low porosity.
560-570	Limestone, silty, 80%, micritic-pellet, yellowish gray (5 Y 7/2) to v. pale orange (10 YR 8/2), micrograined to medium (pellets), subrounded, poorly cemented, interparticle porosity; Phosphate grains, 10%, brown to black, v. fine to coarse,

Depth	Description
	subangular to subrounded; Quartz grains, 10%, clear, medium to coarse, subangular.
570-580	Limestone, silty, 40%, same as above; Sandstone, 40%, phosphatic, clear to white, v. fine, weakly cemented with calcitic cement, intergranular porosity; Phosphate grains, 15%, brown to black, coarse to >2 mm, subrounded; Quartz grains, 5%, clear, medium to coarse.
580-610	Sandstone, 45%, same as above; Silty limestone, 40%, same as above, phosphate grains, 10%, brown to black, coarse to v. coarse, subrounded; Quartz grains, 5%, as above; *Dentalia sp*.
610-620	Limestone, 70%, micritic-pellet, yellowish gray (5 Y 7/2) to v. pale orange (10 YR 8/2), microcrystalline to medium, poorly cemented with calcitic cement, interparticle porosity; Sand, 15%, phosphatic, clear to brown to black, v. fine, subrounded; Phosphate grains, 10%, coarse to v. coarse, brown to black, subrounded; Quartz grains, 5%, clear, coarse, subrounded; *Dentalia sp*., few *Lepidocyclina sp*. (weathered), fossil molds, mollusk and bryozoa fragments, interparticle porosity.
620-630	Limestone, micritic-pellet, yellowish-gray (5 Y 7/2), micrograined to v. fine, poorly to moderately well-cemented with calcite cement, *Lepidocyclina sp*., fossil molds, mollusk and bryozoa fragments, interparticle porosity.
630-650	Limestone, 95%, same as above; Phosphate grains, 5%, brown to black, v. fine to coarse.
650-660	Limestone, 95%, micritic-pellet, yellowish-gray (5 Y 7/2), micrograined to fine, poorly cemented with calcitic cement, *Lepidocyclina sp*., fossil molds, mollusk fragments, interparticle porosity; Phosphate grains, 5%, brown to black, v. fine to v. coarse, subrounded.
660-670	Same as above, without *Lepidocyclina sp*.

Depth	Description
670-680	Limestone, micritic-pellet, yellowish-gray (5 Y 7/2), micrograined to fine, poorly cemented with calcitic cement, fossil molds, interparticle porosity.
680-720	Limestone, 80%, micritic-pellet, yellowish-gray (5 Y 7/2), micrograined to fine, moderately well cemented with calcitic and sparry calcite cement, fossil molds, interparticle porosity; Silty sand, 20%, light olive gray (5 Y 5/2), v. fine, with phosphate grains, brown to black, v. fine to fine, subrounded, low porosity.
720-730	Limestone, same as above, with few *Lepidocyclina sp*.
730-740	Limestone, micritic-pellet, yellowish-gray (5 Y 7/2), micrograined to v. fine, poorly to moderately well cemented with calcite cement, minor *Lepidocyclina sp*., bryozoa, and fossil molds, interparticle porosity.
740-750	Limestone, micritic-pellet-skeletal, yellowish gray (5 Y 7/2), micrograined to fine, poorly cemented with calcareous cement, glauconitic, *Lepidocyclina ocalana sp*., bryozoa, mollusk fragments, coral, interparticle porosity.
750-760	Limestone, micritic-skeletal-pellet, yellowish gray (5 Y 7/2) to v. pale orange (10 YR 8/2), micrograined to medium, poorly cemented with calcite cement, glauconitic, numerous *Lepidocyclina ocalana sp*., *Operculinoides sp*., bryozoa, echinoid spines, minor mollusk fragments, interparticle porosity.
760-770	Same as above, with small gastropods.
770-780	Limestone, same as above, with numerous *Lepidocyclina ocalana sp*., *Operculinoides sp*., bryozoa.
780-790	Limestone, same as above, with *Lepidocyclina ocalana sp*., bryozoa, and fewer *Operculinoides sp*.
780-790	Limestone, skeletal-micritic, yellowish gray (5 Y 7/2), micrograined to medium, moderately

Depth	Description
	well-cemented with calcite cement, coquina of large (10-20 mm) Lepidocyclina ocalana sp., and numerous Operculinoides sp. and bryozoa, some Globigerina sp., interparticle porosity.
790-800	Limestone, skeletal-micritic-pellet, v. pale orange (10 YR 8/2), micrograined to medium, moderately cemented with calcareous cement, glauconitic, Lepidocyclina ocalana sp., Operculinoides sp., bryozoa, small whole echinoids (Periarchus lyelli floridanus?), interparticle porosity.
800-810	Limestone, pellet-micritic, v. pale orange (10 YR 8/2) to yellowish gray (5 Y 7/2), coarsely micrograined to v. fine, (pellets v. fine to fine), poorly cemented, uniform finely granular appearance, interparticle porosity.
810-820	Limestone, same as above, with few large (10 mm) Lepidocyclina ocalana sp.
820-830	Limestone, micritic-pellet, v. pale orange (10 YR 8/2), coarsely micrograined to fine (pellets), moderately cemented, a microcoquina of fine-grained coated Operculinoides sp., interparticle porosity.
830-840	Limestone, same microcoquina as above, well-cemented.
840-850	Limestone, micritic-pellet, v. pale orange (10 YR 8/2), micrograined to fine, a microcoquina of Operculinoides sp. and other forams, well cemented, hard sparry calcite filling some fossil molds, minor glauconite, large (15 mm) Lepidocyclina ocalana sp., interparticle porosity.
850-860	Limestone, same as above, with Operculinoides sp. and small (4 mm) recrystalled whole echinoid.
860-880	Limestone, micritic-pellet, white (N9) to v. pale orange (10 YR 8/2), micrograined to v. fine, a microcoquina moderately to well-cemented, glauconitic, Operculinoides sp., Textularia sp., Coskinolina floridana sp., Dictyoconus cookei, Lepidocyclina sp., echinoid fragments, numerous bryozoan fragments, interparticle porosity.

Depth	Description
880-890	Limestone, same as above, slightly more glauconitic, with D. cookei, Globigerina sp., Lepidocyclina sp., Operculinoides sp., and bryozoa fragments.
890-900	Limestone, micritic-pellet-skeletal, v. pale orange (10 YR 8/2), micrograined to fine, poorly to moderately cemented, glauconitic, Operculinoides sp., Lepidocyclina ocalana sp., numerous bryozoa fragments, interparticle porosity.
900-910	Limestone, 50%, micritic, white (N9), micrograined, moderately cemented, v. few weathered fossils, low interparticle porosity; Dolomite, 50%, pale yellowish brown (10 YR 6/2), micrograined to v. fine, moderately well cemented, minor intercrystalline porosity.
910-920	Dolomite, 60%, pale yellowish brown (10 YR 6/2), coarsely micrograined to v. fine, well-cemented, minor intercrystalline and pinpoint vug porosity; Limestone, 40%, as above.
920-930	Limestone, 60%, micritic, white (N9) to v. pale orange (10 YR 8/2), micrograined, moderately well-cemented, v. few weathered fossils, interparticle porosity; Dolomite, 40%, moderate yellowish brown (10 YR 5/4), micrograined to v. fine, well-cemented, minor intercrystalline porosity.
930-940	Limestone, 50%, same as above, with few D. gunteri (?) and Coskinolina floridana; Dolomite, 50%, same as above.
940-950	Limestone, 60%, micritic-pellet, white (N9) to v. pale orange (10 YR 8/2), micrograined to v. fine, moderately well-cemented, few Dictyoconus sp. and Coskinolina sp., interparticle porosity; Dolomite, 40%, same as above.
950-970	Limestone, 60%, micritic-pellet, white (N9), micrograined to v. fine, poorly to moderately well-cemented, few Dictyoconus sp., interparticle porosity; Dolomite, 40%, pale yellowish brown (10 YR 6/2), finely micrograined to v. fine, well-cemented, minor

Depth	Description
	intercrystalline and pinpoint vug porosity; Claystone, trace.
970-990	Dolomite, 60%, pale yellowish brown (10 YR 6/2), finely micrograined to v. fine, well-cemented, minor intercrystalline and pinpoint vug porosity; Limestone, 40%, micritic, white (N9) to v. light gray (N8), finely micrograined to v. fine, moderately well cemented, few D. cookei, interparticle porosity; Claystone, trace.
990-1000	Limestone, 50%, micritic-pellet, white (N9) to v. pale gray (N8) to v. pale orange (10 YR 8/2), finely micrograined to fine, moderately well-cemented, some siliceous cement and siliceous replacement of fossils, v. few D. cookei, interparticle porosity; Dolomite, 50%, pale yellowish brown (10 YR 6/2), micrograined to v. fine, well cemented, minor intercrystalline and pinpoint vug porosity.
1000-1010	Dolomite, 60%, pale yellowish brown (10 YR 6/2), micrograined to v. fine, subhedral to euhedral v. fine crystals lining fossil molds and pinpoint vugs, well-cemented, moderate pinpoint vug and intercrystalline porosity; Limestone, 40%, same as above.
1010-1030	Dolomite, 60%, v. pale orange (10 YR 8/2) to pale yellowish brown (10 YR 6/2), v. fine grained, slightly sucrosic, well-cemented, minor fossil molds lined with crystals, minor intercrystalline and pinpoint vug porosity; Limestone, 40%, same as above.
1030-1040	Dolomite, 60%, same as above; Limestone, 35%, micritic-pellet, white (N9) to v. light gray (N8) to v. pale orange (10 YR 8/2), micrograined to v. fine, poorly to moderately well-cemented, some siliceous cement, slightly glauconitic, interparticle porosity; Claystone, 5%, medium light gray (N6), poorly cemented, nonplastic.
1040-1060	Dolomite, 50%, same as above; Limestone, 50%, same as above.

Depth	Description
1060-1070	Limestone, 60%, micritic, white (N9) to v. pale orange (10 YR 8/2), micrograined to v. fine, poorly to moderately cemented, interparticle porosity; Dolomite, 40%, grayish orange (10 YR 7/4) to pale yellowish brown (10 YR 6/2), micrograined to v. fine, slightly sucrosic, intercrystalline porosity.
1070-1080	Limestone, 50%, micritic-pellet, same as above; Dolomite, 30%, as above; Claystone, 20%, as above.
1100-1120	Limestone, 50%, micritic-pellet, white (N9) to v. pale orange (10 YR 8/2), micrograined to v. fine, moderately well-cemented, few *D. cookei*, interparticle porosity; Dolomite, 30%, as above; Claystone, 20%, as above.
1120-1130	Dolomite, 80%, mottled medium gray (N5), pale yellowish brown (10 YR 6/2) and grayish black (N2), micrograined to v. fine subhedral crystals, slightly sucrosic, some crystals lining fossil molds, well-cemented, minor intercrystalline porosity; Limestone, 20%, as above.
1130-1140	Dolomite, v. pale orange (10 YR 8/2) to moderate yellowish brown (10 YR 5/4), v. fine subhedral crystals, sucrosic, moderately cemented, moldic and intercrystalline porosity.
1140-1160	Dolomite, moderate yellowish brown (10 YR 5/4), coarsely micrograined to v. fine subhedral crystals, finely sucrosic, well-cemented, v. even texture, v. minor intercrystalline porosity.
1160-1170	Dolomite, 80%, grayish orange (10 YR 7/4), v. fine subhedral crystals, moderately well cemented, moldic porosity (with small *Dictyoconus* molds recognizable); Limestone, 20%, micritic-pellet, white (N9).
1170-1180	Calcareous dolomite, 80% (relic micritic-pellet), v. pale orange (10 YR 8/2) to dark yellowish brown (10 YR 4/2), micrograined to v. fine, with subhedral crystals lining fossil molds, moderately well-cemented, minor moldic and intercrystalline porosity; Limestone, 10%, micritic-pellet, white (N9); Claystone, 10%, as above.

Depth	Description
1180-1190	Dolomite, moderate yellowish brown (10 YR 5/4), v. fine, slightly sucrosic, well-cemented, minor moldic and intercrystalline porosity.
1190-1200	Dolomite, 90%, moderate yellowish brown (10 YR 5/4), v. fine, well-cemented, intercrystalline porosity; Limestone, 10%, as above.
1200-1210	Calcareous dolomite, v. pale orange (10 YR 8/2) to dark yellowish brown (10 YR 4/2), v. fine, subhedral crystals, sucrosic, moderately well-cemented, crystals lining fossil molds, intercrystalline and moldic porosity.
1210-1220	Calcareous dolomite, v. pale orange (10 YR 8/2), coarsely micrograined to v. fine subhedral crystals, finely sucrosic, moderately well-cemented, crystals lining fossil molds, moldic and intercrystalline porosity.
1220-1230	Dolomite, 85%, moderate yellowish brown (10 YR 5/4), v. fine subhedral crystals, slightly sucrosic, moderately well-cemented, minor moldic and pinpoint vug porosity; Limestone, 10%, micritic, white (N9); Claystone, 5%, as above.
1230-1240	Dolomite, 85%, pale yellowish brown (10 YR 6/2) to moderate yellowish brown (10 YR 5/4), v. fine subhedral crystals, well-cemented, minor intercrystalline and pinpoint vug porosity; Limestone, 10%, micritic, white (N9), Claystone, 5%, as above.
1240-1260	Dolomite, moderate yellowish brown (10 YR 5/4), v. fine subhedral crystals, good alteration, sucrosic, well-cemented, minor moldic and intercrystalline porosity.
1260-1270	Calcareous dolomite, mottled pale yellowish brown (10 YR 6/2) and medium dark gray (N4), coarsely micrograined to v. fine, sucrosic, subhedral crystals lining and filling molds, moderate alteration, well-cemented, moldic and intercrystalline porosity.

Depth	Description
1270-1280	Dolomite, grayish orange (10 YR 7/4) to pale yellowish brown (10 YR 6/2), v. fine subhedral crystals, good alteration, well-cemented, well-developed moldic porosity with subhedral v. fine crystals lining molds.
1280-1290	Dolomite, same as above, more sucrosic.
1290-1300	Calcareous dolomite, grayish orange (10 YR 7/4), v. fine subhedral crystals, moderately good alteration, some molds filled with dark noncalcareous material, well-cemented, good moldic porosity.
1300-1310	Calcareous dolomite, moderate yellowish brown (10 YR 5/4), v. fine subhedral crystals, moderately well-cemented with calcareous cement, good alteration, intercrystalline and minor moldic porosity.
1310-1320	Calcareous dolomite, 60%, same as above; Claystone, 30%, same as above; Limestone, 10%, micritic-pellet, white (N9).
1320-1330	Calcareous dolomite, pale yellowish brown (10 YR 6/2) to dark gray (N3), v. fine subhedral crystals moderately well-cemented with calcareous cement, moderate alteration, minor moldic and intercrystalline porosity.
1330-1340	Limestone, 70%, micritic-pellet, white (N9) to v. pale orange (10 YR 8/2), coarsely micrograined to v. fine, moderately well-cemented, interparticle porosity; Dolomite, 20%, grayish orange (10 YR 7/4), same as above; Claystone, 10%, as above.
1340-1350	Dolomite, moderate yellowish brown (10 YR 5/4), coarsely micrograined to v. fine subhedral crystals, well-cemented, good alteration, minor moldic porosity.
1350-1360	Dolomite, pale yellowish brown (10 YR 6/2) to moderate yellowish brown (10 YR 5/4), coarsely micrograined to v. fine, well-cemented with calcareous cement, moderate to good alteration, minor moldic and intercrystalline porosity.
1360-1370	Calcareous dolomite, v. pale orange (10 YR 8/2) to moderate yellowish brown

Depth	Description
	(10 YR 5/4), coarsely micrograined to v. fine subhedral crystals, moderately well-cemented with calcitic cement, some flattened darkened fossil traces, moderate alteration, moldic and intercrystalline porosity.
1370-1380	Calcareous dolomite, light olive gray (5 Y 6/1), finely micrograined to v. fine, well-cemented with calcareous cement, v. fine subhedral crystals lining few fossil molds, poor to moderate alteration, moldic porosity.
1380-1390	Calcareous dolomite, v. pale orange (10 YR 8/2) to medium gray (N5) somewhat mottled, coarsely micrograined to v. fine subhedral crystals, calcareous cement, poor alteration (molds of *Dictyoconus* distinguishable), moldic and intercrystalline porosity.
1390-1400	Calcareous dolomite, v. pale orange (10 YR 8/2), coarsely micrograined to v. fine subhedral crystals, calcareous cement, slightly sucrosic, poor to moderate alteration, intercrystalline porosity.
1400-1410	Calcareous dolomite, light grayish orange (10 YR 7/4), finely micrograined to v. fine, calcareous cement, good alteration, intercrystalline and minor moldic porosity.
1410-1430	Limestone, skeletal-micritic, pale yellowish brown (10 YR 6/2), v. fine to fine, granular, well-cemented with calcareous cement, slightly dolomitized, coquina of *D. cookei* and *D. gunteri*, interparticle porosity.
1430-1440	Limestone, skeletal-micritic, v. pale orange (10 YR 8/2), v. fine to fine, granular, moderately well-cemented with calcareous cement, granular, slightly dolomitized, coquina of *D. cookei*, interparticle porosity.
1440-1450	Dolomite, moderate yellowish brown (10 YR 5/4), coarsely micrograined to v. fine, well-cemented, good alteration, flattened darkened fossil molds, moldic and intercrystalline porosity.
1450-1460	Calcareous dolomite, 90%, white (N9) to dark gray (N3), v. fine to fine subhedral

Depth	Description
	crystals, moderately cemented, poor (relic white forams in dark gray dolomite cement) to good alteration, moldic and intercrystalline porosity; Limestone, 10%, skeletal-micritic, white (N9), v. fine to fine, D. cookei, interparticle porosity.
1460-1470	Limestone, micritic-skeletal, white (N9), finely micrograined to v. fine, well-cemented, few D. cookei and smaller (v. fine) benthic forams, minor interparticle porosity.
1470-1480	Dolomitic limestone, micritic-skeletal, white (N9) to pale yellowish brown (10 YR 6/2), micrograined to v. fine, well-cemented with dolomite cement, poor alteration (cement has been altered, fossils still intact), D. cookei, interparticle and moldic porosity.
1480-1490	Limestone, micritic-skeletal, white (N9) to pale yellowish brown (10 YR 6/2) where slightly dolomitized, micrograined to v. fine, well-cemented, v. few D. cookei, minor interparticle porosity.
1490-1500	Dolomite, pale yellowish brown (10 YR 6/2) to moderate yellowish brown (10 YR 5/4), micrograined to v. fine subhedral crystals, well-cemented, moldic porosity.
1500-1510	Dolomite, pale yellowish brown (10 YR 6/2) to moderate yellowish brown (10 YR 5/4) to dark gray (N3), same as above.
1510-1520	Calcareous dolomite, 90%, v. pale orange (10 YR 8/2), to moderate yellowish brown (10 YR 5/4), coarsely micrograined to v. fine, some subhedral crystals, dark streaks and flattened fossil molds, subhedral crystals lining or filling molds, moldic and intercrystalline porosity; Claystone, 10%, as above.
1520-1530	Calcareous dolomite, 80%, same as above; Claystone, 20%, same as above.
1530-1550	Dolomite, moderate yellowish brown (10 YR 5/4), coarsely micrograined to v. fine subhedral crystals, well-cemented, thin dark laminae or flattened fossils, moldic porosity.

Depth	Description
1550-1560	Calcareous dolomite, grayish orange (10 YR 7/4) to pale yellowish brown (10 YR 6/2), finely micrograined, well-cemented, moderate alteration, minor moldic porosity.
1560-1580	Calcareous dolomite, v. pale orange (10 YR 8/2) to grayish orange (10 YR 7/4), finely micrograined, well-cemented, moderate alteration, dark and flattened molds with v. fine crystals lining or filling them, minor moldic porosity.
1580-1600	Calcareous dolomite, pale yellowish brown (10 YR 6/2) to medium gray (N5), same as above.
1600-1610	Calcareous dolomite, 70%, v. pale orange (10 YR 8/2) to moderate yellowish brown (10 YR 5/4), finely micrograined to v. fine subhedral crystals, well-cemented with calcareous cement, good alteration, moldic and intercrystalline porosity; Limestone, 30%, skeletal-micritic, white (N9) to v. pale orange (10 YR 8/2), micrograined to v. fine poorly cemented, few *Dictyoconus sp.*, interparticle porosity.
1610-1620	Calcareous dolomite, 60%, same as above, Limestone, 40%, same as above.
1620-1650	Limestone, skeletal-micritic, v. pale orange (10 YR 8/2) to pale yellowish brown (10 YR 6/2), coarsely micrograined to fine, granular, moderately well-cemented with calcareous cement, microcoquina of benthic forams, few *Dictyoconus sp.*, interparticle porosity.
1650-1660	Same as above, with v. few *Lepidocyclina sp.*.
1660-1670	Limestone, micritic-skeletal, v. pale orange (10 YR 8/2), coarsely micrograined to v. fine, moderately well-cemented with calcareous cement, slightly dolomitized, granular, interparticle porosity.
1670-1680	Same as above, with v. few *Lepidocyclina sp.* and odd bivalve.

Depth	Description
1680-1700	Limestone, skeletal-micritic, v. pale orange (10 YR 8/2), coarsely micrograined to v. fine, moderately well-cemented, granular, microcoquina of benthic forams, v. few *Lepidocyclina sp.*, interparticle porosity.
1700-1710	Limestone, same as above, with coated *Dictyoconus sp.* (weathered).
1710-1740	Limestone, skeletal, v. pale orange (10 YR 8/2) to pale yellowish brown (10 YR 6/2), v. fine to medium, a microcoquina of well-cemented v. fine to medium benthic forams, numerous (40% of sample) weathered *D. americanus*, interparticle porosity.
1740-1760	Limestone, skeletal, v. pale orange (10 YR 8/2) to pale yellowish brown (10 YR 6/2), v. fine to fine, a microcoquina of v. fine to fine benthic forams, numerous (60% of sample) weathered *D. americanus*, interparticle porosity.
1760-1770	Limestone, same as above, except weathered *D. americanus* comprise 80% of sample.
1770-1780	Limestone, skeletal, v. pale orange (10 YR 8/2) to pale yellowish brown (10 YR 6/2), a microcoquina of fine to coarse grained benthic forams, well-cemented with clear calcareous cement, weathered *D. americanus* comprising 20% of sample, some interparticle porosity.
1780-1790	Limestone, same as above, with weathered *D. americanus* comprising 40% of sample.
1790-1810	Limestone, same as above, with weathered *D. americanus* comprising 50% of sample.
1810-1820	Calcareous dolomite (relic-skeletal), pale yellowish brown (10 YR 6/2), v. fine grained with coarse relic skeletal, moderately well-cemented, slightly sucrosic, moderate alteration, moldic and intercrystalline porosity.

Depth	Description
1820-1830	Limestone, skeletal, yellowish brown (10 YR 6/2), v. fine with coarse grained benthic forams, slightly dolomitized, moderately well-cemented with calcareous and dolomitic cement, weathered *D. americanus* comprising 15% of sample, interparticle and integranular porosity.
1830-1840	Limestone, same as above with weathered *D. americanus* comprising 10% of sample.
1840-1850	Limestone, skeletal, v. pale orange (10 YR 8/2) to pale yellowish brown (10 YR 6/2), a microquina of v. fine to coarse benthic forams, well-cemented with clear calcareous cement, weathered *D. americanus*, 5%, interparticle porosity.
1850-1860	Limestone, micritic-skeletal, v. pale orange (10 YR 8/2), coarsely micrograined to v. fine, poorly to moderately cemented, v. few *Lepidocyclina sp.*(?), interparticle porosity.
1860-1870	Limestone, skeletal-micritic, v. pale orange (10 YR 8/2), coarsely micrograined to medium, poorly to moderately cemented, few weathered *Lepidocyclina sp.*, interparticle porosity.
1870-1880	Limestone, micritic-skeletal, v. pale orange (10 YR 8/2), coarsely micrograined to v. fine, moderately well-cemented, v. few weathered *Dictyoconus sp.* and *Lepidocyclina sp.*, interparticle porosity.
1880-1890	Limestone, same as above; Claystone, trace.
1890-1900	Limestone, skeletal-micritic, v. pale orange (10 YR 8/2), coarsely micrograined to medium, granular, moderately well-cemented, numerous *Operculinoides jennyi*, interparticle porosity; Claystone, trace.
1900-1910	Limestone, same as above, with *Lepidocyclina sp*.
1910-1920	Limestone, skeletal-micritic, v. pale orange (10 YR 8/2), coarsely micrograined to medium, granular, moderately well-cemented, weathered *D. americanus* and *Lepidocyclina sp.*, *Operculinoides jennyi*, interparticle porosity.

Depth	Description
1920-1930	Limestone, same as above, also with *Eponides gunteri* and *Linderina floridensis*.
1930-1940	Limestone, same as above, with more numerous *Lepidocyclina sp.* and *Operculinoides jennyi*.
1940-1950	Limestone, same as above, with more numerous *Lepidocyclina sp.* and *Operculinoides jennyi*.
1950-2000	MISSING INTERVAL--DRILLER DID NOT TAKE SAMPLES
2000-2010	Limestone, micritic-skeletal, v. pale orange (10 YR 8/2), coarsely micrograined to v. fine, poorly to moderately well-cemented, few *Lepidocyclina sp*., interparticle porosity.
2010-2040	Limestone, same as above, also with *Eponides gunteri*.
2040-2070	Limestone, same as above, with more numerous *Eponides gunteri* and few *Lepidocyclina sp*.
2070-2080	Same as above, with more *Lepidocyclina sp*.
2080-2090	Same as above, a coquina of *Operculinoides jennyi* and *Lepidocyclina sp*.
2090-2100	Limestone, skeletal-micritic, v. pale orange (10 YR 8/2), coarsely micrograined to v. fine, moderately well-cemented, numerous *Operculinoides jennyi* and *Lepidocyclina sp*., few *Eponides gunteri*, interparticle porosity.

[Cored interval from 2100-2110 feet]

Depth	Description
2100-2120	Limestone, micritic-skeletal, v. pale orange (10 YR 8/2), coarsely micrograined to v. fine, poorly cemented, *Operculinoides jennyi* *Lepidocyclina sp*., interparticle porosity.
2120-2130	Same as above, also with *Eponides gunteri*.
2130-2140	Same as above, with *Lepidocyclina sp*., *Operculinoides jennyi*, and numerous *Pseudophragmina sp*.
2140-2150	Limestone, micritic, v. pale orange (10 YR 8/2), coarsely micrograined to v. fine, poorly cemented, few *Operculinoides jennyi*, interparticle porosity.

Depth	Description
2150-2160	Limestone, same as above, with numerous (some large) *Operculinoides jennyi* and some *Pseudophragmina sp*.
2160-2180	Dolomite, pale yellowish brown (10 YR 6/2), coarsely micrograined to v. fine anhedral crystals, moderate alteration (some relic fossil molds), moderately well-cemented, slightly sucrosic, moldic porosity.
2180-2220	Dolomite, same as above, with minor chert.
2200-2210	Dolomite, dark yellowish brown (10 YR 4/2), coarsely micrograined anhedral crystals, well-cemented, good alteration, minor moldic porosity.
2210-2220	Dolomite, same as above, with minor chert.
2220-2250	Dolomite, 90%, moderate yellowish brown (10 YR 5/4), v. fine subhedral crystals, moderate to good alteration, well-cemented, slightly sucrosic, minor moldic porosity; Chert, 10%.
[Cored interval from 2245-2255 feet]	
2250-2260	Dolomite, moderate yellowish brown (10 YR 5/4) to dark yellowish brown (10 YR 4/2), v. fine subhedral crystals, good alteration, moderately well-cemented, intercrystalline and minor moldic porosity; Chert, minor.
2260-2280	Dolomite, 95%, same as above; Chert, 5%.
2280-2290	Dolomite, 85%, moderate yellowish brown (10 YR 5/4), v. fine subhedral crystals, good alteration, moderately well-cemented, slightly sucrosic, intercrystalline porosity; Chert, 15%.
2290-2300	Dolomite, 80%, dark yellowish brown (10 YR 4/2), coarsely micrograined to v. fine, good alteration, well-cemented, intercrystalline porosity; Chert, 20%.

Depth	Description
2300-2310	Dolomite, 80%, moderate yellowish brown (10 YR 5/4), v. fine subhedral crystals, good alteration, well-cemented, slightly sucrosic, intercrystalline porosity; Chert, 20%.
2310-2320	Dolomite, 90%, same as above; Chert, 10%.
2320-2330	Dolomite, 80%, dark yellowish brown (10 YR 4/2), coarsely micrograined to v. fine, good alteration, well-cemented, intercrystalline porosity; Chert, 20%.
2330-2340	Dolomite, 95%, same as above; Chert, 5%.
2340-2350	Dolomite, 80%, same as above; Chert, 20%.
2350-2360	Dolomite, 75%, pale yellowish brown (10 YR 5/4) to dark yellowish brown (10 YR 4/2), coarsely micrograined to v. fine anhedral to subhedral crystals, well-cemented, good alteration, intercrystalline porosity; Chert, 25%.
2360-2380	Dolomite, 85%, same as above; Chert, 15%.
2380-2390	Dolomite, 75%, moderate yellowish brown (10 YR 5/4), coarsely micrograined to v. fine anhedral to subhedral crystals, good alteration, well-cemented, intercrystalline porosity; Chert, 25%.
2390-2400	Dolomite, 90%, moderate yellowish brown (10 YR 5/4), v. fine subhedral crystals, good alteration, well-cemented, intercrystalline porosity; Chert, 10%.
2400-2410	Calcareous dolomite, pale yellowish brown (10 YR 6/2) to moderate yellowish brown (10 YR 5/4), coarsely micrograined to v. fine subhedral crystals, poor to good alteration, poor to moderately cemented with calcareous cement, darkened fossil molds, intercrystalline porosity.
2410-2420	Limestone, slightly dolomitic, skeletal-micritic, v. pale orange (10 YR 8/2) to grayish orange (10 YR 7/4), coarsely micrograined to v. fine, poorly cemented, some dolomite cement, glauconitic, interparticle porosity.

Depth	Description
2420-2440	Limestone, skeletal-pellet-micritic, v. pale orange (10 YR 8/2), coarsely micrograined to fine, granular, poorly cemented, slightly glauconitic, interparticle porosity.
[Cored interval from 2425-2435 feet]	
2440-2450	Limestone, 80%, white (N9) to v. pale orange (10 YR 8/2), same as above; Chert, 20%.
[Cored interval from 2445-2455 feet]	
2450-2460	Limestone, pellet-skeletal-micritic, white (N9) to v. pale orange (10 YR 8/2), coarsely micrograined to v. fine, poorly cemented, interparticle porosity.
2460-2470	Limestone, micritic-pellet-skeletal, white (N9), coarsely micrograined to v. fine, poorly to moderately cemented, glauconitic, slightly cherty, interparticle porosity.
2470-2480	Limestone, micritic-skeletal-pellet, white (N9), coarsely micrograined, poorly cemented, fine granular, interparticle porosity.
2480-2490	Limestone, 85%, same as above and glauconitic; Chert, 15%.
2490-2500	Limestone, 80%, same as above and glauconitic; Chert, 20%.
2500-2510	Limestone, 90%, micritic, white (N9), finely micrograined, well-cemented, glauconitic, minor moldic porosity; Chert, 10%.
2510-2530	Limestone, micritic-skeletal, white (N9) to v. light gray (N8), finely micrograined to v. fine, well-cemented, some cherty cement, glauconitic, _Pseudophragmina_ _sp_., interparticle porosity.
2530-2540	Limestone, 90%, same as above; Chert, 10%.
2540-2550	Limestone, micritic-skeletal, white (N9) to v. light gray (N8), finely micrograined to medium, well-cemented, some cherty cement, glauconitic, _Pseudophragmina_ _sp_. (v. few), interparticle and moldic porosity.
2550-2560	Limestone, micritic-skeletal, white (N9), finely micrograined to v. fine, well cemented, glauconitic, _Pseudophragmina_ _sp_., interparticle porosity.

Depth	Description
2560-2580	Limestone, skeletal-pellet-micritic, white (N9), finely micrograined to medium, well-cemented, glauconitic, *Pseudophragmina sp.*, interparticle porosity.
2580-2590	Limestone, skeletal-micritic-pellet, white (N9), finely micrograined to v. fine, v. well-cemented, interparticle porosity.
2590-2600	Limestone, same as above, with *Pseudophragmina sp.* and *Valvulina sp.*
2600-2610	Limestone, 90%, same as above; Chert, 10%.
2610-2620	Limestone, micritic-skeletal, white (N9), micrograined to v. fine, well-cemented, interparticle porosity.
2620-2640	Limestone, micritic-pellet-skeletal, v. pale orange (10 YR 8/2), micrograined to v. fine, v. well-cemented, interparticle porosity.
[Cored interval from 2625-2635 feet]	
2640-2650	Limestone, 90%, micritic-pellet, pale yellowish brown (10 YR 6/2), micrograined to v. fine, granular, moderately well-cemented, minor interparticle porosity; Claystone, 10%, nonplastic.
2650-2670	Dolomitic limestone, micritic-pellet, pale yellowish brown (10 YR 6/2), coarsely micrograined, finely granular, poorly cemented, some dolomitic cement, interparticle and intercrystalline porosity.
2670-2680	Limestone, micritic-pellet, v. pale orange (10 YR 8/2), micrograined to v. fine, poorly to moderately well-cemented, interparticle porosity.
2680-2700	Limestone, same as above, slightly dolomitized.
2700-2710	Limestone, same as above.
2710-2720	Limestone, skeletal-micritic, v. pale orange (10 YR 8/2) to pale yellowish brown (10 YR 6/2), micrograined to medium, well-cemented, slightly dolomitized, interparticle porosity.

Depth	Description
2720-2740	Limestone, skeletal-pellet-micritic, v. pale orange (10 YR 8/2), micrograined to v. fine, v. well-cemented, interparticle porosity.
2740-2750	Dolomitic limestone, micritic-skeletal-pellet, v. pale orange (10 YR 8/2) to pale yellowish brown (10 YR 6/2), micrograined to v. fine, well-cemented, some dolomite cement, interparticle and intercrystalline porosity.
2750-2780	Limestone, skeletal-pellet-micritic, v. pale orange (10 YR 8/2), micrograined to fine, v. well-cemented with calcareous cement, interparticle porosity.
2780-2790	Limestone, pellet-skeletal-micritic, v. pale orange (10 YR 8/2) to pale yellowish brown (10 YR 6/2), micrograined to fine, moderately well-cemented, interparticle porosity.
2790-2800	Limestone, same as above, slightly coralline.
2800-2810	Limestone, same as above, slightly coralline and dolomitized.
2810-2820	Limestone, micritic-pellet-coralline, white (N9), to v. pale orange (10 YR 8/2), finely micrograined to fine, well-cemented, interparticle and intraparticle porosity.
2820-2830	Limestone, micritic, white (N9), finely micrograined, v. well-cemented, minor intraparticle porosity.
2830-2840	Limestone, micritic-coralline, same as above.
2840-2860	Limestone, micritic-skeletal, v. pale orange (10 YR 8/2), finely micrograined to v. fine, poorly to moderately cemented, interparticle porosity.
2860-2880	Limestone, micritic-skeletal-pellet, v. pale orange (10 YR 8/2), coarsely micrograined to v. fine, finely granular, poorly cemented, minor dolomite cement, interparticle porosity.

Depth	Description
2880-2890	Limestone, 60%, same as above; Dolomite, 40%, pale yellowish brown (10 YR 6/2), v. fine subhedral crystals, good alteration, slightly sucrosic, moderately well-cemented, intercrystalline porosity.
2890-2900	Dolomite, moderate yellowish brown (10 YR 5/4), v. fine subhedral crystals, moderate to good alteration, moderately well-cemented, slightly sucrosic, minor moldic and pinpoint vug porosity.
2900-2910	Dolomite, moderate yellowish brown (10 YR 5/4), coarsely micrograined to v. fine, good alteration, well-cemented, minor moldic porosity.
2910-2920	Dolomite, moderately yellowish brown (10 YR 5/4), coarsely micrograined, poor to moderate alteration-dolomite crystals filling fossil molds, well-cemented, good moldic porosity.
2920-2930	Dolomite, v. pale orange (10 YR 8/2) to moderate yellowish brown (10 YR 5/4), finely micrograined to v. fine, good alteration, well-cemented, moldic porosity.
2930-2940	Dolomite, moderate yellowish brown (10 YR 5/4), v. fine subhedral crystals, good alteration, moderately well-cemented, moldic and intercrystalline porosity.
2940-2950	Dolomite, pale yellowish brown (10 YR 6/2) to moderate yellowish brown (10 YR 5/4), coarsely micrograined to v. fine anhedral to subhedral crystals, moderately good alteration, well-cemented, moldic and intercrystalline porosity.
2950-2960	Dolomite, pale yellowish brown (10 YR 6/2), finely to coarsely micrograined, well-cemented, good alteration, dolomite crystals filling fossil molds, slightly calcareous, minor moldic porosity.
2960-2970	Dolomite, moderate yellowish brown (10 YR 5/4), coarsely micrograined to v. fine subhedral crystals, good alteration, well-cemented, minor intercrystalline porosity.

Depth	Description
2970-2980	Dolomitic limestone, 60%, micritic-pellet, v. pale orange (10 YR 8/2), coarsely micrograined to v. fine, well-cemented, dolomitic cement, interparticle porosity; Dolomite, 40%, moderate yellowish brown (10 YR 5/4) to dark yellowish brown (10 YR 4/2), v. fine anhedral to subhedral crystals, good alteration, well-cemented, minor moldic and intercrystalline porosity.
2980-2990	Dolomite, moderate yellowish brown (10 YR 5/4), v. fine subhedral crystals, moderate to good alteration, moderately well-cemented, moldic and intercrystalline porosity.
2990-3000	Dolomite, 80%, moderate yellowish brown (10 YR 5/4) to dark yellowish brown (10 YR 4/2), v. fine subhedral crystals, good alteration, well-cemented, slightly sucrosic, intercrystalline porosity; Limestone, 20%, micritic-skeletal, white (N9), micrograined to v. fine.
3000-3010	Dolomite, moderate yellowish brown (10 YR 5/4), v. fine to fine subhedral to anhedral crystals, good alteration, sucrosic, moderately well-cemented, intercrystalline porosity.
3010-3020	Dolomite, moderate yellowish brown (10 YR 5/4), v. fine subhedral crystals, good alteration, well-cemented, minor intercrystalline and moldic porosity.
3020-3030	Dolomite, moderate yellowish brown (10 YR 5/4) to dark gray (N3), finely micrograined to fine anhedral to subhedral crystals, good alteration, well-cemented, minor moldic and intercrystalline porosity.
3030-3050	Dolomite, dark gray (N3) to moderate yellowish brown (10 YR 5/4), coarsely micrograined to v. fine subhedral crystals, well-cemented, good alteration, minor moldic and intercrystalline porosity.
3050-3060	Dolomite, moderate yellowish brown (10 YR 5/4) to dark gray (N3), coarsely micrograined to v. fine subhedral to enhedral crystals, well-cemented, good alteration, minor intercrystalline porosity.

Depth	Description
3060-3070	Dolomite, moderately yellowish brown (10 YR 5/4) with dark gray (N3) mottling, coarsely micrograined to v. fine, well-cemented, good alteration, minor pinpoint vug porosity.
3070-3080	Dolomite, pale yellowish brown (10 YR 6/2) with some dark gray N3) mottling, coarsely micrograined to v. fine, well-cemented, good alteration, v. minor pinpoint vug porosity.
3080-3090	Dolomite, moderate yellowish brown (10 YR 5/4), coarsely micrograined to v. fine, subhedral crystals, well-cemented, good alteration, moldic and intercrystalline porosity.
3090-3100	Dolomite, pale yellowish brown (10 YR 6/2) to moderate yellowish brown (10 YR 5/4), finely to coarsely micrograined, well-cemented, good alteration, v. minor moldic porosity.
3100-3120	Dolomite, pale yellowish brown (10 YR 6/2), finely to coarsely micrograined, well-cemented, good alteration, almost no moldic porosity.
3120-3130	Dolomite, pale yellowish brown (10 YR 6/2), dark gray (N3), coarsely micrograined to fine subhedral crystals, moderate alteration (relic-skeletal), well-cemented, sucrosic, intercrystalline porosity.
3130-3140	Calcareous dolomite, pale yellowish brown (10 YR 6/2) to moderate yellowish brown (10 YR 5/4), coarsely micrograined to v. fine, poor to moderate alteration (relic-skeletal), well-cemented, slightly sucrosic, dolomite crystals filling molds, minor moldic porosity.
3140-3150	Dolomite, moderate yellowish brown (10 YR 5/4) with dark gray mottling (N3), v. fine subhedral crystals, sucrosic, well-cemented, good alteration, intercrystalline porosity.
3150-3160	Dolomite, slightly calcareous, dark yellowish brown (10 YR 4/2), coarsely micrograined to fine anhedral to subhedral crystals, moderate to good alteration, well-cemented, minor moldic and intercrystalline porosity.

Depth	Description
3160-3180	Dolomite, slightly calcareous, moderate brown (5 YR 3/4) with dark gray (N3), dark yellowish brown (10 YR 4/2) and pale yellowish brown (10 YR 6/2) mottling, finely micrograined to v. fine, some subhedral crystals, well-cemented, variable alteration with some intact forams (calcareous), dolomite crystals filling some molds, somewhat sucrosic, moldic and intercrystalline porosity.
3180-3200	Calcareous dolomite, pale yellowish brown (10 YR 6/2) to dark yellowish brown (10 YR 4/2), coarsely micrograined to v. fine, some subhedral crystals, well-cemented, poor to good alteration with dolomite crystals filling some molds, moldic and intercrystalline porosity.
3200-3220	Calcareous dolomite, grayish orange (10 YR 7/4) to moderate yellowish brown (10 YR 5/4), coarsely micrograined to v. fine subhedral crystals, well-cemented, moderate alteration (relic-skeletal) with dolomitic crystals filling or lining molds, moldic and intercrystalline porosity.
3220-3230	Calcareous dolomite, light gray (N7) to moderate yellowish brown (10 YR 5/4), same as above.
3230-3240	Dolomite, moderate yellowish brown (10 YR 5/4), coarsely micrograined to fine subhedral crystals, well-cemented, good alteration, slightly sucrosic, intercrystalline and minor moldic porosity.
3240-3250	Calcareous dolomite, moderate yellowish brown (10 YR 5/4) to dark yellowish brown (10 YR 4/2), coarsely micrograined to fine subhedral crystals, moderate alteration (relic pellet), moderately well-cemented, intercrystalline and minor moldic porosity.
3250-3260	Calcareous dolomite, same as above, slightly more sucrosic.

Depth	Description
3260-3280	Dolomite, moderate yellowish brown (10 YR 5/4) with some dark gray (N7), coarsely micrograined to fine subhedral crystals, well-cemented, moderate to good alteration, slightly sucrosic, intercrystalline porosity.
3280-3290	Dolomite, pale yellowish brown (10 YR 6/2) to dark yellowish brown (10 YR 4/2), same as above.
3290-3300	Calcareous dolomite, v. pale orange (10 YR 8/2) to pale yellowish brown (10 YR 6/2), finely micrograined to v. fine, some subhedral crystals, moderate alteration (relic skeletal), some dolomite crystals lining and filling molds, intercrystalline and minor moldic porosity.
3300-3310	Dolomite, slightly calcareous, pale yellowish brown (10 YR 6/2), coarsely micrograined to fine subhedral crystals, well-cemented, moderate to good alteration (some relic skeletal), good moldic porosity.
3310-3320	Dolomite, slightly calcareous, pale yellowish brown (10 YR 6/2) to dark yellowish brown (10 YR 4/2), coarsely micrograined to v. fine, well-cemented, good alteration (minor relic skeletal), minor moldic porosity.

GDU NORTH PORT ST. LUCIE
MONITOR WELL SAMPLE LOG

Depth	Description
0-10	Sand, quartz, v. fine to coarse, subangular, unconsolidated; Organic matter, roots, leaves, some brown to dark gray clay.
10-20	Shell, 60%, dark gray (N3), fragments to 10 mm, subangular to angular, poorly sorted, unconsolidated; Sand, 20%, quartz, same as above; Organic matter, 20%, same as above.
20-40	Shell hash, white (N9) to v. pale orange (10 YR 8/2) to dark gray (N3), fragments and whole specimens to 15 mm, subangular to angular, poorly sorted, unconsolidated.
40-80	Shell hash, same as above, with fragments to 8 mm.
80-140	Shell hash, 90%, v. pale orange (10 YR 8/2) to medium light gray (N6), fragments and whole specimens to 8 mm, subangular to angular, moderately well sorted, unconsolidated; Sandstone, 10%; Marl, trace.
140-150	Shell hash, 70%, same as above; Sandstone, 30%; Marl, trace.
150-160	Sand, silty, 80%, light olive gray (5 Y 5/2), v. fine, subrounded to subangular, unconsolidated, phosphatic (40% of sand fraction), low porosity; Limestone, sandy, 10%; Shell fragments, 10%, fragments and whole specimens to 15 mm.
160-180	Sand, clayey-silty, 90%, grayish olive (10 Y 4/2), v. fine, plastic, phosphate grains, brown to black, v. fine, numerous Bulimina elongata and other v. small foraminifera, low porosity; Shell fragments, 10%, <10 mm.
180-200	Clay, sandy-silty, 95%, grayish olive (10 Y 4/2), micrograined to v. fine, plastic, phosphate grains as above, numerous Bulimina elongata and other v. small foraminifera, low porosity; Shell fragments, 5%, <10 mm.

Depth	Description
205-235	Same as above, very stiff.
235-265	Clay, sandy-silty, 100%, same as above.
265-310	Clay, sandy-silty, mottled light olive gray (5 Y 5/2) to grayish olive (10 Y 4/2), micrograined to v. fine, plastic, phosphate grains as above, Bulimina elongata and other foraminifera, low porosity.
310-355	Clay, silty-sandy, light olive gray (5 Y 5/2), micrograined to v. fine, plastic, phosphatic Bulimina elongata, low porosity.
355-395	Clay, silty-sandy, grayish olive (10 Y 4/2), micrograined to v. fine, plastic, phosphatic, low porosity.
395-415	Clay, sandy-silty, 95%, grayish olive (10 Y 4/2), micrograined to v. fine, plastic; Phosphate grains, 5%, brown to black, v. fine to coarse, subrounded.
415-430	Sand, silty, 70%, light olive gray (5 Y 5/2), v. fine, subrounded, nonplastic, unconsolidated, Bulimina elongata; Phosphate grains, 20%, brown to black, fine to coarse, subrounded; Shell fragments, 10%, <5 mm.
430-450	Silt, sandy, 80%, light olive gray (5 Y 5/2), micrograined to v. fine, plastic; Phosphate grains, 10%, as above; Shell fragments, 10%, <5 mm.
450-470	Silt, sandy, 80%, as above; Phosphate grains, 10%, v. fine to v. coarse; Shell fragments, 10%, <10 mm.
470-480	Silt, sandy, 75%, light olive gray (5 Y 5/2), finely micrograined to v. fine, nonplastic, Dentalia sp., Buliminua elongata and other foraminifera; Phosphate grains, 20%, brown to black, v. fine to coarse, subrounded; Quartz grains, 5%, clear, coarse, subangular; Shell fragments, trace.
480-500	Silt, clayey, 90%, grayish olive (10 Y 4/2), finely micrograined, plastic, stiff; Phosphate grains, 10%, brown to black, v. fine to coarse, subrounded.

Depth	Description
500-520	Silt, clayey, 80%, as above, v. stiff; Phosphate grains, 10%, as above; Sandstone and limestone conglomerate pebbles, 10%; Shell fragments, trace, 5-10 mm.
520-530	Silt, clayey, 80%, as above; Phospate grains, 20%, brown to black, v. fine to medium, subrounded.
530-550	Silt, clayey, 90%, light olive gray (5 Y 5/2), micrograined, somewhat plastic; Phosphate grains, 10%, as above.
550-560	Silt, clayey, 80%, same as above; Phosphate grains, 20%, same as above.
560-590	Silt, clayey, 70%, yellowish gray (5 Y 7/2) to light olive gray (5 Y 5/2), micrograined, somewhat plastic; Phosphate grains, 20%, brown to black, fine to small pebbles, subrounded; Limestone and sandstone conglomerates, 10%; Quartz grains, clear, v. coarse; Shell fragments, <5 mm.
590-600	Silt, clayey, 60%, same as above; Phosphate grains, 30%, brown to black, coarse to small pebbles; Limestone and sandstone conglomerates, 5%; Quartz grains, 5%, clear, coarse; few forams and shell fragments.
600-610	Silt, clayey, 50%, same as above; Limestone, micritic, 40%, white (N9), v. fine, well-cemented, slightly fossiliferous; Phosphate grains, 15%, brown to black, v. fine to coarse, subrounded; Quartz grains, 5%, clear, medium; few shell fragments <5 mm.
610-630	Same as above, with few sandstone pebbles.
630-670	Limestone, micritic, 50%, yellowish gray (5 Y 7/2), micrograined to v. fine, poorly cemented, few shell fragments, interparticle porosity; Silt, 40%, yellowish gray (5 Y 7/2), micrograined, somewhat plastic; Phosphate grains, 10%, brown to black, v. fine to medium, subrounded.
670-680	Limestone, micritic, 80%, white (N9) to yellowish gray (5 Y 7/2), micrograined to v. fine, granular, moderately cemented, few Dentalia sp., Lepidocyclina sp., mollusk fragments, bryozoan fragments, interparticle porosity; Silt, 20%, as above.

Depth	Description
680-700	Limestone, 90%, same as above, with few more *Lepidocyclina sp.*; Silt, 10%, same as above.
700-710	Limestone, micritic, white (N9) to yellowish gray (5 Y 7/2), micrograined to v. fine, poorly cemented, granular, interparticle porosity.
710-720	Limestone, same as above, with v. few mollusk fragments and *Lepidocyclina sp.*.
720-730	Limestone, micritic-skeletal, white (N9) to v. pale orange (10 YR 8/2), finely micrograined to v. fine, poorly cemented, glauconitic, *Camerina vanderstokii*, *Lepidocyclina ocalana sp.*, bryozoan and mollusk fragments, interparticle porosity.
730-750	Limestone, same as above, more glauconitic, with more numerous bryozoan fragments and *Lepidocyclina ocalana sp.*, (some >5 mm).
750-760	Limestone, same as above, more glauconitic, with numerous bryozoan fragments, *Lepidocyclina ocalana sp.*, *Camerina vanderstokii*, and few *Operculinoides sp.*, and echinoid spines.
760-770	Limestone, micritic-skeletal, white (N9) to v. pale orange (10 YR 8/2), micrograined to v. fine, poorly to moderately cemented, glauconitic, numerous *Lepidocyclina ocalana* (up to 10 mm), *Camerina vanderstokii*, bryozoan and mollusk fragments, echinoid spines, interparticle porosity.
770-780	Limestone, same as above, with more numerous bryozoan fragments and few *Operculinoides sp.*
780-790	Limestone, pellet-micritic, v. pale orange (10 Yr 8/2), micrograined to v. fine (pellets v. fine), poorly cemented, uniform finely granular appearance, *very* few fossils, interparticle porosity.
790-800	Limestone, pellet-micritic, white (N9) to v. pale orange (10 YR 8/2), micrograined to v. fine, poorly to moderately cemented, glauconitic, two small whole echinoids, *Lepidocyclina ocalana sp.*, interparticle porosity.

Depth	Description
800-810	Limestone, same as above, with echinoid and mollusk fragments, Lepidocyclina ocalana sp., and Globigerina sp.
810-830	Limestone, micritic, white (N9) to v. pale orange (10 YR 8/2), micrograined to v. fine, well-cemented, glauconitic, cherty (?), Lepidocyclina sp., numerous coated Dictyoconus sp.(?), interparticle porosity.
830-840	Limestone, micritic-skeletal, v. pale orange (10 YR 8/2), micrograined to v. fine, moderately well-cemented, glauconitic, cherty replacement of small forams, some Lepidocyclina ocalana sp., numerous coated Dictyoconus cookei, interparticle porosity.
840-850	Limestone, micritic-skeletal, white (N9) to v. pale orange (10 YR 8/2), finely micrograined to v. fine, v. well-cemented with calcite cement, some chert, few D. cookei, interparticle porosity.
850-860	Limestone, same as above, also with few Lepidocyclina ocalana sp.
860-870	Limestone, micritic-skeletal, white (N9) to v. pale orange (10 YR 8/2), micrograined to v. fine, well-cemented, some calcite cement, few Lepidocyclina sp., numerous (20% of sample) D. cookei, interparticle porosity.
870-890	Limestone, micritic-pellet, white (N9) to v. pale orange (10 YR 8/2), finely micrograined to v. fine, well-cemented, a microcoquina of medium-grained D. cookei, Textularia sp., Coskinolina floridana, and other forams comprising 50% of sample, interparticle porosity.
890-900	Limestone, same as above, slightly cherty, same microcoquina comprising 20% of sample.
900-920	Limestone, micritic, white (N9) to v. pale orange (10 YR 8/2), micrograined, poorly to moderately cemented, some chert, D. cookei, and Coskinolina floridana, interparticle porosity.

Depth	Description
920-940	Limestone, micritic, white (N9), micrograined, poorly to moderately cemented, minor cherty, D. cookei and Coskinolina floridana, interparticle porosity.
940-950	Limestone, micritic, white (N9) to v. pale orange (10 YR 8/2) to light gray (N7), finely micrograined, moderately to well-cemented, slightly dolomitized, Textularia sp., D. cookei, Coskinolina floridana, interparticle and v. minor moldic porosity.
950-960	Limestone, as above, slightly more dolomitized.
960-980	Limestone, as above, with some dark fossil molds.
980-1000	Limestone, micritic, white (N9) to light gray (N7) to v. pale orange (10 YR 8/2), finely to coarsely micrograined, well-cemented, slightly dolomitized, few large Dictyoconus sp., and few Coskinolina floridana, minor interparticle and moldic porosity.
1000-1010	Limestone, dolomitic, micritic, grayish orange (10 YR 7/4) to v. pale orange (10 YR 8/12), coarsely micrograined to v. fine, well-cemented, slightly sucrosic, minor dolomite crystals lining molds, one whole echinoid (Peronella dalli?), minor moldic and interparticle porosity.
1010-1020	Limestone, dolomitic, micritic to micritic-pellet, grayish orange (10 YR 7/4) to v. pale orange (10 YR 8/2) to light gray (N7), finely micrograined to v. fine, well cemented, slightly sucrosic, minor moldic and interparticle porosity.
1020-1030	Dolomite, calcareous, grayish orange (10 YR 7/4) to pale yellowish brown (10 YR 6/2), micrograined to v. fine, well-cemented, slightly sucrosic, minor moldic and intercrystalline porosity.
1030-1040	Dolomite, calcareous, pale yellowish brown (10 YR 6/2) to moderate yellowish brown (10 YR 5/4), micrograined, well-cemented, moderately good alteration, minor moldic porosity.

Depth	Description
1040-1050	Dolomite, calcareous, 80%, v. pale orange (10 YR 8/2) to grayish orange (10 YR 7/4), micrograined, well-cemented, poor to moderate alteration, minor moldic porosity; Claystone, 20%, pale yellowish brown (10 YR 6/2) to dark yellowish brown (10 YR 4/2), finely micrograined, poorly cemented, nonplastic, thin laminae.
1050-1060	Dolomite, pale yellowish brown (10 YR 6/2) to moderate yellowish brown (10 YR 5/4), coarsely to finely micrograined, well-cemented, moderately good alteration, slightly sucrosic, minor moldic porosity.
1060-1070	Dolomite, calcareous, moderate yellowish brown (10 YR 5/4) to grayish black (N2) to v. light gray (N8), finely micrograined to v. fine, well-cemented, good alteration, minor pinpoint vug and moldic porosity.
1070-1080	Dolomite, v. pale orange (10 YR 8/2) to pale yellowish brown (10 YR 6/2), finely micrograined to v. fine, well-cemented, slightly calcareous, good alteration, minor moldic and pinpoint vug porosity.
1080-1100	Dolomite, moderate yellowish brown (10 YR 5/4), v. fine, well-cemented, good alteration, slightly sucrosic, intercrystalline and moldic porosity.
1100-1110	Dolomite, moderate yellowish brown (10 YR 5/4) with v. thin moderate brown (5 YR 3/4) laminae, v. fine well-cemented, good alteration, slightly sucrosic, good moldic (*Dictyoconus* sp. molds distinguishable) and intercrystalline porosity.
1110-1120	Dolomite, moderate yellowish brown (10 YR 5/4) to dark gray (N3) mottled, micrograined, well-cement, good alteration, good moldic and minor pinpoint vug porosity.
1120-1130	Dolomite, same as above, with some darkened fossil molds.
1130-1140	Dolomite, moderate yellowish brown (10 YR 5/4) and mottled v. pale orange (10 YR 8/2) and dark gray (N3), finely micrograined to v.

Depth	Description
	fine, sucrosic, well-cemented, good alteration, good pinpoint vug and moldic porosity.
1140-1150	Dolomite, moderate yellowish brown (10 YR 5/4), coarsely micrograined to v. fine, well-cemented moderately good alteration, good moldic porosity.
1150-1160	Dolomite, grayish orange (10 YR 7/4), same as above.
1160-1170	Dolomite, grayish orange (10 YR 7/4) to pale yellowish brown (10 YR 6/2), coarsely micrograined to v. fine, well-cemented, uniformly finely granular appearance, finely sucrosic, good alteration, moldic porosity.
1170-1190	Dolomite, calcareous, moderate yellowish brown (10 YR 5/4), finely micrograined to fine, well-cemented, finely sucrosic, moderate alteration (relic skeletal), good moldic porosity (Dictyoconus sp. molds discernable).
1190-1200	Dolomite, pale yellowish brown (10 YR 6/2) to moderate yellowish brown (10 YR 5/4), v. fine, well-cemented, good alteration, finely sucrosic, good moldic and intercrystalline porosity.
1200-1210	Dolomite, pale yellowish brown (10 YR 6/2), coarsely micrograined to v. fine, well-cemented, slightly sucrosic, good alteration, minor moldic and intercrystalline porosity.
1210-1220	Dolomite, v. pale orange (10 YR 8/2) to pale yellowish brown (10 YR 6/2), finely micrograined, well-cemented, finely sucrosic, good alteration, minor pinpoint vug and moldic porosity.
1220-1230	Dolomite, v. pale orange (10 YR 8/2) to grayish orange (10 YR 7/4), finely micrograined, well-cemented, moderately good alteration, some darkened fossil molds and some lined with dolomite crystals, minor pinpoint vug and moldic porosity.

Depth	Description
1230-1240	Dolomite, 50%, same as above; Dolomite, 50% moderate yellowish brown (10 YR 5/4) to medium gray (N5), v. fine subhedral crystals v. good alteration, well-cemented, thin dark brown laminae, good moldic (Dictyoconus sp.) and intercrystalline porosity.
1240-1250	Dolomite, 50%, medium gray (N5) to moderate yellowish brown (10 YR 5/4), coarsely micrograined to v. fine subhedral crystals, moderately to v. good alteration (some relic skeletal), slightly sucrosic, well-cemented, good moldic (Dictyocomus sp.) and intercrystalline porosity; Limestone, 50%, micritic-pellet, white (N9), v. fine, well-cemented, Dictyoconus sp., interparticle porosity.
1250-1270	Dolomite, calcareous, grayish orange (10 YR 7/4) to medium dark gray (N4), v. fine anhedral to subhedral crystals, well-cemented, moderately good alteration, intercrystalline and minor moldic porosity.
1270-1280	Dolomite, pale yellowish brown (10 YR 6/2) to moderate yellowish brown (10 YR 5/4), coarsely micrograined to v. fine subhedral crystals, good alteration, well-cemented, dolomite crystals lining molds, moldic and minor pinpoint vug porosity.
1280-1290	Dolomite, 60%, pale yellowish brown (10 YR 6/2) finely micrograined to v. fine, some subhedral crystals, well-cemented, good alteration, dolomite crystals lining molds, moldic porosity; Claystone, 40%, medium gray (N5), finely micrograined, nonplastic, calcareous, moderately cemented.
1290-1300	Dolomite, 90%, same as above; Claystone, 10%, same as above.
1300-1310	Dolomite, moderate yellowish brown (10 YR 5/4), v. fine subhedral crystals, well-cemented, good alteration, moldic and intercrystalline porosity.
1310-1320	Dolomite, 95%, same as above; Claystone, 5%, same as above.

Depth	Description
1320-1330	Dolomite, calcareous (relic-skeletal), v. pale orange (10 YR 8/2) to moderate yellowish brown (10 YR 5/4), v. fine subhedral crystals, poor to good alteration (relic skeletal to sucrosic), well-cemented, good moldic and intercrystalline porosity.
1330-1350	Limestone, micritic to micritic-skeletal, v. pale orange (10 YR 8/2) to light gray (N7), cryptograined to v. fine, well-cemented, slightly dolomitized, Dictyoconus sp., moldic and interparticle porosity.
1350-1360	Limestone, 80%, same as above; Dolomite, 20%, moderate yellowish brown (10 YR 5/4), coarsely micrograined, well-cemented, good alteration, minor moldic porosity.
1360-1370	Limestone, dolomitic, 50%, micritic, v. pale orange (10 YR 8/2) to v. light gray (N3), finely micrograined, well-cemented, minor moldic porosity; Limestone, dolomitic, 50% skeletal micritic, white (N9) (grains) to moderate yellowish brown (10 YR 5/4) (matrix), micrograined to fine, well-cemented with dolomitic cement, interparticle porosity.
1370-1380	Same as above, with few Dictyoconus sp.
1380-1390	Dolomite, moderate yellowish brown (10 YR 5/4), coarsely micrograined to v. fine anhedral crystals, well-cemented, slightly sucrosic, good alteration, flattened darkened fossil molds, v. good moldic porosity with Dictyoconus sp. molds distinguishable.
1390-1400	Dolomite, 50%, same as above, with more numerous flattened darkened fossil molds; Limestone, 25%, white (N9), micritic, well-cemented; Dolomite, 25%, calcareous (relic-skeletal), white (N9) (grains) to moderate yellowish brown (10 YR 5/4) (matrix), v. fine to medium, well-cemented with dolomite cement, poor to moderate alteration, interparticle and intercrystalline porosity.
1400-1410	Dolomite, calcerous, 50%, (relic-skeletal) same as above; Limestone, 30%, same as above, with few Dictyoconus sp.; Dolomite, 20%, same as above.

Depth	Description
1410-1420	No sample
1420-1430	Dolomite, 60%, grayish orange (10 YR 7/4) to moderate yellowish brown (10 YR 5/4), micrograined to v. fine subhedral crystals, well-cemented, moderate to good alteration, finely sucrosic, intercrystalline and pinpoint vug porosity; Limestone, 35%, skeletal-micritic, white (N9) to v. pale orange (10 YR 8/2), micrograined to medium, slightly dolomitized, few Dictyoconus sp., interparticle porosity; Claystone, 5%, nonplastic, finely micrograined, calcareous.
1430-1450	Dolomite, 40%, same as above, with flattened darkened fossil molds and thin dark brown laminae; Limestone, 40%, same as above, cherty, with more numerous Dictyoconus sp.; Claystone, 20%, as above.
1450-1460	Dolomite, calcareous, relic-skeletal, 50%, grayish orange (10 YR 7/4), mottled moderate yellowish brown (10 YR 5/4) and dark gray (N3), and grayish black (N2), with white (N1) relic-skeletal inclusions, micrograined to v. fine anhedral to subhedral crystals, well-cemented with dolomite cement, poor (black dolomite cement surrounding white Dictyoconus sp.) to good alteration, intercrystalline and moldic porosity; Limestone, 50% skeletal-micritic, white (N9), v. fine to medium, well-cemented, Dictyoconus sp., interparticle porosity.
1460-1470	Limestone, 70%, micritic and skeletal-micritic, white (N9), same as above; Dolomite, calcareous, relic-skeletal, 30%, same as above.
1470-1480	Limestone, 80%, same as above; Dolomite, calcareous, relic-skeletal, same as above.
1480-1490	Dolomite, calcareous, 70%, v. pale orange (10 YR 8/2) to moderate yellowish brown (10 YR 5/4), finely micrograined to v. fine, anhedral to subhedral crystals, well-cemented poor (relic-skeletal) to good alteration, intercrystalline and moldic porosity; Limestone, 30%, same as above, with some cherty replacement of Dictyoconus sp.

Depth	Description
1490-1500	Dolomite, 80%, moderate yellowish brown (10 YR 5/4) to medium gray (N5), v. fine subhedral crystals, good alteration, finely sucrosic, intercrystalline and well-developed moldic porosity; Limestone, 20%, same as above, slightly dolomitized, with *Dictyoconus* sp.
1500-1510	Dolomite, 90%, pale yellowish brown (10 YR 6/2) to dark gray (N3), finely micrograined, well-cemented, dense, v. minor pinpoint vug porosity; Limestone, 10%, same as above.
1510-1530	Dolomite, grayish orange (10 YR 7/4), v. fine subhedral crystals, finely sucrosic, well-cemented, good alteration intercrystalline and good moldic porosity.
1530-1540	Dolomite, grayish orange (10 YR 7/4) to moderate yellowish brown (10 YR 5/4), v. fine anhedral to subhedral crystals, finely sucrosic, good alteration, well-cemented, intercrystalline and good moldic porosity.
1540-1550	Dolomite, 50%, same as above; Limestone, dolomitic, 50%, skeletal-micritic, white (N9) grains with moderate yellowish brown (10 YR 5/4) dolomite cement, well-cemented interparticle and intercrystalline porosity; Claystone, trace.
1550-1560	Dolomite, pale yellowish brown (10 YR 6/2) to moderate yellowish brown (10 YR 5/4), finely micrograined to v. fine, anhedral to subhedral crystals, well-cemented, good alteration, sucrosic in part, moldic porosity (with crystals lining molds) and intercrystalline porosity.
1560-1570	Dolomite, pale yellowish brown (10 YR 6/2) to dark yellowish brown (10 YR 4/2), same as above, with flattened darkened fossil molds.
1570-1580	Dolomite, 50%, very pale orange (10 YR 8/2) to pale yellowish brown (10 YR 6/2), finely micrograined, anhedral crystals, well-cemented, good alteration, v. little moldic porosity; Limestone, micritic, light gray (N7), finely micrograined, v. well-cemented, few darkened fossil molds, v. little porosity.

Depth	Description
1580-1590	Dolomite, 80%, v. pale orange (10 YR 8/2) to moderate yellowish brown (10 YR 5/4), finely micrograined, well-cemented, good alteration, slightly sucrosic, some moldic porosity; Limestone, 20%, same as above.
1590-1600	Dolomite, calcareous, v. pale orange (10 YR 8/2) to moderate yellowish brown (10 YR 5/4), finely micrograined, well-cemented, good alteration, v. little moldic porosity; Claystone, trace.
1600-1610	Dolomite, calcareous, grayish orange (10 YR 7/4), finely micrograined, well-cemented, good alteration, v. little porosity; Claystone, trace.
1610-1620	Dolomite, calcareous, same as above, with some darkened fossil molds and v. minor moldic porosity.
1620-1630	Limestone, 60%, skeletal-pellet-micritic, white (N9) to v. pale orange (10 YR 8/2), v. fine to medium, moderately well-cemented, <u>Dictyoconus</u> <u>americanus</u> sp., interparticle porosity; Dolomite, 40%, moderate yellowish brown (10 YR 5/4), v. fine subhedral crystals, good alteration, well-cemented, good moldic porosity.
1630-1640	Limestone, 60%, same as above, with more numerous <u>D.</u> <u>americanus</u>; Dolomite, calcareous, 40%, pale yellowish brown (10 YR 6/2) to moderate yellowish brown (10 YR 5/4), finely micrograined to v. fine, poor to moderate alteration (some relic-skeletal), well-cemented, minor moldic and intercrystalline porosity.
1640-1650	Dolomite, moderate brown (5 YR 4/4), v. fine to fine subhedral crystals, v. good alteration, well-cemented, sucrosic, good moldic porosity; Limestone, trace, as above.
1650-1660	Dolomite, 50%, as above; Limestone, skeletal, 50%, v. pale orange (10 YR 8/2), medium to coarse, poorly cemented with calcite cement, <u>D.</u> <u>americanus</u> sp., interparticle porosity.

Depth	Description
1660-1670	Dolomite, 50%, very pale orange (10 YR 8/2) to moderate yellowish brown (10 YR 5/4), finely micrograined to very fine, anhedral to subhedral crystals, poor to moderate alteration (some relic skeletal), slightly sucrosic, intercrystalline and moldic porosity; Limestone, 50%, skeletal, very pale orange (10 YR 8/2), v. fine to medium, clear calcite cement, numerous *D. americanus*, interparticle porosity.
1670-1680	Limestone, micritic-skeletal, very pale orange (10 YR 8/2), micrograined to fine, well-cemented, some recrystallization with calcite crystals, coralline casts, few *D. americanus* sp. and few *Lepidocyclina* sp. (?), interparticle and moldic porosity.
1680-1690	Limestone, same as above, v. slightly glauconitic.
1690-1700	Limestone, micritic-skeletal, v. pale orange (10 YR 8/2), micrograined to fine, well-cemented, granular appearance, *D. americanus* sp., interparticle and moldic porosity.
1700-1710	Limestone, same as above, with v. few *D. americanus* sp. and coralline fragments.
1710-1720	Limestone, skeletal-micritic, v. pale orange (10 YR 8/2), fine to medium, moderately well-cemented, *D. americanus* sp. comprising 30% of sample (weathered), interparticle porosity.
1720-1730	Limestone, skeletal-micritic, v. pale orange (10 YR 8/2), uniformly medium grained, poorly to moderately cemented, *D. americanus* sp. (weathered) comprising 20% of sample (medium to v. coarse), interparticle porosity.
1730-1740	Limestone, same as above, with v. coarse weathered *D. americanus* sp. comprising 60% of sample
1740-1750	Limestone, skeletal, v. pale orange (10 YR 8/2), medium to coarse, moderately well-cemented with clear calcite cement, few (<10%) *D. americanus* sp., interparticle porosity.

Depth	Description
1750-1760	Limestone, skeletal, same as above, with weathered v. coarse *D. americanus* sp. comprising 20% of sample.
1760-1770	Limestone, micritic-skeletal, v. pale orange (10 YR 8/2), micrograined to v. fine, poor to moderately cemented, uniformly medium to coarse *D. americanus* sp. comprising 30% of sample, few *Coskinolina* sp. (?), interparticle porosity.
1770-1780	Cement, 80%; Limestone, 20%, same as above.
1780-1790	Limestone, micritic-skeletal, v. pale orange (10 YR 8/2), v. fine to medium, moderately well-cemented, few (15% of sample) *D. americanus* sp., interparticle porosity.
1790-1800	Limestone, same as above, with *D. americanus* (10% of sample) and few *Coskinolina* sp. (?).

Appendix C
12-INCH CASING INJECTION TEST DATA

Appendix C
12-INCH CASING INJECTION TEST DATA

Actual Time	Time Since Pump Started (min)	Flow Rate (gpm)	Wellhead Pressure (psi)	Totalizer (gpm X 100)	Remarks
July 25, 1987					
9:26 a.m.	0	0	15.0	300	Start step injection test
9:27 a.m.		665	16.0	308	
9:28 a.m.		665	17.5	315	
9:29 a.m.		665	18.5	322	
9:30 a.m.	4	665	19.5	329	
9:32 a.m.		665	21.0	343	
9:35 a.m.		700	22.5	366	
9:38 a.m.	12	700	22.0	388	
9:41 a.m.		700	22.0	410	
9:44 a.m.		700	22.3	433	
9:50 a.m.		700	22.8	481	
9:55 a.m.		700	24.2	522	
10:00 a.m.	34	700	25.0	560	
10:01.25 a.m.		980	27.0	571	Step up to 980 gpm
10:02 a.m.		1015	27.5	579	
10:03.25 a.m.		980	28.0	592	
10:04 a.m.		1015	28.0	601	
10:05 a.m.		980	28.0	612	
10:06 a.m.	40	980	28.0	623	Monitor well still flowing
10:07 a.m.		980	28.0	633	
10:10 a.m.		1015	28.0	665	
10:15 a.m.		980	28.0	719	
10:20 a.m.	54	980	28.0	773	
10:35 a.m.		980	28.0	934	Still flowing
11:00 a.m.		980	28.0	1200	Stopped flowing
11:35 a.m.		980	28.0	1575	3.3 drawdown from pad
12:00 p.m.	154	980	28.0	1837	2.0 drawdown
12:30 p.m.		980	28.0	2155	
2:00 p.m.	274	980	28.5	3111	Shut down at 980
7:15 p.m.		980			Stable at 980/28.0 psi
7:16 p.m.		1400	30.5	4816	Step up to 1,400 gpm
7:18 p.m.		1400	30.5	4837	
7:20 p.m.		1400	30.5	4866	
7:22 p.m.		1400	30.5	4895	
7:25 p.m.	599	1400	31.0	4938	
7:31 p.m.		1400	31.0	5023	
7:35 p.m.		1400	31.0	5080	
7:40 p.m.		1400	31.0	5151	
7:45 p.m.		1400	31.0	5221	
7:48 p.m.	622	1960	35.0	5275	Step up to 1,960 gpm
7:49 p.m.		1960	35.0	5294	
7:51 p.m.		1960	35.0	5332	
7:53 p.m.		1960	35.0	5371	
7:55 p.m.		1960	35.0	5408	
8:00 p.m.	634	1960	34.5	5503	
8:05 p.m.		1960	34.0	5600	
8:10 p.m.		1960	34.5	5696	
8:15 p.m.	649	1960	34.5	5792	
8:20.25 p.m.			41.0	5910	
8:21.25 p.m.				5932	
8:32 p.m.		2310	38.5	6179	Step up to 2,310 gpm
8:34 p.m.	668	2310	38.5	6225	
8:37 p.m.		2310	39.0	6294	
8:41 p.m.	675	2310	40.0	6386	
8:45 p.m.		2310	40.0	6478	
8:49 p.m.					Shut in
July 26, 1987					
1:00 p.m.	--	0	22	--	Static water level

Actual Time	Time Since Pump Started (min)	Flow Rate (gpm)	Wellhead Pressure (psi)	Totalizer (gpm X 100)	Remarks
July 28, 1987					
9:21 a.m.	0	0	22	8742	Restart test - static
9:22 a.m.	1	2940	51.0	8771	Run constant rate test
9:23 a.m.	2	2940	50.5	8800	
9:24 a.m.	3	2940	50.5	8830	
9:25 a.m.	4	2940	51.0	8860	
9:30 a.m.	9	2940	52.0	9006	
9:35 a.m.	14	2940	52.5	9154	
9:40 a.m.	19	2940	52.5	9302	
9:45 a.m.	24	2940	52.5	9449	
9:50 a.m.	29	2940	52.5	9596	
9:55 a.m.	34	2940	52.5+	9743	
10:00 a.m.		2940	52.5+	9891	
10:15 a.m.		2940	52.5+	10,333	
10:49 a.m.	88	2940	52.5	11,331	
11:00 a.m.		2940	52.5+	11,654	
11:30 a.m.	129	2940	52.5	12,536	
12:00 p.m.	159	2940	52.5+	13,417	
12:31 p.m.	190	2940	52.5	14,329	
1:49 p.m.		2940	52.5	16,619	
2:00 p.m.		2940	52.5	16,946	
2:30 p.m.	279	2940	52.5	17,825	
3:00 p.m.		2940	52.5	18,705	
4:00 p.m.	369	2940	52.5	20,474	
5:00 p.m.	429	2940	52.5	22,229	
6:00 p.m.	489	2940	52.5	23,999	
7:11 p.m.		2940	52.5	26,085	
8:00 p.m.	609	2940	52.5	27,520	
9:00 p.m.	669	2940	52.5	27,282	
9:30 p.m.	699	2940	52.5	30,164	
11:00 p.m.	789	0	22	30,164	Static water level
July 30, 1987					
9:32 a.m.	0	0	0	31,228	Start test
					Adjusting flow
9:35 a.m.			46.0		
9:36 a.m.	4	2,800	47.0	31,288	Run test after cleaning
9:37 a.m.			48.0		open hole
9:38 a.m.	6		49.0		
9:40 a.m.		2940	48.5	31,425	
9:45 a.m.	13		48.5	31,602	
9:55 a.m.	23		48.5	31,850	
10:05 a.m.	33		48.5	32,113	
10:06					Adjusted flow
10:12 a.m.		2850	48.0	32,402	
10:17 a.m.			48.0	32,481	
10:25	53		48.0	32,695	
10:32 a.m.	60		48.0	32,856	Stopped test

Appendix D
INJECTION WELL PILOT HOLE WATER QUALITY
MONITOR WELL PILOT HOLE WATER QUALITY
SHALLOW MONITOR WELLS WATER QUALITY
INJECTION WELL AND MONITOR WELL BACKGROUND WATER QUALITY

Appendix D (Continued)
INJECTION WELL PILOT HOLE WATER QUALITY

Date	Time	Depth (Ft)	Temperature (°C)	Specific Conductance (μmhos/cm)	Chloride (mg/l)	Remarks
6/18/87	3:30 a.m.	2460-2490	24	23,000	9,147	
6/19/87	7:20 a.m.	2490-2520	24	21,000	8,447	
6/19/87	8:40 a.m.	2520-2550	24	23,000	9,197	
6/19/87	10:20 a.m.	2550-2580	24	24,000	9,547	
6/19/87	11:40 a.m.	2580-2610	24	24,300	9,897	
6/20/87	1:50 a.m.	2610-2640	24	23,500	9,397	
6/20/87	3:30 a.m.	2640-2670	24	24,000	9,697	
6/20/87	5:30 a.m.	2670-2700	24	21,000	8,247	
6/20/87	7:30 a.m.	2700-2730	24	25,000	10,047	
6/20/87	8:45 a.m.	2730-2760	24	25,500	10,597	
6/20/87	9:40 a.m.	2760-2790	24	25,500	10,547	
6/20/87	12:05 p.m.	2790-2820	24	27,000	11,196	
6/20/87	12:30 p.m.	2820-2850	24	27,300	11,296	
6/20/87	1:40 p.m.	2850-2880	24	27,000	11,046	
6/20/87	3:40 p.m.	2880-2910	24	31,000	13,596	
6/20/87	6:15 p.m.	2910-2940	24	35,000	15,695	
6/20/87	8:50 p.m.	2940-2970	24	40,000	18,194	
6/21/87	2:40 a.m.	2970-3000	24	40,000	18,394	
6/21/87	9:50 a.m.	2996-3026	24	40,000	17,944	
6/21/87	1:30 p.m.	3026-3056	24	46,000	19,694	
6/21/87	5:30 p.m.	3056-3086	24	--	19,044	
6/22/87	12:50 a.m.	3090-2120	24	44,000	18,744	Adding fresh water while drilling
6/22/87	11:35 a.m.	3116-3146	24	48,000	19,344	
6/23/87	10:00 a.m.	3146-3176	24	48,000	19,794	
6/23/87	2:30 p.m.	3176-3207	22.5	50,000	19,443	
6/23/87	7:00 p.m.	3207-3237	22.5	50,000	19,544	
6/23/87	9:30 p.m.	3237-3267	25	50,000	19,394	
6/23/87	11:25 p.m.	3267-3297	25	51,000	19,645	
6/24/87	1:30 a.m.	3297-3324	25	50,000	19,544	Total depth

Appendix D
INJECTION WELL PILOT HOLE WATER QUALITY

Date	Time	Depth (Ft)	Temperature (°C)	Specific Conductance (µmhos/cm)	Chloride (mg/l)	Remarks
5/20/87	--	845-875	--	--	130	Insufficient sample for specific conductance
5/20/87	--	875-905	--	--	165	
5/20/87	--	905-935	--	--	--	No sample
5/20/87	--	935-965	--	--	155	Insufficient sample for specific conductance
5/20/87	--	965-995	--	--	145	Insufficient sample for specific conductance
5/20/87	--	995-1025	--	--	155	Insufficient sample for specific conductance
5/21/87	--	1025-1055	--	--	165	Insufficient sample for specific conductance
5/21/87	--	1055-1085	--	--	160	Insufficient sample for specific conductance
5/21/87	--	1085-1115	--	--	175	Insufficient sample for specific conductance
5/21/87	--	1115-1145	--	--	360	
5/21/87	--	1145-1175	25	1,620	315	
5/21/87	--	1175-1205	25	1,650	335	
5/21/87	--	1205-1235	22	1,950	440	Ran 3 times
5/21/87	--	1235-1265	25	1,400	255	
5/21/87	--	1265-1295	25.5	1,580	375	
5/21/87	--	1295-1325	255	1,650	320	
5/21/87	--	1325-1355	25	1,700	340	
5/21/87	--	1355-1385	26	1,840	370	
5/21/87	6:30 p.m.	1385-1415	25	1,720	390	
5/21/87	8:15 p.m.	1435-1465	22	1,980	445	
5/21/87	9:30 p.m.	1465-1495	22	1,920	475	
5/21/87	11:15 p.m.	1495-1525	22	2,100	595	
5/22/87	1:10 a.m.	1525-1555	22.5	2,800	885	
5/22/87	3:00 a.m.	1555-1585	22.5	3,800	1,165	
5/22/87	5:30 a.m.	1585-1615	26	3,900	1,315	Switched to large probe
5/22/87	6:20 a.m.	1615-1645	27	3,850	1,280	
5/22/87	7:05 a.m.	1645-1675	27	4,200	1,455	
5/22/87	8:30 a.m.	1675-1705	27	3,780	1,210	
5/22/87	10:00 a.m.	1705-1735	29.5	5,000	1,719	
5/22/87	11:00 a.m.	1735-1765	29	4,900	1,644	
5/22/87	12:15 p.m.	1765-1795	28.5	4,600	1,660	
5/22/87	1:20 p.m.	1795-1825	27.5	4,700	1,610	
5/22/87	2:45 p.m.	1825-1855	25	4,700	1,585 1,550 1,575	
5/22/87	4:00 p.m.	1855-1885	25.5	4,600	1,500	
5/22/87	5:10 p.m.	1885-1915	25	4,900	1,599	
5/22/87	6:30 p.m.	1915-1945	23	4,400	1,650 1,450 1,450	
5/22/87	--	1945-1975	--	--	--	Lost sample at shift change
5/22/87	8:45 p.m.	1976-2006	23.5	4,300	1,450	
6/14/87	2:35 a.m.	2005-2035	27	6,000	1,200	
6/14/87	4:15 a.m.	2035-2065	26.5	6,600	1,170	
6/14/87	5:35 p.m.	2065-2095	26.5	6,800	1,360	
6/15/87	9:20 a.m.	2100-2130	27	7,500	2,050	
6/15/87	2:00 p.m.	2130-2160	26	6,600	1,800	Added fresh water while coring
6/15/87	4:15 p.m.	2160-2190	26	7,000	1,890	
6/15/87	--	2190-2220	25.5	7,000	2,000	
6/15/87	--	2220-2250	26	7,400	2,250	
6/17/87	2:00 a.m.	2250-2280	25	1,160	4,150	
6/17/87	5:50 a.m.	2280-2310	25	1,170	4,470	
6/17/87	8:55 a.m.	2310-2335	29	1,180	4,530	
6/17/87	2:20 p.m.	2335-2365	24	16,000	5,798	
6/17/87	5:25 p.m.	2365-2395	24	19,500	7,748	
6/18/87	12:20 a.m.	2430-2460	24	19,000	7,398	

Appendix D
MONITOR WELL PILOT HOLE WATER QUALITY

Date	Time	Depth (Ft)	Temperature (°C)	Specific Conductance (µmhos/cm)	Chloride (mg/l)	Remarks
7/21/87	8:30 a.m.	990	24	1780	210	
7/21/87	11:00 p.m.	1020	24	1800	255	
7/22/87	6:30 a.m.	1050	27.5	2400	555	
7/22/87	10:10 a.m.	1087	28	2200	535	
7/22/87	1:30 p.m.	1110	26.5	2200	605	
7/22/87	3:00 p.m.	1140	27.0	2600	715	
7/22/87	4:50 p.m.	1170	26.5	2600	920	
7/22/87	10:30 p.m.	1200	27.0	3500	945	
7/23/87	2:45 a.m.	1230	27.0	2800	820	
7/23/87	6:15 a.m.	1260	26.0	3200	950	
7/23/87	3:30 p.m.	1300	26.0	3100	985	
7/23/87	6:00 p.m.	1330	26.0	3500	1190	
7/23/87	7:00 p.m.	1350	26.0	3300	1040	
7/23/87	9:30 p.m.	1380	26.0	3400	1065	
8/4/87	7:45 a.m.	1455	24.0	3100	1315	
8/4/87	8:50 a.m.	1485	24.5	3400	1300	
8/4/87	11:00 a.m.	1515	25.0	3400	1280	
8/4/87	12:30 p.m.	1546	24.5	3200	1290	
8/4/87	3:00 p.m.	1576	24.5	3300	1330	
8/4/87	11:15 p.m.	1600	25.0	3600	1495	Began open circulation at 1580 feet
8/5/87	4:00 a.m.	1630	24.5	4400	1875	
8/5/87	6:10 a.m.	1690	25.5	4900	2199 2349	Reverse air open circulation
8/5/87	7:35 a.m.	1710	26	4700	2099 2099	"
8/5/87	8:45 a.m.	1720	25	5200	2349	"
8/5/87	11:30 a.m.	1760	28	5400	2399	"
8/5/87	11:50 a.m.	1760	27.5	5380	2299 2249	Drill pipe sample
8/5/87	5:00 a.m.	1660	25.0	4600	2090	
8/17/87	4:30 p.m.	1780	25.0	680	550	Well taking fluid. Sample mostly makeup water.

Appendix D
SHALLOW MONITOR WELL WATER QUALITY

Date	Time	Well Number	Chloride (mg/l)	Specific Conductance (μmhos/cm)	Temperature (°C)
5/5/87	--	87-1	30	440	23
		87-2	40	650	23
		87-3	120	580	23
		87-4	80	640	23
5/12/87	10:00 a.m.	87-1	40	440	22.5
		87-2	45	640	22.5
		87-3	120	700	22.5
		87-4	80	740	22.5
5/18/87	2:00 p.m.	87-1	50	440	25
		87-2	45	690	25
		87-3	120	710	25
		87-4	95	810	25
5/26/87	6:00 p.m.	87-1	30	450	25
		87-2	40	540	25
		87-3	125	720	25.5
		87-4	95	800	25
6/1/87	9:00 a.m.	87-1	50	440	24.5
		87-2	45	710	24.5
		87-3	120	730	24.5
		87-4	110	840	24.5
6/8/87	9:30 a.m.	87-1	35	440	23
		87-2	50	690	23
		87-3	115	700	23
		87-4	90	700	23
6/15/87	11:00 a.m.	87-1	30	420	25
		87-2	40	740	25
		87-3	120	560	25
		87-4	105	820	25
6/22/87	7:30 p.m.	87-1	49	440	25
		87-2	45	640	25
		87-3	120	720	25
		87-4	120	800	25
6/29/87	--	87-1	30	440	25
		87-2	35	750	27
		87-3	120	690	26
		87-4	95	790	26
7/6/87	6:00 p.m.	87-1	30	450	27.5
		87-2	40	710	26
		87-3	115	700	25.5
		87-4	90	730	25
7/13/87	11:30 a.m.	87-1	25	440	26
		87-2	40	750	27
		87-3	110	690	27
		87-4	100	780	26
7/20/87	4:30 p.m.	87-1	30	440	27
		87-2	45	720	26
		87-3	120	730	26
		87-4	95	790	25.5
7/27/87	2:00 p.m.	87-1	25	440	26.5
		87-2	35	720	26.5
		87-3	110	700	26.5
		87-4	120	810	26.5

Appendix D (Continued)
SHALLOW MONITOR WELL WATER QUALITY

Date	Time	Well Number	Chloride (mg/l)	Specific Conductance (µmhos/cm)	Temperature (°C)
8/3/87	7:00 p.m.	87-1	30	440	24
		87-2	35	650	24
		87-3	105	700	25
		87-4	110	750	25
8/10/87	9:30 a.m.	87-1	25	400	25
		87-2	45	750	26
		87-3	115	680	25.5
		87-4	135	840	25.5

Sample No. 41502-41505

Lab ID No. 82112

CH2M HILL

ENVIRONMENTAL LABORATORIES
7201 N.W. Eleventh Place
P.O. Drawer 1647
Gainesville, Florida 32602
904/377-2442

REPORT OF ANALYSIS

Client GDU - North Port

Project No. SE15807.T2

Attention Leslie Shannon

Received 4-30-87

Address GNV office

Reported 5-27-87

Description of Sample: Drill Pad Shallow Monitor Well
Collected by Leslie Shannon
4-27-87

Sample No.	Description	Chloride (mg/L)	Conductivity(umhos/cm)
41502	87-1	21.0	448
41503	87-2	35.0	693
41504	87-3	114	745
41505	87-4	86.0	806

Respectfully submitted,

Chemist

STATE OF FLORIDA
DEPARTMENT OF ENVIRONMENTAL REGULATION

SOUTHEAST FLORIDA DISTRICT
1900 SOUTH CONGRESS AVENUE
WEST PALM BEACH, FLORIDA 33406

BOB MARTINEZ
GOVERNOR
DALE TWACHTMANN
SECRETARY
J. SCOTT BENYON
DISTRICT MANAGER

AUG 0 6 1987

St. Lucie County
DW - North Port St. Lucie
Wastewater Treatment Facility
Deep Well

Leslie Shannon
CH_2M Hill
P. O. Box 1647
Gainesville, FL 32602

Dear Ms. Shannon:

In response to your telephone request of August 4, 1987 the attached lists titled "Pollution Source - Sewage Effluent Groundwater Monitoring Parameters" page 35 and "Groundwater Quality Standards Based Upon 17-22.104 Drinking Water Standards" page 25 and 26 should be used for background sampling on the North Port St. Lucie deep well monitor zones. I have been informed that the same lists are currently being incorporated into all domestic wastewater deep well monitoring plans issued by the South East District Office.

Sincerely,

Paul L. Phillips
TAC Co-Chairman

PLP:my

Ground Water Quality Standards (Based Upon Chapter 17-22.104 Drinking Water Standards)

Primary Standards

	Parameter	Maximum Concentration Limit (MCL) (mg/l unless otherwise noted)
Inorganics	Arsenic	0.05
	Barium	1.0
	Cadmium	0.010
	Chromium	0.05
	Lead	0.05
	Mercury	0.002
	Nitrate (as N)	10.0
	Selenium	0.01
	Silver	0.05
	Sodium	160.0
	Fluoride	1.4
Organic Pesticides	Endrin	0.0002
	Lindane	0.004
	Methoxychlor	0.1
	Toxaphene	0.005
	2,4-D	0.1
	2,4,5-TP, Silvex	0.01
Volatile Organics	Trihalomethanes (total)	0.10
	Trichloroethylene	3.0 ug/l
	Tetrachloroethylene	3.0 ug/l
	Carbon Tetrachloride	3.0 ug/l
	Vinyl Chloride	1.0 ug/l
	1,1,1-Trichloroethane	200.0 ug/l
	1,2-Dichloroethane	3.0 ug/l
	Benzene	1.0 ug/l
	Ethylene Dibromide	0.02 ug/l
	Turbidity	1 T.U. Monthly Avg. 5 T.U. 2-day Avg.
	Microbiological	Total Coliform (MF) 4/100 ml
Radionuclides	Radium-226 and Radium-228	5 pCi/l
	Gross Alpha	15 pCi/l

Ground Water Quality Standards (continued)

Secondary Standards

	Parameter	Maximum Concentration Limit (MCL) (mg/l unless otherwise noted)
Inorganic	Iron	0.3
	Copper	1
	Manganese	0.05
	Zinc	5
	Chloride	250
	Sulfate	250
	Total Dissolved Solids (TDS)	500 (may be>if no other MCL is exceeded)
	pH (at collection point)	6.5 (min. allowable-no max)
	color	15 color units
	corrosivity	neither corrosive nor scale forming
	foaming agents	0.5
	odor	3 (threshold odor number)

Pollution Source - Sewage Effluent

Groundwater Monitoring Parameters

Inorganic

sulfide (field measurement)

soluble orthophosphate
ammonium
organic nitrogen

Metals

antimony

Volatile Organics

toluene
1,2 dichlorobenzene

chloroform
1,2 dichloroethylene
chloroethane

Pesticides

aldrin
dieldrin

Base/Neutral Organics

diethylphthallate
dimethylphthallate
butylbenzylphthallate
naphthalene
anthracene
phenanthrene

Acid Extractables

phenol
2,4,6-trichlorophenol
2-chlorophenol

CH2M HILL ENVIRONMENTAL LABORATORIES
7201 NW ELEVENTH PLACE
P.O. DRAWER 1647
GAINESVILLE, FLORIDA 32602

STATE OF FLORIDA
CERTIFICATION NUMBER: 82112

10/29/87

REPORT OF ANALYSIS

Sample Nos. 45861 - 45863

Client: GDU NORTH PORT ST. LUCIE DIW
Attention: LESLIE SHANNON
Address: GNV OFFICE

Project No. SE15807.T2
Received: 08/31/87

Description of Sample:

WATER
Location: MONITOR WELLS
Collected on 08/30/87 by LESLIE SHANNON

	45861	45862	45863
PARAMETER	LOWER MONITOR ZONE	UPPER MONITOR ZONE	TRAVEL BLANKS
GENERAL			
pH (Units)	7.50	7.90	N/A
Field pH (Units)	7.60	7.85	N/A
Total Alkalinity (as CaCO3)	120	140	N/A
Color (APHA)	10	25	N/A
Conductivity (umhos/cm)	20,500	3,400	N/A
Field Conductivity(umhos/cm)	20,000	3,010	N/A
Calcium Hardness (as CaCO3)	2240	500	N/A
Turbidity (NTU)	17	3.4	N/A
Odor (TON)	N.O.O.	N.O.O.	N/A
Saturation Index (pH - pHs)	1.03	0.85	N/A
SOLIDS			
Total Dissolved Solids	14,900	2,060	N/A
METALS			
Antimony	<0.2	<0.2	<0.2
Arsenic	<0.002	<0.002	<0.002
Barium	<0.2	<0.2	<0.2
Cadmium	<0.01	<0.01	<0.01
Total Chromium	<0.05	<0.05	<0.05
Copper	0.03	<0.02	<0.02
Iron	0.72	0.70	0.03
Lead, Total	<0.05	<0.05	<0.05
Manganese	0.04	0.08	<0.01
Mercury	<0.0002	<0.0002	<0.0002

NOTE: VALUES ARE MG/L UNLESS OTHERWISE STATED.
N.O.O.=NO ODOR OBSERVED.

Respectfully submitted,

Analyses performed in accordance with
methods approved by the USEPA

Thomas C. Emenhiser

Thomas C. Emenhiser, Laboratory Manager

This information is test data and no interpretation is intended or implied.

REPORT OF ANALYSIS

Sample Nos. 45861 - 45863

	45861	45862	45863
PARAMETER	LOWER MONITOR ZONE	UPPER MONITOR ZONE	TRAVEL BLANKS
Selenium	<0.001	<0.001	<0.001
Silver	<0.05	<0.05	<0.05
Sodium	6,270	502	0.24
Zinc	0.02	0.21	<0.01
ANIONS			
Chloride	9,000	1,000	N/A
Fluoride	0.63	0.78	N/A
Sulfate	205	246	N/A
Sulfide	2.27	0.75	N/A
NUTRIENTS			
Ammonia (as N)	0.92	0.60	N/A
Nitrate & Nitrite (as N)	<0.02	<0.02	N/A
Organic Nitrogen (as N)	0.24	0.08	N/A
Kjeldahl Nitrogen (as N)	1.16	0.68	N/A
Ortho-Phosphorus (as P)	0.03	<0.01	N/A
ORGANICS			
Surfactants (MBAS)	<0.02	<0.02	N/A

NOTE: VALUES ARE MG/L UNLESS OTHERWISE STATED.
N.O.O.=NO ODOR OBSERVED.

Analyses performed in accordance with
methods approved by the USEPA

Respectfully submitted,

Thomas C. Emenhiser

Thomas C. Emenhiser, Laboratory Manager

This information is test data and no interpretation is intended or implied.

End of 2 page report

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Scientists

October 01, 1987

SE15807.T2

Mr. Don Hash
CH2M HILL\GNV
P.O. Box 1647
Gainesville, Florida 32602

RE: Analytical Data for Laboratory No. 9726

Dear Mr. Hash:

On September 02, 1987, the CH2M HILL Montgomery Laboratory received two samples with a request for analysis of selected organic parameters.

The analytical results and the associated quality control data are enclosed. No unusual difficulties were encountered during the analysis of these samples.

If you should have any questions concerning the data, please call.

Sincerely,

Ward Dickens
Manager, Organic Analysis

Enclosures
cc: Craig Vinson

ORG/001-54

ORGANIC ANALYSIS

ANALYTICAL INSTRUMENTATION

- Finnigan Models 4021, 5100, 4510 Gas Chromatographs/Mass Spectrometer/Data Systems equipped with Tekmar's LSC-2, LSC-3, and the 4200 automatic Heated Sample Module.
- Varian Models 3700 and 6000 Gas Chromatographs equipped with flame ionization, electron capture, thermionic specific, flame photometric detectors and autosamplers. State of the art Varian Vista 402 Data System and Hewlett Packard integrators.
- Dohrman DX-20 Total Organic Halide System.
- Water High Pressure Liquid Chromatograph with UV and Fluorescence detectors.

ANALYTICAL METHODOLOGY

- Priority Pollutants: The water samples are analyzed in accordance with procedures described in methods 608, 624, and 625, EPA-600/4-82-057 (1982). The soil samples are analyzed in accordance with procedures described in Methods 8080, 8240, and 8270, Test Methods for Evaluating Solid Waste, 1982.
- Phenoxyacid Herbicides: Samples are analyzed in accordance with procedures outlined in Method 7, Federal Register, Vol. 38, No. 75, Part II, November 28, 1973.
- Total Organic Halides: Samples are analyzed in accordance with procedures outlined in Method 9020, USEPA, Test Methods for Evaluating Solid Waste, 1982, SW-846, Second Edition.
- Trihalomethanes: Samples are analyzed in accordance with procedures described in Method 501.2, Federal Register, Vol. 44, No. 231, Part II, November 29, 1979.
- Ethylene dibromide: Water samples are analyzed in accordance with procedures outlined in Method 504, Federal Register (50 FR 46902), November 13, 1985.

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ORGANIC REPORT OF ANALYSIS

CH2M HILL/GNV
P.O. BOX 1647
GAINESVILLE, FLORIDA 32602

Date: 09/30/87

Project Number: SE15807.

ATTN: MS. KATHRYN STARCHER

Laboratory Number: 09726

RE: Sample(s) received by CH2M HILL on 09/02/87.
GDU - NORTH PORT ST. LUCIE

Analysis Description	45861 LOWER MONITORING ZONE	45862 UPPER MONITORING ZONE
	WATER	WATER
EDB (ug/L)	<0.02	<0.02
1,1,2,2-Tetrachloroethane (%)	104	107

Analyses performed in accordance with methods approved by the USEPA.

COMMENT: Tetrachloroethane, reported as percent recovered, is a surrogate.

Respectfully Submitted,

Ward Dickens

Ward Dickens
Organic Laboratory Manager

CH2M HILL
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ORGANIC REPORT OF ANALYSIS

QUALITY CONTROL DATA
FOR YOUR SAMPLES

Date: 09/30/87

Project Number: NO CHARG

ATTN: Q.C. OFFICER

Laboratory Number: W0909

RE: Sample(s) collected by CH2M HILL on 09/09/87.

Analysis Description	BLANK DATA FOR YOUR SAMPLES
	WATER
EDB (ug/L)	<0.02
1,1,2,2-Tetrachloroethane (%)	104

Analyses performed in accordance with methods approved by the USEPA.

COMMENT: Tetrachloroethane, reported as percent recovered, is a surrogate.

Respectfully Submitted,

Ward Dickens

Ward Dickens
Organic Laboratory Manager

CH2M HILL
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ACID COMPOUNDS
GC/MS REPORT

Laboratory No : W09157B1
Date Received : 09/15/87
Date Extracted: 09/15/87
Date Analyzed : 09/23/87

Client: QUALITY CONTROL DATA

Sample Description: BLANK DATA FOR YOUR SAMPLES

Matrix: WATER

Compounds	MDL1 PPB	Conc.2 PPB	Compounds	MDL1 PPB	Conc.2 PPB
Phenol	10	BMDL			
2-Chlorophenol	10	BMDL			
O-Cresol	10	BMDL			
M & P-Cresol	10	BMDL			
2-Nitrophenol	10	BMDL			
2,4-Dimethylphenol	10	BMDL			
2,4-Dichlorophenol	10	BMDL			
Benzoic Acid	50	BMDL			
4-Chloro-3-methylphenol	10	BMDL			
2,4,6-Trichlorophenol	10	BMDL			
2,4,5-Trichlorophenol	10	BMDL			
2,4-Dinitrophenol	50	BMDL			
4-Nitrophenol	50	BMDL			
2-Methyl-4,6-dinitrophenol	50	BMDL			
Pentachlorophenol	10	BMDL			
OTHER COMPOUNDS:					

SURROGATE RECOVERIES	% REC.
2-Fluorophenol	84
D5-Phenol	78
2,4,6-Tribromophenol	68

1 MDL = Method Detection Limit
2 BMDL = Below Method Detection Limit
3 ND = Not Determined

REVIEW

MSC

Comments:

CH2M HILL
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BASE/NEUTRAL COMPOUNDS
GC/MS REPORT

Laboratory No : W0915781
Date Received : 09/15/87
Date Extracted: 09/15/87
Date Analyzed : 09/23/87

Client: QUALITY CONTROL DATA

Sample Description: BLANK DATA FOR YOUR SAMPLES

Matrix: WATER

Compounds	MDL1 PPB	Conc.2 PPB	Compounds	MDL1 PPB	Conc.2 PPB
Aniline	10	BMDL	N-nitrosodiphenylamine	10	BMDL
Bis(2-chloroethyl)ether	10	BMDL	1,2-Diphenylhydrazine	10	BMDL
1,3-Dichlorobenzene	10	BMDL	4-Bromophenyl phenyl ether	10	BMDL
1,4-Dichlorobenzene	10	BMDL	Hexachlorobenzene	10	BMDL
Benzyl Alcohol	10	BMDL	Phenanthrene	10	BMDL
1,2-Dichlorobenzene	10	BMDL	Anthracene	10	BMDL
Bis(2-chloroisopropyl)ether	10	BMDL	Dibutyl phthalate	10	BMDL
Hexachloroethane	10	BMDL	Fluoranthene	10	BMDL
N-nitroso-di-n-propylamine	10	BMDL	Pyrene	10	BMDL
Nitrobenzene	10	BMDL	Benzidine	50	BMDL
Isophorone	10	BMDL	Butyl benzyl phthalate	10	BMDL
Bis(2-chloroethoxy)methane	10	BMDL	2,3,7,8-Tetrachlorodibenzo-p-dioxin	10	BMDL
1,2,4-Trichlorobenzene	10	BMDL	Benzo (a) anthracene	10	BMDL
Naphthalene	10	BMDL	Chrysene	10	BMDL
4-Chloroaniline	10	BMDL	3,3'-Dichlorobenzidine	50	BMDL
Hexachlorobutadiene	10	BMDL	Bis(2-ethylhexyl)phthalate	10	BMDL
2-Methylnaphthalene	10	BMDL	Di-n-octyl phthalate	10	BMDL
Hexachlorocyclopentadiene	10	BMDL	Benzo (b) fluoranthene	10	BMDL
2-Chloronaphthalene	10	BMDL	Benzo (k) fluoranthene	10	BMDL
3-Nitroaniline	50	BMDL	Benzo (a) pyrene	10	BMDL
Acenaphthylene	10	BMDL	Indeno (1,2,3-cd) pyrene	10	BMDL
Dimethyl phthalate	10	BMDL	Dibenzo (a,h) anthracene	10	BMDL
2,6-Dinitrotoluene	10	BMDL	Benzo (g,h,i) perylene	10	BMDL
2-Nitroaniline	50	BMDL			
Acenaphthene	10	BMDL			
Dibenzofuran	10	BMDL	OTHER COMPOUNDS:		
2,4-Dinitrotoluene	10	BMDL			
Fluorene	10	BMDL			
4-Chlorophenyl phenyl ether	10	BMDL			
4-Nitroaniline	50	BMDL			
Diethyl phthalate	10	BMDL			

SURROGATE RECOVERIES	% REC.
D5-Nitrobenzene	105
2-Fluorobiphenyl	75
D10-Pyrene	97
D14-Terphenyl	93

1 MDL = Method Detection Limit
2 BMDL = Below Method Detection Limit
3 ND = Not Determined

REVIEW

HK

Comments:

CH2M HILL
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PESTICIDES / PCBs
GC REPORT

Laboratory No : W09087B1
Date Received : 09/08/87
Date Extracted: 09/08/87
Date Analyzed : 09/15/87

Client: QUALITY CONTROL DATA

Sample Description: BLANK DATA FOR YOUR SAMPLES

Matrix: WATER

Compounds	MDL1 PPB	Conc.2 PPB	Compounds	MDL1 PPB	Conc.2 PPB
Aldrin	0.01	BMDL			
alpha-BHC	0.01	BMDL			
beta-BHC	0.02	BMDL			
delta-BHC	0.01	BMDL			
gamma-BHC	0.01	BMDL			
Chlordane	0.1	BMDL			
4,4'-DDD	0.02	BMDL			
4,4'-DDE	0.02	BMDL			
4,4'-DDT	0.02	BMDL			
Dieldrin	0.02	BMDL			
Endosulfan I	0.02	BMDL			
Endosulfan II	0.02	BMDL			
Endosulfan Sulfate	0.1	BMDL			
Endrin	0.02	BMDL			
Endrin Aldehyde	0.02	BMDL			
Endrin Ketone	0.02	BMDL			
Heptachlor	0.01	BMDL			
Heptachlor Epoxide	0.01	BMDL			
4,4'-Methoxychlor	0.04	BMDL			
Toxaphene	0.5	BMDL			
PCB - 1016	0.8	BMDL			
PCB - 1221	2	BMDL			
PCB - 1232	2	BMDL			
PCB - 1242	0.8	BMDL			
PCB - 1248	0.4	BMDL			
PCB - 1254	0.2	BMDL			
PCB - 1260	0.2	BMDL			
OTHER COMPOUNDS:					
SURROGATE RECOVERIES	% REC.				
			1 MDL = METHOD DETECTION LIMIT		
2,4,6-Tribromobiphenyl	90		2 BMDL = BELOW METHOD DETECTION LIMIT	REVIEW	
Dibutylchlorendate	115				
				MLH	

Comments:

CH2M HILL
Engineers
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SDWA HERBICIDE ANALYSIS
GC REPORT

Laboratory No : W09167B1
Date Received : 09/16/87
Date Extracted: 09/16/87
Date Analyzed : 09/17/87

Client: QUALITY CONTROL DATA

Sample Description: BLANK DATA FOR YOUR SAMPLES

Matrix: WATER

Compounds	MDL1 PPB	Conc.2 PPB	Compounds	MDL1 PPB	Conc.2 PPB
2,4-D	0.5	BMDL			
Silvex	0.1	BMDL			
OTHER COMPOUNDS:					

SURROGATE RECOVERIES	% REC.
2,4,5-T	39

1 MDL = METHOD DETECTION LIMIT
2 BMDL = BELOW METHOD DETECTION LIMIT

REVIEW

WLH

Comments:

CH2M HILL
Engineers
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ACID COMPOUNDS
GC/MS REPORT

Laboratory No : 09726001
Date Received : 09/02/87
Date Extracted: 09/16/87
Date Analyzed : 09/23/87

Client: GDU - NORTH PORT ST. LUCIE

Sample Description: 45861 LOWER MONITORING ZONE

Matrix: WATER

Compounds	MDL1 PPB	Conc.2 PPB	Compounds	MDL1 PPB	Conc.2 PPB
Phenol	10	BMDL			
2-Chlorophenol	10	BMDL			
O-Cresol	10	BMDL			
M & P-Cresol	10	BMDL			
2-Nitrophenol	10	BMDL			
2,4-Dimethylphenol	10	BMDL			
2,4-Dichlorophenol	10	BMDL			
Benzoic Acid	50	BMDL			
4-Chloro-3-methylphenol	10	BMDL			
2,4,6-Trichlorophenol	10	BMDL			
2,4,5-Trichlorophenol	10	BMDL			
2,4-Dinitrophenol	50	BMDL			
4-Nitrophenol	50	BMDL			
2-Methyl-4,6-dinitrophenol	50	BMDL			
Pentachlorophenol	10	BMDL			
OTHER COMPOUNDS:					

SURROGATE RECOVERIES	% REC.
2-Fluorophenol	86
D5-Phenol	72
2,4,6-Tribromophenol	105

1 MDL = Method Detection Limit
2 BMDL = Below Method Detection Limit
3 ND = Not Determined

REVIEW

MSC

Comments:

CH2M HILL
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BASE/NEUTRAL COMPOUNDS
GC/MS REPORT

Laboratory No : 09726001
Date Received : 09/02/87
Date Extracted: 09/15/87
Date Analyzed : 09/23/87

Client: GDU - NORTH PORT ST. LUCIE

Sample Description: 45861 LOWER MONITORING ZONE

Matrix: WATER

Compounds	MDL^1 PPB	Conc.^{2} PPB	Compounds	MDL^1 PPB	Conc.^{2} PPB
Aniline	10	BMDL	N-nitrosodiphenylamine	10	BMDL
Bis(2-chloroethyl)ether	10	BMDL	1,2-Diphenylhydrazine	10	BMDL
1,3-Dichlorobenzene	10	BMDL	4-Bromophenyl phenyl ether	10	BMDL
1,4-Dichlorobenzene	10	BMDL	Hexachlorobenzene	10	BMDL
Benzyl Alcohol	10	BMDL	Phenanthrene	10	BMDL
1,2-Dichlorobenzene	10	BMDL	Anthracene	10	BMDL
Bis(2-chloroisopropyl)ether	10	BMDL	Dibutyl phthalate	10	BMDL
Hexachloroethane	10	BMDL	Fluoranthene	10	BMDL
N-nitroso-di-n-propylamine	10	BMDL	Pyrene	10	BMDL
Nitrobenzene	10	BMDL	Benzidine	50	BMDL
Isophorone	10	BMDL	Butyl benzyl phthalate	10	BMDL
Bis(2-chloroethoxy)methane	10	BMDL	2,3,7,8-Tetrachlorodibenzo-p-dioxin	10	BMDL
1,2,4-Trichlorobenzene	10	BMDL	Benzo (a) anthracene	10	BMDL
Naphthalene	10	BMDL	Chrysene	10	BMDL
4-Chloroaniline	10	BMDL	3,3'-Dichlorobenzidine	50	BMDL
Hexachlorobutadiene	10	BMDL	Bis(2-ethylhexyl)phthalate	10	BMDL
2-Methylnaphthalene	10	BMDL	Di-n-octyl phthalate	10	BMDL
Hexachlorocyclopentadiene	10	BMDL	Benzo (b) fluoranthene	10	BMDL
2-Chloronaphthalene	10	BMDL	Benzo (k) fluoranthene	10	BMDL
3-Nitroaniline	50	BMDL	Benzo (a) pyrene	10	BMDL
Acenaphthylene	10	BMDL	Indeno (1,2,3-cd) pyrene	10	BMDL
Dimethyl phthalate	10	BMDL	Dibenzo (a,h) anthracene	10	BMDL
2,6-Dinitrotoluene	10	BMDL	Benzo (g,h,i) perylene	10	BMDL
2-Nitroaniline	50	BMDL			
Acenaphthene	10	BMDL			
Dibenzofuran	10	BMDL	OTHER COMPOUNDS:		
2,4-Dinitrotoluene	10	BMDL			
Fluorene	10	BMDL			
4-Chlorophenyl phenyl ether	10	BMDL			
4-Nitroaniline	50	BMDL			
Diethyl phthalate	10	BMDL			

SURROGATE RECOVERIES	% REC.
D5-Nitrobenzene	105
2-Fluorobiphenyl	81
D10-Pyrene	108
D14-Terphenyl	104

1 MDL = Method Detection Limit
2 BMDL = Below Method Detection Limit
3 ND = Not Determined

REVIEW
MSC

Comments:

CH2M HILL
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SEMIVOLATILE
TENTATIVELY IDENTIFIED
COMPOUND

Laboratory Number: 09726001

Client: GDU - North Port St. Lucie

Sample Description: #4586 Lower Monitoring Zone

Compound	Scan	PUR/FIT	CAS Number	Conc. PPB
Molecular Sulfur(S8)	2615	964/986	10544-50-0	250

CH2M HILL
Engineers
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PESTICIDES / PCBs
GC REPORT

Laboratory No : 09726001
Date Received : 09/02/87
Date Extracted: 09/08/87
Date Analyzed : 09/23/87

Client: GDU - NORTH PORT ST. LUCIE

Sample Description: 45861 LOWER MONITORING ZONE

Matrix: WATER

Compounds	MDL1 PPB	Conc.2 PPB	Compounds	MDL1 PPB	Conc.2 PPB
Aldrin	0.02	BMDL			
alpha-BHC	0.02	BMDL			
beta-BHC	0.04	BMDL			
delta-BHC	0.02	BMDL			
gamma-BHC	0.02	BMDL			
Chlordane	0.2	BMDL			
4,4'-DDD	0.04	BMDL			
4,4'-DDE	0.04	BMDL			
4,4'-DDT	0.04	BMDL			
Dieldrin	0.04	BMDL			
Endosulfan I	0.04	BMDL			
Endosulfan II	0.04	BMDL			
Endosulfan Sulfate	0.1	BMDL			
Endrin	0.04	BMDL			
Endrin Aldehyde	0.04	BMDL			
Endrin Ketone	0.04	BMDL			
Heptachlor	0.02	BMDL			
Heptachlor Epoxide	0.02	BMDL			
4,4'-Methoxychlor	0.08	BMDL			
Toxaphene	1	BMDL			
PCB - 1016	1.6	BMDL			
PCB - 1221	4	BMDL			
PCB - 1232	4	BMDL			
PCB - 1242	1.6	BMDL			
PCB - 1248	0.2	BMDL			
PCB - 1254	0.1	BMDL			
PCB - 1260	0.1	BMDL			
OTHER COMPOUNDS:					

SURROGATE RECOVERIES	% REC.
2,4,6-Tribromobiphenyl	80
Dibutylchlorendate	118

1 MDL = METHOD DETECTION LIMIT
2 BMDL = BELOW METHOD DETECTION LIMIT

REVIEW

WLH

Comments:

CH2M HILL Engineers
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SDWA HERBICIDE ANALYSIS
GC REPORT

Laboratory No : 09726001
Date Received : 09/02/87
Date Extracted: 09/16/87
Date Analyzed : 09/22/87

Client: GDU - NORTH PORT ST. LUCIE

Sample Description: 45861 LOWER MONITORING ZONE

Matrix: WATER

Compounds	MDL1 PPB	Conc.2 PPB	Compounds	MDL1 PPB	Conc.2 PPB
2,4-D	5	BMDL			
Silvex	1	BMDL			
OTHER COMPOUNDS:					

SURROGATE RECOVERIES	% REC.	
2,4,5-T	36	

1 MDL = METHOD DETECTION LIMIT
2 BMDL = BELOW METHOD DETECTION LIMIT

REVIEW

WLH

Comments:

CH2M HILL
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ACID COMPOUNDS
GC/MS REPORT

Laboratory No : 09726002
Date Received : 09/02/87
Date Extracted: 09/16/87
Date Analyzed : 09/23/87

Client: GDU - NORTH PORT ST. LUCIE

Sample Description: 45862 UPPER MONITORING ZONE

Matrix: WATER

Compounds	MDL1 PPB	Conc.2 PPB	Compounds	MDL1 PPB	Conc.2 PPB
Phenol	10	BMDL			
2-Chlorophenol	10	BMDL			
O-Cresol	10	BMDL			
M & P-Cresol	10	BMDL			
2-Nitrophenol	10	BMDL			
2,4-Dimethylphenol	10	BMDL			
2,4-Dichlorophenol	10	BMDL			
Benzoic Acid	50	BMDL			
4-Chloro-3-methylphenol	10	BMDL			
2,4,6-Trichlorophenol	10	BMDL			
2,4,5-Trichlorophenol	10	BMDL			
2,4-Dinitrophenol	50	BMDL			
4-Nitrophenol	50	BMDL			
2-Methyl-4,6-dinitrophenol	50	BMDL			
Pentachlorophenol	10	BMDL			
OTHER COMPOUNDS:					

SURROGATE RECOVERIES	% REC.
2-Fluorophenol	77
D5-Phenol	61
2,4,6-Tribromophenol	94

1 MDL = Method Detection Limit
2 BMDL = Below Method Detection Limit
3 ND = Not Determined

REVIEW

MSC

Comments:

CH2M HILL
Engineers
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Economists
Scientists

BASE/NEUTRAL COMPOUNDS
GC/MS REPORT

Laboratory No : 09726002
Date Received : 09/02/87
Date Extracted: 09/15/87
Date Analyzed : 09/23/87

Client: GDU - NORTH PORT ST. LUCIE

Sample Description: 45862 UPPER MONITORING ZONE

Matrix: WATER

Compounds	MDL1 PPB	Conc.2 PPB	Compounds	MDL1 PPB	Conc.2 PPB
Aniline	10	BMDL	N-nitrosodiphenylamine	10	BMDL
Bis(2-chloroethyl)ether	10	BMDL	1,2-Diphenylhydrazine	10	BMDL
1,3-Dichlorobenzene	10	BMDL	4-Bromophenyl phenyl ether	10	BMDL
1,4-Dichlorobenzene	10	BMDL	Hexachlorobenzene	10	BMDL
Benzyl Alcohol	10	BMDL	Phenanthrene	10	BMDL
1,2-Dichlorobenzene	10	BMDL	Anthracene	10	BMDL
Bis(2-chloroisopropyl)ether	10	BMDL	Dibutyl phthalate	10	BMDL
Hexachloroethane	10	BMDL	Fluoranthene	10	BMDL
N-nitroso-di-n-propylamine	10	BMDL	Pyrene	10	BMDL
Nitrobenzene	10	BMDL	Benzidine	50	BMDL
Isophorone	10	BMDL	Butyl benzyl phthalate	10	BMDL
Bis(2-chloroethoxy)methane	10	BMDL	2,3,7,8-Tetrachlorodibenzo-p-dioxin	10	BMDL
1,2,4-Trichlorobenzene	10	BMDL	Benzo (a) anthracene	10	BMDL
Naphthalene	10	BMDL	Chrysene	10	BMDL
4-Chloroaniline	10	BMDL	3,3'-Dichlorobenzidine	50	BMDL
Hexachlorobutadiene	10	BMDL	Bis(2-ethylhexyl)phthalate	10	BMDL
2-Methylnaphthalene	10	BMDL	Di-n-octyl phthalate	10	BMDL
Hexachlorocyclopentadiene	10	BMDL	Benzo (b) fluoranthene	10	BMDL
2-Chloronaphthalene	10	BMDL	Benzo (k) fluoranthene	10	BMDL
3-Nitroaniline	50	BMDL	Benzo (a) pyrene	10	BMDL
Acenaphthylene	10	BMDL	Indeno (1,2,3-cd) pyrene	10	BMDL
Dimethyl phthalate	10	BMDL	Dibenzo (a,h) anthracene	10	BMDL
2,6-Dinitrotoluene	10	BMDL	Benzo (g,h,i) perylene	10	BMDL
2-Nitroaniline	50	BMDL			
Acenaphthene	10	BMDL			
Dibenzofuran	10	BMDL	OTHER COMPOUNDS:		
2,4-Dinitrotoluene	10	BMDL			
Fluorene	10	BMDL			
4-Chlorophenyl phenyl ether	10	BMDL			
4-Nitroaniline	50	BMDL			
Diethyl phthalate	10	BMDL			

SURROGATE RECOVERIES	% REC.
D5-Nitrobenzene	94
2-Fluorobiphenyl	81
D10-Pyrene	91
D14-Terphenyl	87

1 MDL = Method Detection Limit
2 BMDL = Below Method Detection Limit
3 ND = Not Determined

REVIEW

MSC

Comments:

CH2M HILL
Engineers
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Economists
Scientists

PESTICIDES / PCBs
GC REPORT

Laboratory No : 09726002
Date Received : 09/02/87
Date Extracted: 09/08/87
Date Analyzed : 09/12/87

Client: GDU - NORTH PORT ST. LUCIE

Sample Description: 45862 UPPER MONITORING ZONE

Matrix: WATER

Compounds	MDL1 PPB	Conc.2 PPB	Compounds	MDL1 PPB	Conc.2 PPB
Aldrin	0.01	BMDL			
alpha-BHC	0.01	BMDL			
beta-BHC	0.02	BMDL			
delta-BHC	0.01	BMDL			
gamma-BHC	0.01	BMDL			
Chlordane	0.1	BMDL			
4,4'-DDD	0.02	BMDL			
4,4'-DDE	0.02	BMDL			
4,4'-DDT	0.02	BMDL			
Dieldrin	0.02	BMDL			
Endosulfan I	0.02	BMDL			
Endosulfan II	0.02	BMDL			
Endosulfan Sulfate	0.1	BMDL			
Endrin	0.02	BMDL			
Endrin Aldehyde	0.02	BMDL			
Endrin Ketone	0.02	BMDL			
Heptachlor	0.01	BMDL			
Heptachlor Epoxide	0.01	BMDL			
4,4'-Methoxychlor	0.04	BMDL			
Toxaphene	0.5	BMDL			
PCB - 1016	0.8	BMDL			
PCB - 1221	2	BMDL			
PCB - 1232	2	BMDL			
PCB - 1242	0.8	BMDL			
PCB - 1248	0.4	BMDL			
PCB - 1254	0.2	BMDL			
PCB - 1260	0.2	BMDL			
OTHER COMPOUNDS:					

SURROGATE RECOVERIES	% REC.
2,4,6-Tribromobiphenyl	94
Dibutylchlorendate	112

1 MDL = METHOD DETECTION LIMIT
2 BMDL = BELOW METHOD DETECTION LIMIT

REVIEW

WLH

Comments:

CH2M HILL
Engineers
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Scientists

SDWA HERBICIDE ANALYSIS
GC REPORT

Laboratory No : 09726002
Date Received : 09/02/87
Date Extracted: 09/16/87
Date Analyzed : 09/18/87

Client: GDU - NORTH PORT ST. LUCIE

Sample Description: 45862 UPPER MONITORING ZONE

Matrix: WATER

Compounds	MDL1 PPB	Conc.2 PPB	Compounds	MDL1 PPB	Conc.2 PPB
2,4-D	0.5	BMDL			
Silvex	0.1	BMDL			
OTHER COMPOUNDS:					

SURROGATE RECOVERIES	% REC.
2,4,5-T	87

1 MDL = METHOD DETECTION LIMIT
2 BMDL = BELOW METHOD DETECTION LIMIT

REVIEW

WLH

Comments:

CH2M Hill
Attn: Don Hash

09-15-87

Report #: 50126 (3747)
Page 2 of 2

QUALITY CONTROL DATA SHEET

DUPLICATES:

PARAMETER	% DIFFERENCE	DATE	ANALYST
Gross Alpha	2.1	09-01-87	J.B.
Gross Beta	3.6	08-31-87	J.B.

SPIKES:

PARAMETER	% RECOVERY	DATE	ANALYST
Gross Alpha	119.2	09-01-87	J.B.
Gross Alpha	115.2	09-01-87	J.B
Gross Beta	91.3	08-31-87	J.B.
Gross Beta	87.9	08-31-87	J.B.

Respectfully submitted,
ORLANDO LABORATORIES, INC.

Laboratory Manager

Quality Control

CH2M HILL
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Scientists

September 15, 1987

SE15807.T2

Ms. Kathryn Starcher
CH2M HILL/GNV
P.O. Box 1647
Gainesville, Florida 32602

RE: Analytical Data for Laboratory No. 9726

Dear Ms. Starcher:

On September 02, 1987, the CH2M HILL Montgomery Laboratory received two samples with a request for analysis of selected organic parameters.

The analytical results and the associated quality control data are enclosed. No unusual difficulties were encountered during the analysis of samples.

If you should have any questions concerning the data, please call.

Sincerely,

Ward Dickens

Ward Dickens
Manager, Organic Analysis

Enclosures
cc: Craig Vinson

ORG/001-54

CH2M HILL Montgomery Office 2567 Fairlane Drive, P.O. Box 230548,
Montgomery, Alabama 36116
205.271.1444

ORGANIC ANALYSIS

ANALYTICAL INSTRUMENTATION

- Finnigan Models 4021, 5100, 4510 Gas Chromatographs/Mass Spectrometer/Data Systems equipped with Tekmar's LSC-2, LSC-3, and the 4200 automatic Heated Sample Module.
- Varian Models 3700 and 6000 Gas Chromatographs equipped with flame ionization, electron capture, thermionic specific, flame photometric detectors and autosamplers. State of the art Varian Vista 402 Data System and Hewlett Packard integrators.
- Dohrman DX-20 Total Organic Halide System.
- Water High Pressure Liquid Chromatograph with UV and Fluorescence detectors.

ANALYTICAL METHODOLOGY

- Priority Pollutants: The water samples are analyzed in accordance with procedures described in methods 608, 624, and 625, EPA-600/4-82-057 (1982). The soil samples are analyzed in accordance with procedures described in Methods 8080, 8240, and 8270, Test Methods for Evaluating Solid Waste, 1982.
- Phenoxyacid Herbicides: Samples are analyzed in accordance with procedures outlined in Method 7, Federal Register, Vol. 38, No. 75, Part II, November 28, 1973.
- Total Organic Halides: Samples are analyzed in accordance with procedures outlined in Method 9020, USEPA, Test Methods for Evaluating Solid Waste, 1982, SW-846, Second Edition.
- Trihalomethanes: Samples are analyzed in accordance with procedures described in Method 501.2, Federal Register, Vol. 44, No. 231, Part II, November 29, 1979.
- Ethylene dibromide: Water samples are analyzed in accordance with procedures outlined in Method 504, Federal Register (50 FR 46902), November 13, 1985.

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ORGANIC REPORT OF ANALYSIS

CH2M HILL/GNV
P.O. BOX 1647
GAINESVILLE, FLORIDA 32602

Date: 09/14/87

Project Number: SE15807.

ATTN: MS. KATHRYN STARCHER

Laboratory Number: 09726

RE: Sample(s) received by CH2M HILL on 09/02/87.
GDU - NORTH PORT ST. LUCIE

Analysis Description	45861 LOWER MONITORING ZONE	45862 UPPER MONITORING ZONE
	WATER	WATER
EDB (ug/L)	<0.02	<0.02
Dibromochloropropane (ug/L)	ND	ND
1,1,2,2-Tetrachloroethane (%)	104	107

Analyses performed in accordance with methods approved by the USEPA.

COMMENT: Tetrachloroethane, reported as percent recovered, is a surrogate.

Respectfully Submitted,

Ward Dickens

Ward Dickens
Organic Laboratory Manager

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ORGANIC REPORT OF ANALYSIS

QUALITY CONTROL DATA
FOR YOUR SAMPLES

Date: 09/14/87

Project Number: NO CHARG

ATTN: Q.C. OFFICER

Laboratory Number: W0909

RE: Sample(s) collected by CH2M HILL on 09/09/87.

Analysis Description	BLANK DATA FOR YOUR SAMPLES
	WATER
EDB (ug/L)	<0.02
Dibromochloropropane (ug/L)	ND
1,1,2,2-Tetrachloroethane (%)	104

Analyses performed in accordance with methods approved by the USEPA.

Respectfully Submitted,

Ward Dickens

Ward Dickens
Organic Laboratory Manager

COMMENT: Tetrachloroethane, reported as percent recovered, is a surrogate.

OLI

Orlando Laboratories, Inc.

P. O. Box 19127 • Orlando, Florida 32814 • 305/896-6645

REPORT OF ANALYSIS

CH2M Hill
Attn: Don Hash
7201 NW 11th Place
Gainesville, Fla. 32602

Report #: 50126 (3747)
Sampled by: Client
Date sampled: Unknown
Date received: 09-02-87
Date reported: 09-15-87
Page 1 of 2

IDENTIFICATION: Samples identified as marked.

Results expressed in pCi/l.

RESULTS OF ANALYSIS

DETERMINATION	GROSS ALPHA Storet #01501	COUNTING ERROR Storet #01502
45861 GDU	11.0	± 11.1
45862 GDU	2.0	± 7.8
	GROSS BETA Storet #03501	**COUNTING ERROR Storet #03502**
45861 GDU	70.9	± 48.0
45862 GDU	<2.3	± 0.1

Results expressed in mg/1 unless otherwise designated. < = Less Than.
Our Florida Department of Health & Rehabilitative Service Identification Number is 83141.

Respectfully submitted,
ORLANDO LABORATORIES, INC.

Monte Boot
Laboratory Manager

Quality Control

CH2M HILL ENVIRONMENTAL LABORATORIES
7201 N.W. 11th Place, P.O. Box 1647
Gainesville, Florida 32602
904/377-2442
State of Florida Certification Nos.: 82112, T82124

Sample No. 45861
Number of Samples: 1
Date Completed: 09/03/87
Date Reported: 09/10/87

REPORT OF ANALYSIS

Page 1 of 2

Client: General Development Utilities
Attention: Leslie Shannon
Address: CH2M HILL Gainesville Office

Project No. SE15807.T2
Received: 08/31/87

Description of Sample: Water Samples
Location: North Port St. Lucie DIW
Collected on 08/30/87 by Leslie Shannon
Sample was iced

EPA Method 601	#45861 Lower Monitor Zone-- Monitor Well (ppb)
Chloromethane	BMDL
Bromomethane	BMDL
Vinyl Chloride	BMDL
Chloroethane	BMDL
Dichloromethane	BMDL
1,1-Dichloroethene	BMDL
1,1-Dichloroethane	BMDL
Trans-1,2-Dichloroethene	BMDL
Chloroform	BMDL
1,2-Dichloroethane	BMDL
1,1,1-Trichloroethane	BMDL
Carbon Tetrachloride	BMDL
Dichlorobromomethane	BMDL
1,2-Dichloropropane	BMDL
Cis-1,3-Dichloropropene	BMDL
Trichloroethene	BMDL
Dibromochloromethane and Trans-1,3,-Dichloropropene and 1,1,2-Trichloroethane	BMDL
2-Chloroethylvinyl Ether	BMDL
Bromoform	BMDL
1,1,2,2-Tetrachloroethene and 1,1,2,2-Tetrachloroethane	BMDL

NOTE: Method Detection Limit = 1 ppb unless specified otherwise
ppb = Parts per billion
BMDL = Below Method Detection Limit

Respectfully submitted,

Laboratory Manager

The information shown on this sheet is test data only and no interpretation of this data is intended or implied.

EPA Method 602	#45861 Lower Monitor Zone-- Monitor Well (ppb)
Tert-Butyl Methyl Ether	BMDL
Benzene	BMDL
Toluene	1.4
Chlorobenzene	BMDL
Ethyl Benzene	BMDL
o-,m- and p-Xylene	BMDL
1,3-Dichlorobenzene	BMDL
1,2-Dichlorobenzene	BMDL
1,4-Dichlorobenzene	BMDL

NOTE: Method Detection Limit = 1 ppb
unless specified otherwise
ppb = Parts per billion
BMDL=Below Method Detection Limit

Respectfully submitted,

Thomas C.
Laboratory Manager

The information shown on this sheet is test data only and no interpretation of this data is intended or implied.

CH2M HILL ENVIRONMENTAL LABORATORIES
7201 N.W. 11th Place, P.O. Box 1647
Gainesville, Florida 32602
904/377-2442
State of Florida Certification Nos.: 82112, T82124

Sample Nos. 45862-45863
Number of Samples: 2
Date Completed: 09/03/87
Date Reported: 09/10/87

REPORT OF ANALYSIS

Page 1 of 2

Client: General Development Utilities
Attention: Leslie Shannon
Address: CH2M HILL Gainesville Office

Project No.: SE15807.T2
Received: 08/31/87

Description of Sample: Water Samples
Location: North Port St. Lucie DIW
Collected on 08/30/87 by Leslie Shannon
Samples were iced

EPA Method 601	#45862 Upper Monitor Zone-- Monitor Well (ppb)	#45863 Travel Blank (ppb)
Chloromethane	BMDL	BMDL
Bromomethane	BMDL	BMDL
Vinyl Chloride	BMDL	BMDL
Chloroethane	BMDL	BMDL
Dichloromethane	BMDL	BMDL
1,1-Dichloroethene	BMDL	BMDL
1,1-Dichloroethane	BMDL	BMDL
Trans-1,2-Dichloroethene	BMDL	BMDL
Chloroform	BMDL	BMDL
1,2-Dichloroethane	BMDL	BMDL
1,1,1-Trichloroethane	BMDL	BMDL
Carbon Tetrachloride	BMDL	BMDL
Dichlorobromomethane	BMDL	BMDL
1,2-Dichloropropane	BMDL	BMDL
Cis-1,3-Dichloropropene	BMDL	BMDL
Trichloroethene	BMDL	BMDL
Dibromochloromethane and 1,1,2-Trichloroethane and Trans-1,3,-Dichloropropene	BMDL	BMDL
2-Chloroethylvinyl Ether	BMDL	BMDL
Bromoform	BMDL	BMDL
1,1,2,2-Tetrachloroethene and 1,1,2,2-Tetrachloroethane	BMDL	BMDL

NOTE: Method Detection Limit = 1 ppb
unless specified otherwise
ppb = Parts per billion
BMDL = Below Method Detection Limit

Respectfully submitted,

Thomas C.
Laboratory Manager

The information shown on this sheet is test data only and no interpretation of this data is intended or implied.

EPA Method 602	#45862 Upper Monitor Zone-- Monitor Well (ppb)	#45863 Travel Blank (ppb)
Tert-Butyl Methyl Ether	BMDL	BMDL
Benzene	BMDL	BMDL
Toluene	1.3	BMDL
Chlorobenzene	BMDL	BMDL
Ethyl Benzene	BMDL	BMDL
o-,m- and p-Xylene	BMDL	BMDL
1,3-Dichlorobenzene	BMDL	BMDL
1,2-Dichlorobenzene	BMDL	BMDL
1,4-Dichlorobenzene	BMDL	BMDL

NOTE: Method Detection Limit = 1 ppb
unless specified otherwise
ppb = Parts per billion
BMDL = Below Method Detection Limit

Respectfully submitted,

Laboratory Manager

The information shown on this sheet is test data only and no interpretation of this data is intended or implied.

GENERAL DEVELOPMENT UTILITIES INC.
1001 PRINEVILLE ROAD
PORT ST. LUCIE, FL. 33452

WATER BACTERIOLOGY REPORT

TYPE OF SAMPLE MONITOR WELL - DEEP WELL INJ - N.PORT - W/W

SAMPLING				TESTING			RESULTS		
SAMPLE NUMBER	DATE	TIME	LOCATION	PLATE NUMBER	DATE	TIME	Cl_2	COLI FORM	NON COLI.
2125			Control Start	C1	8/30/87	6:00pm	-	<1	
2126	8/30/87	1:30pm	Upper Monitor Zone	1	"	"	-	<1	192
2127			Control	C2	"	"	-	<1	
2128	"	1:30pm	Lower Monitor Zone	2	"	"	-	<1	
2129			Control End	C3	"	"	-	<1	

L. SHANNON
TECHNICIAN

Gary Smith
TECHNICIAN

8/31/87 4:00pm
Gary Smith
TECHNICIAN
DATE/TIME

SAMPLE RESULTS SATISFACTORY ☑ UNSATISFACTORY ☐

RECOMMENDATIONS

DATE 9-2-87 SIGNATURE Peter Walch DIRECTOR LAB ID# 56049

CH2M HILL ENVIRONMENTAL LABORATORIES
7201 NW ELEVENTH PLACE
P.O. DRAWER 1647
GAINESVILLE, FLORIDA 32602

STATE OF FLORIDA
CERTIFICATION NUMBER: 82112

10/29/87

REPORT OF ANALYSIS

Sample No. 45928

Client: GDU NORTH PT. ST. LUCIE IW
Attention: LESLIE SHANNON
Address: GNV OFFICE

Project No. SE15807.T2
Received: 09/02/87

Description of Sample:

INJECTION ZONE WATER
Collected on 08/18/87 by LESLIE SHANNON

PARAMETER	45928 GRAB 8.18.87 STATION 1 5:00P
GENERAL	
pH (Units)	7.45
Stability Index (2pHs - pH)	8.77
Total Alkalinity (as CaCO3)	100
Phenolphthalein Alkalinity	0.0
Carbon Dioxide (free)	7.0
Bicarbonates (as HCO3-)	<0.1
Hydroxides (OH-)	<0.1
Color (APHA)	20
Conductivity (umhos/cm)	41,400
Field Conductivity(umhos/cm)	50,000
Calcium Hardness (as CaCO3)	5,880
Magnesium Hardness (as CaCO3)	320
Total Hardness (as CaCO3)	6,200
Carbonate Hardness (as CaCO3)	100
NonCarbonate Hardness, asCaCO3	6100
Turbidity (NTU)	3.5
Odor (TON)	N.O.O.
Saturation Index (pH - pHs)	1.32
Carbonate (as CO3=)	<0.1
ANIONS	
Chloride	19,400
Fluoride	0.50
Sulfate	3400

NOTE: VALUES ARE MG/L UNLESS OTHERWISE STATED.
N.O.O.=NO ODOR OBSERVED.
FIELD CHLORINE = 22,100 MG/L.

Analyses performed in accordance with
methods approved by the USEPA

Respectfully submitted,

Thomas C. Emenhiser

Thomas C. Emenhiser, Laboratory Manager

This information is test data and no interpretation is intended or implied.

End of 1 page report

CH2M HILL
Engineers
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Economists
Scientists

September 3, 1987

Dr. James B. Cowart
Department of Geology
Florida State University
108 Carraway
Tallahassee, FL 32306

Dear Dr. Cowart:

I shipped a 5-gallon injection zone water sample from the General Development Utilities (GDU) North Port St. Lucie injection well by Greyhound Bus today. It is in a large white styrofoam cooler with your phone number on the mailing label.

The sample was taken August 18, 1987 after pumping 58,000 - 78,000 gallons from the injection zone. Although some upper Floridan aquifer water had been pumped down the injection well, the injection zone was pumped out until chlorides and conductivity representative of that zone were obtained. The well configuration at the time of sampling was a 12-inch casing to 2,750 feet and a 12-1/4-inch hole to 3,324 feet.

Please call me at (904) 377-2442 if I can be of any further assistance.

Sincerely,

Leslie Shannon

Leslie Bell Shannon

LBS:cs
xc: Paul Phillips/DER, West Palm Beach
Jeff Lehnen/CH2M HILL

CH2M HILL Gainesville Office 7201 N.W. 11th Place., P.O. Box 1647, Gainesville, Florida 32602 904.377.2442
EasyLink 62508220
Telex 756070

Appendix E
INJECTION WELL CASING TALLY
MONITOR WELL CASING TALLY
CASING MILL CERTIFICATES

Appendix E
INJECTION WELL CASING TALLY

Dia./Thickness	Casing Number	Casing Length	Casing Tally
54.75/0.375	1	--	--
54.75/0.375	2	--	39.88
42/0.500	1	--	--
42/0.500	2	--	--
42/0.500	3	--	--
42/0.500	4	--	--
42/0.500	5	--	--
32/0.500	1	40.00	40.00
32/0.500	2	39.94	79.94
32/0.500	3	40.01	119.95
32/0.500	4	40.04	159.99
32/0.500	5	39.99	199.98
32/0.500	6	40.01	239.99
32/0.500	7	40.02	280.01
32/0.500	8	40.02	320.03
32/0.500	9	39.99	360.02
32/0.500	10	39.96	399.98
32/0.500	11	40.02	440.00
32/0.500	12	40.02	480.02
32/0.500	13	40.02	520.04
32/0.500	14	40.00	560.04
32/0.500	15	40.02	600.06
32/0.500	16	40.02	640.08
32/0.500	17	40.00	680.08
32/0.500	18	40.01	720.09
32/0.500	19	39.99	760.08
32/0.500	20	39.95	800.03
32/0.500	21	40.03	840.06
32/0.500	22	39.99	880.05
22/0.500	1	37.09	37.09
22/0.500	2	40.05	77.14
22/0.500	3	40.05	117.19
22/0.500	4	40.07	157.26
22/0.500	5	40.08	197.34
22/0.500	6	40.02	237.36
22/0.500	7	40.05	277.41
22/0.500	8	40.06	317.47
22/0.500	9	40.04	357.51
22/0.500	10	40.08	397.59
22/0.500	11	40.09	437.68
22/0.500	12	40.10	477.78
22/0.500	13	40.08	517.86
22/0.500	14	40.10	557.96
22/0.500	15	40.05	597.91
22/0.500	16	40.08	637.99

Appendix E (Continued)
INJECTION WELL CASING TALLY

Dia./Thickness	Casing Number	Casing Length	Casing Tally
22/0.500	17	40.08	678.07
22/0.500	18	40.10	718.17
22/0.500	19	40.08	758.25
22/0.500	20	40.09	798.34
22/0.500	21	40.09	838.43
22/0.500	22	40.09	878.52
22/0.500	23	40.08	918.60
22/0.500	24	40.08	958.63
22/0.500	25	40.05	998.73
22/0.500	26	40.10	1,038.83
22/0.500	27	40.10	1,078.93
22/0.500	28	40.08	1,119.01
22/0.500	29	40.09	1,159.10
22/0.500	30	40.09	1,199.19
22/0.500	31	40.08	1,239.27
22/0.500	32	40.08	1,279.35
22/0.500	33	40.08	1,319.43
22/0.500	34	40.07	1,359.50
22/0.500	35	40.04	1,399.54
22/0.500	36	40.08	1,439.62
22/0.500	37	40.07	1,479.69
22/0.500	38	40.08	1,519.77
22/0.500	39	40.09	1,559.86
22/0.500	40	40.06	1,599.92
22/0.500	41	40.07	1,639.99
22/0.500	42	40.07	1,680.06
22/0.500	43	40.07	1,720.13
22/0.500	44	40.10	1,760.23
22/0.500	45	40.08	1,800.31
22/0.500	46	40.08	1,840.39
22/0.500	47	39.97	1,880.36
22/0.500	48	19.95	1,900.31
22/0.500	49	30.03	1,930.34
22/0.500	50	40.09	1,970.43
12.75/0.500	1	43.24	43.24
12.75/0.500	2	43.66	86.90
12.75/0.500	3	44.32	131.22
12.75/0.500	4	43.71	174.93
12.75/0.500	5	43.47	218.40
12.75/0.500	6	43.49	261.89
12.75/0.500	7	44.40	306.29
12.75/0.500	8	44.29	350.58
12.75/0.500	9	44.77	395.35
12.75/0.500	10	43.19	438.54
12.75/0.500	11	44.35	482.89
12.75/0.500	12	38.20	521.09
12.75/0.500	13	43.77	564.86

Appendix E (Continued)
INJECTION WELL CASING TALLY

Dia./Thickness	Casing Number	Casing Length	Casing Tally
12.75/0.500	14	37.48	602.34
12.75/0.500	15	33.95	636.29
12.75/0.500	16	36.31	672.60
12.75/0.500	17	44.81	717.41
12.75/0.500	18	44.95	762.36
12.75/0.500	19	43.16	805.52
12.75/0.500	20	44.72	850.24
12.75/0.500	21	39.58	889.82
12.75/0.500	22	40.00	929.82
12.75/0.500	23	40.01	969.83
12.75/0.500	24	38.49	1,008.32
12.75/0.500	25	40.81	1,049.13
12.75/0.500	26	43.48	1,092.61
12.75/0.500	27	36.94	1,129.55
12.75/0.500	28	42.21	1,171.76
12.75/0.500	29	40.87	1,212.63
12.75/0.500	30	42.30	1,254.93
12.75/0.500	31	43.24	1,298.17
12.75/0.500	32	40.00	1,338.17
12.75/0.500	33	39.94	1,378.11
12.75/0.500	34	39.44	1,417.55
12.75/0.500	35	38.80	1,456.35
12.75/0.500	36	40.01	1,496.36
12.75/0.500	37	40.00	1,536.36
12.75/0.500	38	38.78	1,575.14
12.75/0.500	39	44.92	1,620.06
12.75/0.500	40	44.84	1,664.90
12.75/0.500	41	43.72	1,708.62
12.75/0.500	42	43.82	1,752.44
12.75/0.500	43	44.68	1,797.12
12.75/0.500	44	43.24	1,840.36
12.75/0.500	45	44.33	1,884.69
12.75/0.500	46	44.19	1,928.88
12.75/0.500	47	44.37	1,973.25
12.75/0.500	48	44.49	2,017.74
12.75/0.500	49	43.14	2,060.88
12.75/0.500	50	44.85	2,105.73
12.75/0.500	51	43.12	2,148.85
12.75/0.500	52	34.06	2,182.91
12.75/0.500	53	43.10	2,226.01
12.75/0.500	54	43.40	2,269.41
12.75/0.500	55	44.58	2,313.99
12.75/0.500	56	43.66	2,357.65
12.75/0.500	57	43.23	2,400.88
12.75/0.500	58	43.15	2,444.03
12.75/0.500	59	44.02	2,488.05
12.75/0.500	60	43.21	2,531.26
12.75/0.500	61	43.22	2,574.48
12.75/0.500	62	43.42	2,617.90

Appendix E (Continued)
INJECTION WELL CASING TALLY

Dia./Thickness	Casing Number	Casing Length	Casing Tally
12.75/0.500	63	24.79	2,642.69
12.75/0.500	64	37.39	2,680.08
12.75/0.500	65	31.67	2,711.75
12.75/0.500	66	38.92	2,750.67
12.75/0.500	67	39.41	2,790.08

Appendix E
MONITOR WELL CASING TALLY

Dia./Thickness	Casing Number	Casing Length	Casing Tally
36/0.375	1	40.17	40.17
24/0.500	1	40.03	40.03
24/0.500	2	40.03	80.06
24/0.500	3	40.05	120.11
24/0.500	4	40.06	160.17
24/0.500	5	40.05	200.23
16/0.500	1	36.87	36.87
16/0.500	2	40.38	77.25
16/0.500	3	40.20	117.45
16/0.500	4	40.42	157.87
16/0.500	6	40.34	198.21
16/0.500	7	40.45	238.66
16/0.500	8	40.43	279.09
16/0.500	9	40.32	319.41
16/0.500	10	39.64	359.05
16/0.500	11	40.10	399.15
16/0.500	12	40.29	439.44
16/0.500	13	40.15	479.59
16/0.500	14	40.24	519.83
16/0.500	15	40.28	560.11
16/0.500	17	40.30	600.41
16/0.500	18	40.44	640.85
16/0.500	19	38.09	678.94
16/0.500	20	40.52	719.46
16/0.500	21	40.19	759.65
16/0.500	22	40.24	799.89
16/0.500	23	40.11	840.00
16/0.500	5	40.43	880.43
16/0.500	16	40.28	920.71
16/0.500	24	40.43	961.14
6.625/0.562	1	37.44	37.44
6.625/0.562	2	36.29	73.73
6.625/0.562	3	36.73	110.46
6.625/0.562	4	40.63	151.09
6.625/0.562	5	39.86	190.95
6.625/0.562	6	39.87	230.82
6.625/0.562	7	40.87	271.69
6.625/0.562	8	41.10	312.79
6.625/0.562	9	40.67	353.46
6.625/0.562	10	36.12	389.58
6.625/0.562	11	39.73	429.31
6.625/0.562	12	39.48	468.79
6.625/0.562	13	37.42	506.21
6.625/0.562	14	36.93	543.14

Appendix E (Continued)
MONITOR WELL CASING TALLY

Dia./Thickness	Casing Number	Casing Length	Casing Tally
6.625/0.562	15	36.51	579.65
6.625/0.562	16	43.87	623.52
6.625/0.562	17	41.74	665.26
6.625/0.562	18	43.89	709.15
6.625/0.562	19	43.89	753.04
6.625/0.562	20	43.87	796.91
6.625/0.562	21	40.08	836.99
6.625/0.562	22	41.57	878.56
6.625/0.562	23	37.48	916.04
6.625/0.562	24	42.60	958.64
6.625/0.562	25	44.01	1002.65
6.625/0.562	26	35.93	1038.58
6.625/0.562	27	36.24	1074.82
6.625/0.562	28	37.47	1112.29
6.625/0.562	29	44.21	1156.50
6.625/0.562	30	40.27	1176.77
6.625/0.562	31	37.48	1234.25
6.625/0.562	32	42.28	1277.53
6.625/0.562	33	40.00	1317.53
6.625/0.562	34	43.87	1361.40
6.625/0.562	35	43.34	1404.74
6.625/0.562	36	44.84	1449.58
6.625/0.562	37	44.33	1493.91
6.625/0.562	38	43.19	1537.10
6.625/0.562	39	43.94	1581.04
6.625/0.562	40	44.04	1625.08
6.625/0.562	41	43.92	1669.00
6.625/0.562	42	37.44	1706.44
6.625/0.562	43	43.74	1750.18

L. B. FOSTER COMPANY

Route 1, Box 15
Washington, WV 26181

STANDARD CERTIFIED TEST REPORT TUBULAR PRODUCTS

CUSTOMER

Name Youngquist Brothers Inc.

Address 281 St. James Drive

City & State Port St. Lucie, Florida 33452

Date April 27, 1987

5805

Customer's Order No. Gen. Dev. Utilities Port St. Lucie, St. Lucie County, Fla.

LBF Invoice No. 4BH-082619

Material Fosterweld

Grade ASTM A139 Gr. B

				MECHANICAL PROPERTIES			CHEMICAL ANALYSIS (%)				
Coil or Lot No.	Size O.D.	Wt/Ft. or Wall Thick.	Min. Hydro. Test Pres. P.S.I.	Yield Strength P.S.I. Point	Tensile Strength P.S.I.	Elong. in 2" %	C	Mn	P	S	SI
22718	36"	.375	550	53,500	76,000	34	.21	.75	.012	.010	
55887	42"	.500	630	50,000	80,550	44	.258	.88	.014	.007	
53912	42"	.500	630	54,840	68,940	47	.15	.68	.014	.017	
943008	54.75"	.375	365	43,150	72,120	36.5	.21	.84	.016	.012	

Donald E. Adams

The undersigned, in behalf of The L. B. Foster Company, hereby certifies that the above materials have been inspected and tested in accordance with the methods prescribed in the applicable specifications and the results of such inspection and tests shown above. In determining properties or characteristics for which no methods of inspecting or testing are prescribed by said specifications, the standard mill inspection and testing practices of The L. B. Foster Company have been applied. Unless it appears otherwise in the results of such inspection and tests shown above, the undersigned agent of The L. B. Foster Company believes that said materials conform to said specifications.

Subscribed and sworn to before me
this 27th day of Apr. 19 87

Donald E. Adams
Notary Public

Robert E. Blankensop
Robert E. Blankensop, Office Supervisor
Agents' Name & Title

L. B. Foster Company, Washington, W. Va.

FOSTER

L.B.FOSTER COMPANY

ROUTE 1, BOX 15
WASHINGTON, WEST VIRGINIA 26181
PHONE 304 - 863-3316

May 1, 1987

Youngquist Brothers Inc.
281 St. James Drive
Port St. Lucie, Florida 33452

Re: L.B. Foster Order#43H-052619, Youngquist P.O.#5805

Please be advised that the Heat Numbers which were written on the 42"OD x .500 Wall Fosterweld Pipe (2 pcs. @ 40') are erroneous. The subject heat numbers on the pipe are 55880 & 53915. These heat numbers are non-existent and were written in error by our production people. The correct heat numbers are 55887 & 53912 as shown on the attached test report.

Please accept our apology for any confusion which this may have caused.

Very truly yours,

Robert E Blankensop

Robert E. Blankensop
Office Supervisor

L. B. FOSTER COMPAN'
Route 1, Box 15
Washington, WV 26181

STANDARD CERTIFIED TEST REPORT
TUBULAR PRODUCTS

CUSTOMER

Name: Youngquist Brothers Inc.
Address: 281 St. James Drive
City & State: Port St. Lucie, Florida 33452

Date: April 27, 1987
5805
Customer's Order No. Gen. Dev. Utilities Port St. Lucie, St. Lucie County, Fla.
LBF Invoice No. 43H-052619

Material: Fosterweld
Grade: ASTM A139 Gr.B

Coil or Lot. No.	Size O.D.	Wt/Ft. or Wall Thick.	Min. Hydro. Test Pres. P.S.I.	MECHANICAL PROPERTIES			CHEMICAL ANALYSIS (%)				
				Yield Strength P.S.I. Point	Tensile Strength P.S.I.	Elong. In 2 %	C	Mn	P	S	Si
T22718	36''	.375	550	53,500	76,000	34	.21	.75	.012	.010	
55887	42''	.500	630	50,000	80,550	44	.258	.88	.014	.007	
53912	42''	.500	630	54,840	68,940	47	.15	.68	.014	.017	
943008	54.75''	.375	365	43,150	72,170	36.5	.21	.84	.016	.012	

OFFICIAL SEAL
NOTARY PUBLIC
STATE OF WEST VIRGINIA
Donald E. Adams
Rt. 4, Box 371
Parkersburg, W. Va. 26101
My commission expires August 6, 1996

The undersigned, in behalf of The L. B. Foster Company, hereby certifies that the above materials have been inspected and tested in accordance with the methods prescribed in the applicable specifications and the results of such inspection and tests shown above. In determining properties or characteristics for which no methods of inspecting or testing are prescribed by said specifications, the standard mill inspection and testing practices of The L. B. Foster Company have been applied. Unless it appears otherwise in the results of such inspection and tests shown above, the undersigned agent of The L. B. Foster Company believes that said materials conform to said specifications.

S ed and sworn to before me
7th day of Apr 19 87
onald E Adams
tary Public

Robert E Blankensop
Robert E. Blankensop, Office Supervisor
Agents' Name & Title
L.B. Foster Company, Washington, W.Va.

Form

L. B. FOSTER COMPANY
Route 1, Box 15
Washington, WV 26181

STANDARD CERTIFIED TEST REPORT
TUBULAR PRODUCTS

CUSTOMER

Name Youngquist Brothers Inc.

Address 281 St. James Drive

City & State Port St. Lucie, Florida 33452

Date May 1, 1987

Customer's Order No. Gen. Dev. Utilities Port St. Lucie, St. Lucie County, Fla.

LBF Invoice No. 43K-052619

Material Fosterweld

Grade ASTM A139 Gr. B

				MECHANICAL PROPERTIES			CHEMICAL ANALYSIS (%)				
Coil or Lot No.	Size O.D.	Wt/Ft. or Wall Thick.	Min. Hydro Test Pres. P.S.I.	Yield Strength P.S.I. Point	Tensile Strength P.S.I.	Elong. in 2" %	C	Mn	P	S	Si
79748	32"	.500	656	51,370	70,390	34	.22	.84	.009	.019	
799804	32"	.500	656	51,230	73,430	28.5	.20	.76	.010	.018	
809246	32"	.500	656	56,990	75,730	32.5	.23	.86	.011	.028	
809260	32"	.500	656	49,700	71,170	33	.21	.79	.006	.017	
809283	32"	.500	656	54,760	73,140	28	.25	.81	.008	.020	
953293	32"	.500	656	53,420	70,790	28	.24	.78	.010	.013	

OFFICIAL SEAL
NOTARY PUBLIC
STATE OF WEST VIRGINIA
Donald E. Adams
Rt. 4, Box 311
Parkersburg, W. Va. 26101
My commission expires August 6, 1995

The undersigned, in behalf of The L. B. Foster Company, hereby certifies that the above materials have been inspected and tested in accordance with the methods prescribed in the applicable specifications and the results of such inspection and tests shown above. In determining properties or characteristics for which no methods of inspecting or testing are prescribed by said specifications, the standard mill inspection and testing practices of The L. B. Foster Company have been applied. Unless it appears otherwise in the results of such inspection and tests shown above, the undersigned agent of The L. B. Foster Company believes that said materials conform to said specifications.

Subscribed and sworn to before me
this 1st day of May 19 87

Donald E. Adams

Notary Public

Robert E. Blankensop, Office Supervisor

Agents' Name & Title

L.B. Foster Company, Washington, W.Va.

FOSTER

L.B.FOSTER COMPANY

1051 Winderley Place
Suite 105
Maitland, Florida 32751
(305) 660-1222

May 5, 1987

Youngquist Brothers
281 St. James Drive
Port St. Lucie, Florida 33452

Attention: Mr. Jimmy Brantley

Reference: Your P. O. #5805
Our Invoice #052620-7060 & 6742

Gentlemen:

We produced this pipe in our Savannah, Georgia plant. In past jobs we have furnished large diameter pipe, such as 48" - 54" and 60", which cannot be hydrostatic tested in that facility. We can test thru 32" diameter there but can test thru 84" in our Parkersburg, West Virginia facility.

Due to the limitation of the Savannah plant we have supplied several jobs of large diameter pipe and with mutual agreement have waived the hydrostatic test in the sizes above 32".

The order was entered with the notation "with no hydro" in error and with previous jobs in mind. It is, however, our mill practice to hydrostatic test pipe through the size range of 32" since it can be done easily and at very little cost. The reason we do this is that quite often we will end up with an over-run of pipe and we put this in our yard to sell. Then if we have a sale where we need hydro tested pipe, it is available without having to run it back thru the plant to be tested.

This is to assure you that this pipe has been tested to the requirements of A139 Gr B Specifications.

If I can be of any further help call me at once.

Yours truly,

Milo Culbertson

MILO CULBERTSON - DISTRICT MANAGER

/cb

Rail, Construction, and Tubular Products
Architectural Hardware Products
Bank Equipment Products

L. B. FOSTER COMPANY
P. O. BOX 7796
GARDEN CITY, GA 31418-7796

STANDARD CERTIFIED TEST REPORT
TUBULAR PRODUCTS

CUSTOMER

Name: YOUNGQUIST BROTHERS INC

Address: RR # 3A BOX 502

15000 PINE RIDGE RD

City & State: FT MYERS, FL 33908

Date: MAY 28, 1987

5805

Customer's Order No.: 43H010-052620

LBF Invoice No.

281 ST JAMES DR
ST LUCIE COUNTY
PORT ST LUCIE, FL

Material: FOSTERWELD SPIRAL STEEL PIPE

Grade: ASTM A-139 GR B

Heat No.	Size O.D.	Wall Thick.	Min. Hydro. Test Pres. P.S.I.	MECHANICAL PROPERTIES			CHEMICAL ANALYSIS (%)				
				Yield Strength P.S.I. Point	Tensile Strength P.S.I.	Elong. In 2" %	C	Mn	P	S	Si
42877	22"	500		39,080	63,950	47	.23	.97	.006	.024	
14787				52,614	70,389	33	.19	.60	.019	.016	
534533				49,770	73,233	30	.19	.58	.016	.015	
534539				56,169	71,811	33	.18	.56	.015	.019	
611338				49,059	75,366	30	.18	.53	.022	.019	

The undersigned, in behalf of The L. B. Foster Company, hereby certifies that the above materials have been inspected and tested in accordance with the methods prescribed in the applicable specifications and the results of such inspection and tests shown above. In determining properties or characteristics for which no methods of inspecting or testing are prescribed by said specifications, the standard mill inspection and testing practices of The L. B. Foster Company have been applied. Unless it appears otherwise in the results of such inspection and tests shown above, the undersigned agent of The L. B. Foster Company believes that said materials conform to said specifications.

Subscribed and sworn to before me
this 28th day of May 1987

Notary Public

M. HAROLD ROBINSON
Notary Public, Chatham County, Ga.
My Commission Expires Sept. 3, 1990

Otis R Kessler
OTIS R. KESSLER PLANT MANAGER
Agents' Name & Title

L. B. FOSTER
COMPANY

Form No. SM 648

FOSTER

L.B.FOSTER
COMPANY

1051 Winderley Place
Suite 105
Maitland, Florida 32751
(305) 660-1222

June 1, 1987

Youngquist Brothers
281 St. James Drive
Port St. Lucie, Florida 33452

Attention: Mr. Jimmy Brantley

Reference: Your P. O. #5805
Our Invoice #052620-7060 & 6742

Gentlemen:

This letter is to certify that the 22" x .500 wall pipe that we have furnished to you on the Port St. Lucie job is A-139-B material and has been hydrostatic tested to the ASTM requirements for A-139-B pipe.

Although the test report did not include any hydrostatic test, the mill in fact did test the pipe to 1000 PSI at the time of manufacture. The 1000 PSI is greater than what is required under ASTM A-139-B Spec.

If I can be of any further help please call me at once.

Yours truly,

Milo Culbertson

MILO CULBERTSON - DISTRICT MANAGER

/cb

Sworn to and subscribed before me on this 1st day of June, 1987 at Orlando, Florida.

Corrine M. Blanton

CORRINE M. BLANTON - NOTARY PUBLIC
STATE OF FLORIDA AT LARGE

NOTARY PUBLIC. STATE OF FLORIDA
MY COMMISSION EXPIRES: FEB. 17, 1991.
BONDED THRU NOTARY PUBLIC UNDERWRITERS.

STATE OF PENNSYLVANIA

COUNTY OF ALLEGHENY

RELEASE OR WAIVER OF LIEN

TO WHOM IT MAY CONCERN:

In consideration of the sum of One Dollar ($1.00) and all other good and valuable consideration in hand paid, receipt whereof is hereby acknowledged, L. B. Foster Company, as supplier of Steel Pipe/Invoice 52620-6742 for the improvement of the real property identified as 281 St. James Dr, Port St. Lucie, St. Lucie County, 33452 which was or now is in the course of construction upon the above mentioned premises, and/or for otherwise improving said premises, hereby waives and releases all claims, liens and right to lien, for any and all works, labor and material by L. B. Foster Company performed and furnished in, upon and about said premises under the terms of an order from Youngquist Brothers, Rt 34 Box 502 Pine Ridge Road, Fort Myers, Fl 33908 to and including the 21 day of May, 19 87; and the undersigned hereby acknowledges that all and singular the payments heretofore received and settlements made by Youngquist Bros Ck #12779 @51,001.60 on account of said contract have been and are hereby accepted by the undersigned in full satisfaction of the claims, liens and right to lien so far waived and released, irrespective of the form or forms of such payments and settlements or the manner in which received.

In Witness Whereof, L. B. Foster Company has caused these presents to be subscribed by its duly authorized agent this 2 day of June, 19 87.

L. B. FOSTER COMPANY

BY: ______________________

Sworn to and subscribed before me this 2nd day of June, 19 87.

____
NOTARY PUBLIC

BONNIE L. YEAGER, NOTARY PUBLIC
GREEN TREE BOROUGH, ALLEGHENY COUNTY
MY COMMISSION EXPIRES MAY 6, 1991
Member, Pennsylvania Association of Notaries

OSTER **L.B.FOSTER COMPANY**

REFERENCE BELOW 10 DIGITS WHEN REMITTING

INVOICE 032620- 6742

PAGE 1

43H010

DUNS NO.

ST-09
0AC88

DRAWER CS 198131
ATLANTA, GA 30384-8131

YOUNGQUIST BROS INC
RURAL ROUTE 34 BOX 502
15000 PINE RIDGE ROAD
FT MYERS FL 33903

SHIP TO
YOUNGQUIST BROTHERS
231 ST. JAMES DR.
PORT ST. LUCIE, FL. 33452

VLEDGE TE	CUSTOMER PURCHASE ORDER NO.	CUSTOMER ACCT. NO.	REFER TO LBF INVOICE NO.	ALUM. JOB OR RENTAL NO.	DATE SHIPPED
3-87	5805	098840			05-21-87

FREIGHT				INVOICE TERMS			PAYMENT METHOD	BILL OF LADING WEIGHT
NG	VIA	F.O.B.	PAYMENT	PERCENT	DISCOUNT DAYS	NET DAYS		
RUCKING CO	TRUCK	SP	PPD/ALW	1.00	10	30	NORM	183696

DESCRIPTION	SHIPPED	UOM	UNIT PRICE	UOM	EXTENSION
110-8-32855 22.00 X .500 WALL BLK FOSTERWELD STEEL PIPE A139B MUST BEVEL BOTH END OF PIPE, WITH NO HYDRO, 40 FT. LGTHS. - - JOB: OWNER, GENERAL DEVELOPMENT UTIL., PORT ST. LUCIE, ST. LUCIE COUNTY, FL. CUSTOMER IS G.C. B/L 23487, 23488, 23489, 23490	1600.00	FT	30.65000	FT	49040.
AMOUNT BEFORE TAX					49040.
FLORIDA 5.00000					2452.

CASH DISCOUNT OF 490.40 IF CHECK RECEIVED BY 06-01-87

TOTAL $ 51492.0

ods represented by this invoice were produced in compliance with the Fair Labor Standards Act of 1938 as amended," and all other laws applicable to
this order.

RMS AND CONDITIONS STATED ABOVE AND ON THE REVERSE SIDE HEREOF AND/OR ATTACHED HERETO."

CUSTOMER COPY

United States Steel Corporation

TUBULAR PRODUCTS

TALLURGICAL TEST REPORT

01 0C 78 (REV. 7-78)

CONTRACT NO.

P O. DATE	PURCHASE ORDER NO		
	2-W-2-024 13609-SJK		
SHIPPERS NO.	MILL ORDER NO.	INVOICE NO.	
	BH44595		
VEHICLE IDENTITY		09/23/85	

MAIL TO 3

THIS IS TO CERTIFY THAT THE PRODUCT DESCRIBED HEREIN WAS MFGD., SAMPLED, TESTED, AND/OR INSPD. IN ACCORDANCE WITH THE SPECIFICATION AND FULFILLS REQUIREMENTS IN SUCH RESPECTS.

PREPARED BY THE OFFICE OF:
E.L. BARTOLOTTA Q.A. MGR.

DATE 09/25/85

NO	MATERIAL DESCRIPTION			MATL.	HEAT/ LOT NO.	MIN HYDRO PSI	YIELD STR. PSI	TENSILE STR. PSI	ELONG. % IN 2"	GAGE WIDTH IN	FLAT	BEND
	SIZE	WALL	SPECIFICATION & GRADE									
	12 3/4 OD	.500	API 5L GR B 34TH ED 5/84 ASTM A53-83, ASME SA53 GR B	SMLS 1983	L02941	2060	44700	74400	41.0	1 1/2	OK	
	12 3/4 OD	.500	API 5L GR B 34TH ED 5/84 ASTM A53-83, ASME SA53 GR B	SMLS 1983	N07167	2060	70600	95600	33.0	1 1/2	OK	
	12 3/4 OD	.500	API 5L GR B 34TH ED 5/84 ASTM A53-83, ASME SA53 GR B	SMLS 1983	N07196	2060	45000	72000	39.0	1 1/2	OK	
	12 3/4 OD	.500	ASTM A106-83 GR B ASME SA106 GR B 1983	SMLS	N06713	2060	43000	72500	37.0	1 1/2	OK	

NO	HEAT NO	TYPE	C	MN	P	S	SI	CU	NI	CR	MO	SN	AL	N	V	B	TI	CB	CO
	L02941	HEAT	23	63	016	009													
	L02941	PROD	24	64	017	008													
	N07167	HEAT	23	104	013	014									11				
	N07167	PROD	22	103	011	012									12				
	N07196	HEAT	23	61	012	008													
	N07196	PROD	21	64	010	009													
	N06713	HEAT	24	58	011	013	242												
	N06713	PROD	24	60	012	013	250												

END OF DATA THIS SHEET ***

THESE MILL TEST REPORTS APPLY TO:
YOUR P. O. # 05808
LA BARGE INVOICE #SN140140

DECIMAL POSITIONS FOR ELEMENTS ARE INDICATED BY THE LEFT MARGIN, VERTICAL DOTTED LINE OR DEMICAL POINT.

LaBargepipe&steel
company

CUSTOMER: You uist Brothers Incorporated
15000 Pine Ridge Road
Fort Myers, Florida 33908

DATE: Jun 25, 1987

ORDER NO.: 05808

SHIPPING NO.: 140123

INVOICE NO.:

FORM L15.1A

CERTIFICATE OF TESTS

HEAT NUMBER	FOOTAGE	SIZE	WALL	DESCRIPTION	SPECIFICATIONS
1200	310.84'	12-3/4" OD	.500"	SEAMLESS BLACK STEEL PIPE	API 5L GRADE B
1201	398.33'	12-3/4" OD	.500"	SEAMLESS BLACK STEEL PIPE	API 5L GRADE B

HEAT NUMBER	CHEMICAL ANALYSIS											PHYSICALS			
	LADLE CHECK	C	MN	P	S	SI	CR	Mo				YIELD POINT	TENSILE STRENGTH	% ELONG IN 2"	
1200		.21	.70	.012	.006							43,400	74,000	40.0	
1201		.19	.51	.018	.017							48,000	67,000	44.3	

OTHER TESTS OR REMARKS: ALL OTHER TESTS SATISFACTORY

HEAT TREATMENT: ____________________

BASE MATERIAL: ____________________

HYDRO TEST: ____________________

BENDS: ____________________

LaBARGE REF. NO.: ____________________

LOT NO.: ____________________

M. S. Kelly

M. S. Kelly

I CERTIFY THIS REPORT TO BE TRUE AND CORRECT ACCORDING TO THE RECORDS OF THIS COMPANY.

NIPPON STEEL CORPORATION

INSPECTI CERTIFICATE

(MILL SHEET)

Chiyoda-Ku, Tokyo 100, Japan

Yawata Works: 1-1 Edamitsu1-C'
Yawata Higashi-Ku, shu 805, Japan

H-21252
'86

CONTRACT NO 6-843-N3-5-7-G1141(6)

CUSTOMER CONTROL NO

COMMODITY : SEAMLESS STEEL LINEPIPE

SPECIFICATION : API 5LB7 ASTM A106B7 ASTM A53B (TRIPLE CERTIFIED)

DOCUMENT NO. :

CUSTOMER : L.B.FOSTER CO.,HOUSTON

SHIPPER : C.ITOH & CO., LTD.

SHEET NO. : B000003140

DATE OF ISSUE : 1986-07-14

REFERENCE NO. 497 014300++

Size	No. of Product	XXXXX XXXXX XXXXX LENGTH FEET	Cast No. (Heat No.)	Control No. Test piece No.	Control No. Inspection No.	Direction	G L	Tensile Test XX XX XX XX YS0.5% UNDER-L PSI	Tensile Test Tensile Strength	Tensile Test El (%)	Flattening Test	Sub Size	Impact Test at	Hardness		Hydrostatic Test	Drift Test	N D I	Visual & Dimension	C ×100 Nb ×1000	Si ×100 V ×100	Mn ×100 B ×10000	P ×1000 Ti ×100	S ×1000 sol Al ×1000	Cu ×100 × 100 ×1000	Ni ×100 × 100 ×1000	Cr ×100 × 100 ×1000	Mo ×100 × 100 ×1000	Al ×1000 ×10000	Ceq ×100
				SPEC	MIN. MAX.	L	2	35000	60000	300							LADLE			27	10	29 106	40	50						
				SPEC	MIN. MAX.												CHECK			30	10	29 106	48	58						
12 3/4X.500																														
N12"X0.500"XORL	16		N85628	115029	55759	L	2	40400	68100	430	G					G			G	LADLE 17	17	74	13	2						
		620000																												
																				CHECK 18	16	76	12	3						
																				CHECK 17	16	76	12	3						

GRAND TOTAL

NO.OF PIECES---------------- 16 PIECES

WEIGHT---------------- 18,414 KG

LENGTH---------------- 620,000 FEET

TENSILE TEST SPECIMEN:LONGITUDE:---STRIP

HYDROSTATIC TEST

PRESSURE-------------------MIN 1650 PSI

HOLDING TIME---------------MIN 5 SECONDS

Sheet Control No 119 * 009 1110714005

1 : 1.4" 2 : 2" 3 : 50mm 4 : 4" 8 : 8" B : 5.65 √A F : 5D

G : GOOD

2 : 2.5mm 3 : 3.3mm 5 : 5.0mm 6 : 6.67mm 7 : 7.5mm

G : GOOD

WE HEREBY CERTIFY THAT THE MATERIAL DESCRIBED HEREIN HAS BEEN MADE IN ACCORDANCE WITH THE RULES OF THE CONTRACT.

K. Yamashita

MANAGER, INSPECTION
Yawata Works

検　査　証　明　書
INSPECTION CERTIFICATE

住友金属工業株式会社　和歌山製鉄所
〒640 和歌山市湊1850番地
SUMITOMO METAL INDUSTRIES, LTD.
WAKAYAMA STEEL WORKS
1850 Minato, Wakayama, Japan

証明書番号 Certificate No. ; 3YM00528　頁 Page ; 001　日付 Date ; Y 1986 M 7 D 4

需要家 Customer ; L.B.FOSTER

需要家管理番号 Order No. ;

品名 Commodity ; E.R.W. STEEL API LINE PIPE WITH PLAIN ENDS, BEVELED

注文者 Shipper : SUMITOMO CORPORATION
REFERENCE NO.; 057KEA0145/1

規格 Standard ; API 5L GR.B / ASTM A53 GR.B

H21233
'86

契約番号 Contract No.	寸法 Size ※1 O.D.	W.T.	LENGTH	QUANTITY	NOMINAL NET WEIGHT	ACTUAL NET WEIGHT
6P15S227401	24"	0.500"	40'	38 P 1,520'	86,602 KG 190,753 LBS	86,212 KG 189,894 LBS
作業番号 Mill Work No. WYYW4829						

H-21233

化学成分 Chemical Composition %

製鋼番号 Heat No.	※2	C ×100	Si ×100	Mn ×100	P ×1000	S ×1000	Cu, Cr, Ni, Mo, V, CEQ. = ×100, PCM. = ×1000, B, N, Ca = ×10000 その他元素 Other elements = ×1000	※3
MIN.	L	-	-	-	-	-		
MAX.	L	26	-	115	40	50		
MIN.	C	-	-	-	-	-		
MAX.	C	30	-	120	50	60		
8664221	L	17	11	76	19	10		
	C	17	14	75	16	8		
8666172	L	17	11	75	26	12		
	C	16	14	78	29	12		

引張試験 Tensile Test & 衝撃試験 Impact Test

Lot or Test No.	※4	※5	※6 A	※6 B	※7	※8	降伏点又は耐力 Y.P. or Y.S. (1)	引張強さ T.S. (2)	伸び E.L. % (3)	Y.R. %	溶接部引張 T.S. (Weld) (Avg.)
TENSILE							*10=0.5	*11=S	*12=2"		(BASE)
								*11=S			(WELD)
MIN.	L	T		B		B	35000	60000	295		60000
MAX.						B	-	-	-		-
H1L0001	L	T		B		B	52200	69700	427		83900
H1L0002	L	T		B		B	55800	72800	401		90200

試験・検査 Descriptions of Test	外観・寸法 Visual & Dimensions	水圧 Hydrostatic ※9	へん平 Flattening	溶接部延性 Weld Ductility	曲げ Bending	押しひろげ Flaring, (Drift Expanding)	つば出し Flange	縦圧 Crush	拡大 Expansion	展開 Reverse Flattening	非破壊検査 N.D.I.	ドリフト Drift	ガイドベンド Guided Bend	塗覆装 Coating & Lining	メッキ Galvanized	リバースベンド Reverse Bend
		880 B									*UT					
	GOOD	GOOD	GOOD	GOOD	-	-	-	-	-	-	GOOD	-	-	-	-	-

備考 Remarks
*UT=ULTRASONIC TEST

上記注文品は御指定の規格または仕様に従って製造され、その要求事項を満足していることを証明します。
WE HEREBY CERTIFY THAT THE MATERIAL HEREIN DESCRIBED HAS BEEN MANUFACTURED, INSPECTED AND TESTED IN ACCORDANCE WITH ABOVE STANDARD AND SPECIFICATION AND SATISFIES THE REQUIREMENTS.

技術管理部　品質保証室長
MANAGER OF QUALITY SYSTEM SECTION
QUALITY CONTROL DEPARTMENT

OURITEM No. SH KN KS 7 6096 1270 AA 5000 K 25L8-A53B C 8K U 2 H TKZ P G069 S ST T MF E-10 M 3YM00528E0081 PM07 15 · 10

Note
※1 Unit (単位)
" = Inch, ' = Feet, Space = mm
S = Schedule, M = m
A, B or NB (inch) = Nominal Size
KG = Kg
= Nominal Weight LBS/Feet
SWG or BWG = Gauge
P = Piece, L = Lift,
B = Bundle or Box

※2 L = Ladle (Heat)
C = Lot Check (Product Analysis)
M = Mill Control Check (Mill Control Product Analysis)

※3 Kind of Steel (鋼種)
K = Killed, S = Semikilled
R = Rimmed

※4 L = Lot Test,
M = Mill Control Test

※5 Direction (方向)
L = Longitudinal
T = Transverse
Z = Through Thickness

※6 Sampling Position (採取位置)
(A) T = Top B = Bottom
M = Middle
(B) B = Base Metal (母材部)
W = Weld Metal (溶接部)
H = H.A.Z. (熱影響部)
P = Plate or Coil

※7 Content of Impact Test
E = Absorbed Energy
S = Shear Area
C = Cleavage Area
L = Lateral Expansion

※8 Unit (単位)
(Tensile Test 引張試験)
1,2 = kgf/mm², B = Lbs/in²
H = Hectbars, M = MPa
N = N/mm², S = KSI
T = Ton/in²
(Impact Test 衝撃試験)
K = kgf·m, 2 = Joule/cm²
3 = ft·lbf/in², F = ft·lbf
J = Joule, 1 = kgf·m/cm²
G = ft·lbf/in² Full Size
% = Percent, M = mm, N = inch

※9 Unit (単位)
Hydrostatic Test (水圧試験)
A = atm, B = PSI, M = MPa
C = N/cm², K = kgf/cm²
N = N/mm², P = KPa
R = bar

※10 Determination Method of Yield Strength (降伏強さの測定方法)
A = 0.2% offset
U = Upper Yield Point
L = Lower Yield Point
Numeral (数字) = % Extension Under Load

※11 Type of Specimen (試片形状)
JIS 4 = No 4, 5 = No 5, 1 = No 11
A = No 12A, B = No 12B
C = No 12C, Z = Z3121
F = Full Section P = Plate
S = Strip
R = Round Bar

※12 Gauge Length (標点距離)
MM = mm, " = inch
A = , X̄ or √So

※13 Unit (mm)
Actual Gauge Length

CC-331
'87

CORINTH PIPEWORKS S.A.
WORK TEST CERTIFICATE

COPY

MILL'S INSPECTION CERTIFICATE

Head Office : 10, Merlin str.
GR 106 71 Athens - Greece
TEL. (1) 36 37 646, 36 28 995,
36 10 637
TELEX : (21) 4088 SOCO GR

Plant: Corinth - GREECE
TEL. (741) 22 923, 22 902
TELEX : (23) 2150 SOCO GR

CREDIT No.140-LCI-005347

Contract No. : P.O. No.PT-1252

Commodity : ERW BLACK STEEL PIPE API 5L X42/ 5LB/ASTM A53B TRIPLE CERTIFIED,

Specification : PLAIN BEVELLED ENDS AS PER P.O. NO.PT-1252.

Size : 16" X 0.500" (82.77)

Weight : M.T. 55.415

Tatal Length : FEET 1,476 PCS 37

Customer : C.ITOH PIPE AND TUBE INC.
1001 FANNIN ST.,SUITE 2450 HOUSTON, TEXAS 77002/USA

Shipper : CORINTH PIPEWORKS S.A.

Sheet No. : 087

Date of Issue : DECEMBER 9,1986

HEAT NO	Y.P.	T.S.	A% GL	WELD TEST			FLATENING TEST *	HYDRO TEST **		CHEMICAL COMPOSITION % ***								REMARKS
										C X 100	Mn X 100	P X1000	S X1000					
15855	53411	65022	42.8	65859			G	G		11.9	93.3	5	3					PRODUCTION NO. 4
181254	51536	65166	42.7	71970			G	G		16.0	92.4	8	2					" " 5
20784	52505	66707	41.1	64440			G	G		10.8	100.2	14	4					" " 6,7,8

Reviewed/Released/
~~Witnessed by~~
OODY-TOTTRUP INT'L
15.12.86.

SURVEYOR

- * TEST CARRIED ON 100% OF COILS
- ** TEST CARRIED ON 100% OF PIPES AT 2230PSI
- *** CHECK ANALYSIS

WE HEREBY CERTIFY THAT THE MATERIAL DESCRIBED HEREIN HAS BEEN MADE IN ACCORDANCE WITH THE RULES OF THE CONTRACT.

Y. P. = YIELD POINT
T. S. = TENSILE STRENGTH
A% = ELONGATION %
GL = GAGE LENGTH
G = GOOD

CORINTH PIPEWORKS S.A.
HELLENIC LARGE DIAMETER STEEL PIPES
[illegible] G INDUS[illegible]
[illegible] STREET, AT[illegible]S
TEL 36.37.646 TELEX 214088

QUALITY CONTROL MANAGER
J. AVAGIANOS

CC-331
'87

CORINTH PIPEWORKS S.A.

WORK TEST CERTIFICATE

MILL'S INSPECTION CERTIFICATE

Head Office : 10, Merlin str.
GR 106 71 Athens - Greece
TEL. (1) 36 37 646, 36 28 995,
36 10 637
TELEX : (21) 4088 SOCO GR

Plant: Corinth - GREECE
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CREDIT No.140-LCI-005347

Contract No. : P.O. No.PT-1252

Commodity : ERW BLACK STEEL PIPE API 5L X42/ 5LB/ASTM A53B TRIPLE CERTIFIED,

Specification : PLAIN BEVELLED ENDS AS PER P.O. NO.PT-1252.

Customer : C.ITOH PIPE AND TUBE INC.
1001 FANNIN ST.,SUITE 2450 HOUSTON, TEXAS 77002/USA

Shipper : CORINTH PIPEWORKS S.A.

Size : 16" X 0.500" (82.77)

Weight : M.T. 55.415

Tatal Length : FEET 1,476 PCS 37

Sheet No. : 087

Date of Issue : DECEMBER 9,1986

HEAT NO	Y. P.	T. S.	A % GL	WELD TEST				FLATTENING TEST *	HYDRO TEST **		CHEMICAL COMPOSITION % ***								REMARKS
											C X 100	Mn X 100	P X1000	S X1000					
15855	53411	65022	42.8	65859				G	G		11.9	93.3	5	3					PRODUCTION NO. 4
181254	51536	55166	42.7	71970				G	G		16.0	92.4	8	2					" " 5
20784	52505	66707	41.1	54440				G	G		10.8	100.2	14	4					" " 6,7,8

Reviewed/Released/
~~Witnessed by~~
ODY-TOTTRUP INT'L
GMBraithwaite
15.12.86.

- * TEST CARRIED ON 100% OF COILS
- ** TEST CARRIED ON 100% OF PIPES AT 2230PSI
- *** CHECK ANALYSIS

Y. P. = YIELD POINT
T. S. = TENSILE STRENGTH
A% = ELONGATION %
GL = GAGE LENGTH
G = GOOD

CORINTH PIPEWORKS S.A
G INDUS
STREET, ATHENS
TEL 36.37.646 TELEX 214088

QUALITY CONTROL MANAGER
J. AVAGIANOS

SURVEYOR

WE HEREBY CERTIFY THAT THE MATERIAL DESCRIBED HEREIN HAS BEEN MADE IN ACCORDANCE WITH THE RULES OF THE CONTRACT.

CORINTH PIPEWORKS S.A.

WORK TEST CERTIFICATE

NEW ADDRESS
10 MERLIN STR.
GR - 106 71 ATHENS
GREECE

MILLS INSPECTION CERTIFICATE

Head Office : 58, Panepistimiou St.
ATHENS - GREECE
TEL. (1) 3637646
TELEX : (21) 4088 SOCO GR.

Plant : Corinth - GREECE
TEL. (741) 22.923

CREDIT No.140-LCI-004859

Contract No.: P.O. No.PT-1181

Commodity : ERW BLACK STEEL PIPE API 5L X42/5LB/ASTM A53 B TRIPLE CERTIFIED, PLAIN BEVELLED ENDS AS PER

Specification : P/O No.PT-1181

Customer : C.ITOH PIPE AND TUBE INC
1001 FANNIN STREET/SUITE 2450/HOUSTON TEXAS 77002/USA

Shipper : CORINTH PIPEWORKS S.A.

Size : OD 16" x 0.500"

Weight : M.T. 36.643

Total Length : FEET 976 PCS 25

Sheet No : 024

Date of Issue : AUGUST 20,1985

HEAT No	Y. P. PSI	T. S. PSI	A% GL 2"	WELD TEST				FLATTENING TEST*	HYDRO TEST**		CHEMICAL COMPOSITION % ***								REMARKS
											C X 100	Mn X 100	P X1000	S X1000					
179714	51771	63927	38.2	69286				G	G		11.9	93.7	10	9					

* TEST CARRIED ON 100% OF COILS
** TEST CARRIED ON 100% OF PIPES AT 2230PSI
*** CHECK ANALYSIS

Y. P. = YIELD POINT
T. S. = TENSILE STRENGTH
A% = ELONGATION %
GL = GAGE LENGTH
G = GOOD

SURVEYOR

WE HEREBY CERTIFY THAT THE MATERIAL DESCRIBED HEREIN HAS BEEN MADE IN ACCORDANCE WITH THE RULES OF THE CONTRACT.

CORINTH PIPEWORKS S.A.
ATHENS
TEL. 36.37.646 TELEX 214088

QUALITY CONTROL MANAGER

AVAGIANOS

Laburgepipe&steel company

CUSTOMER: Young 'st Brothers Incorporated
15000 ne Ridge Road
Fort Myers, Florida 33908

DATE: July , 1987

ORDER NO.: Verbal-Jimmy

SHIPPING NO.: 140825

INVOICE NO.: 206895

FORM L15.1A

CERTIFICATE OF TESTS

HEAT NUMBER	FOOTAGE	SIZE	WALL	DESCRIPTION	SPECIFICATIONS
1345	950.60'	6-5/8" OD	.562"	SEAMLESS BLACK STEEL PIPE	ASTM A-106 GRADE B

COPY ONLY

HEAT NUMBER	CHEMICAL ANALYSIS											PHYSICALS			
	LADLE CHECK	C	MN	P	S	SI	CR	Mo				YIELD POINT	TENSILE STRENGTH	% ELONG IN 2"	HYDRO
1345		.17	.43	.016	.014	.21						55,000	70,000	32.1	2800

OTHER TESTS OR REMARKS: FLATTENING TESTS SATISFACTORY

EAT TREATMENT: ______

ASE MATERIAL: ______

YDRO TEST: ______

BENDS: OK

LaBARGE REF. NO.: ______

LOT NO.: ______

M. S. Kelly

M. S. Kelly

I CERTIFY THIS REPORT TO BE TRUE AND CORRECT ACCORDING TO THE RECORDS OF THIS COMPANY.

Labargepipe&steel
company

CUSTOMER: Young ist Brothers Incorporated
15000 ne Ridge Road
Fort Myers, Florida 33908

DATE: July , 1987

ORDER NO.: Verba- Jimmy

SHIPPING NO.: 140825

INVOICE NO.: 206895

FORM L15.1A

CERTIFICATE OF TESTS

HEAT NUMBER	FOOTAGE	SIZE	WALL	DESCRIPTION	SPECIFICATIONS
1345	950.60'	6-5/8" OD	.562"	SEAMLESS BLACK STEEL PIPE	ASTM A-106 GRADE B

COPY ONLY

HEAT NUMBER	CHEMICAL ANALYSIS											PHYSICALS			
	LADLE CHECK	C	MN	P	S	SI	CR	Mo				YIELD POINT	TENSILE STRENGTH	% ELONG IN 2"	HYDRO
1345		.17	.43	.016	.014	.21						55,000	70,000	32.1	2800

OTHER TESTS OR REMARKS: FLATTENING TESTS SATISFACTORY

HEAT TREATMENT: ____________________

BENDS: OK

BASE MATERIAL: ____________________

LaBARGE REF. NO.: ____________________

HYDRO TEST: ____________________

LOT NO.: ____________________

M. S. Kelly

M. S. Kelly

I CERTIFY THIS REPORT TO BE TRUE AND CORRECT ACCORDING TO THE RECORDS OF THIS COMPANY.

LaBurge pipe&steel company

CUSTOMER: Young [illegible]st Brothers Incorporated
15000 [illegible]ne Ridge Road
Fort Myers, Florida 33908

DATE: July , 1987

ORDER NO.: Verbal-Jimmy

SHIPPING NO.: 140825

INVOICE NO.: 206895

FORM L15.1A

CERTIFICATE OF TESTS

HEAT NUMBER	FOOTAGE	SIZE	WALL	DESCRIPTION	SPECIFICATIONS
1345	950.60'	6-5/8" OD	.562"	SEAMLESS BLACK STEEL PIPE	ASTM A-106 GRADE B

COPY ONLY

HEAT NUMBER	CHEMICAL ANALYSIS											PHYSICALS			
	LADLE CHECK	C	MN	P	S	SI	CR	Mo				YIELD POINT	TENSILE STRENGTH	% ELONG IN 2"	HYDRO
1345		.17	.43	.016	.014	.21						55,000	70,000	32.1	2800

OTHER TESTS OR REMARKS: FLATTENING TESTS SATISFACTORY

HEAT TREATMENT:

BASE MATERIAL:

HYDRO TEST:

BENDS: OK

LaBARGE REF. NO.:

LOT NO.:

M. S. Kelly

M. S. Kelly

I CERTIFY THIS REPORT TO BE TRUE AND CORRECT ACCORDING TO THE RECORDS OF THIS COMPANY.

1-684- SSR

検査証明書
INSPECTION CERTIFICATE

10 住友金属工業株式会社 鋼管製造所
SUMITOMO METAL INDUSTRIES, LTD.
STEEL TUBE WORKS
1, Nishino-cho, Higashi-mukojima, Amagasaki, Japan

証明書番号 Certificate No. BYYF 2179
日付 Date MAY.14,198
注文者 Shipper 009 438 278300++ C. ITOH & CO., LTD
需要家 Customer
品名 Commodity STEEL PIPE FOR HGH TEMPERATURE SERVICE (HOT-FINISHED) NOS
規格 Standard ASTM A106 GR.B / ASTM A53 GR.B ASME SA106 GR.B
仕様書 Specification

NOTES

作業番号 Mill Work No.	外径 O.D.	内径 I.D.	肉厚 W.T.	長さ Length	本数 No. of pcs.	総ベ長さ Total Length	重量 Weight (kg)	需要家管理番号 Order No. or Job No.
BYYF2179	6-5/8"		0.562"	36F-40F	21	786-4 F	12991	

化学成分 Chemical Composition %

製鋼番号 Heat No.		C	Si	Mn	P	S	Cu	Ni	Cr	Mo
min.		–	10	29	–	–				
max.		22	–	106	048	058				
J714014	L	22	20	65	021	012				
	P	~~21~~	~~19~~	~~62~~	~~017~~	~~009~~				
		22	20	62	018	009				

引張試験 Tensile Test G.L. 2"

試番 Lot or T.P. No.			耐力又は降伏点 Y.S. or Y.P.	引張強さ T.S.	伸び %
			35000	60000	30
			–	–	–
	LS	P	39800	69000	40

硬さ Hardness
衝撃試験 Impact Test

試験・検査 Description of Tests

外観・寸法 Dimension	水圧試験 Hydrostatic Test 圧力 Pressure	結果 Result	へん平 Flattening	押し広げ Flaring	曲げ Bending	Ring Expansion	Ring Tensile	Flange
GOOD	2800	GOOD	GOOD					

リングゲージ Ring Gauge	ドリフト Drift

上記注文品は指定の規格および仕様に従って製造され、その要求事項を満足していることを証明します。

WE HEREBY CERTIFY THAT THE MATERIAL HEREIN DESCRIBED HAS BEEN MANUFACTURED, INSPECTED AND TESTED IN ACCORDANCE WITH ABOVE STANDARD AND SPECIFICATION AND SATISFIES THE REQUIREMENTS.

住友金属工業株式会社 鋼管製造所
SUMITOMO METAL INDUSTRIES, LTD.
STEEL TUBE WORKS
技術部 品質保証室長
Manager of Quality Assurance Section

THESE MILL TEST REPORTS APPLY TO:
OUR P. O. # VERBAL Jimmy
LA BARGE INVOICE # 206951
FILED
ORIGINAL MILL TEST REPORT

15684-5SK

Dalmine D

CERTIFICATO DI COLLAUDO D'OFFICINA

Work's test certificate - Abnahmeprüfzeugnis B (DIN 50049 3.1.B)
Certificat d'épreuves d'usine

N. 05311 fg. 001 di 001

Stabilimento di DALMINE
REPARTO COLLAUDO
Inspection Dpt. - Abnahmeabteilung
Départ de réception

Cliente - Customer - Kunde - Client: TAD-USA INC.
1010 RANKIN ROAD HOUSTON, TEXAS USA

Ordine del Cliente - Customer's order - Bestellung - Commande du Client: 2517 23 EH/FE/P12627

Commessa - Mill order - Unsere Auftragsbestätigung - Notre Confirmation de Commande: N. 1002267 /001

Norma di collaudo - Test specification - Abnahmenorm - Spécification: ASTM A 106 - ASTM A 53 / A.P.I. 5 L

Acciaio - Steel - Stahl - Acier: GR. B

Dimensioni - Dimensions - Abmessungen - Dimensions: 6" X .562
168.3 X 14.27
11000-13500

Prova Test Probe Epreuve N.	Provetta - Test specimen - Probestab - Eprouvette: Dimensioni Dimensions Abmessungen Dimensions	Sezione Section Querschn. Section	Lungh. Length Länge Longueur	Trazione - Tension - Zugversuch - Traction: Snervamento Yield Streckgrenze Limit. apparent d'élasticité KSI: Richiesto Required Vorgesch. Demandé Min	Max	Otten. Result Ermitt. Obtenu	Rottura Tensile Strength Zugfestigkeit Rupture KSI: Richiesto Required Vorgesch. Demandé Min	Max	Otten. Result Ermitt. Obtenu	Allungamento Elongation Dehnung Allongement % Lo 2 I: Richiesto Required Vorgesch. Demandé Min	Otten. Result Ermitt. Obtenu	Allargamento - Flaring test - Aufweitung - Evasement	Bordatura - Flange test - Bördelversuch - Rabattement de collerette	Schiacciamento - Flatt. test - Ringfaltversuch - Aplatissement	Piegamento - Bend test - Faltversuch - Pliage	Mandrinatura anello - Ring expanding test - Ringaufdornversuch - Mandrinage anneau	Trazione anello - Ring tensile test - Ringzugversuch - Traction anneau	Resilienza - Impact test - Kerbschlagzähigkeit - Résilience: Dimensioni Dimensions Abmessungen Dimensions	Temp. °C	Direzione Orientation Richt. Direct.	Richiesto Required Vorgesch. Demandé Min	Media	Ottenuto Result Ermittelt Obtenu
1102	25.4x15.4	394.7	50	35		50.3	60		75.7	30	39			OK									

THESE MILL TEST REPORTS APPLY TO:
YOUR P. O. # VERBAL Jimmy
LA BARGE INVOICE # 206951

*** 253
LENGTH : 11000 - 13500
SEAMLESS HOT FINISHED PIPES
VISUAL AND DIMENSIONAL CONTROL OF TUBES WITH SATISFACTORY RESULT
THE STEEL IS FULLY KILLED AND PRODUCED BY ELECTRIC FURNACE
ALL TUBES HAVE PASSED HYDROSTATIC TEST PRESSURE AT 193 BARS (2800 PSI)
CEQ% = C + MN/6 + CR+MO+V/5 + NI+CU/15 = 0.43% MAX. - C% 0.27% MAX.

Prova Test Probe Epreuve	Colata Heat Schmelze Coulée N.	Analisi chimica di colata - Heat analysis - Schmelzanalyse - Analyse chimique de coulée: C%	MN%	SI%	P%	S%	NI%	CR%	MO%	CU%	V%	CEQ%	Mill-control Tensile test: Yield strength	Tensile strength	Elong
	962888	0.19	0.74	0.25	0.016	0.025	0.11	0.13	0.02	0.27	.005	0.38			
		PRODUCT ANALYSIS													
		0.20	0.73	0.26	0.016	0.024	0.11	0.15	0.02	0.27	.005	0.39			
		0.20	0.73	0.26	0.016	0.025	0.11	0.15	0.02	0.27	.005	0.39			

Avviso di spedizione: E1200595 DEL 23/12/86
Quantità - Quantity - Menge - Quantité
N. 12 m 140.520 Kg. 8.497.000
Ft 461.7 Lbs 18732.0

Allegati - Enclosures - Anlagen - Annexes

Data - Date - Datum - Date: 23 12 86

DALMINE S.p.A.
Il Capo Collaudo - Chief Inspection Dpt. - Chef der Abnahmeabteilung - Le Chef de la réception
D.L. 137613

1 N/mm² = 1 MPa; 1 bar = 10⁵ Pa

C7061385 E1200595 001 054 00 001

Mod. QUA/064 HD - ARES TREVIOLO BG 1989

1. 84-85K

検　査　証　明　書
INSPECTION CERTIFICATE

[10] 住友金属工業株式会社　鋼管製
SUMITOMO METAL INDUSTRIES,LTD.
STEEL TUBE WORKS
1, Nishino-cho, Higashi-mukojima, Amagasaki, Japan

明書番号 ertificate No. BYYF 2179

日付 Date MAY.14,198

文者 hipper 009 438 278300++ C. ITOH & CO.,LTD

需要家 ustomer

品名 ommodity TEEL PIPE FOR HIGH TEMPERATURE SERVICE (HOT-FINISHED) NOS

規格 Standard ASTM A106 GR.B / ASTM A53 GR.B
ASME SA106 GR.B

仕様書 Specification

OTES

作業番号 Mill Work No.	外径 O.D.	内径 I.D.	肉厚 W.T.	長さ Length	本数 No. of pcs.	総長さ Total Length	重量 Weight (kg)	需要家注文番号 Order No. or Job No.
BYYF2179	6-5/8"		0.562"	36F-40F	21	786.4 F	12991	

製鋼番号 Heat No.		C	Si	Mn	P	S	Cu	Ni	Cr	Mo	試番 Lot or T.P. No.		Y.S. or Y.P.	T.S.	El. %
	min.	-	10	29	-	-							35000	60000	30
	max.	22	-	106	048	058							-	-	-
J714014	L	22	20	65	021	012						LS P	39800	69000	40
	P	~~21~~	~~19~~	~~62~~	~~017~~	~~009~~									
		22	20	62	018	009									

Tensile Test G.L. 2"

THESE MILL TEST REPORTS APPLY TO:
OUR P. O. # Verbal Jimmy
LA BARGE INVOICE # 206951

FILED
ORIGINAL MILL TEST REPORT

試験・検査 Description of Tests

外観・寸法 Dimension	水圧試験 Hydrostatic Test 圧力 Pressure	結果 Result	へん平 Flattening	押し広げ Flaring	曲げ Bending	リング拡大 Ring Expansion	リング引張 Ring Tensile	つば出し Flange
GOOD	P 2800	GOOD	GOOD					

リングゲージ Ring Gauge	ドリフト Drift

上記注文品は指定の規格および仕様に従って製造され、その要求事項を満足していることを証明します。

WE HEREBY CERTIFY THAT THE MATERIAL HEREIN DESCRIBED HAS BEEN MANUFACTURED, INSPECTED AND TESTED IN ACCORDANCE WITH ABOVE STANDARD AND SPECIFICATION AND SATISFIES THE REQUIREMENTS.

住友金属工業株式会社 鋼管製造
SUMITOMO METAL INDUSTRIES
STEEL TUBE WORKS
技術部 品質保証課長
Manager of Quality Assurance Secti

3684 - SSK

Dalmine D

CERTIFICATO DI COLLAUDO D'OFFICINA

Work's test certificate - Abnahmeprüfzeugnis B (DIN 50049 3.1.B)
Certificat d'epreuves d'usine

N. 05511 fg. 001 di 001

Stabilimento di DALMINE
REPARTO COLLAUDO
Inspection Dpt. - Abnahmeabteilung
Répart de réception

Cliente / Customer / Kunde / Client: TAD-USA INC.
1010 RANKIN ROAD HOUSTON, TEXAS USA

Ordine del Cliente - Customer's order / Bestellung - Commande du Client: 2517 P3 FU/EE/P12627

Commessa - Mill order / Unsere Auftragsbestätigung - Notre Confirmation de Commande: N. 1042167 /001

Norma di collaudo - Test specification / Abnahmenorm - Specification: ASTM A 106 - ASTM A 53 A.P.I. 5 L

Acciaio - Steel - Stahl - Acier: GR. B

Dimensioni - Dimensions / Abmessungen - Dimensions: 6" X .562 168.3 x 14.27 1-000-13500

Prova Test Probe Epreuve N.	Provetta - Test specimen / Probestab - Eprouvette: Dimensioni Dimensions Abmessungen Dimensions	Sezione Section Quersch. Section	Lungh. Length Länge Longueur	Trazione - Tension - Zugversuch - Traction: Snervamento Yield Streckgrenze Limit. apparent d'élasticité KGF Richiesto Required Vorgesch. Demandé Min	Max	Otten. Result Ermitt. Obtenu	Rottura Tensile Strength Zugfestigkeit Rupture KGF Richiesto Required Vorgesch. Demandé Min	Max	Otten. Result Ermitt. Obtenu	Allungamento Elongation Dehnung Allongement % Lo 2 I Richiesto Required Vorgesch. Demandé Min	Otten. Result Ermitt. Obtenu	Allargamento - Flaring test / Aufweitung - Evasement	Bordatura - Flange test / Bördelversuch / Rabattement de collerette	Schiacciamento - Flatt. test / Ringfaltversuch / Aplatissement	Piegamento - Bend test / Faltversuch - Pliage	Mandrin. anello - Ring expanding test / Ringaufdornversuch / Mandrinage anneau	Trazione anello - Ring tensile test / Ringzugversuch / Traction anneau	Resilienza - Impact test / Kerbschlagzähigkeit - Resilience: Dimensioni Dimensions Abmessungen Dimensions	Temp. °C	Direzione Orientation Richt. Direct.	Richiesto Required Vorgesch. Demandé Min	Media	Ottenuto Result Ermittelt Obtenu
4092	25.4x15.4	394.7	50	35		50.3	60		75.7	30	39			OK									

THESE MILL TEST REPORTS APPLY TO:
OUR P. O. # VERBAL Jimmy
LA BARGE INVOICE # 206951

*** 253
LENGTH : 11000 - 13500
SEAMLESS HOT FINISHED PIPES
VISUAL AND DIMENSIONAL CONTROL OF TUBES WITH SATISFACTORY RESULT
THE STEEL IS FULLY KILLED AND PRODUCED BY ELECTRIC FURNACE
ALL TUBES HAVE PASSED HYDROSTATIC TEST PRESSURE AT 193 BARS (2800 PSI)
CEQ% = C + MN/6 + CR+MO+V/5 + NI+CU/15 = 0.43% MAX. - C% 0.27% MAX.

Prova Test Probe Epreuve	Colata Heat Schmelze Coulée N.	Analisi chimica di colata - Heat analysis - Schmelzanalyse - Analyse chimique de coulée: C%	MN%	SI%	P%	S%	NI%	CR%	MO%	CU%	V%	CEQ%	Mill-control Tensile test: Yield strenght	Tensile strenght	Elong
	962888	0.19	0.74	0.25	0.016	0.015	0.11	0.13	0.02	0.27	.005	0.36			
		PRODUCT ANALYSIS													
		0.20	0.73	0.25	0.016	0.014	0.11	0.15	0.02	0.27	.005	0.39			
		0.20	0.73	0.26	0.016	0.015	0.11	0.15	0.02	0.27	.005	0.39			

Avviso di spedizione: E1200545 DEL 23/12/86
Quantità - Quantity - Menge - Quantité
N. 12 m 140.520 Kg. 8494.000
Ft 461.7 Lbs 18737.0

Allegati / Enclosures / Anlagen / Annexes

HM

Data - Date - Datum - Date: 23.12.86

DALMINE S.p.A.
Il Capo Collaudo - Chief Inspection Dpt.
Chef der Abnahmeabteilung - Le Chef de la réception
B. 1 1326 I

1 N/mm² = 1 MPa; 1 bar = 10^5 Pa

C7061305 E1200505 001 US4 00 001

Mod. QUA/084 MC - ARES TREVIOLO BG 1989

3684-83K

検査証明書
INSPECTION CERTIFICATE

10 住友金属工業株式会社 鋼管製造所
SUMITOMO METAL INDUSTRIES.LTD.
STEEL TUBE WORKS
1. Nishino-cho. Higashi-mukojima. Amagasaki. Japan

明書番号 Certificate No. BYYF 2179

日付 Date MAY.14,198

注文者 Shipper 009 438 278300++ C. ITOH & CO.,LTD

需要家 Customer

品名 Commodity EEL PIPE FOR HIGH TEMPERATURE SERVICE (HOT-FINISHED)
NOS

規格 Standard ASTM A106 GR.B / ASTM A53 GR.B
ASME SA106 GR.B

仕様書 Specification

NOTES

作業番号 Mill Work No.	外径 O.D.	内径 I.D.	肉厚 W.T.	長さ Length	本数 No. of pcs.	延べ長さ Total Length	重量 Weight (kg)	需要家管理番号 Order No. or Job No.
BYYF2179	6-5/8"		0.562"	36F-40F	21	786.4 F	12991	

製鋼番号 Heat No.		C	Si	Mn	P	S	Cu	Ni	Cr	Mo
min.		–	10	27	–	–				
max.		22	–	106	048	058				
J714014	L	22	20	65	021	012				
	P	21	19	62	017	009				
		22	20	62	018	009				

引張試験 Tensile Test G.L. 2"

試番 Lot or T.P. No.			降伏点又は耐力 Y.S. or Y.P.	引張強さ T.S.	伸び %	かたさ Hardness	衝撃試験 Impact Test
			35000	60000	30		
			–	–	–		
	LS	P	39800	69000	40		

試験・検査 Description of Tests

外観・寸法 Dimension	水圧試験 Hydrostatic Test 圧力 Pressure	結果 Result	へん平 Flattening	押し広げ Flaring (Cone Expansion)	曲げ Bending	リング拡大 Ring Expansion	リング引張 Ring Tensile	つば出し Flange
GOOD	P 2800	GOOD	GOOD					

リングゲージ Ring Gauge	ドリフト Drift

THESE MILL TEST REPORTS APPLY TO:
OUR P. O. # Verbal Jimmy
LA BARGE INVOICE # 206951
FILED
ORIGINAL MILL TEST REPORT

上記注文品は指定の規格および仕様に従って製造され、その要求事項を満足していることを証明します。

WE HEREBY CERTIFY THAT THE MATERIAL HEREIN DESCRIBED HAS BEEN MANUFACTURED, INSPECTED AND TESTED IN ACCORDANCE WITH ABOVE STANDARD AND SPECIFICATION AND SATISFIES THE REQUIREMENTS.

住友金属工業株式会社 鋼管製造所
SUMITOMO METAL INDUSTRIES
STEEL TUBE WORKS
技術部 品質保証室長
Manager of Quality Assurance Section

136 1-SSR

Dalmine D

CERTIFICATO DI COLLAUDO D'OFFICINA

Work's test certificate - Abnahmeprüfzeugnis B (DIN 50049 3.1.B)

Certificat d'épreuves d'usine

N. 05511 fg. 001 di 001

Stabilimento di DALMINE

REPARTO COLLAUDO

Inspection Dpt. - Abnahmeabteilung

Réparl de réception

Cliente / Customer / Kunde / Client: TAD-USA INC.
1010 [illegible] ROAD HOUSTON, TEXAS USA

Ordine del Cliente - Customer's order / Bestellung - Commande du Client: 2517 23 [illegible] P12627

Commessa - Mill order / Unsere Auftragsbestätigung - Notre Confirmation de Commande: N. 1002267 1001

Norma di collaudo - Test specification / Abnahmenorm - Specification: ASTM A 106 - ASTM A 53 / A.P.I. 5 L

Acciaio - Steel - Stahl - Acier: GR. B

Dimensioni - Dimensions / Abmessungen - Dimensions: 6" X .562 / 168.3 x 14.27 / 11000-13500

Prova / Test / Probe / Epreuve N.	Provetta - Test specimen / Probestab - Eprouvette: Dimensioni / Dimensions / Abmessungen / Dimensions	Sezione / Section / Quers ch. / Section	Lungh. / Length / Länge / Longueur	Trazione - Tension - Zugversuch - Traction: Snervamento / Yield / Streckgrenze / Limit. apparent. d'élasticité KSI — Richiesto / Required / Vorgesch. / Demandé Min	Max	Otten. / Result / Ermitt. / Obtenu	Rottura / Tensile Strength / Zugfestigkeit / Rupture KSI — Richiesto / Required / Vorgesch. / Demandé Min	Max	Otten. / Result / Ermitt. / Obtenu	Allungamento / Elongation / Dehnung / Allongement % Lo 2" — Richiesto / Required / Vorgesch. / Demandé Min	Otten. / Result / Ermitt. / Obtenu	Allargamento - Flaring test / Aufweitung - Evasement	Bordatura - Flange test / Bördelversuch / Rabattement de collerette	Schiacciamento - Flatt. test / Ringfaltversuch / Aplatissement	Piegamento - Bend test / Faltversuch / Pliage	Mandrin. anello - Ring expanding test / Ringaufdornversuch / Mandrinage anneau	Trazione anello - Ring tensil test / Ringzugversuch / Traction anneau	Resilienza - Impact test / Kerbschlagzähigkeit - Résilience: Dimensioni / Dimensions / Abmessungen / Dimensions	Temp. °C	Direzione / Orientation / Richt. / Direct.	Richiesto / Required / Vorgesch. / Demandé Min	Media	Ottenuto / Result / Ermittelt / Obtenu
002	25.4x15.4	394.7	50	35		50.3	60		75.7	30	39			OK									

*** 253
LENGTH : 11000 - 13500
SEAMLESS HOT FINISHED PIPES
VISUAL AND DIMENSIONAL CONTROL OF TUBES WITH SATISFACTORY RESULT
THE STEEL IS FULLY KILLED AND PRODUCED BY ELECTRIC FURNACE
ALL TUBES HAVE PASSED HYDROSTATIC TEST PRESSURE AT 193 BARS (2800 PSI)
CEQ% = C + MN/6 + CR+MO+V/5 + NI+CU/15 = 0.43% MAX - C% 0.27% MAX.

THESE MILL TEST REPORTS APPLY TO:
YOUR P. O. # VERBAL Jimmy
LA BARGE INVOICE # 206951

Prova / Test / Probe / Epreuve	Colata / Heat / Schmelze / Coulée N.	C%	MN%	SI%	P%	S%	NI%	CR%	MO%	CU%	V%	CEQ%	Mill-control Tensile test: Yeld strenght	Tensile strenght	Elong
	962888	0.19	0.74	0.25	0.010	0.015	0.11	0.13	0.02	0.27	.005	0.36			
		PRODUCT ANALYSIS													
		0.20	0.73	0.25	0.016	0.016	0.11	0.15	0.02	0.27	.005	0.30			
		0.20	0.73	0.25	0.016	0.015	0.11	0.15	0.02	0.27	.005	0.30			

Avviso di spedizione: E1200595 DEL 23/12/86

Quantità - Quantity - Menge - Quantité

N 12 m 140,520 Kg 8494,000

Ft 460,7 Lbs 18732,0

Allegati / Enclosures / Anlagen / Annexes

Data - Date - Datum - Date: 23 12 86

DALMINE S.p.A.

Il Capo Collaudo - Chief Inspection Dpt. / Chef der Abnahmeabteilung - Le Chef de la réception: 0.14374 I

N/mm² = 1 MPa; 1 bar = 10⁵ Pa

C/061305 E1200595 001 054 00 001

Mod. QUA/084 MC - ARES TREVIOLO 06 1989

Appendix F
PROJECT MEETING SUMMARIES

September 4, 1984

FC15807.TI

SUMMARY OF MEETING

PROJECT: North Port St. Lucie Wastewater Treatment Plant Disposal Alternatives, Port St. Lucie, Florida - FC15807.TI

LOCATION: SFWMD Offices, West Palm Beach, Florida - August 22, 1984

ATTENDING:
Leslie Wedderburn/SFWMD
Pat Gleason/SFWMD
Bruce Adams/SFWMD
David Butler/SFWMD
Carlos Zubiria/GDU
Dick Bedard/CH2M HILL/BCR
Jeff Lehnen/CH2M HILL

PREPARED BY: Jeff Lehnen/CH2M HILL

COPIES:
John Guidry/DER, West Palm Beach
Richard Deuerling/DER, Tallahassee
John Carter/DER, Port St. Lucie
J.I. Garcia-Bengochea/CH2M HILL
Bruce Spiller/CH2M HILL

- Dick Bedard stated that the purpose of the meeting was to present the water management district staff with the background work that has been done at the North Port St. Lucie WWTP investigating the various effluent disposal options available. The conclusion of the study is that deep well injection is technically feasible and is the most cost effective method of disposal immediately available at the site.

- Various other means of disposal, including the spray irrigation of the FPL power line right-of-way west of the site and other large tracts of agricultural land, were investigated. No suitable tracts of land are immediately available for spray irrigation within a reasonable distance of the site. Negotiations are currently under way with a large agricultural interest about utilizing the plant effluent for irrigation, however, no firm commitment has been reached.

- The present spray irrigation system is on land scheduled to be developed into a golf course starting June 1985. Therefore, an alternate means of disposal must be in operation by then. GDU is presently working on the design of converting the onsite polishing ponds into percolation ponds. The expansion of the water system to serve the houses adjacent to the proposed percolation ponds is being studied.

At the same time, the design of the injection well system is proceeding with the intention that both the percolation ponds and the injection system will be constructed, at least one of which by June 1985. Upon completion of the new golf course, spray irrigation of the course will be resumed.

o A copy of the effluent disposal study was left with the Water Management District for their review. Leslie Wedderburn indicated that the project would be discussed with the TAC in the meeting scheduled for August 29, 1984.

ab/gncr12/03

SUMMARY OF MEETING

MEETING DATE: January 8, 1985

PROJECT: North Port St. Lucie WWTP
Injection Well System

LOCATION: SFWMD Offices, West Palm Beach, Florida

ATTENDING: John Guidry/DER/WPB
Pat Gleason/SFWMD/WPB
John Carter/DER/PSL
Scott Seyfried/DER/WPB
David Butler/SFWMD/WPB
Richard Deuerling/DER/TALL
Carlos Zubiria/GDU/MIA
J. I. Garcia-Bengochea/CH2M HILL/GNV
Jeff Lehnen/CH2M HILL/GNV

SUMMARY PREPARED BY: Jeff Lehnen, February 8, 1985

1) The meeting opened with an update on the status of the project. The construction permit application was submitted to DER on December 20, 1984 with the technical specifications for the injection system.

Carlos Zubiria of GDU discussed their efforts in finalizing a disposal plan for the North Port WWTP. Negotiations are underway with General Development Corporation (GDC) concerning the long term use of the present spray irrigation site. The Department of Transportation (DOT) is also considering an east-west expressway through the area.

It was agreed that GDU will prepare a wastewater reuse plan for submittal to the SFWMD. If the plan is submitted by January 21, 1985, the WMD Board will consider the permit application at the February 14, 1985 meeting.

The general plan is to try to continue spray irrigation of the effluent on the existing spray site or at an alternate site. The injection well may be utilized as backup to the spray system to dispose of excess flow during wet periods, if necessary. Emergency disposal if the spray system and injection system are out of service will be to the canal adjacent to the north side of the WWTP and to the North Fork of the St. Lucie River.

2) A memorandum from David Butler, SFWMD, to John Guidry, DER, with review comments on the injection system design was discussed. The following points were agreed to:

   a) In addition to the 100 foot water supply well to be drilled near the drilling pad, four (4) shallow monitoring wells will be constructed, three around the pad and one at Pond 1. David Butler will determine if a permit will be required for the water supply well.

   b) If the present ponds are modified to percolation ponds, the drinking water system will be extended to the surrounding area.

   c) The drilling pad will be curbed as shown on the Drawings.

   d) Monitoring well water quality background samples will be collected prior to the start of injection.

   e) Salt used for increasing the density of the drilling fluid will be stored in a weatherproof structure to prevent any spillage on the ground.

3) The technical specifications will be amended to include the monitoring wells and salt storage requirements agreed to above. Copies of the hydraulic surge analysis will also be forwarded to John Guidry.

4) The 30-day letter of notice of the public meeting for the permit will be sent following the receipt of the specification addendum.

aaj/WP1/24

MEETING SUMMARY

CH2M HILL

MEETING DATE: April 14, 1987

LOCATION: DER Office, West Palm Beach, Florida

SUBJECT: North Port St. Lucie WWTP Injection System, General Development Utilities - Preconstruction TAC Meeting

PROJECT NO.: SE15807.T2

ATTENDING:
Don White/DER-WPB
Al Mueller, Jr./DER-WPB
Paul Phillips/DER-PSL
Mark E. Elsner/DER-PSL
Ron Lane/DER-WPB
David Butler/SFWMD-WPB
Micheal Merritt/USGS-MIA
Brian Gentry/SFWMD-WPB
Michael Yates/GDU-MIA
Jeff Lehnen/CH2M HILL-GNV

COPIES:
Cathy Conrardy/DER-TALL
Gene Coker/EPA-ATL
J.I. Garcia Bencochea/CH2M HILL-GNV
John Curtiss/CH2M HILL-DFB
Jim Moses/SLCHU-PSL
Brian Hurley/SLCBD-PSL

SUMMARY PREPARED BY: Jeff Lehnen

Don White opened the meeting by summarizing the purpose for which he called the meeting. The DER construction permit for the referenced project was due to expire April 9, 1987 and GDU requested a one-year extention in a letter dated March 11, 1987. This meeting was called as a preconstruction meeting and to determine if any changes were necessary to the construction permit to satisfy the current regulations and TAC members concerns.

1. Don White will be putting some requirements in the construction permit, basically outlining the data submittal requirements during construction and approvals following completion of construction and testing of the wells that will be necessary prior to

staring injection of effluent. This is a normal procedure and the conditions will only formalize this.

2. The mechanical integrity testing program was discussed. DER would like to be notified three days in advance of the Part 1 testing which will include the casing pressure test and cement bond logging and again, three days prior to the Part 2 mechanical integrity testing which will be the baseline temperature log.

   It was agreed that the baseline temperature log will be run after the injection test with freshwater, and before any injection begins of effluent. These tests will satisfy DER requirements for demonstration of mechanical integrity and were agreed to by all.

3. The emergency effluent storage and emergency discharge were discussed. Should the pump station be out of service, the injection pump pond will overflow into the adjacent unused ponds Nos. 3, 4 and 5. Once these three ponds are full and the pump station is still not in service, the effluent will overflow into the adjacent canal on the north side of the property. Chlorine will be added to the effluent as it enters the pump station pond under emergency conditions and will also be applied again at the overflow into the adjacent canal.

   It was estimated that there is approximately six days of storage in these ponds at the present day flow, and approximately one day of storage at the injection well capacity flow of 4.8 MGD. These ponds are not currently being used for the spray irrigation system and are presently dry. The ponds will continue to be available for emergency storage once the injection well is on line, irregardless of the use of the spray irrigation system.

   These requirements differ somewhat from those submitted in the final plans and specs as part of the construction permitting process in that we have added additional chlorination points to insure that the discharged water into the canal, should that occur, is fully chlorinated.

4. The background monitoring requirements on the two monitoring zones in the monitor well were outlined by Don White. Upon completion of the two zones, they will be sampled for primary and secondary drinking water standards and the minimum criteria or "free from" priority pollutants. One sample will be collected from each zone for background sampling purposes.

   A complete analysis of the wastewater was also requested, but Paul Phillips pointed out that this data may already be on file and will notify GDU if another sample will be required. These background sampling requirements will be included in the modified construction permit.

   The location of the shallow groundwater monitoring wells were shown on the revised site plan. It was pointed out that the well that was intended to be placed near pond No. 1 has been alternately located to the northwest corner of the pond that will be lined just to the west of the injection well site. These wells will be monitored weekly during construction for conductivity and chlorides.

   All attendees agreed that the groundwater monitoring plan for construction was acceptable.

5. The surge protection system on the injection system pump station was discussed. The method of operation was outlined by Jeff Lehnen showing that the water level is maintained by water level sensors which will add air or vent air to adjust the water level in the tank within a prescribed range. Should the water level rise or fall beyond the operating range, a high or low water level alarm will be sounded with an alarm at the pump station as well as the alarm in the lab building. Considerable discussion centered around the reliability of the surge tank system, and it was agreed that though it is not a perfect system, it has a high degree of reliability.

   Paul Phillips would like to review the surge analysis which was submitted as part of the construction permit application in 1985. The surge analysis which was previously submitted was in Don White's file and was given to Paul Phillips for his review. In the surge analysis the tank sizing, recommended operating range, and analysis of the pressure in the system under various operating conditions is analyzed.

Jeff Lehnen stated that he felt that the surge tank design as submitted, was a reliable design and that no additional facilities will be required to provide a hydraulic surge protection to the system. This is a similar design to surge systems used on other CH2M HILL injection well systems currently operating satisfactorily.

Mark Elsner of the Port St. Lucie DER office will be reviewing the surge analysis for Paul Phillips.

6. Don White then pointed out that the cuttings must be disposed of at an approved site, and at the requirement would be in the revised permit conditions. Jeff Lehnen pointed out that the drilling contractor is required by the present plans and specs to provide proof that a site will accept the solids and fluids to be disposed of. The Contractor is also required to present the dump ticket from the facility upon the return of each truck to the resident observer to prove that the load was dumped at the appropriate site. These requirements are contained in the construction documents for the injection system.

7. Don White also requested that the weekly summaries that will be prepared during construction include a cover page which summarizes the critical events as well as any abnormal occurrence on the project during the reporting period. Jeff Lehnen pointed out that this was standard procedure on CH2M HILL weekly summaries and that we would then cover the actual daily reports from CH2M HILL's resident observers, as well as the drilling contractors daily reports with the summary page.

   These summaries will be sent out on Friday or Monday of each week and will be from the period of Thursday to Thursday of the previous week. All agreed that this would be acceptable.

8. During drilling in the artesian section of the aquifer, it is required that a blowout preventer (BOP) be

installed on the wellhead so that uncontrolled artesian flow will not occur. The present plans and specs require the drilling contractor to have his BOP onsite and in place and in a demonstrated operating condition. Jeff Lehnen pointed out that we would require the drilling contractor to demonstrate his ability to close in the well to our satisfaction prior to drilling into the artesian section.

Paul Phillips and Don White both requested that DER be allowed to observe such a demonstration. It was agreed that one would be set up in the near future to provide assurance that the drilling contractor can indeed close in the well, in a reasonable time frame to prevent artesian flow from occurring.

9. Concern was expressed by Paul Philips about the criteria used for selecting the 22-inch casing setting depth. The 22 inch casing which is anticipated to be set at approximately 1,900 feet will be set at a depth based on the analysis of the rock formation samples which are collected during drilling as well as the geophysical logs which will be run on the pilot hole. An interval comprised of solid low permability rock will be targeted for seating the bottom of the casing.

   It was also pointed out that this is the standard operating procedure for CH2M HILL and that it is very difficult to set the bottom of the casing adjacent to a permeable formation. This practice contributes to the quality of cement around the bottom of the casing which will help prevent any fluid movement along the casing near the bottom of the casing.

10. The issue of 24-hour on-site resident observation for the engineer's personnel was discussed. Jeff Lehnen presented the rational that CH2M HILL uses in providing 12-hour daily inspection and then 12-hour on-call observation at night. It was pointed out that during the night time hours the resident observer is on call to the driller for availability at any time and plans to be on site during critical operations where resident observation is required for construction or testing purposes. The resident observers have rented a house about a mile from the site which gives them quick

response to any need on site that may occur during the evening hours.

It was agreed that the plan for resident observation of 12-hours during the day and 12-hours on call during the night would be acceptable to DER for this project. The project will be overseen by Jeff Lehnen, the Project Manager, and the Engineer of Record will be Dr. Garcia.

The chain of responsibility that CH2M HILL prefers to use is where the resident observers are the first point of contact by the drilling contractor, and using their judgement, will contact Jeff Lehnen as necessary. Should it be necessary to contact Dr. Garia, Jeff Lehnen will take care of that. That way, the resident is in the loop for all decisions and there is no side tracking of decision making processes around the resident observers by the drilling contractor. It was also pointed out that the resident observers for CH2M HILL are professional full-time employees, one is an engineer, and one is a geologist. CH2M HILL feels that the resident observers being full time employees with professional experience have something at stake in the job, whereas, the use of contract resident observers may not result in as high a quality performance.

11. Jeff Lehnen presented the present construction schedule under which the two contractors will be operating. The drilling contractor, Youngquist Brothers, Inc., Fort Meyers, will be drilling within approximately one week, and the time of completion on his contract will be approximately September 14, 1987.

The pump station contractor, Elkins Industrial, Jacksonville, will be starting construction on the pump station within a few weeks, and their time of completion on their contract is November 24, 1987. The pump station contractor will be providing the pipe line and the instrumentation to the wellhead so that the drilling contractor must be completed and out of the way before the pump station contractor can complete his contract.

During the time between the completion of the wells and the completion of the pump station, CH2M HILL will submit the Engineering Report presenting the data collected during construction and testing of the injection well for TAC review. DER will review the submitted information, and if it meets their requirements, will prepare a letter authorizing the operation of the pump station and the operational testing of the system using effluent. GDU was cautioned that prior to receipt of that letter, that no effluent will be injected into the well.

The construction permit will allow for operational testing of the system for up to six months and following approximately three months of operational testing, the operating permit application will be submitted. These requirements will be outlined in the revised special conditions of the construction permit and were agreed to by all.

12. Mike Merritt questioned the placement of the multi-zoned monitor well concerning the natural hydraulic gradiant in the artesian aquifer in the area. He presented a gradient map which showed that the gradient in the St. Lucie area is to the east-northeast and he questioned whether or not the monitor well would be able to detect vertical migration of effluent into the monitor well being located to the south of the injection well.

    Jeff Lehnen described affects of injection conceptually and showed that the injected fluid would migrate radially away from the injection well and would very soon reach out 80 feet beyond the injection well. The multi-zone monitoring well located 80 feet away from the injection well will then be overlying the injected fluid. Should the injection fluid migrate vertically through the confining beds, it should be detected my the monitor well.

    Mike Merritt's concerns over detecting a leak occurring around the injection casing up into the monitor zone were expressed. The possibility of a leak occurring over 1,000 feet around the cemented final string of casing is very remote and the ability of the monitor well to detect such a leak is still possible. It was agreed that the present locations of the well are probably adequate.

Mike Merritt also requested that a description of the rock cores that will be collected through the confining bed be included in the final engineering report. It was agreed that these would be provided and the cores were offered to any of the present agencies for their study following the laboratory testing of selected core pieces. No one was interested in receiving the cores upon completion of laboratory testing.

It was also requested that during the pump test on the interval from 1,900 to 3,300 feet, that geophysical logs be run. It was agreed that resistivity, temperature, and flow meter logs will be run while pumping the zone at 1,000 gallons per minute for the TV survey of that interval.

13. The documention required by DER for review was then discussed. Since there was great concern expressed over the possibility that the pump station design was never reviewed by DER when the original submittals were made, an updated permit modification will be submitted. This submittal will be made even though the pump station is included in the construction permit as per Mr. Scott Benyon's letter of May 19, 1986. The submittal will include a design report describing the design criteria and operation of the pump station and injection system in general, as well as a system curve showing the criteria for the pump selection. The present plans and specifications for both the pump station contract and the injection well contract will also be submitted for DER's records. These documents will be sent to DER by Tuesday of next week for their review.

It was agreed than another meeting would be held following the review of these documents by DER. That meeting will be held on April 28, 1987 at 10:00 a.m. in DER's office in West Palm Beach. At that time, the pump station design criteria will be reviewed and any changes that DER feels are necessary will be discussed.

It was agreed that during the period of time until the TAC meeting that the injection well contractor will be allowed to proceed with construction of the injection well up to the point where the pilot hole has been drilled to 900 feet and geophysical logs have been run.

If that occurs prior to the TAC meeting, the drilling contractor may be shut down and is expected to insist on going on an hourly standby rate of $100 per hour, which is established in his drilling contract with GDU. This will amount to $2,400 per day while he is idle pending the outcome of the TAC meeting.

It was agreed by all that there did not appear to be a real problem with the injection well contract, and that their primary concern was over the pump station design and the possibility that it was never reviewed by DER.

14. Don White then read the requirements for public notice on injection well permits from an EPA document. It appears that the public notification may not be necessary if the changes made since the last submittal to DER in March 1985 will be considered as changes in construction requirements. If they are considered changes in construction requirements, then they will be formally considered as minor modifications and would not require public notification. If these changes are not considered minor modifications, then the formal public notification procedure may be necessary, which will create a substantial delay in the project as well as substantial cost to GDU pending the outcome of that notification.

    Don White will research the matter further and will be prepared to make a decision at the upcoming TAC meeting concerning whether or not public notification is necessary as part of the permit modification.

15. David Butler then requested that further discussion needs to take place concerning reuse and spray irrigation on the upcoming golf course which will be constructed on the exiting woodland spray irrigation site. Michael Yates stated that he was not familiar enough with the job to be able to comment and informed David Butler that he would have Eric Meyer of GDU contact him since Eric Meyer is familiar with the reuse considerations.

MEETING SUMMARY

MEETING DATE: April 24, 1987

LOCATION: DER Office, Port St. Lucie, Florida

SUBJECT: North Port St. Lucie WWTP Injection System, General Development Utilities - Design Review Meeting

PROJECT NO.: SE15807.T2

ATTENDING:
Don White/DER-WPB
Paul Phillips/DER-PSL
Mark E. Elsner/DER-PSL
Michael Yates/GDU-MIA
Jeff Lehnen/CH2M HILL-GNV
John Curtiss/CH2M HILL-DFB

COPIES:
Cathy Conrardy/DER-TALL
Gene Coker/EPA-ATL
J.I. Garcia Bengochea/CH2M HILL-GNV
Jim Moses/SLCHU-PSL
Brian Hurley/SLCBD-PSL
Al Mueller, Jr./DER-WPB
Ron Lane/DER-WPB
David Butler/SFWMD-WPB
Micheal Merritt/USGS-MIA
Brian Gentry/SFWMD-WPB

SUMMARY PREPARED BY: Jeff Lehnen

1. The design capacity of the vertical turbine pumps was discussed. Each pump is rated at 1,840 gpm at 115 feed of head. The station will have two pumps with provisions for a third. This arrangement will give the station a firm capacity, with one pump out of service, of 2.65 mgd. As wastewater flow increases in the future, a third pump will be installed resulting in a firm capacity of 4.06 mgd.

   Wastewater flow is presently averaging 0.4 mgd. The capacity of the 12-inch injection well is 4.06 mgd at a fluid velocity in the casing of 8 feet per second.

2. The pumps are controlled by float switches in the lined pond which will operate between elevations 14.5 and

16.5. This is approximately 450,000 gallons. As the water level rises, the first pump will be called to run. If the water level still continues to rise, or the pump discharge pressure is not above a certain value, the second pump is called to run. If the third pump were installed, and the water level continued to rise, the third pump would be called to run.

3. The surge analysis was reviewed. The analysis was run for the worst case condition where three pumps are running at 3,500 gpm and are shut off simultaneously. The analysis shows the pressure at various points in the system following the pump shut off. With the surge tank, the system does not reach a vacuum at any time.

4. The emergency power generator will power the pump station in the case of a power outage. The starting mode of the generator was questioned and was later confirmed to be automatic starting with a time delay start.

5. Existing plant flowmetering includes a parshall flume in the splitter box for total flow and a flowmeter on the irrigation pump station indicating flow to the spray site. The injection system will have a flowmeter to indicate flow to the injection well. Paul Phillips suggested that the total plant flowmetering be left in place for reporting purposes. It was agreed that flows will be reported as required by DER.

6. The rupture disk on the surge tank is replaceable and the contract or is required by the specifications to provide two spare disks.

7. The emergency chlorination system was discussed. At the high level alarm condition in the lined pond, the operator will activate the chlorinator at the chlorine contact basin to chlorinate the flow into the lined pond. The overflow into storage pond Nos. 3, 4, and 5 will be chlorinated. When these ponds fill, emergency overflow into the canal will be chlorinated again at the overflow pipe. DER may require that the initial overflow into Pond No. 3 be super chlorinated by adding chlorine directly into the pond.

Automatic chlorination was considered. However, the reliability of the system when it will only operate at very infrequent intervals was of concern. Manual activation was chosen for this reason.

8. The treatment process is complete mix with average day flows of 0.4 mgd. The plant is staffed eight hours a day. Since the injection system pump station operation is automatic, this arrangement will be acceptable to DER.

9. Since pump NPSH is unique to the specific model of pump, the final pump intake elevation and pump can bottom elevation will be as recommended by the pump manufacturer. This is noted in the drawings.

10. Following discussion, it was agreed that the existing construction permit will be modified to include the plans and specification dated December 1986 and the revised specific conditions as discussed in the TAC meeting on April 14, 1987. No permit fee will be required and no public notice is necessary since the changes to the permit are minor.

MEETING SUMMARY

MEETING DATE: April 28, 1987

LOCATION: DER Office, Port St. Lucie, Florida

SUBJECT: North Port St. Lucie WWTP Injection System, General Development Utilities - TAC Meeting

PROJECT NO.: SE15807.T2

ATTENDING:
Don White/DER-WPB
Al Mueller, Jr./DER-WPB
Paul Phillips/DER-PSL
Mark E. Elsner/DER-PSL
Cathy Conrardy/DER-TALL
Val Laubenhiemer/CPSLBD-PSL
Michael Yates/GDU-MIA
Jeff Lehnen/CH2M HILL-GNV

COPIES:
Gene Coker/EPA-ATL
J.I. Garcia Bengochea/CH2M HILL-GNV
John Curtiss/CH2M HILL-DFB
Jim Moses/SLCHU-PSL
Brian Hurley/SLCBD-PSL
Ron Lane/DER-WPB
David Butler/SFWMD-WPB
Micheal Merritt/USGS-MIA

SUMMARY PREPARED BY: Jeff Lehnen

1. Don White distributed draft copies of the revised construction permit for the above referenced project. The revised permit contains specific conditions which were discussed in the TAC meeting held on April 14, 1987, and the design review meeting held April 24, 1987.

2. General Condition 16-a was reviewed and it was agreed that the daily reports from CH2M HILL will be signed by resident observers who are the Engineer of Record's authorized representatives. This will serve as acceptable certification that the data submitted is true, accurate, and complete.

3. Mark Eisner requested that he be notified prior to any geophysical logging so that he can be onsite during the logging if he can.

4. The requirement in Specific Condition 4 to submit the cementing program 15 days prior to cementing was discussed. The cementing report will include the best estimate of the amounts and types of cement that will be used on each casing. Other types of cement that may be used if lost cement intervals are encountered will be included in the report. The methods used for cementing will also be included.

5. Specific Conditions 9 and 12 were reviewed. Changes were made to Condition 12 to require that a summary report will be prepared to include the specific data included in Items A through E. This data will be submitted to DER for review prior to the issuance of authorization to inject effluent. A certificate of completion will also be submitted for the pump station prior to authorization for effluent injection.

   Specific Condition 9 required that all of the data collected during construction and testing be submitted to DER in the final report with the operating permit application. These will be submitted following operational testing of the system with effluent for several months.

6. Specific Condition 16-a requires that prior to the transfer of ownership of the system that an analysis of the wastewater to be injected be submitted to DER. It was agreed that this condition has little impact on municipal systems.

7. Special Condition 17 was modified to include only item a, and Items b and c were deleted. This item requires that the 40-inch casing be set into the Hawthorn Formation.

   A new Special Condition 18 will read about as follows: Set the 22-inch casing into water with greater than 10,000 mg/L TDS and into an adequate formation to restrict vertical movement of fluids. This condition addresses the concerns of DER of setting the casing below the USDW and into a competent formation.

8. Cathy Conrardy requested that an original copy of the payment bond for financial responsibility for plugging and abandoning the well be sent to her if she cannot locate one in her files. She will contact GDU if another original document is necessary. This bond was submitted to DER with the permit application in 1985.

9. It was also requested that the casing pressure test be run when the temperature is stabilize in the casing. It was pointed out that an accurate test can be run even if the temperature is dropping in the casing and that 17-28 allows for temperature corrections. We will try to run the test with the temperature stable if possible.

   A method of confirming the test has also been developed where the water in the casing is evacuated to approximately 120 feet and the water level is monitored. A leak in the casing would cause the water level to rise. This procedure will be used only if necessary.

10. A recent sample of the wastewater has not been located by DER and if one is not found, GDU will be contacted to run a new sample.

11. The gradient of the shallow aquifer was not shown in the permit application, but the gradient of the Floridan aquifer was. The shallow aquifer gradient is presumed to be to the north, since a deep canal runs along the north property line of the WWTP. The monitor wells around the drilling pad are located in all four quadrants, therefore, contamination of the shallow aquifer around the drilling pad should be detected.

12. Discussion of the final elevation of the pump intakes and the pump cans followed. It was agreed that a new Special Condition 19 will be added and will read about as follows: Submit final shop drawing on pumps and pump cans to DER for concurrence with the intended design

performance prior to release of the pumps for construction. DER will respond within three days of receipt of the submittals.

The pump intake elevations will be as recommended by the pump manufacturer based on the NPSH of the particular pump selected. This approach allows various manufacturers to supply the pumps and avoids sole sourcing of the pumps which would add unnecessary cost to the project.

13. Cathy Conrardy then questioned the ability of the monitoring well to detect vertical migration of effluent. Jeff Lehnen pointed out that the water levels in both monitoring zones are continuously monitored. Should effluent migrate vertically into the saline monitoring zone, the density of the water would be lowered, and the water level would rise in that zone. That water level change would be recorded on the continuous water level recorders on the monitoring well. It was acknowledged that the location of the monitoring well was acceptable.

    The water quality is sampled monthly and the wells will be purged of at least 1.5 casing volumes prior to sampling so that the water samples are representative of the monitoring interval.

    Cathy stated that she may have additional questions once she returns to her office and it was requested that she contact Jeff Lehnen with those questions.

14. The revised construction permit will be signed within a week and will be sent to GDU within several weeks. No public notice or fee will be necessary.

CH2M HILL

MEETING SUMMARY

MEETING DATE: June 9, 1987

LOCATION: DER Office, West Palm Beach, Florida

SUBJECT: North Port St. Lucie WWTP Injection System, General Development Utilities - TAC Meeting

PROJECT No.: SE15807.T2

ATTENDING:
Peggie Highsmith/DER-WPB
Paul Phillips/DER-PSL
Mark E. Elsner/DER-TALL
Michael Yates/GDU-MIA
Jeff Lehnen/CH2M HILL-GNV
James Dwyer/CH2M HILL-TPA
Gene Coker/EPA-ATL
David Butler/SFWMD-WPB
Michael Merritt/USGS-MIA
Cathy Conrardy/DER-TALL

COPIES:
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J. I. Garcia Bengochea/CH2M HILL/GNV
John Curtiss/CH2M HILL-DFB
Jim Moses/SLCHU-PSL
Brian Hurley/SLCBD-PSL
Ron Lane/DER-WPB
Pete Walch/GDU-PSL

SUMMARY PREPARED BY: Jeff Lehnen

1. The geophysical logs on the injection well pilot hole to 2,000 feet were reviewed. The interface from brackish to salty water occurs between 1,750 and 1,800 feet. The lower monitoring interval was proposed to be from 1,900 to 1,950 feet. This would be approximately 100 to 200 feet below the 10,000 mg/l TDS isochlor.

   The upper monitoring interval was proposed to be from 950 to 1,200 feet.

2. The TAC wants the lower monitoring interval to be 2,200 on 2,300 feet if a permeable zone exists. This will not be determined until the pilot hole on the injection well is drilled to 3,300 feet and the lithologic and geophysical logs are available. The present design for

the monitoring well will accommodate setting the lower monitoring zone deeper by setting the 6-inch casing at the 1,900-foot depth.

3. The TAC wants the upper monitoring zone to be from 1,600 to 1,650 feet, which is the base of the USDW.

   The present design will not accommodate monitoring at the 1,600 to 1,650 foot interval with the open annulus. The 16-inch casing cannot be set much deeper than 950-feet due to drilling circulation problems that would occur. If the mudded hole was deepened into the high permeability interval of the Floridan aquifer with the Hawthorne formation clays open to the borehole, circulation would be lost and the clays would likely collapse or squeeze into the borehole.

   Monitoring at a greater depth for the upper zone will require an additional casing to be installed if open annulus monitoring is used. This will result in a significant cost increase for the well.

   The same zone could be monitored with a screened monitor tube installed outside the 6-inch casing. However, Jeff Lehnen cautioned that installation is difficult and there is a risk of the tube failing. The TAC was asked if a tube were installed and it didn't work, would the TAC accept the upper open annulus zone. The TAC indicates that they probably would not accept the upper zone only.

4. The next meeting will be held when the injection well geophysical logs are available to 3,300 feet. A final casing setting for the 12-inch casing will be determined and the monitoring intervals will be finalized.

lj/gnCR35/005

TAC MEETING SUMMARY CH2M HILL

MEETING DATE: June 30, 1987

LOCATION: West Palm Beach DER Offices

SUBJECT: General Development Utilities North Port St. Lucie Injection Well System

PROJECT: SE15807.T2.01

ATTENDING:
Don White/DER-WPB
Paul Phillips/DER-PSL
Mark E. Elsner/DER-PSL
Michael Yates/GDU-MIA
Jeff Lehnen/CH2M HILL-GNV
Peggie Highsmith/DER-WPB
Patrick Smith/DER-WPB
Oliver Board/DER-WPB
Tony O'Donnell/GDU-MIA
David Butler/SFWMD-WPB
Michael Merritt/USGS-MIA

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J.I. Garcia Bengochea/CH2M HILL-GNV
Jim Moses/SLCHU-PSL
Brian Hurley/SLCBD-PSL
Al Mueller, Jr./DER-WPB
Ron Lane/DER-WPB
Brian Gentry/SFWMD-WPB
John Curtiss/CH2M HILL-DFB

SUMMARY PREPARED BY: Jeff Lehnen

1. Since the last TAC meeting the pilot hole on the injection well has been drilled to 3,324 feet. During the drilling of the pilot hole five 10-foot rock cores were collected at intervals in the borehole. These intervals are as follows; 2,100'-2,110', 2,245'-2,255', 2,425'-2,435', 2,445'-2,455' and 2,624'-2,634'.

   The geophysical logs were run to TD in the pilot hole. Gamma, LSN electric, caliper, temperature, and fluid resistivity were run under static conditions. The well was pumped at rates between 840 and 1,040 gallons per minute and temperature, fluid resistivity, and flowmeter logs were run.

A TV survey was then run on the well to evaluate the open hole section to TD. The contractor has set a plug in the open hole at about 2,880 feet and is currently reaming with a 22-inch bit for the final 12-inch casing setting.

2. The geophysical logs, TV survey, and the lithologic log were then reviewed with the TAC. As was agreed last TAC meeting, the interface between the brackish and salt water occurs around 1,750 to 1,800 feet in the borehole. The 10,000 mg/l TDS isochlor at 1,800 feet occurs in the confining bed which extends from 1,620 feet down to a dolomitic interval which occurs at about 2,300 feet. The dolomite extends to at least 2,400 feet and has good permeability and produces water to the borehole during pumping of the well. The zone contains salt water and therefore may be considered part of the injection zone.

   Below 2,400 feet a thick sequence of limestone, some dolomitized limestone, and chert occurs to a depth of about 2,890 feet. This interval may be an effective confining bed though in some wells in southeast Florida it appears that the zone interconnects the 2,400-foot interval with the 2,890-foot injection zone.

   The interval from 2,890 to 3,200 feet is composed of a dolomite with massive fractures and cavities developed. From 3,200 feet to TD of 3,324 feet the borehole is a dolomite with very little cavity development and based on the pumped logs appears to produce no flow to the borehole.

   Based on the geophysical logs as well as the lithologic log distributed to the TAC members, CH2M HILL feels that the top of the injection zone may very well be the 2,300-foot dolomite and that it extends to about 3,200 feet. The confining beds therefore that exist between the injection zone and the USDW extend from 1,800 to approximately 2,300 feet and the interval between 2,400 and 2,890 feet is also additional confining material.

3. It was generally agreed by the TAC that the interval from 1,800 to 2,300 feet would be considered the upper confining bed and that the interval from 2,400 to 2,890 feet would be considered the lower confining bed or primary confining zone.

   The TAC did not agree that the top of the injection zone occurs at approximately 2,300 feet. It was again pointed out that this zone has permeability and does indeed produce water to the borehole during pumping as shown on the temperature logs and the flow meter log. Based on the flow meter log an estimated 10 to 15 percent of the water being produced while pumping the well at 1,040 gallons per minute came from the 2,300 to 2,400-foot interval.

   The TV survey was then reviewed by the members of the TAC. The TV survey agrees very well with the information gathered on the geophysical logs. CH2M HILL then recommended that the final casing setting on the injection well be set at 2,750 feet. Even though the injection zone may occur at 2,300 feet, it is in the best interest of GDU to go ahead and case down to 2,750 feet. Should the interval between those two productive zones be confining, it will afford additional confining bed above the injection zone.

4. CH2M HILL also recommended that the monitoring intervals be in conformance with FAC 17-28 which prohibits completion of a monitor well into the confining beds or injection zone. The lower monitoring interval therefore should be no deeper than 1,900 feet and the upper interval therefore would be 950 to 1,200 feet as shown in the specifications for the project as well as the construction permit.

   The merits of monitoring deeper to GDU were then discussed by the TAC. By monitoring at 2,300 feet, should effluent migration occur vertically, the effluent would be picked up presumably at an earlier date if the lower zone is monitoring at a deeper depth than if the lower zone were monitoring at 1,900 feet.

   The action plan at that point was then discussed. Even though that lower zone would not be considered a USDW zone, GDU would immediately be required to determine if effluent migration was occurring into the USDW as well as the source of the effluent. A remedial action plan would be required in order to protect the USDW further and possibly to consider cleaning up the USDW should effluent migration occur.

GDU expressed concern over completing a monitor well into the 2,300-foot zone based on the fact that it is by definition a permittable injection zone, and the possibility always exists in the future that another injection well will be drilled and may be completed into the upper zone. That would result in GDU's lower monitoring interval occurring in a permitted injection zone. They are also concerned about the potential connection between the 2,300 to 2,400-foot zone and the 2,890 to 3,200-foot zone since it appears to be the case in some wells in southeast Florida. DER stated that should the monitor interval be completed in the lower zone, that it is unlikely that future permit applications would be granted to inject into that zone.

5. The TAC then adjourned without GDU or CH2M HILL present to discuss the issue. Following the adjournment, CH2M HILL and GDU proposed the following program in order to prevent a delay in construction, should a decision not be reached.

   Since monitoring in the 2,300-foot interval is very important to the TAC and will afford an earlier warning of effluent migration should it occur, GDU is prepared to monitor in the lower interval and will be prepared to accept an operating permit condition that will require them to evaluate the base of the USDW should effluent migration be detected into the lower monitoring zone. This could be accomplished by the drilling of a second monitor well at that time or it may be accomplished by modifying the existing monitor well to monitor at a higher interval than the 2,300-foot zone should it be necessary to evaluate the base of the USDW.

   The TAC accepted the proposed completion which is summarized as follows. The final casing on the injection well will be set at 2,750 feet. The lower monitoring interval on the monitor well will extend from approximately 2,180 to 2,350 feet. The exact depth will be determined based on the data obtained from the monitor well pilot hole and the exact depth will be determined as necessary to produce water for monitoring purposes.

The upper zone will extend from 950 to 1,200 feet monitoring within the major permeable zone of the USDW. The remainder of the drilling and testing program was briefly discussed and it was agreed that the DER Port St. Lucie office will be contacted for the pressure test on the 12-inch casing as well as geophysical logging that will occur on the monitor well and injection well.

The next TAC meeting will be to review the final data that is collected in the injection well prior to written approval for effluent injection from DER.

Meeting adjourned.

TAC MEETING SUMMARY

MEETING DATE: July 14, 1987

LOCATION: DER Office, West Palm Beach, Florida

SUBJECT: North Port St. Lucie Deep Injection Well System

PROJECT NO.: SE15807.T2.03

ATTENDING:
Scott Benyon/DER/WPB
Alex Padva/DER/WPB
Don White/DER-WPB
Paul Phillips/DER-PSL
Mark E. Elsner/DER-PSL
Michael Yates/GDU-MIA
Jeff Lehnen/CH2M HILL-GNV
Peggie Highsmith/DER-WPB
David Butler/SFWMD-WPB
Michael Merritt/USGS-MIA
Cathy Conrardy/DER-TALL
Gene Coker/EPA-ATL

COPIES:
Leslie Shannon/CH2M HILL/GNV
Jim Brantly/Youngquist Bros.
Tim Youngquist/Youngquist Bros.
J.I. Garcia Bengochea/CH2M HILL-GNV
Jim Moses/SLCHU-PSL
Brian Hurley/SLCBD-PSL
Al Mueller, Jr./DER-WPB
John Curtiss/CH2M HILL-DFB

SUMMARY PREPARED BY: Jeff Lehnen JL

1. This TAC meeting is being held to reevaluate the setting depths of the monitoring intervals on the monitor well as a result of a meeting and request by Scott Benyon, District Manager, to revisit the issue. Following the TAC meeting held on June 30, 1987, a letter was prepared by Dr. Garcia/CH2M HILL and was sent to Scott Benyon as well as all the members of the TAC. In that letter CH2M HILL and GDU objected to the decision that was made in the previous TAC meeting and stated that in their opinion the monitoring of the 2,300-foot zone put GDU in violation of a FAC 17:28 proviso prohibiting completing monitoring wells into the final confining bed or injection zone.

The letter requested that Mr. Benyon review the TAC decision and confirm that decision in writing to GDU before the monitor well was completed at that depth. A meeting was held with Mr. Benyon and Dr. Garcia in which the issue was discussed and the outcome of the meeting was that Mr. Benyon recommended that the TAC would be reconvened on this issue and that the matter be reviewed in light of the concerns expressed by Dr. Garcia and GDU.

2. Jeff Lehnen then reviewed the geophysical logs to 2,000 feet with the TAC and made the recommendation to complete the lower monitoring zone between 1,500 and 1,550 feet which is in a permeable dolomite near the base of the USDW. The upper monitoring zone would remain as shown in the plans between 950 and 1,200 feet, which is in the major use portion of the Floridan Aquifer in the area. Gene Coker then expressed his concerns that an early detection zone would not be provided by not monitoring the 2,300-foot interval and that monitoring where CH2M HILL recommends would not be in conformance with the regulations. It was pointed out that the regulations read that the monitoring well will be capable of detecting fluid movement in the direction of or into a USDW. By monitoring near the base of the USDW, the monitoring interval would be able to detect fluid movement into the USDW. Gene then stated that without the early detection monitoring interval within the confining zone, that he would recommend against permitting the system since he is of the opinion that the well would still not be in compliance with the regulations.

3. The discussion then centered around the definition of "final" confining bed. CH2M HILL considers the interval from 1,620 to 2,300 feet the final confining bed before the effluent enters the USDW and thereby violates the regulations. The TAC generally sees the final confining bed as the interval from 2,400 to 2,890 feet, which is the final confining bed immediately overlaying the injection zone. Since the regulations specifically use the term final confining bed, it is generally agreed that this is the crux of the issue of whether or not completing the well at 2,300 feet is a violation of FAC 17:28 or not. Scott Benyon then requested that a vote be taken of the TAC

members on three questions that he then posed to the TAC.

a. If the final confining bed is immediately above the injection zone at 2,890 feet, where should the lower monitor zone be completed?

b. If the final confining bed is immediately beneath the USDW, where should the lower monitor zone be completed.

c. Which confining bed, the one between 1,620 and 2,300 feet or the one between 2,400 and 2,890 feet, is the final confining bed?

Each of the TAC members were then given an opportunity to respond to the three questions. On Question a, the general consensus among the TAC members was that if the final confining bed is immediately above the injection zone that the lower monitoring well should be completed around 2,300 feet. On Question b, the general consensus of the TAC was that if the final confining bed is immediately beneath the USDW that the 2,300-foot interval should also be monitored. On Question c, which is the final confining bed, there were some opinions that the final confining bed was the lower 2,400 to 2,890-foot interval and some opinions were expressed that the entire interval from 1,620 to 2,890 feet is a confining zone and that a final confining bed could not be defined within that zone.

Scott Benyon then requested that CH2M HILL and GDU representatives adjourn to his office to discuss the matter.

Following the discussion Alex Padva informed the TAC that CH2M HILL will prepare a letter making a recommendation to monitor in a specific interval at or near the base of the USDW and that Mr. Benyon will make his final decision following receipt of that letter and the recommendations therein. Gene Coker expressed his concern over the course of events and informed the TAC that he will be preparing a memo expressing his concerns over the issue.

4. The cementing of the 12-inch final casing was reviewed. A temperature log was run on the first stage of cement and agreed well with the tags with tremie lines in the annular space. Following the completion of the last stage of cement, a temperature log was run which showed the various cement stages and temperature shifts between each stage quite clearly. The cement was brought up to approximately 280 feet and the remainder of the 12-inch casing was left uncemented so that during cement bond logging a free pipe signal will be available for log calibration. The annulus will be fully cemented to ground surface following the cement bond logging.

   During the cementing of the stage at 2,060 feet, one of the cement lines parted at about 200 feet below pad. The details concerning the parted tremie pipe were summarized in a letter to Don White, copies of which were distributed to all the TAC members. Since the tremie pipe was full of tremie when it separated, the decision was made at the time to continue cementing and DER was notified within a day of the parted tremie line. The tremie pipe extends from approximately 2,060 up to 200 feet below pad. The TAC agreed that the tremie pipe was probably not a problem and questioned whether or not it would affect the cement bond log. Since it was a steel pipe with cement inside and out, it probably wouldn't be discernable on the cement bond log.

5. Copies of the TAC meeting summary from June 30, 1987, were distributed to the attendees. Copies of the geophysical logs in the injection well from 1,950 to 3,324 feet were also distributed to the TAC members. The schedule on the project is that the cement bond log will be run within a day on the injection well and the monitor well is currently being reamed at about 400 feet for the 16-inch casing setting.

David Buffler

STATE OF FLORIDA
DEPARTMENT OF ENVIRONMENTAL REGULATION

SOUTHEAST FLORIDA DISTRICT
1900 SOUTH CONGRESS AVENUE, SUITE A
WEST PALM BEACH, FLORIDA 33406
(305) 964-9668

BOB MARTINEZ
GOVERNOR
DALE TWACHTMANN
SECRETARY
J. SCOTT BENYON
DISTRICT MANAGER

DEC 07 1987

Michael Yates
General Development Utilities
1111 S. Bayshore Drive
Miami, FL 33131

Dear Mr. Yates:

RE: North Port St. Lucie Injection Well
Wastestream Analysis

Enclosed is the listing of parameters for the wastestream analysis which is required prior to deep well injection of domestic wastewater. I've also enclosed a copy of our November 30, 1987 letter to Jeff Lehnen with CH_2M Hill that lists all the items we require to complete our review for operational testing approval.

I have received the copies of the borehole television survey and telephone confirmation from Jeff Lehnen on CH_2M Hill's preparation of the other items. Please let me know if you have questions on this matter, 305/964-9668.

Sincerely,

Peggie Highsmith

Peggie Highsmith
UIC Permitting

PH:my:326

cc: TAC Members
Jeff Lehnen - CH_2M Hill/Gainesville

FILE

STATE OF FLORIDA
DEPARTMENT OF ENVIRONMENTAL REGULATION

SOUTHEAST FLORIDA DISTRICT
1900 SOUTH CONGRESS AVENUE, SUITE A
WEST PALM BEACH, FLORIDA 33406
(305) 964-9668

BOB MARTINEZ
GOVERNOR
DALE TWACHTMANN
SECRETARY
J. SCOTT BENYON
DISTRICT MANAGER

November 30, 1987

Jeffrey Lehnen
CH2M Hill
7201 N.W. 11th Place
Gainesville, FL 32605

Dear Jeffrey:

RE: Operational Testing
North Port St. Lucie Injection Well

We received Volumes I and II of your Engineering Report for the subject well on November 19, 1987. In response to your request for authorization to begin operational testing, our receipt and acceptance of the following items are required before approval can be issued:

(1) Borehole television survey tapes as described in Section 4 and Appendix H of the referenced engineering report.

(2) An evaluation certified by the engineer of record of the temperature log and pressure test that indicates mechanical integrity of the injection well has been demonstrated by these methods.

(3) Certification of the completion of the pump station and system monitoring equipment.

(4) Wastestream analysis.

Please call Peggie Highsmith, 305/964-9668, if you have questions about these items.

Sincerely,

Thomas G. Walker

Thomas G. Walker, P.E.
Permitting Chief

TGW:pny:326

FILE

STATE OF FLORIDA
DEPARTMENT OF ENVIRONMENTAL REGULATION

SOUTHEAST FLORIDA DISTRICT
1900 SOUTH CONGRESS AVENUE, SUITE A
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Sincerely,

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Thomas G. Walker, P.E.
Permitting Chief

TGW:pny:326

GROUND WATER QUALITY ANALYSIS STANDARDS FOR DOMESTIC WASTEWATER PLANT MONITORING

(Based on 17-22.104 Drinking Water Standards)

PARAMETER	MAXIMUM CONCENTRATION LIMIT (MCL) mg/l
METALS	
Primaries	
Arsenic (As)	0.05
Barium (Ba)	1.0
Cadmium (Cd)	0.010
Chromium (Cr)	0.05
Lead (Pb)	0.05
Mercury (Hg)	0.002
Selenium (Se)	0.01
Silver (Ag)	0.05
Sodium (Na)	160.0
Secondaries	
Iron (Fe)	0.3
Copper (Cu)	1.0
Manganese (Mn)	0.05
Zinc (Zn)	5.0
OTHER INORGANICS	
Ammonia Nitrogen $(NH^+_4 \rightleftarrows NH_3 + H^+)$	___
Nitrate/Nitrite (NO_3/NO_2 as N)	10.0
Sulfate($SO_4{=}$)	250
Hydrogen Sulfide (H_2S field measurement)	___
Soluble Orthophosphate $(H_2PO^-_4, HPO_4^=, PO_4^{-3})$	___
Chlorides	250
Total Dissolved Solids (TDS)	500
Foaming Agents (MBAS)	0.5
PH (Field)	6.5 (min allowed no max)
MICRO BIOLOGICAL	
Fecal Coliform	___ colonies/100 mls

ORGANICS

MCL: reference
drinking H2O
standards

-Volatiles (as determined from following methods)

EPA Method 601 (GC) - purgeable Halocarbons
and EPA Method 602 (GC) - purgeable Aromatics
-or-EPA Method 624 (GCMS) - purgeables

-Organic Pesticides

Aldrin	1.9 ug/l*
Dieldrin	2.5 ug/l*
Endrin	0.2 ug/l
Lindane	4.0 ug/l
Methoxychlor	100 ug/l
Toxaphene	5.0 ug/l
2,4- D	100 ug/l
2,4,5-TP, Silvex	10 ug/l

-Total Phenol (TP) 20 ug/l*

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*These are guidance concentrations

David Butler

STATE OF FLORIDA
DEPARTMENT OF ENVIRONMENTAL REGULATION

SOUTHEAST FLORIDA DISTRICT
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WEST PALM BEACH, FLORIDA 33406
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BOB MARTINEZ
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J. SCOTT BENYON
DISTRICT MANAGER

November 30, 1987

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CH_2M Hill
7201 N.W. 11th Place
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(3) Certification of the completion of the pump station and system monitoring equipment.

(4) Wastestream analysis.

Please call Peggie Highsmith, 305/964-9668, if you have questions about these items.

Sincerely,

Thomas G. Walker

Thomas G. Walker, P.E.
Permitting Chief

TGW:phy:326

[illegible]

NOV [illegible]
[illegible]
West Palm Beach

TO: Scott Benyon, DER/West Palm Beach
Paul Phillips, DER/West Palm Beach
Cathy Conrardy, DER/Tallahassee
Mike Merritt, USGS/Miami
David Butler, SFWMD/West Palm Beach
Gene Coker, EPA/Atlanta
Michael Yates, GDU/Miami
Pete Walch, GDU/Port St. Lucie
Jimmy Brantley, Youngquist Bros./Ft. Myers
J. I. Garcia-Bengochea, CH2M HILL/Gainesville
John Curtiss, CH2M HILL/Deerfield Beach

FROM: Leslie Shannon, CH2M HILL
Jeffrey Lehnen, CH2M HILL

DATE: November 17, 1987

SUBJECT: General Development Utilities
North Port St. Lucie Injection System Final Report

PROJECT: SE15807.T2

We are pleased to transmit the report on the construction and testing of the GDU North Port St. Lucie injection well entitled "Engineering Report--Drilling and Testing of the Deep Injection Well System." The report is in two volumes, with Volume I containing the text and appendices A through F, and Volume II containing appendices G and H.

The pump station will be completed and the system will be operational by approximately the first week of December. In accordance with Specific Condition 12, we would like to receive written authorization to proceed with operational testing as soon as possible after the system is operational.

An operating permit application will be made after a period of operational testing. This report will become part of that application by reference.

We appreciate your past support and cooperation and look forward to timely receipt of the written authorization. Please call with any questions (904/377-2442).

gnCR43/049

CH2M HILL
Engineers
Planners
Economists
Scientists

RECEIVED

DEC 16 1987

RESOURCE CONTROL DEPARTMENT

December 11, 1987

SE15807.T2

Mr. Thomas G. Walker, P.E.
Permitting Chief
Department of Environmental Regulation
1900 South Congress Avenue
Suite A
West Palm Beach, Florida 33406

Dear Thomas:

Subject: GDU North Port St. Lucie WWTP Injection System Operational Testing

In reference to your letter dated November 30, 1987, I am responding to the items requested.

1. The TV survey tapes were sent directly to the TAC members on December 1, 1987. Peggie Highsmith confirmed by phone receipt of the tapes on December 4, 1987.

2. The background temperature log run on the completed injection well on August 5, 1987, was run over 5 days after pumping water into the well for the injection test.

   The temperature log shows a gradual warming with depth from 100 feet to 800 feet where a slight cooling occurs to 1,080 feet which corresponds to the top of the transmissive Floridan aquifer. The water then warms to a depth of 2,375 feet where a transmissive saltwater zone appears and the gradient reverses and cools to the bottom of the well.

   The temperature log is consistent with the expected regional gradient and indicates there is no fluid movement into or out of the casing.

   The pressure test was run on the 12-inch casing on July 13, 1987. The casing was pressurized to 98.4 psi and in one hour, the pressure was 97.3 psi. The pressure test meets the criteria to demonstrate mechanical integrity with this method.

CH2M HILL Gainesville Office 7201 N.W. 11th Place., P.O. Box 1647, Gainesville, Florida 32602 904.377.2442
EasyLink 62508220
Telex 756070

3. The pump station is expected to be completed by December 24, 1987. At that time, CH2M HILL will issue a certificate of substantial completion to the contractor. We will forward a copy to you at that time. If additional documentation is required, please contact us.

4. As discussed on December 11, 1987, with Peggie Highsmith, a wastewater sample will be collected and analyzed for the parameters listed in the attached letter. The sample will be taken by December 24, 1987 prior to injection. The complete lab results will be available within eight weeks of sampling. As discussed with Ms. Highsmith on December 11, 1987, authorization to begin injection will not be delayed by the wastewater sample lab analysis.

Should you have any further questions, please contact us.

Sincerely,

J. I. Garcia-Bengochea

J. I. Garcia-Bengochea, P.E.
Engineer of Record

tl/gnCR49/010
xc: Michael Yates/GDU/MIA
Peggie Highsmith/DER/WPB
Cathy Conrardy/DER/TALL
Mike Merritt/USGS/MIA
David Butler/SFWMD/WPB
Gene Coker/EPA/ATL
Jeff Lehnen/CH2M HILL
John Curtiss/CH2M HILL

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DEC 07 1987

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UIC Permitting

PH:my:326

cc: TAC Members
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Thomas G. Walker

Thomas G. Walker, P.E.
Permitting Chief

TGW:~~phy~~ pk:326

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Nitrate/Nitrite (NO_3/NO_2 as N)	10.0
Sulfate(SO_4=)	250
Hydrogen Sulfide (H_2S field measurement)	___
Soluble Orthophosphate ($H_2PO^-{}_4$, $HPO_4^=$, PO_4^{-3})	___
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Total Dissolved Solids (TDS)	500
Foaming Agents (MBAS)	0.5
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*These are guidance concentrations